Assessment of the Effect of Different Preservatives on the Shell-Life of Soymilk Stored at Different Temperatures

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ABSTRACT: This study examined the effect of different preservatives on the shell-life of soymilk stored at different temperatures. The utilization of soybean for the production of soy milk was studied. Soy milk was extracted from whole and dehulled seed, pasteurized and fermented. All soy milk samples were analyzed for proximate composition (moisture%, ash %, total solids, fat) and the organoleptic tests (color, thickness, appearance, body, texture, taste, smell, flavor and overall acceptability) of the soy milk samples were evaluated to determine the shelf-stability of the products during refrigeration and room temperature storage. The moisture, protein, fibre, fat, ash, carbohydrate and total solids of soy milk from whole and dehulled seed differed significantly ($p<0.05$). There was marked variation in the % fat content of the products. The results of the sensory evaluation revealed that flavor with respect to taste and smell had significant influence ($p<0.05$) on overall acceptability of soy milk product. The sensory properties of yam bean yoghurt samples were compared with soybean yoghurt. The sensory properties showed that sample stored at refrigeration temperature maintained good quality up to 16 days storage while samples stored at room temperature were of poor quality by the 4th day. The implication of these results is discussed. So, the soy milk manufacturers need to improve on the sensory properties in particular flavor and taste for better consumer acceptability. Also, they may improve on packaging by labeling to specifications that precisely represent the content and type.

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Key words: Soy milk, chemical evaluation, sensory properties, consumer acceptance, shelf-stability

1. INTRODUCTION

Soybean (Glycine max) is a legume of an exceptionally high protein content ranging between 38% and 42 %, with lysine constituting a substantial proportion (Nwanebu, 1994 cited in Egbo, 2012; Lawson, 2004). Soybean as a plant protein is cheaper and could serve as an alternative to cow milk. It contain up to 40% protein compared with 1.0% to 5.6% protein content of most animal milk (Farinde *et al.*, 2008).

Soymilk is produced in different ways. The most common method is the Illinois method, which involves grinding of the soybean in hot water to obtain in the milk (Iwe, 2003). Other methods include wet extraction and dry extraction (Hackler *et al.*, 1962). It has been reported that the shelf life of soymilk is very short (Nwanebu, 1994 cited in Egbo, 2012). This is as a result of the pH of the milk (7.0-7.5) (Adebayo-Tayo et al., 2009) and the activities of the various micro-organisms contained in the milk, which may have been inherently present in the soybean as reported by Adebayo-Tayo et al. (2009), Nwanebu (1994 cited in Egbo, 2012), or due to inadequate processing and post-processing contamination (Adeleke *et al.*, 2000; Onweluzo and Nwakalor, 2009; Ikpeme *et al.*, 2009). Changes associated with these activities vary but usually include increase in pH, increase in titratable acidity, curdling and separation of curd and whey (Nwanebu, 1994 cited in Egbo, 2012; Adeleke *et al.*, 2000; Adebayo-Tayo et al., 2009; Farinde *et al.*, 2008).

Although there is some soy milk in the Nigerian markets, the ones that are shelf stable are scare. We also observed the lack of studies on the evaluation of new methods of processing and preservation of soy milk. Most studies on soymilk tend to deal with blending of different fruits to increase the different nutrient that are deficient in soymilk (Omueti and Ajeowale, 2005; Adetunji *et al.*, 2006; Onuorah *et al.*, 2007; Laswai *et al.*, 2009; Farinde *et al.,* 2010). Soymilk can be produced by different methods. The traditional method or cold grind method involves soaking the beans for 12 to 24 hours at room temperature. Water is frequently changed. Soaked beans are ground to fine paste using a food chopper or in a stone mill. Water is added to the mass during grinding (ratio is 1:3 of beans to water). The resulting slurry is boiled to foaming for one hour with continuous stirring and later strained through cheesecloth (Iwe, 2003)

Another method of production usually called hot grin method (University of Cornell method) or Illinois method involves soaking of the beans for 4-7 hours under tropical ambient temperature. The dehulled soybean is ground in a blender in hot water at this temperature for 10 minutes or blanched in hot water before grinding. The slurry is cooled and filtered to yield the milk which is then sterilized at 121oc for 15 minutes (Iwe, 2003; Nwanebu, 1994 cited in Egbo, 2012; Lawson, 2004). However, the hot grind method is favored since the beany flavor in the milk is markedly reduced because of the denaturation of lipoxidase during grinding (Iwe, 2003). It has been reported that soymilk can be made by soybean flour in a dry extraction method. Soy flour slurries are heated at 99oc and agitated continuously during cooking. The slurry is rapidly cooled in an ice-bath and adjusted to 10% solids with distilled water (Iwe, 2003).

The quest for cheap source of protein has enhanced small scale production of vegetable protein products of which soymilk is an example. Soymilk consumption has encouraged small scale production of the product under household condition with little or no regard to quality control measures (Adeleke *et al.*, 2000; Adebayo-Tayo et al., 2009). The study was designed to examine the effect of different preservatives on the shell-life of soymilk stored at different temperatures. It also aimed at developing shelf stable soya milk by using different ratios of different preservatives (singly and in combination).

2. MATERIALS AND METHODS

2.1. SOURCE OF SOYBEAN

Soybean was purchased from mile 1 market and kept at ambient temperature prior to usage. They were analyzed within a day of purchase.

2.2. PRODUCTION OF SOY MILK

Soymilk was prepared using two methods modified from Illinois method.

2.2.1. Method 1: soybean was sorted to remove stones and damaged, deformed seeds. The soybean was washed and soaked in water (500g in 1 Liter) for 12 hours. It was rinsed and blanched in 1.25% $NaHCO_3$ for 30 minutes. The soybean was washed, manually dehulled and rinsed. The soybean seeds were ground in blender (kenwood) and expressed in the ratio of 3:1 to remove the okra. The resultant slurry was formulated by adding 0.1% of sodium benzoate and 0.1% potassium sorbate, 2% sucrose and propy gallate and Ascorbic pamitate at this ratios: 100ppm Ascorbic palmitate and 100ppm propyl gallate, 200ppm Ascorbic palmitate, 200ppm propyl gallate and Control (without preservative and antioxidant). The milk was heated at 71^{o}C for 15 seconds and subsequently bottled and stored at ambient and refrigeration temperature.

2.2.2. Method 2: soybean was sorted to remove stones and damaged, deformed seeds. The soybean was washed and soaked in water (500g in 1 Liter) for 12 hours. It was rinsed and blanched in 1.25% Na_2CO_3 for 30 minutes. The soybean was washed, manually dehulled and rinsed. The soybean seeds were ground in blender (kenwood) and expressed in the ratio of 3:1 to remove the okra. The resultant slurry was formulated by adding 0.1% of sodium benzoate and 0.1% potassium sorbate, 2% sucrose and propy gallate and Ascorbic pamitate at this ratios: 100ppm Ascorbic palmitate and 100ppm propyl gallate, 200ppm Ascorbic palmitate, 200ppm propyl gallate and Control (without preservative and antioxidant). The milk was heated at 71^{o}C for 15 seconds and subsequently bottled and stored at ambient and refrigeration temperature. Figure 1 shows the processing of soybean to soymilk.

2.3. STORAGE

The soy milk samples were stored at ambient temperature (27°C ± 2^{0}C) for 4 days and refrigerated temperature (4 ± 2 °C) for 16 days.

2.4. PROXIMATE ANALYSIS

2.4.1. CRUDE PROTEIN (KJELDAHL METHOD)

About 0.1g of sample was weighed and added into a clean conical flask of 250ml capacity. 3g digestion catalyst was added into the flask and 20ms concentrated sulphuric acid was also added and the flask was heated to digest the content from black to sky blue colouration. The digest was cooed to room temperature and was diluted to 100ml with distilled water.

2.4.2. DISTILATION

About 20ml diluted digest was measured into a distillation flask and the flask was held in place on an electro-thermal heater hot plate. To the distillation flask was attached condenser, 40% sodium hydroxide is injected into the digest via a syringe at the head to the micro arm steel head until the digest becomes strongly alkaline. The mixture was heated to boil and distill the ammonia gas via the condenser into the receiver beaker. The colour of the acid changed from purple to greenish. Ammonia distillate was introduces into the acid.

2.4.3. TITRATION

The distillate was titrated with 0.1N Hydrochlorinc acid back to purple colour from greenish. The volume of hydrochloric acid added to effect the change was recorded as titre value. **CALCUATION:** %N = titre value x1.4x100x100/

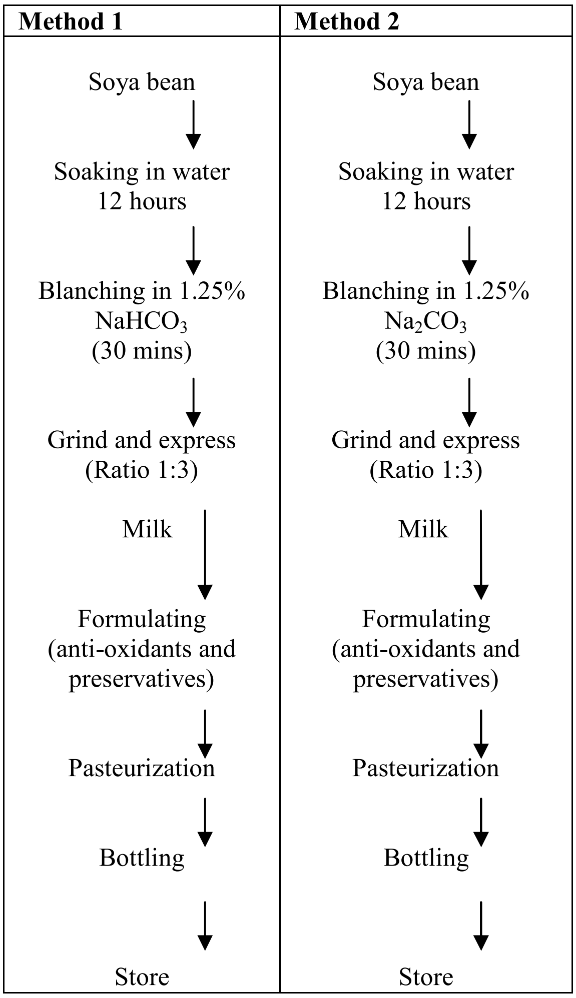

Figure 1: Flowchart illustrating the production sequence of shelf stable milk

2.4.4. CRUDE CARBOHYDRATE (CLEG ANTHOME METHOD)

About 0.1g sample was weighed into 25ml volumetric flask.1.3ml 62% perchloric acid was added and shaking for a period of 20minutes to homogenize completely. The flask was made up to 25ml mark withn distilled water and stopped. The solution formed was filtered through a glass filter paper or allowed to sediment and decanted. 1ml of the titrated was colleted and transformed into a 10ml volumetric flask. This was diluted to volume with distilled water. 11ml of this working solution was pipette into a clean test tube and 5mls anthrone reagent was added. 1ml distilled water and 5m of anthrone reagent was mixed similarly and the whole mixture was read at 630nm. Absorbance of the standard glucose was read and the value of the carbohydrates using the formula: % carbohydrates as glucose = 25xabsorbance of sample/absorbance of standard x1g.

2.4.5. MOISTURE (BY LOSS ON IGNITION)

About 1g sample was weighed into a clean dried porcelain evaporating dish. This was placed on an oven maintained at 105oC for 6hours. The evaporating dish was cooled in desiccators to room temperature, and then this was re-weighed and recorded. Weight of moisture was calculated by subtracting the weight of dried samples from the fresh. % Moisture = fresh weight – dried weight/weight of fresh sampex100/1.

2.4.6. LIPID (BY SOXHLET EXTRACTION METHOD)

About 2g sample was placed into a soxhlet extractor. The extractor was placed into a pre-weighed dried distillation flask. Then the solvent (acetone) was introduced into the distillation flask via the condenser end attached to the soxhlet extractor. The setup was held in place with a retort stand clamp. Cooled water jet was allowed to flow into the condenser and the heated solvent was refluxed as a result, the lipid in the soxhlet chamber was extracted in the process of continuous refluxing. When the lipid was observably extracted; to concentrate the lipid; the flask was then dried with the air oven to constant weight and re-weighed to obtain the weight of lipid. % lipid = weight of flask and extract – weight of flask/weight of sample extractex100/1.

2.4.7. ASH (BY FURNACE METHOD)

Sample was weighed into a porcelain crucible which was previously preheated and weighed. The crucible was inserted into a muffle furnace and regulated to a temperature of 630^{o}C. This was heated for 3hours and allowed to cool.

2.5. SENSORY EVALUATION

All the samples were evaluated for organoleptic characteristics and overall acceptability by 20 panelists that comprised undergraduate, graduate students, teaching and non-teaching staff members of University of Port Harcourt, Rivers State, Nigeria; using nine point hedonic scale ranging from excellent (score = 9) to very poor (score = 0) as extremes (Obi *et al*., 2010). Prior to each assessment, the subjects were informed about the task of the test. In addition to the information, a detailed set of written instruction on testing method was available in each table. A 10ml portion of soymilk was served to each subject in coded intransparent plastic tumblers. Mineral water and cream crackers biscuits were available as neutralizers. The test was performed under conditions of standard light and temperature 20^{O}C. The same subjects were used in all the steps of the sensory evaluation, so accurate data collection could be obtained.

2.6. DATA ANALYSIS

The data obtained were subjected to analysis of variance (ANOVA) using Graph Pad Prism Software, version 5.01. Significant difference between means were determined at $p<0.05$. The result of the experiment collated at the end of the storage was analyzed using statistical means to determine if there were any significant differences among their means. T-test was used to determine the relationship (difference) between the different temperatures of storage for both the market and sample soymilk. This was because t-test measure's the differences between the means of two variables. Also t-test was used to analyze if significant differences exist between the soymilk treated with acid salt ($NaHCO_3$) and the soymilk treated with alkaline salt (Na_2CO_3). For sensory analysis, two way analysis of variance (ANOVA) was used to determine the significant differences between the individual samples of the sample soymilk.

3. RESULTS ANALYSIS

In this study, sample A was $NaHCO_3$ Soymilk treated with Propyl Gallate, sample B was $NaHCO_3$ Soymilk treated with Ascorbyl Palmitate, sample C was $NaHCO_3$ Soymilk treated with both Propyl Gallate and Ascorbyl Palmitate, sample D was $NaHCO_3$ Control, sample E was Na_2CO_3 Soymilk treated with Propyl Gallate, sample F was Na_2CO_3 Soymilk treated with Ascorbyl Palmitate, sample G was Na_2CO_3 Soymilk treated with both Propyl Gallate and Ascorbyl Palmitate while sample H was Na_2CO_3 Control.

3.1. STORAGE

The soy milk samples stored at ambient temperature were of poor quality by the 4th day while the soy milk samples stored at refrigeration temperature maintained good quality up to 16 days of storage.

3.2. PROXIMATE COMPOSITION OF AFRICAN YAM BEAN YOGHURT

The soy bean from whole seed had high protein, fibre, fat, ash, carbohydrate and mositure. The proximate composition of soy milk samples is presented in Table 1. The crude protein content of produced soy milk ranged from 2.66 to 2.81%. Total carbohydrates ranged from 1.99 to 2.69%. The fat content ranged from 1.81 to 2.36%. The ash content ranged from 0.22 to 0.40%. On the other hand, the moisture content of the produced soy milk samples ranged from 89.20 to 93.29% (Table 1). There was no significant difference (P>0.05) between the values recorded for $NaHCO_3$ and that of Na_2CO_3.

Table 1: Proximate composition (%) of produced soymilk

Samples	Ash	Protein	Fat	Carbohydrate	Moisture
A	0.40	2.80	2.35	2.69	89.20
B	0.40	2.80	2.36	2.68	89.20
C	0.41	2.81	2.34	2.67	89.20
D	0.40	2.80	2.35	2.08	89.19
E	0.24	2.67	1.81	1.99	93.29
F	0.23	2.66	1.81	1.99	93.29
G	0.24	2.67	1.81	1.99	93.29
H	0.22	2.69	1.81	1.99	93.29

3.3. CHANGES IN SENSORY ATTRIBUTES OF SAMPLE SOYMILK

The mean scores for the aroma and visual appearance/colour of samples decreased with storage time (Table 2). On day 0, samples treated with $NaHCO_3$ had higher visual appearance scores in comparison to samples treated with Na_2Co_3. Sample D had the highest score for visual appearance with sample B and C having the lowest score for samples treated with $NaHCO_3$. For samples treated with Na_2CO_3, they had a lower score with sample H having the highest score (5.4) and sample F having the lowest score (5.0). For taste, samples treated with Na_2CO_3, they showed the highest score in comparison with samples treated with $NaHCO_3$, with sample H having the highest score for taste and sample F with the lowest score for taste. For samples treated with $NaHCO_3$, sample C had the least score at 5.0 and sample A with the highest score. At the end of assessment (day 12) the aroma and visual appearance of all the samples had become unacceptable with sample treated with Na_2CO_3 having higher scores than samples treated with $NaHCO_3$.

Table 2: Mean scores of sensory evaluation

Attribute	A	B	C	D	E	F	G	H
DAY 0								
Taste	5.8	5.4	5.0	5.5	6.9	6.7	6.8	7.0
Colour	7.2	7.0	7.0	7.5	5.3	5.0	5.2	5.4
Aroma	5.5	5.4	5.3	5.4	6.8	6.4	6.5	6.4
Overall Acceptability	6.5	6.0	6.4	6.1	7.3	7.2	7.2	7.1
DAY 6								
Taste	4.5	4.4	4.0	3.5	6.0	5.7	5.8	5.1
Colour	6.1	5.8	6.0	5.5	4.3	4.7	4.6	4.4
Aroma	4.5	4.4	4.6	4.4	4.8	4.3	4.5	4.3
Overall Acceptability	5.5	5.0	5.4	4.1	6.4	6.2	6.5	5.1
DAY 12								
Colour	3.6	3.2	3.7	2.5	4.3	4.1	4.4	4.0
Aroma	3.3	3.0	3.1	2.0	3.5	4.0	3.8	3.3
Overall Acceptability	3.0	2.9	3.1	1.4	4.4	4.2	4.6	3.1

The changes in the overall acceptability of the different samples are shown in Figure 2. The overall acceptability decreased within the entire sample with control sample showing the most change. The samples treated with Na_2CO_3 retained better quality for longer periods. This is further illustrated in the samples treated with Na_2CO_3 which showed less curdling and whey separation (better quality). These changes (curdling and whey formation) occurred in samples at the 14th day of storage at refrigeration temperature and day 2 at ambient temperature. Overall, less adverse changes (i.e. better acceptability) occurred in the individual samples treated with propyl gallate singly and in combination with Ascorbyl Palmitate. However, at the end of storage, they were all virtually unacceptable. Statistically, it was shown that there was no significant difference (P>0.05) in all the samples both those treated with $NaHCO_3$ and Na_2CO_3.

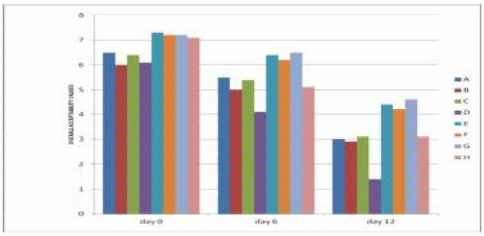

Figure 2: Changes in overall acceptability of in sensory attributes of sample soymilk

4. DISCUSSION

Soymilk is an idea medium for bacteria growth and hence and hence a thermal treatment is necessary to extend its shelf life. Heat processes are involved at several stages during soymilk preparation, including the pre-treatment of beans and extraction to produce the soymilk, followed by either pasteurization or sterilization to increase its shelf life. By controlling the microbiology of the product and packaging it in appropriate containers, the shelf life of soymilk can be greatly extended and the product can be distributed over a wider area.

Proximate analysis of the “soy milk” from each variety of soybeans shows that averagely it has a water content of 91.24, Protein of 2.74, fat content of 2.08, Ash content of 0.32 and Carbohydrate of 2.26 this agrees with the findings of Nelson *et al*. (1978) and Gesinde et al. (2008) with the exception of protein and carbohydrate content which is lower in their own report. This may be due to the variety of soybean used, the method of extraction and other equipments used (Gesinde et al., 2008). It has been reported that soybean varieties greatly affect the protein content and colour of soymilk (Min *et al.*, 2005, Gesinde *et al.*, 2008). Soy milk prepared from beans pre-soaked in $NaHCO_3$ contained more protein and a higher viscosity than milk prepared from beans pre-soaked in Na_2CO_3. Soaking with $NaHCO_3$ as well as blanching gave a higher protein content of soymilk because soaking gives a tender product which results in finer slurry and thus more filtrate will pass thru the filter cloth thereby increasing yield and subsequently the protein content of soymilk (Bourne, 1976). The low protein value for Na_2CO_3 method can also be because Na_2CO_3 reacts with protein and forms a complex, which reduces the protein availability of produced soymilk (Tunde-Akintunde and Souley, 2009).

The higher ash content of $NaHCO_3$ could be due to more mineral being extracted in soymilk due to the action of the acid. These values are comparable to Onuorah *et al.* (2007) findings. The higher moisture content of Na_2CO_3 could be as a result of coagulation of protein and hereby restricting more water expulsions from the cake (Bourne, 1976). The carbohydrate content of $NaHCO_3$ milk was higher and similar to that reported by Wikens *et al.* (1967). The fat content of $NaHCO_3$ was higher and it correlated with the report obtained by Adetunji *et al*. (2006). Farinde *et al.* (2008) suggested that the total solid of soymilk could be improved by adding soybean flour to the soymilk. Increasing the total solid increases the nutritive value of the product thereby improving the keeping quality.

The sensory properties showed that sample stored at refrigeration temperature maintained good quality up to 16 days storage while samples stored at room temperature were of poor quality by the 4th day. Preservation of soymilk by refrigeration has been shown to be relatively effective in retarding microbial growth. The shelf life of pasteurized milk products subjected to ultra high temperature (UHT) is usually extended especially if adequately stored (Saidu, 2005). This can be done through the use of chemical preservatives to minimize food spoilage. In economically under developed countries, lack of functional storage facilities and the inadequacy of transportation and communications may increase the necessity of using certain food additives for purpose of preservation. In tropical regions, high temperature and humidity favour microbial attack and increase the rate of development of oxidative rancidity. Food additives might be used to supplement the effectiveness of traditional methods of food preservation rather than to replace these methods (Alais and Linden, 1999 cited in Egbo, 2012).

The sensory attributes of perceived color and flavor are the most important characteristics in soymilk because they are readily assessed by consumers. Soymilk when subjected to severe heating acquires a brown color and cooked flavor (Kwok et al., 2000 cited in Egbo, 2012). Kwok and Niranjan (1995 cited in Egbo, 2012) have demonstrated the effects of thermal processing on the quality of soymilk and concluded that the main chemical reaction that gives rise to heat-induced color and flavor changes is the maillard reaction. Most work done on soybean products made reference to future research to be done to improve colour, taste and aroma of soybean products either through flavour additives and heat treatments (Farinde *et al.,* 2008; Ikpeme *et al*, 2009). It has been reported that the use of preservatives also reduced *Staphylococcus aureus* population in soymilk to less than hazardous level at the end of ambient storage and lag-phase periods were extended by the preservatives resulting in longer shelf life (Nwanebu, 1994 cited in Egbo, 2012).

The sensory evaluation shows that sample produced with Na_2CO_3 has a higher preference for smell and taste because the methods reduced the beany flavor as reported by Liu (1997 cited in Egbo, 2012). However these samples have the lowest preference in terms of colour. Tunde-Akintunde and Souley (2009) reported that from their results, they noticed that the sensory properties of soymilk increased with decrease in nutritional quality indicating that methods which increase sensory properties of soymilk by reducing its beany flavor have lower nutritional qualities. Wikens *et al*. (1967) found that the off-flavours of soymilk were present in the dry soybean but were formed during the processing and that blanching the beans in hot water prevented the formation of the strong beany flavours. They attributed this result to the rapid heat inactivation of the lipoxidase in the soybean precluding its attacking the unsaturated fatty acid chains in the soybean oil to form a number of lower molecular weight compounds that have objectionable flavor impact. Lipoxygenase catalyze the hydroperoxidation of polyunsaturated lipids in the presence of molecular oxygen and the primary products are hydroperoxide. The volatile carbonyl compounds including aldehydes, ketones and alcohols are partly responsible for the objectionable odor and flavor in soymilk. During the preparation of soymilk, soybean is ground with water and the LOX activity is greatly enhanced when the soybean is damaged or crushed. Therefore the inactivation is carried out at a higher temperature of 80-100^oC during the preparation of soymilk. Inversely at these temperature, protein molecules are denatured (Prabhakaran, 2005), therefore other methods (antioxidants) are sort to complement the use of high temperature.

Although soymilk is a potential substitute for cow milk and could be used for solving malnutrition problems in developing countries, its utilization is hampered by a number of factors. However, acceptability of soybean products has been enhanced by modification of processing methods. Some of the modified soymilk extraction methods include application of heat, soaking of soybean in ethanol or alkali and acid grinding (Iwe, 2003). Kolapo and Oladimeji (2008) reported on the use of natural flavourants to improve soymilk acceptability. It has been reported that pasteurization of vegetable milk extract at 121^oC for 15 minutes effects maximum destruction of microorganisms and made the products microbiologically safe (Onweluzo and Nwakalor, 2009). The effect of pre-soaking soybean in solutions of various chemicals on the reduction of beany flavor in soymilk was investigated. Na_2CO_3 had a significant effect on the reduction of beany flavor in soymilk. Na_2CO_3 soaking at 1.25% for 12 hours was significantly better than $NaHCO_3$ pre-soaking treatment. Beans pre-soaked in carbonate were easier to process than $NaHCO_3$ (Khaleque *et al*, 1970).

The shelf life of the soy milk produced at room temperature was up to 4 days, this deviated from the average shelf life reported generally for most milk and milk- based products. This is the reason why several workers are exploring the use of chemical preservatives for prolonging the shelf life of milk products (Sumati and Shalini, 1986; Uriah and Iwagbe, 1990; Gesinde et al., 2008). Statistical analysis of the data on the organoleptic assay showed that there was no significant different among the variety for sweetness of their soymilk. There were no significant difference ($P>0.05$) in the color, odor and texture of the soy milks treated with $NaHCO_3$ and Na_2CO_3. Benzoic and sorbic acid are among the most commonly used as preservatives in their salt forms (Sodium or potassium) (Wibbertmann et al., 2005). Potassium sorbate has been reported to be more effective against moulds involved in spoilage of foods at pH of 4.0 to 6.0 than against the bacterial flora especially lactic acid. Sodium benzoate has been reported to be less effective than potassium sorbate against moulds though the two preservatives are capable of inhibiting aerobic and catalase positive bacteria such as *Staphylococcus aureus,* coliforms and psychotropic spoilage bacteria (Nwanebu, 1994 cited in Egbo, 2012; Wibbertmann et al., 2005).

5. CONCLUSION

The effect of certain preservatives at various concentrations within their maximum permissible levels along with pasteurization and refrigeration storage on the microbial keeping quality of soymilk used showed that soymilk samples blanched in $NaHCO_3$, pasteurized at 75^oC for 15 seconds and then formulated with 0.1%potassium sorbate and sodium benzoate in addition with either 200ppm propyl gallate or 100ppm propyl gallate and ascorbyl palmitate, gave soymilk of high microbial quality and shelf life stability. Study on the suspension stability of soymilk should be considered as the soymilk separated during the period of study unlike the most market soymilk which is relatively stable. Also other method of preserving soymilk, so as to extend its shelf life should be studied (carbonation).

In line with other studies, it was demonstrated that processing method, storage temperature and storage duration have significant combined effects on the proximate chemical composition and sensory attributes of soymilk. According to most authors, soymilk produced from flour produces better nutritional profile and more desirable sensory properties than milk produced from wet blanched beans. However, liquid soymilk produced from the traditional wet methods, are most stable in sensory attributes when stored at very low temperatures. Conclusively, the quest for cheap source of protein has enhanced small scale production of vegetable protein products of which soymilk is an example. Soymilk consumption has encouraged small scale production of the product under household condition with little or no regard to quality control measures. Soymilk therefore has the potential to substitute dairy milk.

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