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Effect of Period and Condition of Storage on Properties of Yoghurt Produced from Cow Milk and Soymilk Materials

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Abstract: The effect of storage condition and period of storage on microbial load, physicochemical and organoleptic properties of yoghurt produced from Whole Cow Milk (WCMY), Powdered Milk (PMY) and Soymilk (SMY) was assessed in a 3×3×4 factorial arrangement in a completely randomized design. The factors were three base materials, three storage conditions and four storage periods. Each experimental unit was replicated three times. The results showed that the titratable acidity (lactic acid%) values for fresh yoghurt stored in freezer (0.76), refrigerator (0.78) and room temperature (0.80) were similar to those for 7 days old yoghurt (0.90, 1.14 and 1.41% lactic acid) but significantly ($p<0.01$) different from those of 14 days old yoghurt under similar storage conditions. The pH showed similar trend. The total microbial load of 7 days old yoghurt stored at room temperature (1.82×10^8 cfu mL^{-1}) was significantly ($p<0.001$) higher than those for yoghurt stored in the freezer (2.38×10^7 cfu mL^{-1}) and refrigerator (3.87×10^7 cfu mL^{-1}). The same trend was recorded on 14 and 21 days of storage. The taste and aroma of PMY stored in the freezer and refrigerator, rated between fair (3.0) and pleasant (4.0), were significantly ($p<0.01$) higher than those of other yoghurt stored at room temperature rated fair (2.9). The overall acceptability, texture, colour and aroma of PMY, WCMY and SMY stored in freezer and refrigerator were higher than those stored at room temperature. The results also showed a significant difference ($p<0.001$) in the total solids content of PMY between fresh (20.45%) and 7 days (20.02%) on one hand and 14 (12.33%) and 21 (10.14%) days old on the other hand. The highest total protein contents were obtained on fresh and 7 days old yoghurt for all the three base materials. The texture of SMY (1.8) was rated poor after 21 days of storage and was significantly different from that of WCMY (2.6) and PMY (3.3) rated between fair and pleasant. It was concluded that ash yoghurt type produced from the three base materials can be stored in refrigerator or freezer for up to 14 days and up to 7 days at room temperature without deleterious effect on its properties and overall acceptability.

Key words: Soymilk, cowmilk, powder milk, yoghurt, microbial load, Nigeria

INTRODUCTION

Based on the standard of hygiene, microbial quality of ingredients and packaging materials, the shelf-life of yoghurt is around three weeks under refrigerated conditions. Yoghurt is always at risk of proteolytic degradation through proteolysis of milk which may occur during cold storage due to growth of psychrotropic bacteria (Cousin, 1982). Various techniques have been used to improve the keeping quality of yoghurt such as freezing and drying, gas flushing, addition of preservatives, use of aseptic equipment, application of multiple-frequency microwaves and sterilization by heat (Tamine and Robinson, 1989; Adam and Mass, 1999). However, refrigeration is still the most popular method used to control the metabolic activity of the starter culture and its enzymes in yoghurt under storage. Refrigerated storage at 4°C resulted in a gradual decrease in both *Lactobacillus* and *Streptococcus* bacteria in plain non-fat yoghurt and redues fat oxidation and hydration of protein constitients (Laye *et al*., 1993). A total viable yoghurt bacteria range of 140×10^6-8000×10^6 cfu g^{-1} for a brand of commercial yoghurt stored at below 4°C were reported by the same researchers. Yoghurt may be consumed at around 10°C below this temperature the flavour profile is not appreciated due to coldness and above 10°C the product losses its freshness and may undergo reduction in viscosity (Tamine and Robinson, 1989). It was reported (Gafaar, 1992) that all volatile compounds in yoghur decrease during storage at <8°C (Gafaar, 1992). However, the practice of hawking yoghurt under various storage conditions is common in most developing

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nations especially. Dairy farmers and milk processors, particularly in the northern part of Nigeria, lack storage facilities, have no adequate electricity supply and good road network, which limit access to market for their products. In most small-scale processing plants in these areas, refrigerators and freezers and room temperature are often used to store yoghurt for one to four weeks depending on market demand. These products are prone to changes during storage. The current study assessed the effect of period of storage and storage condition on the microbial load physico-chemical and organoleptic properties of yoghurt produced from three different base materials.

MATERIALS AND METHODS

Study area: The experiment was conducted at the Abubakar Tafawa Balewa University, Bauchi. Bauchi town is located at the scrub Savanna zone of Northern Nigeria, on latitude 10°17′N and longitude 9°49′E at an altitude of 690.2 m above sea level (FAO, 1988). The annual rainfall is about 1016-1270 mm. The hottest month is April; the mean annual maximum and minimum temperatures are 32.4 and 18.5°C, respectively.

Sources of milk used in the study: Whole cow milk used in the study was obtained from a peri-urban dairy herd of White Fulani (Bunaji) and Sokoto Gudali (Bokoloji) breeds at various stages of lactation were hand milked once daily (in the morning between 6.30 and 7.00 h). Partially skimmed milk powder (Dano Brand) used was obtained from the Bauchi central market. The milk powder was reconstituted by mixing 1.0 kg with 3 L of clean water at 25-30°C, until smooth paste was obtained, followed by addition of 5 L of hot water (at 85°C) with continuous mixing (Tamine and Robinson, 1989; FAO, 1990; Kordylas, 1991) to obtain 8 L of reconstituted milk. Soybean (*Glycine max* (L.) Merr) obtained from railway market in the outskirts of Bauchi metropolis was used to prepare soymilk. The soybean was cleaned by hand picking all foreign material. Hot water (2.5 L) at 85°C was added to 1.0 kg of soybean in a plastic container and closed with a lid for 30 min. The hot water was decanted and soybean was dehulled and washed thoroughly with tap water (at 25°C). The soybeans were ground to a paste and the soymilk was extracted by passing the paste through muslin cloth with 6.5 L of water (Nelson *et al*., 1976; Metwalli *et al*., 1982). A total of 9 L kg^{-1} of soymilk was obtained.

Yoghurt processing: Samples of Whole Cow Milk (WCM), reconstituted Milk Powder (PM) and Soymilk (SM) were processed into Whole Cow Milk Yoghurt (WCMY), reconstituted Powdered Milk Yoghurt (PMY) and Soymilk Yoghurt (SMY), respectively according to the methods described by Tamine and Robinson (1989) and FAO (1990).

The three base materials were inoculated with dried lactic culture (MC-380 DVS, by Chr Hansen's Laboratory, Inc.) and after coagulation, the yoghurt samples were homogenized using electric blender with addition of 30 g L^{-1} sugar, 50 mL L^{-1} flavour, 0.5% thickener and 120 mg kg^{-1} benzoic acid. The samples were labeled and packaged into 200 mL plastic containers with airtight lids and stored in a freezer (-4-6°C), fridge (4-10°C) and room temperature (26-32°C) for 21 days.

Physico-chemical and microbial analysis: The yoghurt samples were analyzed for titratable acidity as percent lactic acid (AOAC, 1990; Connor, 1995), total solids, total protein, total fats (Werner-Schmid method) as described by Egan *et al*. (1981) and ash (AOAC, 1990). The pH of the yoghurt samples were measured using Cyberscan 20 pH-meter. The total microbial loads of the yoghurt samples were enumerated in freshly prepared 0, 7, 14 and 21 days old yoghurt as described by Matalon and Sandine (1986) and Singleton (1999). Inoculated plates were incubated for 48 h at 38°C.

Organoleptic assessment: Yoghurt samples were randomized and randomly numbered panel of 5 trained judges evaluated the fresh 0, 7, 14 and 21 days old yoghurt on a hedomic scale of 1-5 for taste, aroma, colour, texture and overall acceptability (Williams, 1982). All samples were served in plastic cups and freeze stored and refrigerated samples were allowed to reach the temperature of 6-10°C before evaluation.

Experimental design and statistical analyses: The experiment was conducted in a 3×3×4 factorial arrangement in a completely randomized design. The factors were three base materials (WCMY, PMY and SMY), three storage conditions (freezer, -4-6°C, fridge, 4-10°C and room temperature, 21-32°C) and four storage periods (0, 7, 14 and 21 days). Each experimental unit was replicated three times (Gomez and Gomez, 1984). The data obtained from the physico-chemical, microbial and organoleptic assessments were subjected to analysis of variance using Balance Design. Significantly different means were separated using Standard Error (SE) and Least Significant Difference (LSD).

RESULTS AND DISCUSSION

Physico-chemical properties and microbial load of yoghurt: Table 1 shows the effect of period of storage and storage condition on the physico-chemical properties

Table 1: Effect of period of storage and storage condition on physicochemical and microbial properties of yoghurt

Pereiod of storage	Storage condition						
	TA	pH	Total solids (%)	Total fats (%)	Total protein (%)	Ash (%)	TML
Zero							
SC1	0.76	5.63	18.88	2.81	4.24	0.84	6.27
SC2	0.78	5.63	18.87	2.77	3.64	0.85	6.25
SC3	0.80	5.59	17.71	2.76	3.05	0.81	7.53
7 days							
SC1	0.90	4.45	18.46	2.66	3.73	0.80	23.86
SC2	1.14	4.23	18.37	2.68	3.11	0.84	38.65
SC3	1.41	4.52	17.77	2.58	3.27	0.81	182.09
14 days							
SC1	2.30	4.43	14.95	2.46	3.53	0.78	35.76
SC2	2.54	4.18	13.70	2.45	3.03	0.81	50.51
SC3	3.76	4.60	13.69	1.88	3.12	0.81	230.37
21 days							
SC1	1.97	4.49	10.27	2.05	2.67	0.88	31.70
SC2	2.07	4.35	9.96	1.96	2.33	0.91	36.47
SC3	3.94	5.29	7.90	1.09	1.54	0.84	135.40
SE±	0.32	0.22	1.23	0.47	0.34	-	21.30
LS[2]	***	***	**	***	***	ns	***
LSD	1.050	0.714	3.170	1.550	1.120	-	70.12

[1]SC1 = freezer, SC2 = refrigerator, SC3 = room temperature, LS[2] = Level of Significance (**-p< 0.01, ***-p<0.001), ns = not significant, TA = Titratable Acidity (lactic acid%), TML = Total Microbial Load (x10^6 cfu mL^{-1})

and microbial load of yoghurt. The titratable acidity value of 0.76, 0.78 and 0.80% lactic acid for fresh yoghurt stored in freezer, refrigerator and room temperature, respectively were statistically similar and did not significantly differ from that of the 7 days old yoghurt at the same storage condition. However, the values were significantly ($p<0.001$) different from those of 14 days old yoghurt stored under the three storage conditions. During the 21 days of storage the titratable acidity of yoghurt stored in freezer and refrigerator decreased, while that kept at room temperature tended to increase.

The pH values of fresh yoghurt stored at room temperature, refrigerator and freezer were 5.63, 5.63 and 5.59, respectively and differed significantly ($p<0.001$) with those of 7 and 14 days old yoghurt at the three storage conditions. The total solids showed a significant difference ($p<0.01$) between fresh, 7 days on one hand and 14 and 21 days of storage on the other hand. The total solids of yoghurt stored at room temperature (7.90%) were significantly lower than those of yoghurt stored in freezer (10.27%) and refrigerator (9.90%) at 21 days of storage. There was no statistical difference in the total fats due to storage condition in fresh, 7 and 14 days old yoghurt. However, at 21 days of storage, yoghurt at room temperature had lower fat content (1.09%) than that stored in the refrigerator (1.96%) and freezer (2.05%). The highest values for total protein of yoghurt were obtained on the three storage conditions on zero, 7 and 14 days old yoghurt, while the lowest values were obtained during 21 days of storage. There were no significant differences in the percentage ash contents of yoghurt stored under the three storage conditions. The total microbial loads of 7 days old yoghurt stored at room temperature (182×10^6 cfu mL^{-1}) were significantly ($p<0.001$) higher than those stored in the freezer (23.86×10^6 cfu mL^{-1}) and refrigerator (38.65×10^6 cfu mL^{-1}). The same trend was recorded on 14 and 21 days of storage.

Effect of storage condition on organoleptic properties of yoghurt produced from three base materials: The results of the effect of storage condition on the organoleptic properties of WCMY, PMY and SMY are shown in Table 2. The taste and aroma of PMY stored in a freezer (4.0 and 4.3, respectively) and refrigerator (3.4 and 3.5) rated between fair (3.0) and pleasant (4.0) were significantly ($p<0.01$) higher than those of yoghurt stored at room temperature rated fair (2.9 and 3.2). The taste of WCMY was rated between indifferent and fair at the three storage conditions, while that of SMY was rated indifferent. The colour of PMY stored in the freezer and refrigerator rated pleasant (4.6) and good (4.0), respectively were significantly ($p<0.01$) different from those of freezer stored and refrigerated (2.6) SMY both rated indifferent to fair. The same trend was recorded on aroma. The texture of PMY stored in the freezer and refrigerator rated good (4.3 and 3.9, respectively) were significantly ($p<0.01$) different from the lowest values of 2.4 and 2.3 obtained on WCMY and SMY, respectively stored at room temperature and rated indifferent.

The overall acceptability rating of the products followed the same trend as texture, colour and aroma with PMY stored in the freezer and refrigerator rating higher than those at room temperature. This was also the case with WCMY and SMY.

Table 2: Effect of storage condition on organoleptic properties of yoghurt produced from three base materials

Period of Storage	Base materials: Taste	Aroma	Colour	Texture	Overall acceptability
Whole cow milk					
SC1	2.8	3.2	3.2	2.6	2.7
SC2	2.4	2.6	3.3	2.9	2.6
SC3	2.3	2.4	2.8	2.4	2.3
Powdered milk					
SC1	4.0	4.3	4.6	4.3	4.0
SC2	3.4	3.5	4.0	3.9	3.5
SC3	2.9	3.2	3.5	3.5	3.0
Soymilk					
SC1	2.0	2.2	2.6	2.6	2.3
SC2	2.0	2.1	2.6	2.5	2.1
SC3	1.9	1.9	2.1	2.3	2.0
SE±	0.236	0.464	0.484	0.444	0.454
LS[2]	**	**	**	**	**
LSD	0.607	1.195	1.246	1.143	1.160

[1]SC1 = freezer, SC2 = refrigerator, SC3 = room temperature, LS[2] = Level of Significance (**-p<0.01)

Table 3: Effect of period of storage on physicochemical and microbial properties of yoghurt produced from three base materials

Period of storage (days)	Base materials: TA	pH	TS	TF	TP	Ash (%)	TML
Whole cow milk							
0	0.88	5.17	18.38	3.43	3.42	0.78	8.11
7	1.20	4.24	18.04	3.53	3.24	0.75	83.56
14	3.01	4.15	18.75	3.20	3.16	0.70	117.27
21	3.29	4.64	18.85	2.14	2.00	0.70	54.40
Powdered milk							
0	0.76	5.74	20.45	2.56	4.00	1.03	9.76
7	1.17	4.31	20.02	2.11	3.64	1.02	91.94
14	3.08	4.31	12.33	1.55	3.81	1.02	101.80
21	3.21	4.43	10.14	1.39	2.48	1.06	37.47
Soymilk							
0	0.76	5.94	16.64	2.37	4.13	0.69	2.18
7	1.08	4.67	16.54	2.28	3.25	0.68	69.09
14	2.51	4.74	11.26	2.05	2.71	0.69	97.65
21	1.50	5.07	9.13	1.57	2.06	0.67	91.76
SE±	0.26	0.18	1.00	0.12	0.28	0.05	17.40
LS[1]	***	***	***	***	***	***	***
LSD	0.86	0.58	3.30	3.30	0.92	0.18	57.25

LS[1] = Level of Significance (***-p<0.001), TA = Titratable Acidity (lactic acid%), TS = Total Solids (%), TF = Total Fats (%), TP = Total Protein (%), TML = Total Microbial Load (x 10^6 cfu mL^{-1})

Effect of period of storage on physicochemical properties and microbial load of yoghurt: The effect of period of storage on physicochemical properties and microbial load of yoghurt from the three base materials are shown in Table 3. The titratable acidity of freshly prepared WCMY (0.88%) and 7 days old WCMY (1.20%) which were statistically similar were significantly (p<0.001) lower than the 3.01 and 3.29% obtained on 14 and 21 days of storage, respectively. Similarly, the titratable acidity of freshly prepared PMY (0.76%) and 7 days old (1.17%) were lower (p<0.001) than 14 (3.08%) and 21 (3.21%) days old yoghurt. SMY showed similar trend, although a significantly lower value of 1.50% was recorded on day 21 and the highest value (2.51%) was obtained on day 14 of storage. The pH value of 5.94 obtained on fresh SMY was significantly different from 5.17 obtained on fresh WCMY. The 7 days old WCMY, PMY and SMY had significantly lower pH values of 4.24, 4.31 and 4.67 than for corresponding fresh yoghurt. SMY showed a significant (p<0.001) increase in pH value from 14-21 days of storage. The results also showed a significant difference on the total solids content of PMY between fresh (20.45%) and 7 days (20.02%) on one hand and 14 (12.33%) and 21 days (10.14%) old yoghurt on the other. However, no significant difference was obtained on the total solids of WCMY due to storage period. The total solid values recorded on SMY were significantly (p<0.001) lower than that of WCMY, which was similar to that of PMY at 21 days of storage. Higher (p<0.001) values of fat were recorded on fresh (3.43%) and 7 days old (3.53%) WCMY. Lower values of fat were recorded on PMY at 14 (1.55%) and 21 days (1.39%) of storage. The 1.57% fat obtained on SMY was statistically similar to the lowest values (1.39 and 1.55%) obtained on PMY. The percentage fat showed

a trend of decreased fat with increased period of storage. The highest total protein contents were obtained on fresh and 7 days old yoghurt for all the three base materials. The values were significantly ($p<0.001$) different from 14 and 21 days old WCMY, PMY and SMY. A significant ($p<0.001$) difference was obtained on percentage ash content with the higher values recorded on PMY (1.02-1.06%) and lower values recorded on WCMY (0.70-0.78%) and SMY (0.67-0.69%), which were statistically similar. No statistical difference was recorded on ash due to period of storage within each base material. The total microbial loads of WCMY and PMY were the highest at 7 days (83.56 and 117.27×10^6 cfu mL^{-1}) and 14 days (91.94 and 101.8×10^6 cfu mL^{-1}) of storage. The lowest values were obtained on fresh (8.11 and 54.40×10^6 cfu mL^{-1}) and 21 days (9.76 and 37.47×10^6 cfu mL^{-1}) old WCMY and PMY. However, the total microbial load of SMY was highest at 14 days (97.65×10^6 cfu mL^{-1}) and 21 days (91.76×10^6 cfu mL^{-1}) of storage and was significantly different from that recorded on the fresh (2.18×10^6) and 7 days (69.09×10^6 cfu mL^{-1}) old yoghurt.

Effect of period of storage on organoleptic properties of yoghurts: The effects of period of storage on organoleptic properties of yoghurt from the three base materials are shown in Table 4. The taste of fresh PMY, which was rated good (4.2) was significantly ($p<0.001$) different from that of fresh WCMY (2.6) and SMY (2.4) which were rated fair. The taste of 21 days old WCMY (2.4) and SMY (1.6) were rated fair and indifferent, respectively. The aroma of fresh PMY, which was rated good (4.5) after 21 days of storage significantly different from WCMY rated pleasant (3.2) and SMY rated fair (2.9). The colour ratings of SMY after 21 days of storage was significantly ($p<0.001$) the lowest and rated between poor (1.0) and indifferent (2.0) while that of fresh PMY was rated between pleasant (4.0) and good (5.0). The texture of PMY on day zero was rated between pleasant and good (4.5) which differed significantly ($p<0.001$) from 2.6 rating of WCMY which was similar to SMY rating (3.1). The texture of SMY was rated poor after 21 days of storage significantly different ($p<0.001$) from that of WCMY (2.6) and PMY (3.3) rated between fair and pleasant.

The physicochemical properties of yoghurt: The storage temperature determined the activity of microorganisms, which directly relates to the caseinates and phosphates that determined titratable acidity among other factors. The current results confirmed to the results of Laye *et al.* (1993), who reported titratable acidity change of 0.90-1.10% for refrigerated yoghurt samples after 6 days of storage. The pH of yoghurt samples decreased slightly to about 4.4 after 7 days and was maintained up to 14 days of storage for all the samples at the three storage conditions. The continued activity of β-galactosidase even at low temperatures and other bacterial metabolic enzymes might have caused the additional acid formation. The total solids of yoghurt on day zero and day 14 for all storage conditions differ significantly. Laye *et al.* (1993) reported decrease lactose concentration in all yoghurt samples studied during 12 days refrigerated storage.After 14 days of storage percentage total fat showed a marked decrease in samples stored at room temperature, which continued up to 21 days of storage. The yoghurt bacteria *S. thermophilus* and *L. bulgaricus* exhibit proteolytic activity, which causes bitterness in the absence of lactose especially for yoghurt sotred at warm (room) temperatures. There were no significant difference recorded on ash content, signifying little effect of storage condition or period of storage on mineral composition of yoghurt.

Microbial load: The total microbial load of fresh yoghurt shows no significant difference among the three storage conditions and ranged from 6.27×10^6-7.53×10^6 cfu mL^{-1}, which is adequate to generate the required acidity and flavour in the yoghurts (Harper and Hall, 1981). The total microbal load of yoghurt stored at room temperature

Table 4: Effect of period of storage on organoleptic properties of yoghurt produced from three base materials

Period of storage (days)	Base material				
	Taste	Aroma	Colour	Texture	Overall acceptability
Whole cow milk					
0	2.6	3.2	3.6	2.6	2.7
21	2.4	2.4	2.6	2.6	2.3
Powdered milk					
0	4.2	4.5	4.9	4.5	4.1
21	2.7	2.9	3.1	3.3	2.9
Soymilk					
0	2.4	2.9	3.3	3.1	2.6
21	1.6	2.6	1.6	1.8	1.7
SE±	0.385	0.379	0.375	0.360	0.370
LS	***	***	***	***	***
LSD	1.26	1.24	1.30	1.19	0.95

LS = Level of Significance (***-$p<0.001$)

increased to 182×10^6 cfu mL^{-1} after 7 days of storage significantly higher than 23.06×10^6 and 38.65×10^7 cfu mL^{-1} recorded on freezer and refrigerated yoghurts, respectively. The low temperatures of refrigeration and freezer inhibited the growth of the lactic acid bacteria, which gro well at temperatures between 20 and 40°C with a gneral optimum temperature of 30-32°C. Refrigerated storage resulted in gradual decrease of lactic bacteria in four different brands of yoghurt studied (Laye *et al*., 1993) and ranged from 11.6×10^6-66.9×10^7 cfu g^{-1} after 12 days of storage.

The microbial load continued to grow slightly up to 21 days of storage in a freezer and refrigerator probably due to fluctuation in power supply. However, the microbial load in yoghurt samples stored at room temperature continued to rise up to 14 days of storage and falls at 21 days of storage. The aerobic microorganisms are potential spoilage types and may have developed and caused various forms and degrees of off-flavour and spoilage observed during the 21 days storage of yoghurt at room temperature.

Organoleptic properties: The organoleptic parameters assessed on fresh PMY were rated higher than either WCMY or SMY, although the aroma and colour of WCMY were more acceptable than those of SMY. This could be due to the different properties of the base material than due to storage period. At 21 days of storage the organoleptic parameters assessed were rated lower than that at zero for all the yoghurts. The case of SMY was the most obvious and was rated between poor and indifferent at 21 days of storage. This could be due to the development of off-flavour and bitterness possibly due to rancidity. Mistry and Hassan (1992) reported that yoghurt produced with high milk protein powder (18.88-14.95%) lacked flavour and developed bitterness after 14 days of storage. Trachoo and Mistry (1998) reported similar results with lower score for flavour, overall acceptability, smoothness and sourness recorded on low fat yoghurt fortified with ultrafiltered butter milk. The taste perception of sourness often stimulates the feeling of astringency (Lederer *et al*., 1991). This relationship was demonstrated by the results of the organoleptic evaluation of SMY.

Effect of storage condition on the organoleptic properties of yoghurt: The taste and aroma of refrigerated and freezer stored PMY were rated higher than those of samples stored at room temperature. The same trend was observed with WCMY. This shows a combined effect of temperature of storage and base material on the taste of yoghrut. No significant effect due to storage condition was recorded on SMY for taste and aroma, signifying that the effect of the base material has masked the effect due to storage condition. Tamine and Rosbinson (1989) reported that yoghurt at a temperature below 10°C lacked flavour and losses its freshness when consumed.

The colour rating of PMY samples stored in the refrigerator and freezer were similar and better than those stored at room temperature. The high microbial activity in yoghurt stored at room temperature might have affected the colour ratings of the products, through its effect on light spectra scattering property of the yoghurt due to its effect on fats and protein.

The texture of PMY followed the same trend, with the refrigerated and freezer stored products rated higher than those stored at room temperature. The taste, aroma and colour of WCMY showed the same tendency. The temperatre at which a food is stored or fermented greatly infouence the rate of fermentation, the species of organisms involved and the microbiologically induced changes that occur. The overall acceptability ratings, which are combined effects of taste, aroma, colour and texture of the products of refrigerated or freeze stored yoghurt were higher than those stored at room temperature.

CONCLUSION

Based on the results obtained, it was concluded that yoghurt produced from whole cow milk, powdered milk and soymilk could be stored for up to 14 days in the refrigerator or freezer and for up to 7 days or less at room temperature without deliterious effects on the physicochemical, microbial and organoleptic properties of the product. It was recommended that yoghurt from the three base materials be kept in the refrigerator for not more than 7 days to maintain its freshness.

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