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EFFECT OF STORAGE PERIOD AND STORAGE CONDITION ON COMPOSITION AND MICROBIAL LOAD OF MILK.

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ABSTRACT

Thisstudy assessedthe gffect of-storageperiodandstoragecondition on composition andmicrobial loadofmilk Threethousand millitres Qffresh milk collectedfrom a Fulani cow rearedon extensivesystem. The milk collectedwas dividedinto 'hree (3) treatments. Each 'reatmenl consisltng ofnvenlyfouy• (24) nplicales. Each treatment was placed under differenl condition of storage: Freezer (-2(JC), Refrigerator (MC) and Room 'emperalure. Each week, three replicates were takenfrom each treatmenl and analyzedfor lhe protein content, fal contenl, Iota/ solids, moislure contenr and ash contenr (all in percentage). Also, the Titra'able acidity, Total viable bacteria count. Col(form count and Tolalyeast andmould count were evaluared.

Results showed that there was no significant change in percentage Iola/ solids. moisture content, protein Cc»üent, fat content and ash content Ofmilk samples stored in thefree:er.for thefirst three weeks #storage after which there was significant (p 05) change in allparamelers exceptforpercentagefat content. Milk samples stored in the refrigeralor recordeda decrease in percentage 'Olal solids, percentage protein content, ash content andfat -content While percentage moisture content inc-reused The changes observed in milk samples storedat room temperature Were similar 10 the changes recorded in samples stored in the refrigerator but 'he changes a' room temperature was pronounced. The microbial load Of milk samples stored in 'hefreezer recordeda sharp decrease Whi/o microbial 10adOfmilksamples kept in refrigerator androom temperatureshowed an acceleraled increase. Il can be concluded that slorage Ofmilk at room temperalure leads to high and rapid degradation of milk quality. Refrigeration as a condition Ofstoragefor raw milk is nol an effective way ofpreserving rhe quality ofmilk Therefore, milkshould be storedinfrozen condition loprevenl microbialm *ltipl ication* andpreserve milk qtlality.

Keywom•Milk,Microbialbüd, Fulani"w:

INTRODUCTION

Raw rnilk is a perishable item and milk, a rich source of nutrients, is susceptible to contamin ation by many microorganisms Including pathogenic microbes which can cause food-borne illnesses and are a threat to consumers' health_ However, milk has no protection from external contamination and can be contaminated easily when it is separated from the source animal (Rosenthal, 1991), Preservation or storage Of this nutritious drink is Often a problem to sellers and consumers alike. The sellers often fail to maintain the high quality of fresh milk in the process of passing it from the rural areas to the final consumers in the urban centers The most commonly used method is putting water hyacinthleaves in the milkaspreservative. 'Il-vismethodis highly unreliable and also renders the milk unhygienic, it often affects the quality of the milk (Rokhsana et al. 2007). To ensure milk quality. fresh milk should be handled under firm sanitary conditions, which results in low bacteria Counts, good appearance as well as acceptable flavor (Ismail et. al. 2010). Milk, if not handled properly, can serve as a potential vehicle for transmission of many diseases like tuberculosis CIT), brucellosis, diphtheria, anthrax, foot and mouth disease, hepatitis, Q -fever, listenosis salmonellosis, shigellosis, streptococcal infections, staphylococcal poisoning, E.coli polsoning and botulism (Oociries, 2012). Keeping the quality satisfactorily can bang about high nutritive value of milk which is free from disease producing organisms and foreign constituents preservation or storage should not adversely affect the nutritional characteristics of raw milk (Ismail et al. 2010). Since maintaining ml,lk quality is Of utmost importance to producer and consumer alike, this study aims to investigate different condition of Storage, period of Storage, and their effecton Inilk composition and microbialload.

Varied micro flora in raw milk may arise from several Sources, such as the exterior surfaces of the milk animals and the surfaces Ofmilkhandling equipment such asmilkingmachines, containers, etc (Burton, 1986). The health status of animals, the nature of their feed (forage, ensilage, etc.), and the storage conditions of raw milk arc also important factors that determine

the composition Of their microbial flora (Larfage et al. 2004). microbial load of milk is a major factor in determining Its quality. It indicates the hygienic level exercised during milking, that is, cleanliness of the milking utensils, condition of storage, manner of transport as well as the cleanliness Of the udder Of the individual animal (Asaminew and Eyassu, 2010). The main sources for the bacteria contamination of milk arc: interior of the udder as in case Of mastitis, outcr surface Of the udder, milk handling and storage equipments, milking and housing environment, health. status and hygienic conditions of the animal (Bramley and McKinnon, 1990). It has been obsen•ed that animals suffering from some udder infection usually shed 10^7 bacteria per ml of milk. If this milk is 1% of the total bulk milk, then disregarding the other sources, the total bacteria countof the bulk tank milk would be 10' per ml (Bramley and McKinnon, 1990, Ali et al. 2011). The bacteria which are naturally present on the milk Of animal entcr into milk from the surface of the udder and teats; these also include the bacteria which are present in milking and housing place Of the animals. According to Ali etal- (2011), this group of bacteria are natural flora and they have less contribution in the composite milk.

Of more concern are the microbes thatenter into the milk from teats soiled with manure, bedding, feed or mud; these havc more contribution to the total bacteria count of the milk (Bramlcy, 1982). High coliform count in milk is associated with manure, used bedding and barnyard mud, a total count Of 10^8-10' per gram had been obscrvcd in milk of animals raised on used beddings (Bramley and Mckinnon, 1990; Galton et al. 1984).Bacteria contamination Of milk resulting from milking equipment influences the total bacteria count Of milk more than any other factor (Ali et al. 2011). The milk drops left on the surface of milking equipment act as excellent media for the growth of a variety of microbes leading to high bacteria count in milk resulting from inadequately cleaned and sanitized inflations, milking claws, hoses, pipelines and bulk tanks (Shoiaei and Yadollahi, 2008).

MATERIALS AND METHODS

Experimental Site

The experiment was carried out in the Department of Animal Production and Health CAPII), College of Animal Science and Livestock Production (COLANIM), and Veterinary Microbiology Laboratory, Collegc of Veterinary Medicine of the Federal University Of Agriculture Abeokuta (FUNAAB), Ogun State. Nigeria. Storage was carried out in the Animal product processing laboratory, chemical composition analysis took place in the Feed Quality laboratory of APH Department while the microbiological analysis done in the Veterinary Microbiology Iaboratory.

Experimental procedures

Three thousand millitres of fresh milk was collected (using thc hand milking method) from white Fulani cow of second parity reared on extensive system by Fulani herdsmen in Alabata area, Odeda local government area, Ogun State. The milk collected was divided into three (3) treatments consisting Of twenty four replicates each. Onc treatment was stored in a frcczer (-2ffC);

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another treatment was stored in the refrigerator (8^00 While the third treatment was kept at room temperature (37'C) for five (5) weeks. The milk samples wcrc stored in small sterilized plastic bottles of 20 ml. Each week, three replicates '*ere taken from each of the treatments and analyzed.

Analytical Procedures for Chemical and Microbiological Analyses of Milk protein, Fat, Total solids. Moisture, Ash, were analyzed using the AOAC (1990) analysis procedures

Total Viable Bacteria Count: Nutrient agar was sterilized by autoclaving at 121 "C for 15 minutes and cooled to about 45'C Iml of milk sample was added into sterile test tube containing 9mIs of Normal Saline. After thorough mixing, the sample was serially diluted up to 1:10"'. Sample was surface plated on 1520ml Nutrient agar and allowed to absorb The plated sample was allowcd to solidify and then incubated at 37'C for 24 hours Colony countingwas carried out by microscopic examination.

Coliform Count: Mac Conkey agar was sterilized by autoclaving at 121 • C for 15 minutes and cooled to about 45"C. Iml of milk sample was added into sterile test tube containing 9mls of Normal Saline. After through mixing, the samplc was serially diluted up to 1:10'º. Sample '-vas surface plated using 15-20mls Mac Conkcy agar solution and allowed to absorb. The plated sample was allowed to solidify and then incubated at 3TC for 24 hours. Colony counting was carried out by microscopic

exammanon.

Total Mould and Yeast Count: potato Dextrose agar (PDA)wassterilized by autoclaving at 121 "C for 15 minutes and cooled to about 45"C. ml of milk sample was added into sterile test tube containing 9mls Of Normal Saline water. After through mixing, the sample was serially diluted up to Sarnple was surface plated using 15-20mIs Potato Dextrose agar solution and allowed to absorb. The plated sample was allowed to solidify and then incubated at room temperature for 48 hours. Colony counting was carried out by microscopic examination.

StatisticalAnalysis

D'ta collected were subjected to two way Analysis Of Variance using SAS for win&ow (SAS 1999) and the means were separated usingDuncan'sMul tiplc Range Test.RESULTS The main e ffect of Storage condition on milk composition Table I shows the main effect of Storagc condition on milk composition. Thc mean values for total solid ranged from 11.54±0.83 to 16.47±0.20 with milk samples stored at room temperature having the lowest mean value while milk samples stored in thc freezer recorded thc highestmean value. Moisture

content however showed a re•rrse trend With the mean values ranging from 83.53±0.20 at freezer temperature to 88-46±0.83 at room temperature. The protein content showed the highest mean value of 25.24±4.64 at room temperature while that of the freezer (l .98±0.05) was the lowest among the treatments.

The mean value of 0.99±0.00 for milk samples stored in the freezer was significantly (13<0.05) different from the mean value of 0.96±0.01 obtained at room temperaturc for ash Content; samples stored in the refrigerator also show-cd a significant difference in mean value (0.90±0.02) for ash content. Significant (P<O.05) diffcrengc was also observed among treatments for the far content with milk samples stored in the frcczcr showing thc highest mean valuc of 8.00±0.00 while the lowest mean value of 6.25±0.32 •vas recorded for samples stored at room temperature. Samples stored at room temperature showed the highest mean value of 5.70±1.31 for titratable acidity while Milk samples stored in the freezer showed the lowest mean valve (0.24±0.01).

.05)

Main effect Of storage period on milk composition

Table 4shows thc cffcctOf Storageperiod on milk composition. Wcck I showed the highest mean value (16.99±0.00) for total solids while the lowest mean value (I I .61 ± .06) was observed ar week 5 of storage. Mean value for percentage moisture content was lowest (83.01±0.00) at week while the highest mean value (88.39±1.06) was recorded at week 5 of Storage. Mean value for Ash was lowest at week 5 Of Storage (0.89±0.03) and highest at week I Of Storage (1.00±0.00). Lowest mean value (6.89±0.51) for fatwas recorded at week 5 of storage while the highest mean value (7.99±0.01) was obtained at week I Of Storage. Also there Was significant (11<0.05) difference for mean values for titratablc acidity for all week of storage. The mean values for protein content were also significantly (P<O.05) different among week Of Storage With the highest value (19.03±7.71) occurring at week 5 Of storage and the least value (2.12±0.00) being recorded at week I of storage.

Interactive effect of condition Of storage and period of storage on milk composition

The interactive effect Of Storage condition and period on milk composition is presented in Table 5. For milk samples stored in the freezer, there '"as no significant (P<O.OS) change in percentage total solid from week I of storage till week 3 of storage. However from week 4 Of Storage, there was a significant (P<0.05) decrease in percentage total solid (17.00% at week 3) till week 5 of storage (15.060/0)Thc decline in the Total solid content of milk samples stored in the refrigerator was more pronounced going from 16.99% at week I to 12.02% at-week 5 of storage.The most drastic change in percentage total solid was recorded for milk samples stored at room temperature, showing a significant decrease from 17.(HP/o at week I to 7.75% at week 5 Of Storage. The Moisture content followed a reversed trend to that Of Total solid in each treatment (increasing With week of storage and with decrease in Total solid, from 83.01% at Week I to 84.94% at week 5 for milk samples stored in the freezer, 83.01% at week I to 87.98% at week 5 for milk samples stored in the refrigerator and from 83.00% at week I to 92.25% at week 5 for milk samples stored at room temperature). The protein content however showcd a peculiar trcnd in that thcrc was no significant (P<O.05) change in percentage composition from week I of storage to week 3 of Storage in milk samples stored in the frcczcr (2.12%), after the third wcck however, thcrc was a gradual decline in percentage composition to 1.71% at week 5 of storage. Milk samples stored in the refrigerator on the other hand showed a gradual and significant (P<O.05) increase in percentage protein composition from 213% at week I to 5.59% at Wcck 5. Milk samples stored at room temperature showed a similar trend as that of milk samples stored in the refrigerator with a significant (P<O.05) increase from 2.130/0 at week I to 49.80% at week 5. There was a significant decline in percentage ash content in all treatments except milk samples stored in the freezer which showed no significant (13<0.05) change forash content fromweek I toweek 3.The Fat content remained Constant throughout thc (P<0 period of Storage in Milk samples stored in the freezer. A slight decrcasc in Fat content observed in Milk samples stored in the refrigerato r while a more significant (P<O.05) decline was recorded in Milk samples stored at room temperature. For titratablc acidity, the value for Milk samples stored in the freezer showed no significant (P<O.05) change throughout the period of storage except at week 5. Milk samples stored in the refrigerator however showed a gradual and significant (P<O.05) increase from 0.22 at week I to I. 17 atweek 5, increase was also recorded in titratable acidity for Milk samples stored at room temperature but thc increase recorded was significantly (13<0.05) highcr than that of milk samples stored in the refrigerator.

Table I: The main effect of storage condition on milk composition

Parameters (/0)			Refrig erator	Room
Total solid			13.62±0.485	11.54±0.83'
Moisture		83.53±0.20C	86.38±0.48b	88.46±0.83'
Protein		1 .9E0.05C	4.55+0.33b	25.24+4.64a
Ash		0.99±0.00[a]	0.90+0.0*	0.96±0.01"
Fat	8.00±0.ooa	7.95±0.02b	6.25±0.32C T. acidity 0.24±0.mc	0.75±0.11b
	5.70±1.31'			

Means of the same row with different superscript are significantly (P<O.05) different

Table 2: The main effect of storage period on milk composition

Parameters (%)	Week I	Week 2	Week 3	Week 4	Week 5
Total solid	16.99±0.ooa	70	13.57±0.89c	12.81±0.96	11.61±1.06e
Moisture	83.01±0.ooc	85.59±0.70d	86.43±0.89C	87.19±0.96b	88.39±1.06[a]
Protein	2.12±0.ooe	6.18± .44[d]	10.31±3.39C	15.30±5.90b	19.03±7.71a
Ash	1.00±0.ooa	0.99±0.00b	0.95±0.0?	0.93±0.02d	0.89±0.03C
Fat	7.99±0.01[a]	7.72±0.14b	7.36±0.32C	7.03±0.47d	6.89±0.51e
T. Acidity	0.22±0.ooe	0.72±0.23d	1.83±0.62C	3.39±1.38b	4.98±2.13[a]

[b•C]

Means of the same row with different superscript are significantly (P<0.05) different

Table 3: The interaction effect of storage condition and storage period on milk composition

		Week 1	Week 2	Week 3	Week 4	Week 5
Total solid	Freezer	16.99±0.01a	17.00±0.01 [a]	17.00±0.ooa	16.32±0.01 [b]	15.06±0.03C
	Fridge	16.99±0.02	14.00±0.01 [d]	12.71±0.01e	12.38±0.01 [f]	12.02±0.01h
	Room	17.00±0.01[a]	12.24±0.01 [g]	11.01±0.011	9.73±0.02j	7.75±0.ook
Moisture	Freezer	83.01±0.01k	83.00±0.01 k	83.00±0.ook	83.68±0.01j	84.94±0.03[i]
	Fridge	83.01±0.02[k]	86.00±0.01h	87.29±0.01d	87.62±0.01f	87.98±0.01d
	Room	83.00±0.01k	87.76±0.01e	88.99±0.01C	90.27±0.02b	92.25±0.0?
Protein	Freezer	2.12±0.001	2.12±0.001	2.12±0.001	1.82±0.00)	1.71±0.01j
	Fridge	2.13±0.001	4.69±0.01[h]	5.06±0.01g	5.28±0.01f	5.59±0.ooe
	Room	2.13±0.001	11.73±0.01d	23.74±0.01C	38.80±0.01b	49.80±0.15 [a]
Ash	Freezer	I • 00±0.00a	1.00±0.00[a]	1.00±0.ooa	0.99±0.00b	0.98±0.ooc
	Fridge	1.00±0.00[a]	0.99±0.00b	0.89±0.oog	0.85±0.ooh	0.79±0.001
	Room	I .00±0.oo [a]	0.99±0.oob	0.97±0.00d	0.95±0.ooe	0.90±0.00f
Fat	Freezer	8.00-æc.or	8.00±0.01[a]	8.00±0.ooa	8.00±0.02	8.00±0.ooa
	Fridge	7.99±0.0?	.99±0.01	7.98±0.01 a	7.95±0.ma	7.82±0.01 [b]
	Room	7.99±0.04[a]	7.16±0.01 c	6.10±0.ood	5.15±0.0?	4.86±0.02[f]
T. acidity	Freezer	0.22±0.001	0.22±0.001	0.22±0.001	0.25±0.001	0.29±0.00h

Fridge	0.22±0.001	0.32±0.ooh	0.99±0.oog	1 .03±o.01 [f]	1.17±0.ooe
Room .	0.22±0.001	1.63±0.ood	4.28±0.01C	8.90±0.01 [b]	13.48±0.04a

Means of the same row with different superscript are significantly (P<0.05) different

Effect of storage condition and period on Total Viable Bacteria Count

The effect of Storage condition and period on Total Viable Bacteria Count is presented in Figure I. For Milk samples stored in freezer, a sharp decrease fwm 4.6xIlj• colonies pcr ml at week Of storage to O colonies per ml at •veek 2 was observed. This later increased to I .7XlO" at week 3 of Storage before going back to zero. For Milk samples stored in refrigerator on the other hand, a gradual increase from 4.6Xlfj• at week I to 3.2XlO^{l} ' at week 5 of storage. Milk samples stored at room temperature (Room) however showed an increase from 4.6XIO^{i} ' at week I to 7.0XlO' atwcc.k5 of storage.

Effect Of storage condition and period on Coliform COunt Figure 2 show the effect of storage condition and period On coliform count Of milk. Milk samples stored in freezer showed decline from i×10^{m} at week I to O at week 2 and later from O at week 2 to 5X 10$^{'o}$ at Week 3 before dropping back to O colonies per ml. Milk samples stored in refrigerator showed a steady increase from 6x I O"' at week I to 3.3x atwcck4. From week 4 however, no change was obså•rved. For Milk samples stored at room tcmperature, an increase from at week I to 2.4xI coloniesper ml vasobserved.

Effect of storage condition andperiod on Total Mould and Yeast Count

Figure 3 present the effect of storage condition and period on total mould and yeastcount per mlof milk. Milk samples stored in freezer showed a similar trend as observed for Total viable bacteria count and coliform count- Milk samples stored in refrigerator however showed no particular trend of change while Milk samples stored at room temperature showed a steady increase from 1.1 X ID' at week I to I AX 10^{12} at week 5 Of Storage.

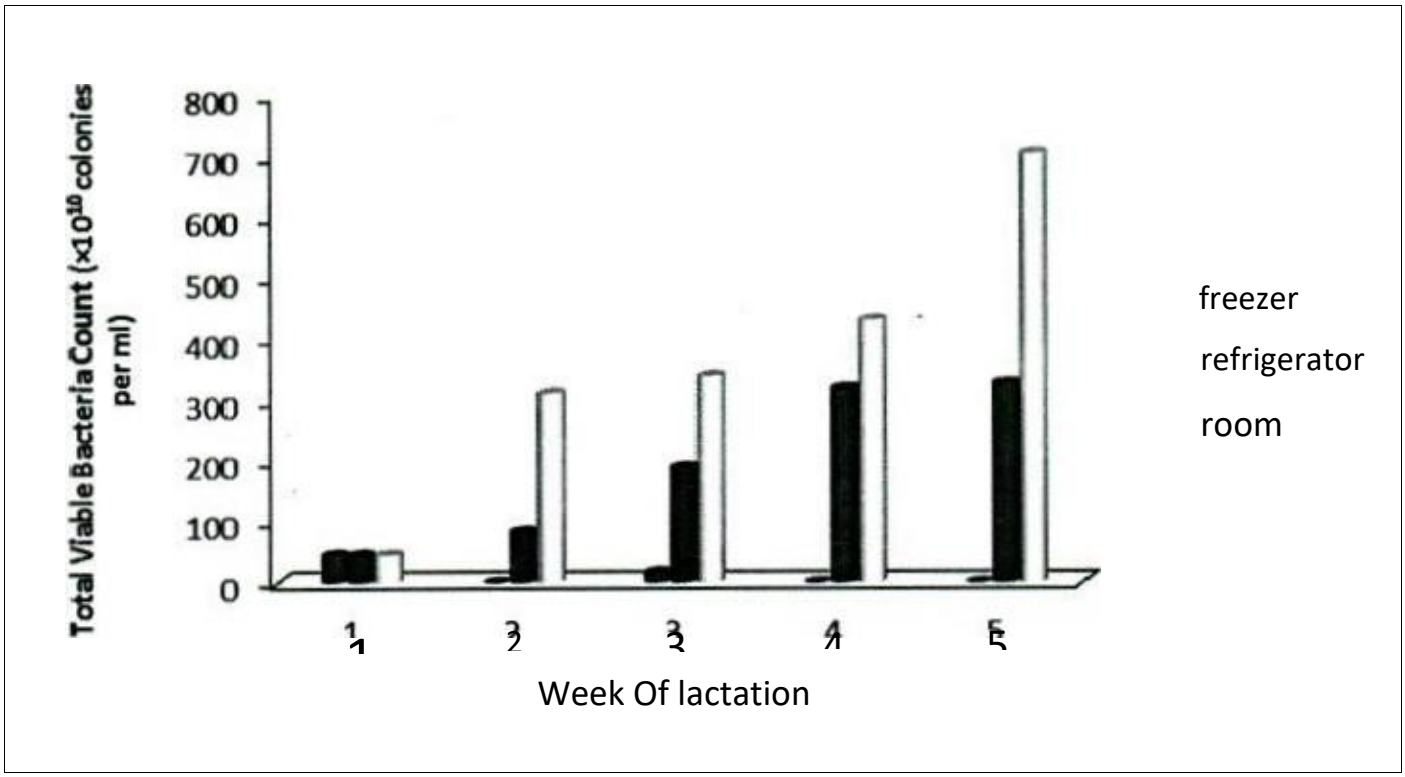

Figure I : Effect of storage condition and period on Total Viable Bacteria Count (x 1 colonies per ml)

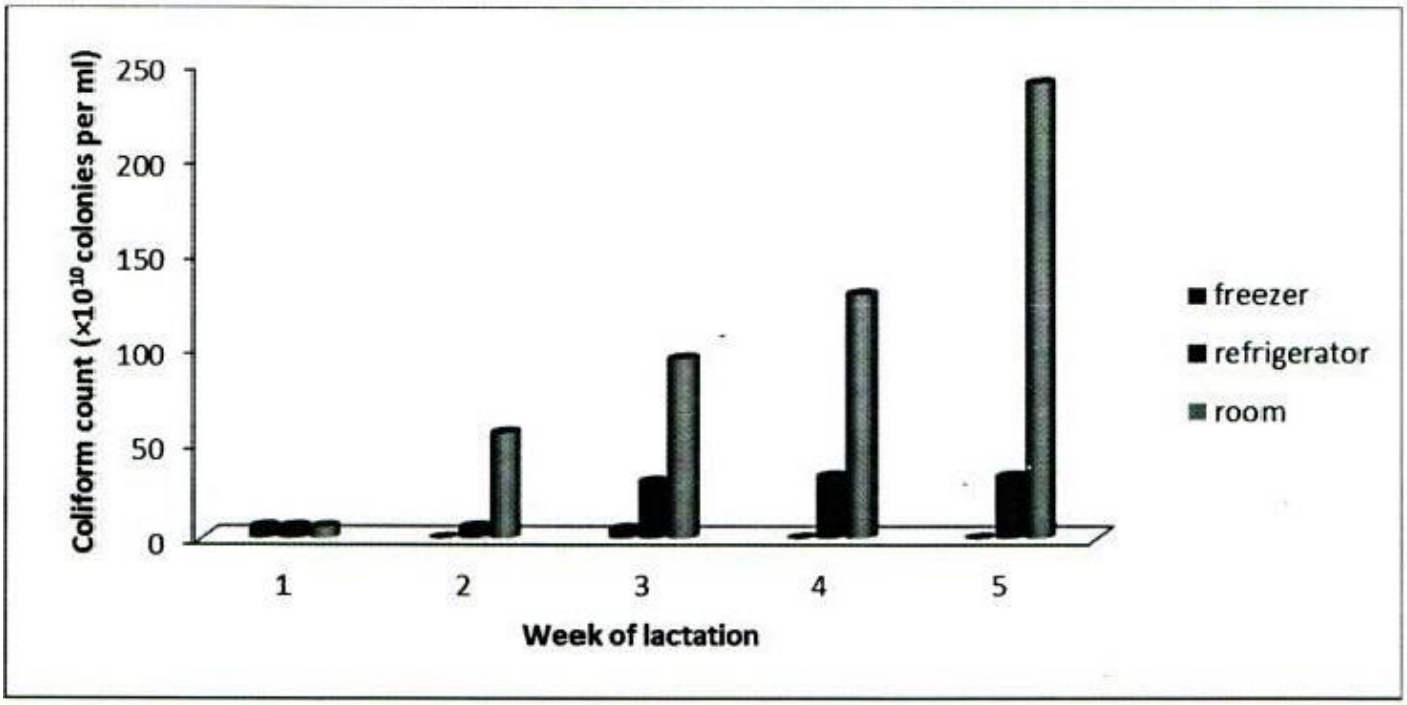

Figure 2: Effect of storage condition and period on Coliform count (x 10^{10} colonies per ml)

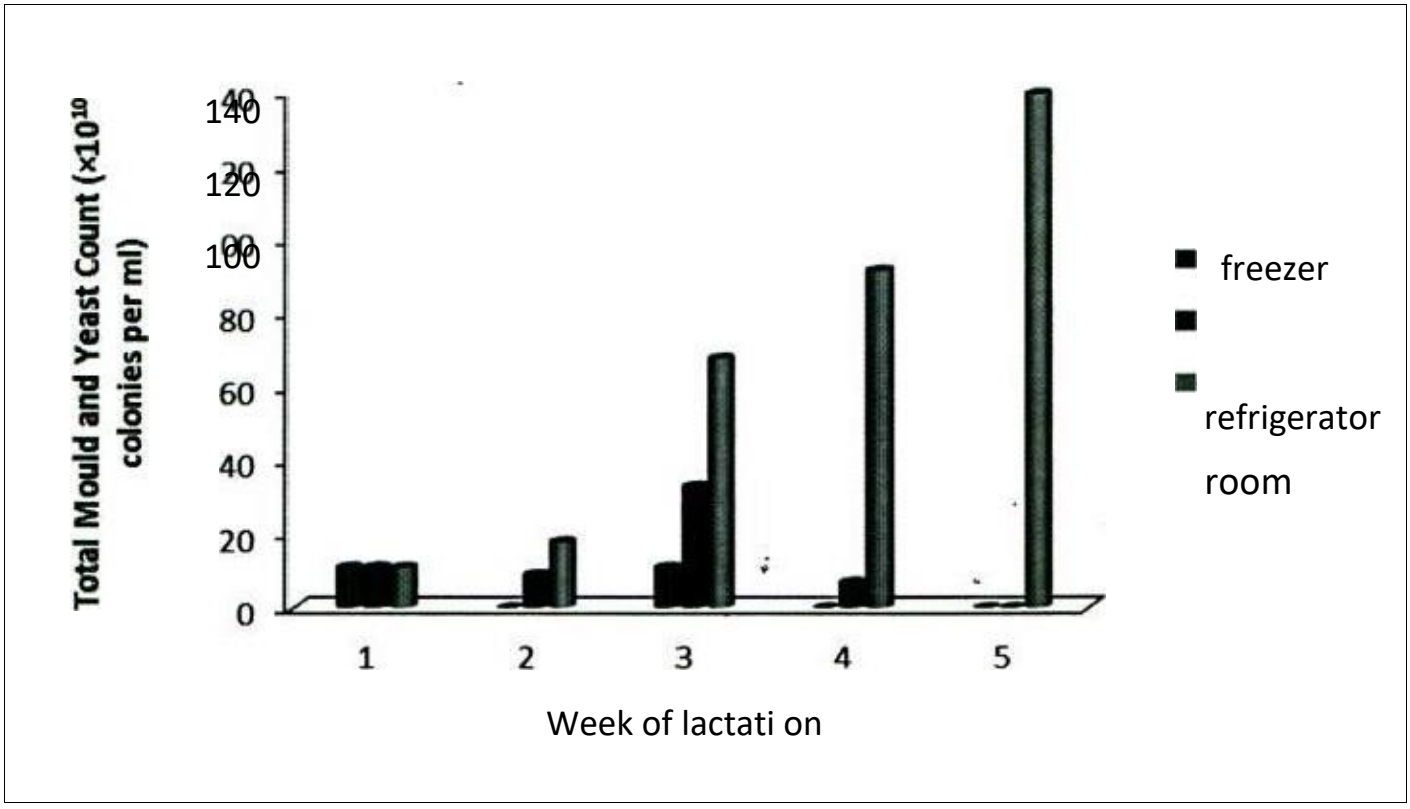

Figure 3: Effect of storage condition and period on Total Mould and Yeast Coum (x I O^H colonies per ml)

DISCUSSION

This study aimed at investigating the effect Of storage condi tion and storage period on composition and microbial load of milk. Thc compositional profile of milk observed was similar to rhe profile shown by Bahman et al, (2012) who reported that the composition Of fresh analyzed samples at room temperature varied for different components Of milk: water (83.2-90.30/,'), total solids (9.97-16.8%), fat (1.31-6.08%), crudc protcin (2.33.4%), and lactose (3.5-6.1"/0). It is also similar to those reported earlier by Walstra et al. (2006) although the values obtained in this study were slightly different, the difference in composition may be caused by many factors including nutrition and management practices.

The gradual change in thc pcrccntagc compositions of these parameters is in line with the report Of Sanchez et al. (2005) who reported a significant change in percentagc composition of all components Of milk stored at freezer temperature after 105 davs of storage except for fat content which showed little or no Significant Change in its percentage composition in milk. For moisturc content, an increase was obscrvcd while a decrease was recorded for protein content and ash content respectively. However, the percentage fat Content more or less showed no change aftcr 5 wccks of storage. Thc result obtained for percentage composition Of fat in milk at freezer temperature goes hand hand With the reports Of previous researchers like Friend ct al, (1983) who recorded a decrease that is not statistically significant, Tacken et al, (2009) who recorded no change, and Sanchez ct al. (2005) who also recorded no change in pcrccntagc composition Of fat in milk with storage at Freezer temperature (-200. result however negates the work of Lee et al. (1986) who reported an increase in percentage composition Of fat in milk kept at freezer temperature.

The percentage composition at refrigeration temperature agrccs with the results of Bahrnan et al. (2012) who recorded a similar change in total solid (13.7% to 11.2% after twenty four hours of storage), moisture content (86.3% to 88.8% after twenty four hours of storage), protein (3.10/0 to 3.2% after 24h). However, the changes observed for ash content of milk samples stored in the refrigerator disagrees With the work of the samc authorwho recorded an increase in ash content (from 0.56% to 0.810/0 after 24h Of storage). Decrease was also recorded in milk fat percentagc composition (8. I(P/o to 7.73%) which is also validated by result obtatncd by Bahman et al. (2012) although they recorded a faster rate Of decrease which may bc duc to the fact that they removed thc fat layer on the milk before carrying out their analysis. The result Of Ismail et al. (2010) also supports the Incrcasc rccordcd in titratablc acidity and protein content because they also recorded similar changes in titratablc acidity and protcln composition of milk (O. to 0.16% and 3.76% to 3.78% respectively after 24 hours Of storage) stored at refrigeration temperature although with shorter storage period than as studied in this umrk. These Changes in compositional profile Of milk during storage at refrigerator temperature however contradict the findings of Zcng ct al. (2007) who recorded no change in percentage composition of milk store at refrigeration temperaturc for seven (7) days. This could bc due to the constant rcfrigcration temperature by constant power supply and a lower refrigeration temperature.

The changes observed in percentage composition of milk at room temperature agree with the finding of Bahman ct al. (2012) except in the case of ash content which does not correspond with thc result obtained by this author (86.3% to 88.9%, 13.7% to 11.1%, 4.6% 3.1% to andO.73'/n to 0.86% for percentage composition of moisture, total solid, fat, protein and ash respectively after 24h of storagc at room temperature. The discrepancy may be due to a shorter time frame used by the author (24h). sharp increase however recorded for protein content may be due to high level of non protein nitrogen in milk samples since milk nitrogen comprises of protein nitrogen and non-protein nitrogen and since ammonia is a source of non protein nitrogen (FUNAAB, 2013) is as a result of high incidence of microbial activity (ammonia is a metabolite of microbial activity) . This is bccausc proximate analysis for protein is based on the amount of nitrogen In the sample (Research, 2013).

The microbiological profile Of milk stored at freezer temperature was greatly improved in that dcath of all micro organisms (total viable bacteria count, coliform count and total mould and yeast count) was recorded after one week of Storage. This agrees with the findings of Dcodhar andJoshi (1991) who also recorded progressive decrease Of all organisms in milk samples after five days of freezing milk samples. However, a slight growth of bacteria population (1.7 XIO" colonies per ml) was observed at third week of storage which later reverted back to zero by the following week. This increase in population may have bccn duc to unstable power supply which may have lead to rise in temperature in the freezer which would have encouraged bacteria .

A gradual but steady increase at refrigeration from 4.6 x to 3.2x was observed in total viable bacteria count Of milk samples. This is similar to the results obtained by perko, (2011) who reported an increase from to 580x Gaikvad and Hembade, (2012) who recorded an increase from 69x IO' to 5.3x after 5 days of refrigeration and Agarwal et al, (2012) who reported a rapid increase of milk samples after 6 h Of storage. Coliform count of milk samples stored at rcfr*razion temperature showed an increase from 6x to 3.3XIO^{t} at the -5— wcck of storage. A slight decrease was observed tool mould and yeast count after onc week of storage ami thÉ4recs with the observations of Slutzal et al. (2010) who recorded a decrease (2.9 to 1.6XIO^{i} colony per ml.) in mould and yeast count after 96 hours of storage. The accelerated increase in all microbial parameters at room temperature from 46 to 704XlO'"cml, 6 to 240x 10'" and I I to 140x for total viable bacteria count, coliform count and total mould and yeast count

and

after 5 weeks of storage) corroborates the report of Agar.val ct al, (2012) who reported a manifold increase at room tureafter 24 h.

CONCLUSION

It can be concluded that there was a gradual decline in percentage composition of milk as period of storage increases. Raw milk Can be stored at frozen condition for up to three weeks and possibly longer with a steady power supply without much declinc in compositional quality. Furthermore, storage Of milk at freezer temperature for more than a Week can be used as a way of improving the microbial quality Of raw milk. However. refrigeration as a condition Of storage for raw milk is not an effective way Of preserving thc quality Of milk either compositionally or microbiologically for more than a period of onc week. This study also shows that storagc of milk at room temperature leads to high and rapid degradation Of milk quality and compositional profile.

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