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Effect of Source, Season, Daily Practices and Hygiene on Cow's Milk Quality in Khartoum State

اثر المصدر و الموسم و الممارسات اليومية و النظافة على جودة لبن الابقار بولاية الخرطوم

Submitted By

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Dedication

To my beloved father Musa who taught me right from wrong?

To my lovely mother Hawaa Adam for her endless giving

To my Brothers

To my sweaty sisters

To my lovely wife and sons

To my widely family

With deep love and respect

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Abstract

The study performed during the period from February /2018 to February /2020 to assess the effect of the (sources and seasons) on cow's milk quality,to investigate the milk that distributed from dairy farms to groceries, to highlight the major hygiene practices on milk quality and to study on some milk physicochemical and microbiological characteristics in (raw and heated) of cow's milk in Khartoum State.Two structures questionnaires (A and B) were distributed randomly to 60 dairy farms and 60 groceries shop keepers respectively. The questionnaire A had seven themes (personal information, housing management, milking management, (labors and manure management), nutrition management, (animal disease and health) and milk distribution) and the questionnaire B had four themes (personal information, milk sources, milk heating and milk marketing). A total of 120 samples of milk were collected from three sources (dairy farms=40), (collection centers=40) and (groceries=40) during summer and autumn season. Samples were subjected to physicochemical analysis the (fat, protein, lactose, total solids, pH and added water) by Lactoskan and total bacteria count (TBC). A total of 48 swab samples were collected from different farms (milkers hands=24) and (milk utensils=24) during summer and autumn season, the samples were subjected to total bacterial count.The data collected was analyzed using (SPSS, version 16, 2007) the questionnaire data analyzed by using the chi-square, general linear model (factorial analysis 3X2) used to estimate the effect of (source and season) and least significant difference (LSD) for mean superscripts and Independent T test was done using for milk added water, the correlation model was used to appearance the relationship between the total bacteria count with (milkers hands and utensils bacteria count) and milk physicochemical.The results obtained showed that, general hygiene and sanitation measures such as use of insecticides, disinfectants and periodic detection of mastitis in dairy farms were significantly ($P < 0.05$) affected by the education level of owners. Cleaning of barns, Times of milking per day, labour's health certificates, Times feed offered per day, method used in getting rid of dead

animals and periodic detection of mastitis were significantly ($p < 0.05$) affected by owner's job. The level of education had significant ($p < 0.05$) effect on mediator committed to health and gets rid of abnormal milk. Type of milk utensils (collecting in and store) and use of any additions to milk were significantly ($p < 0.05$) affected by shop keeper's job. The age grouping had significant ($p < 0.05$) effect on milk source, milk equipment carry on and abnormal milk get rid. On the other hand, the protein, lactose and added water were significantly affected by source of milk and milk fat, protein, lactose, total solids and TBC were significantly affected by season. A significant interaction between (source and season) was obtained for milk fat, protein, lactose and total solids. The added water had highly significant ($p < 0.000$) effect on (fat, protein, lactose and total solids).The milk fat and total solids were significantly ($p < 0.05$) affected by the milk total Bacterial count while the milk protein, lactose and pH were significantly ($p < 0.05$) affected by milk added water. Education and experience were the main factors that affect the hygienic milk production in dairy farms and groceries.The physicochemical of cow's milk (fat, protein, lactose, total solids, and pH) were significantly affected by (seasonal changes and added water) and all were lower in summer. The milk collected from dairy farms was highly quality than milk collected from other sources.

المستخلص

الدراسة صممت فى الفترة من فبراير/ 2018 و حتى فبراير/ 2020 . لتقييم اثر مصادر الالبان و المواسم على جودة لبن الابقار الخام و المعالج حراريا. للتحقق من الالبان الموزعة من المزارع الى البقالات و لابراز اهم ممارسات النظافة العامة تاثر على جودة اللبن و للدراسة على بعض الصفات الفيزيائية و الكيميائية الاحيائية فى لبن الابقار الخام و المعالج حراريا فى ولاية الخرطوم. و هنالك نوعان من الاستبيان أ و ب وزعت عشوائيا ل 60 مزرعة البان و 60 لبائعين بقالات على التوالى. الاستبيان أ يحتوى على سبعة محاور معلومات شخصية و ادارة الاسكان و ادارة الحلب و ادارة العمال و الروث و ادارة التغذية و الصحية وامراض الحيوان و توزيع اللبن. والاستبيان ب يحتوى على اربعة محاور معلومات شخصية و مصادر اللبن و تسخين اللبن وتسويق اللبن. و على صعيد اخر 120 عينة من اللبن جمعت من ثلاثة مصادر مختلفة و هى مزارع الالبان= 40 و مراكز تجميع الالبان= 40 و البقالات= 40 فى موسم الصيف والخريف.و العينات خضعت لتحليل فيزيائ و كيميائ للدهن و البروتين و اللاكتوز و المواد الصلبة والاس الهيدروجينى و الماء المضافة , بواسطة جهاز اللاكتوزكان و بينما بالعد البكتيرى لحساب البكتريا. و تم جمع 48 عينة اسواب من ستة مزارع البان مختلفة من ايدى العمال 24 و اوانى الحلب 24 فى موسم الصيف و الخريف و العينات خضعت للعد البكتيرى. و باستخدام برنامج الحزمة الاحصائية للعلوم الاجتمائية. تم تحليل بيانات الاستبيانات باستخدام مربع كاى و النموذج الخطى العام استخدم لتقدير اثر المصادر و المواسم و Independent T test استخدم لفرز عينات لبن مضاف لها ماء و نموذج الارتباط استخدم لاظهار العلاقة بين بكتريا عينات اللبن وبين بكتريا من عينات اسواب و مع بعض مكونات اللبن الفيزيائية والكيميائية . اوضحت النتائج ان ممارسات النظافة العامة و تصريف المجارى كاستخدام المبيدات الحشرية والمطهرات والكشف الدوري لالتهاب الضرع تاثرت معنويا بالمستوى التعليمي المربين. بالاضافة لتنظيف المحلب و عدد مرات الحلب فى اليوم واستخراج الشهادات الصحية للعمال و عدد مرات تقدم فيها العليقة فى اليوم و الطرق المستخدمة في التخلص من الحيوانات النافقة و الكشف الدوري لالتهاب الضرع تأثرت معنويا بمهنة المربي. كما اثرمستوى التعليم معنويا على الوسيط الملتزم بضوابط صحية و طرق التخلص من الالبان الغير طبيعية. انواع اوانى اللبن للجمع و التخزين و استخدام اضافات للبن تاثرت معنويا بمهنة صاحب البقالة. العمر اثر معنويا على مصادر اللبن واوانى تخزين اللبن و

طرق التخلص من الالبان الغير طبيعية.واظهرت النتائج بان كل من البروتين و اللاكتوز و اضافة ماء لهم اثر معنوى بتاثير مصادر الالبان بينما الدهن و البروتين واللاكتوز و المواد الصلبة و العدد البكتيرى اثر معنوى بتاثير الموسم. بالاضافة الى التفاعلات بين المصادر و المواسم اثرت معنويا على الدهن و البروتين واللاكتوز والمواد الصلبة. و لاضافة الماء فى اللبن اثر معنوى عالى على الدهن و البروتين و اللاكتوز و المواد الصلبة. كما تاثرت دهن اللبن و المواد الصلبة معنويا ببكتيريا اللبن و بينما بروتين اللبن و اللاكتوز و الاس الهيدروجينى للبن تاثرت معنويا باضافة الماء فى اللبن. مستوى التعليم و الخبرة اكثر العوامل تاثيرا على النظافة العامة فى مزارع الالبان والبقالات. العناصر الفيزيائية و الكيميائية للبن مثل الدهن و البروتين و اللاكتوز و المواد الصلبة والاس الهيدروجينى تاثرت معنويا بالتغيرات الموسمية و الماء المضاف فى اللبن. الالبان المنتجة مباشرة من مزارع الالبان اكثر جودة من الالبان فى مراكز التجميع و البقالات.

CHAPTER I

Introduction

The local breeds in Sudan belong to the group of North Sudan Zebu (McDowell, 1972) and (Sudanimals, 2006). The Butana, Kenana and Baggara are multipurpose breeds that are used for milk and meat production as well as draught power (Payne, and Hodges 1997). The Butana and kenana breeds were considered to be the best milk producer of the Sudanese zebu breeds (Sudanimals, 2006).

Milk is the product of the total, full and uninterrupted milking of a dairy female in good health, also nourished and not overworked. It must be collected properly and not contain colostrums (Adib, and Bertrand, 2009). Milk is a whitish food generally produced by the mammary secretary cells of females in a process called lactation; it is one of the defining characteristics of mammals. The milk produced by the glands is contained in the udder. Milk secreted in the first days after parturition is called colostrums (Kebchaoui, 2012). The quality of milk is paramount; therefore, it must be properly stored and transported in optimalconditions (Roux , *et al,* 1995).The milk production of Sudanese indigenous cattle breeds; Kenana and Butana *(B.indicus)* were found to be lower than that of Holstein Friesian cattle *(B.taurus),* even under the same climatic conditions (Ageeb, and Hayes, 2005). Milk is an essential food for human. The majority of milk consumed throughout the world is bovine milk. It is often described as a complete food because it contains all essential nutrients e.g. protein, carbohydrate in the form of lactose, fat, vitamins and minerals (Komorowski, and Early, 1992).Milk is a nutrient fluid produced by the mammary gland of manymammals for the nourishment of their young; this liquid containsproteins, fats, lactose, various vitamins and minerals,milk

and dairyproducts are particular good sources of many nutrients like calcium whichis essential for bone growth, a source of conjugated linoleic acid, fattyacid that inhibits skin cancer, colon cancer and breast cancer. Sudan produces 7.1 million tons of milk per year. Most of milk comes fromindigenous cattle zebu and up to 90% of milk animals are found innomadic areas (FAO, 2002).Milk production, exists a large variety of Sudanese milk producing, cows which lend themselves to further genetic improvement for increasing milk production, such as Kennan and Bottana herds in addition to cross breed. Milk production increase responding to herd growth, health improvement and rearing methods. Milk production potential in Sudan is estimated at 7.424 million tons and available consumable quantity is around 4.5 million tons coming up 60% of total production, (Ministry of investment, 2015).

Milk is should be distributed quickly butin Sudan to transport milk, farmers use donkeys, donkey - trucked cartsand pickup trucks depending on availability cost and the distancesinvolved. Typically, donkeys are used for distances up to 5 -7 kilometers, donkey carts for longer distances up to 15 to 20 kilometers, and pickup trucks forlongest distances. The poor transportation and distribution may affect on milkquality due to bacterial growth in raw milk, resulting from absence of sanitary system of milk production and refrigeration by producers and many selling centers inKhartoum State.Raw milk might cause health hazards for humans if it is consumed with out pasteurization or heat treatment (Afrah, 2009).

The education level of farmers hadno significant ($p < 0.05$) correlation with theacquired knowledge regarding dairy farmpractices where as age was found to be significantly ($p < 0.05$) correlated with knowledge about period of insemination, dairy management practices, foot and mouth disease and symptoms of Age, educational level effect on dairy

farmers. In addition Milk production record was foundto be significantly correlated with the education level (Manoj, 2016).

About 58.5% of dairy farmers were with secondary level, graduate level and post graduate level, while illiterate and primary education level represented a percentage of 41.4%. The dairy farming is an attractive and good investment for educated people (Amira, 2018).The dairy production appears to be an attractive investment for educated people with ownership, management and supervision being in the hands of the farmer(Fawi and Osman, 2013).

The age of the majority of dairy farm owners in Mosay district ranges between 30-40 years (45%), then 41-56 years old (40%) and only one respondent was above 60 years old (5%).In the other hand, there 55% of the producer established their farms in a period more than 10 years, while 40% of the respondent claimed that they started investment in milk production in a period ranging between (3-8 years), (Abdalla, 2015).

All of the interviewed farm owners practiced hand milking. Cleaning the udderof cows before milking is important since it could have direct contactwith the ground, urine, dung and feed refusals while resting. In addition, about 74.57% of respondents wash their hands and cows' teatand udder before milking and 27. 43% of respondent do not wash (Abebaw, 2018).To know the status of hygienic milking practices and sees the entire milk-chain from milking through transporting and marketing of milk and its impact on quality. To assess the quality of raw whole milk from different sources in milk value chain using milk quality tests such as organoleptic test, C.O.B test, pH test, alcohol test, lactometer test, titratable acidity and methylene blue reduction test,Raw milk quality has several aspects, the most important beingress composition and hygienic quality. Compositional quality refers to the levels of total solids, milk fat and solids-non-fat or SNF (whichinclude protein, lactose and minerals) in the

milk. Milk hygienic quality, on the other hand, refers to the levels of various contaminants in milk, whether bacterial, chemical or any other adulterants those were detected (Howard, and Ensminger, 2006).The management practices were different between herds that were vaccinated and herds that were not (Kalis, *et al*., 2001).Within each collection area, rawmilk samples had consistently ($p< o.o5$) lower pH values than pasteurizedone. However, there were no significant differences ($p\geq0.05$) in the pH of pasteurized milk among the areas. And the effect of collection area and milk type on the physicochemical composition of milk is found. Since the vendors take hours to transport raw milk by donkeys fromfarms or whole sales points to the consumers in cans without cooling, (Afrah, 2009). Milk is mainly marketed through themiddle men and reaches the consumers via retail market or from producers directly to the consumers. Moreover, middlemen are numerousin numbers and each supplying one or two retailers (Mustafa, 1994). Milk is more widely influenced by environmental factors than any other biological fluid (Mohamed, and Elzubeir, 2007). Theaggravated problems needed for facilities to keep the milk cool in order to minimize bacterial proliferation (distribution) and sample spoilage prior to examination, as they are generally lacking, Recently scientists have used various milk preservatives to overcome these problems (Ng-Kwai, 1982), (Hanus *et al*., 1992a), (Hanus *et al.,* 1992b), (Heeschen *et al.,* 1994),(Saha*et al.,* 2003) and(FOSS, 2005).

Milk hygienicquality, on the other hand, refers to the levels of various contaminantsin milk, whether bacterial, chemical or any other adulterants those aredetected (Howard and Ensminger, 2006). Adulteration of milk causes deterioration of dairy products; therefore milk quality requires the necessity and greater emphasis on regulatory aspects with advanced methods of analysis and monitoring milk production and processing (Fox and Mc. Sweeney, 1995). Milk as a food is an ideal

medium for the growth of bacteria and if kept at above 16°C the bacteria present will multiply rapidly thereby causing deterioration in milk quality (O'Connor, 1993).AbdElwahab (1993) suggested that to improve hygienic quality and to lengthen the shelf life of milk, some efforts have to be put on milk treatment like refrigeration, heat treatment and chemical preservation. She added that refrigeration and heat treatment are rather expensive to rely on in Sudan, thus leaving the chemical preservation as a possiblealternative to adopt (Yuan, 2001).

Overall objectives

- To identify the effect of source, season, daily practices and hygiene on cow's milk quality.

Specific objectives

- To study the effect of different sources and seasons on milk quality.
- To study the effect of hygiene practices in dairy farm, milk collection centres and grocery.
- To investigate the effect of load of bacteria on milk quality

CHAPTER II

Literature review

2.1 Milk definition

Milk is the normal secretion of the mammary glands of mammals, (Eckles *et al.*, 2004).Milk is the product of the total full and uninterrupted milking of a dairy female in good health, also nourished and not overworked. It must be collected properly and not contain colostrums (Adib and Bertrand, 2009). Milk is a whitish food generally produced by the mammary secretary cells of females in a process called lactation; it is one of the defining characteristics of mammals. The milk produced by the glands is contained in the udder. Milk secreted in the first days after parturition is called colostrums (Kebchaoui, 2012). People use milk from cows, sheep, goats and camels, and of these sourcescow's milk is the most widely produced and processed (FAO, 1990).Fresh milk is considered as a complete diet because it contains the essential nutrientssuch as lactose, fat, protein, minerals and vitamins in balanced ratio rather than the other foods (Hossain, and Dev, 2013).Milk is an essential food for human,the majority of milk consumed throughout the world is bovine milk. It is often described as a complete food because it contains all essential nutrients e.g. protein, carbohydrate in the form of lactose, fat, vitamins and minerals (Komorowski and Early, 1992).The milk can be considered as a source of macro and micro-nutrients, and contains a number of active compounds that play a significant role in both nutrition and health protection (Ceballos *et al*., 2009). The solid components of milk mainly fat and protein make milk an economically and nutritionally important asset (Negash *et al*., 2012).The quality of milk is paramount; therefore, it must be properly stored and transported in optimal conditions (Roux *et al.,* 1995).

2.2Milk nutritional value

Milk is the only food that provides a well balance array ofessential nutrients including proteins, fat, carbohydrates, vitamins andminerals, in the forms are palatable (Kordylas, 1991).The nutritional value of milk is particularly high due to the balance of the nutrients that compose it. The composition varies among animal species and breeds within the same species and also from one dairy to other depending on the period of lactation and diet. Milk contains several groups of nutrients. Organic substances are present in about equal quantity and are divided into elements builder's proteins and energy components (carbohydrates and lipids). It also comprises functional elements, such as traces of vitamins, enzymes and dissolved gases, and contains dissolved salts, especially in the form of phosphates, nitrates and chlorides of calcium, magnesium, potassium and sodium. It also contains dissolved gases (5% by volume), mainly carbondioxide (CO_2), nitrogen (N) and oxygen (O_2) (Gautheron and Lepouze, 2012).Milk is the best source of nutrition and an article of daily diet, easily accepted and consumed by all age group in rural as well as in urban areas. It provide appreciable amount of fats and protein and also provides body building vitamins along with furnishing energy giving lactose and many other nutrients, therefore an ideal food for pregnant female and infants. Milk can provide a wide range of readily available nutrients to maintain health and normal growth of body (Osama *et al*., 2015).Milk is an important part of the human diet and its nutritional significance is apparent from the fact that daily consumption of a quart (1.14 litters) of milk furnishes approximately all the daily requirements from fat, calcium, phosphorus, riboflavin, one half of the protein, one third of vitamin A, ascorbic acid, thiamine and one fourth of calories needed daily by an average individual **(**Bilal and Ahmad, 2004**).** The results of summer milk showed better quality regarding both nutrientssuch as

proteins and microbial load. The noticed difference is likely due to different animal feeding during summerand winter. The grazing on natural pastures during summer results in higher quality milk being rich in protein, lactose and total solids as compared to winter milk. In winter the animals feed on dry forage being never comparableto fresh grass. Thus it is predictable that summer milk would have higher quality than winter milk (Leila *et al.,* 2014).The most importantnutrients in milk to human are protein, calcium, potassium, phosphorus, other trace elements, vitamin A, riboflavin, thiamine and other Bvitamins. Also milk is a fairly low – calorie food so it is a relativelyexpensive source of energy (Chamberlain, 1990).The high levels of calcium and phosphorus in milk is important for bone and tooth formation in young Children and these elements play a significant role in preventing osteoporosis in elderly people (O'Connor, 1995).Ahmed, (2004), reported that, within each collection area raw milkhad always numerically lower pH and higher acidity % values thanpasteurized milk. Pasteurized milk had higher total solid content than rawmilk. Comparison of the same type of milk among collection area revealsthat raw and pasteurized milk in Khartoum North had higher total solidsthan Omdurman. Other researcher foundthat TS of raw milk was the highest in Khartoum North (12.969%) followed by Omdurman (12.783%) and least value in Khartoum (12.656%). Milk is an importantsource of bacterial infection for human health, when milk is consumed with out pasteurization (Frank, 2001) and (Oliver, *et al*., 2009). Milk is a basic food in the human diet with great value as anutritious healthy food; in the first years of human life, milk and dairy productsare an important nutritional fact in the diet of the adult population (Muehlhoff *et al*., 2013).The consumers prefera safe and healthy milk product selection, with a great variety and availabilityin the market. This fact affects the health and

nutrition consumer's informationabout the milk products made with raw milk (Johnson, 1990) and (Murinda *et al*., 2004).

2.3 Physicochemical Characteristics of raw Milk

Normal whole milk contains a balanced proportion of milk fat (4%), lactose (4.8%), proteins (3.5%), minerals (0.7%), vitamins and otherminor constituents such as enzymes and hormones. The pH of normal raw milk is about neutral (pH 6.7) with a corresponding titratable acidity of 0.16-0.17 percentdue to the natural buffering capacity of milk proteins and salts. The density rangesfrom 1.026 to 1.032 g/ml. wholesome milk should contain only a few bacteria andno extraneous matter, if it has been produced hygienically. Depending on how milkis handled during and after milking, the natural composition and physicochemicalproperties of raw milk may change (Lusato, 2006).

2.3.1 Chemical Compositionof Milk

The composition of milk may change due to differences in relative rates of synthesis and secretion of milk components by the mammary gland. Variations are due to differences among species, between individuals within a strain, and between conditions affecting an individual, Conditions affecting the cows may include the weather or seasons and the stage of lactation (Kilic, and Kilic, 1994) and (Haenlein, 2003). The composition of milk varies considerably depending on species, breast feeding, health status and stage of lactation. The major constituents are water, fats, protein, lactose, and mineral matter(FAO, 1997).The chemicalanalysis of cows' milk composition and statisticalanalyses.It can be seen from results that milk fat, protein and totalsolids percentages were the highest during the winterand the lowest during the summer (Elvan and sebnem, 2008).

Typical composition of cow, sheep and goat milk

Animal	Fat %	Protein %	Lactose%	Ash %	Total solid%
Cow	3.9	3.2	4.6	0.72	12.6
Sheep	7.1	5.7	4.6	0.93	18.2
Goat	3.6	3.3	4.6	0.80	12.1

Source (Harding and Ditton, 1995).

2.3.1.1Protein

The contain of fluid milk approximately (3.5%) protein, (80%) of which is casein, the remainders are whey proteins (globulin and albumin).The casein and whey proteins effectivecomplement each other to give milk its high biological value, (Johanson, 1980) and (Philip, 1984). The protein of milk is of great importance to human nutrition and itInfluences the behavior and properties of dairy products (Jenness, 1988).Milk protein consistsmainly of casein with few other protein fractions such as lactolbumin andlactoglubulin. It is an excellent source of proteins that contains of allessential amino acids required by human (Payne, 1990).The protein of milk is of great importance to human nutrition and itinfluences the behavior and properties of dairy products (Afrah, 2009). Proteins area mong the complex of organic substances that contain carbon, hydrogen, oxygen, nitrogen, sulfur, and sometimes phosphorus .The protein contains ranged from (2.80%to 4.00%), (Eckles *et al.*, 2004). Milk protein which affects directly its nutritional value, the protein contentof summer and wintermilk statistically did not show any significant difference (p>0.05), however, the amount ofprotein contained in summer milk was higher than in winter milk, (Leila *etal.*, 2014).The average protein content in milk samples collected from Omdurman 3.58was higher than Khartoum North 3.57 although there was no significant difference (P>0.05) between the two locations (Nahla *et al.*, 2015).

2.3.1.1.1Casein

The four major caseins that exist naturally in milk are αs1 caseins; αs2, *B* and *k*. Caseins are distinguished by their low solubility at pH 4.6 and are differentiated on the basis of the distribution of exchange and sensitivity to precipitation by calcium (Brule *et al.,* 1997). Among the most studied casein is casein k (k-CN), probably because of its importance in the stability of the micelle and its role in dairy processing. The k-CN is also the only casein having carbohydrate residues in its constitution (Fox and Mulvihill, 1992). Caseins (α, β and κ) in the presence of Calcium phosphate, form stable casein micelles (colloidal phase), which are balanced with the soluble phase of milk (St. Gelais *et al.,* 1992).

2.3.1.1.2Whey protein

Other milk proteins are present in the whey serum and whey proteins are defined as soluble proteins in the whey after precipitation of caseins at pH 4.6 and at 20°C (De Wit, 1981). Serum proteins include a first protein fraction (80%) consisted of β-lactoglobulin (β-LG), α-lactalbumin (α -LA Da), bovine serum albumin (BSA) and immunoglobulin. A second non-protein fraction (20%) is composed of proteose, peptone and nitrogen compounds (Filion, 2006).

2.3.1.2 Fat

Incomplete milking results in low milk yield and low fat content because the last milk stripping contains more fat than the foremilk (Lusato, 2006).Fat gives milk its characteristic s of smoothness, flavor and color and it contains around 12 sixty six different fatty acids emulsified and dispersed in water in smallglobules, each globule being surrounded by a membrane to prevent fusion (Chamberlain, 1990). Milk fat is excreted in the form of small droplets which in cow's milk range from 1 to 12 in diameter with the mean of about 3 Triacylglycerols are the predominant lipids in bovine milk

accounting for 97-98% of total lipid. The remaining lipids are diacylglycerols, monoacylglycerols, phospholipids, free fatty acids, and cholesterol and its esters (Muir, 1992). The fat content of milk is often used as a guide to the quality of the milk, and may affect its price (Tull, 1996). Furthermore, there are two different theories of how the fat droplets are secreted. One theory is that the lipid droplets reach the apical region of the cell, where they are secreted and covered by cellular membranes. The lipid droplets are gradually coated with plasma membrane until a narrow neck of membrane and cytoplasm remains. At the point when the membrane in the neck fuses together, the fat globule is secreted and expelled into the alveolar lumen (Mather, and Keenan, 1998). The milk fat is the most valuable constituent of milk, it is the food value of the milk, it was found that the fat content as the average percentage to give 3.8%. (Eckles *et al*, 2004). Fat content with others affect directly nutritional value of the product. Fat content in raw milk is so important that many factories tend to estimate the price of milk based on its fat content. The amount of fat in summer and winter milk was reported as 3.39% and 3.41 respectively, and statistically showing no significant difference (Leila *et al.*, 2014). The mean values of fat content in milk collected from Omdurman 5.02 was higher than milk samples collected from Khartoum North 4.72, Statistically, fat content was significantly ($P<0.01$).The mean value of fat content in milk samples collected from pick-up trucks was 5.08 followed by farms and vendors on donkey cart 4.78% and 4.74%, respectively. Statistically, fat content was significantly ($P\leq0.05$) affected by source of samples, (Nahla *et al.*, 2015). The mean value of fat % in four seasons (winter, spring, summer and autumn) is 3.6, 3.27, 3.1 and 3.4, respectively. Its level was lower in summer season comparing to any other season but winter showed the highest amount of milk fat, (Osman *et al.,* 2015).

2.3.1.2.1Composition of milk fat globule:

Many studies and reviews have dealt with the composition of fatty acids in milk (Bitman and Wood, 1990), (Jensen *et al*. 1991), (Bitman *et al*., 1995) and (Jensen, 2002). Composition of fatty acids in milk is affected by feed and breed. The fatty acids containing from 4 to 14 carbon atoms are synthesized from the acetate and β-hydroxy butrate which are products of the fermentation of carbohydrates in the rumen. This pathway is called *de novo* synthesis. Some of the palmitic acid (C16:0) is also synthesized *de novo*. Long chain fatty acids, *i.e.* those containing 16 or more carbon atoms, are provided to the glands from the blood stream and originate directly from the diet or from the adipose tissue. Palmitic (C16:0) and stearic (C18:0) acids passed through the rumen unchanged while unsaturated fatty acids are subjected to biohydrogenation by the reducing environment caused by the microorganisms in the rumen, resulting mainly in stearic acid together with a smaller amount of oleic acid (C18:1) (Borsting, *et al*. 2003) Furthermore, stearic acid derived from the diet is partly converted to oleic acid by stearoyl-CoA desaturase, in the intestines and the mammary tissue. Unsaturated lipid supplements are often protected/encapsulated to avoid biohydrogenation in the rumen. Moreover, high amounts of unsaturated lipids in the rumen result in incomplete biohydrogenation, so some of the linoleic acid (C18:2) and linolenic acid (C18:3) is transformed into conjugated linoleic acids (CLA). Specific isomers 12 of CLA together with *trans*-C18:1 in the rumen has a negative effect on the *denovo* fat synthesis resulting in lower fat content of the milk (Bessa *et al*. 2000).

2.3.1.2.1 Lipolysis in milk:

Lipoprotein lipase (LPL) is the enzyme mainly responsible for lipolysis in rawmilk. It originates from the mammary gland, where it is

involved in the uptake ofblood lipids for milk synthesis. The enzyme is active in lipid-water interfaces. Its optimum temperature is 33°C, and pH optimum is about 8.5. It is a relatively heatlabile enzyme which is mostly inactivated by a high temperature-short time heat treatment. In milk, LPL is mainly associated with the casein micells (Hohe, *et al.,* 1985). LPL is brought into contact with the triglycerides when the MFGM is disrupted and casein coats the formed lipid-water interface. The enzyme is activated by apo-lipoprotein CII from the blood which assists LPL to bind onto the fat globule (Bengtsson and Olivecrona, 1982). In spite of the high amount of LPL in milk, lipolysis is limited since milk fat is protected by the membrane and raw milk is normally stored at temperatures far below the optimum temperature of LPL. Furthermore, the products of hydrolyses of the triglycerides, the FFA, inhibit the enzyme presumably due to that the FFA binding to the LPL. Furthermore, the proteose-peptone component is found to inhibit LPL (Cartier *et al*., 1990) and (Girardet *et al*., 1993).

2.3.1.3 Lactose

The studies found that lactose in cow's milk ranges from 4.83-4.90% (Ali, 1973).While claimed different values of lactose rangingfrom 3.40 to 6 %, (Khalifa and Bayoumi, 1966). The milk contains about 4.8% of lactose (the predominantcarbohydrate), (Philip, 1984). The limit variation of lactose is3.6 -5.5 .Lactose accounts for about 54% of the solids –not – fat of milkand contributes about 300% of the calories of the whole milk, (FAO, 1997). Lactose is found only in milk, It's is a reducingdisaccharide which, upon hydrolysis, yields one molecule of galactoseand one molecule of glucose and it has the formula C12H22O11 andprolonged heating of aqueous solutions of lactose at temperatures from212 to 266 F ° (100 - 130C°) Results in a decomposition which isindicated by a light brown or "caramel" color, and alsoreported that lactose has an important relation to the manufacture of themilk products, due to the fact that it is easily

decomposed by bacteria (Eckles *et al.*, 2004). The lactose in the milk of Khartoum state ranges from 4.32 to 4.289 (Ahmed, 2004). Milk carbohydrates are sugars which areespecially important for infant feeding because they prevent intestinal putrefaction by encouraging growth of acid –producing bacteria in thestomach .Sugar also affect the absorption of minerals such as calcium andphosphorus (Payne, 1990).There is only one carbohydrate in milk, lactose, being in balance with other milkcomponents. In this study there was no significant difference regarding lactose content between summer and wintermilks being reported as 4.61% and 4.58% respectively (Leila *et al.,* 2014). Lactose content in milk samples collected from Khartoum North was 4.86%, respectively (Nahla *et al.*, 2015).Lactose is a disaccharide comprised of D-glucose linked to D-galactose. The sugar in raw milk may exist in two different crystalline forms, and, which differ in their properties. Lactose is a useful source of dietary energy and is thought by some workers to promote the absorption of calcium from the diet (Muir, 1992). Both types of lactose are widely used in the manufacture of pharmaceuticals. In the production of capsules or tablets it may be employed as a diluents, bulking agent, filler, or recipient, and in powders as a bulking agent. Characteristics such as particle size make different grades of lactose suitable for different applications (Martindale, 1996). Although lactose is a sugar, it does not have a sweet flavour. Its concentration varies slightly in milk (4.5 to 5.2 g / 100 g) contrary to the concentration of fat that of lactose cannot be easily modified by feeding and true step of a dairy race to another. It is used as substrate during the fermentation of milk by lactic acid bacteria, differing in the fermented products such as yoghurt and cheese. It plays a role in fermented milk production. The amount of lactic acid produced by lactic acid bacteria in a fermented milk product depends not only on the bacterium itself (the bacterial strain more less active) and operating parameters, but also on the available amount of lactose bacteria.

The buffer milk power also plays an important role as we shall see later (Fillion, 2006).

2.3.1.4 Total solids (TS)

The higher values of total solids (TS) content of cow's milk varying from 12.13 to 15.39 % (Khalid, and Joseph, 1976). Total solids (TS) content is evaluating the quality of milk. In other words, it represents the amount of water contained in milk, the higher TS content is the better nutritional quality of milkmeaning that it contains more valuable compounds including proteins, fats, minerals and other micronutrients, the results of statistical analysis suggest that summer milk has significantly higher TS content than winter milk, (Leila *et al.,* 2014). The mean solids not fat content of milk collected from Khartoum was 9.13% (Nahla *et al.*, 2015). The mean value of total solid % in four seasons (winter, spring, summer and autumn) was 12.4, 11.5, 11.1 and 12.1, respectively. Milk total solid % was higher in winter than summer (Osman *et al.,* 2015). The mean total solid content of the cows' milk was 11.2%. There were differences statistically between winter and summer periods ($p<0.01$). Because of hot weather, high humidity decrease and dry matter intake, it decreased in the summer,(Elvan and sebnem, 2008).The total solids (TS)content of cow's milk in a dairy herd varied slightly from one season ofthe year to another ranging from 13.72 to 14.83 %,(Khalifa and Bayoumi 1966). The higher values of total solids (TS) content of cow's milk varying from 12.13 to 15.39 %, (Khalid and Joseph, 1976).

2.3.1.5 Ash

Mineral elements occur in milk and dairy products as inorganic ions and salts, as well as part of organic molecules, such as proteins, fats, carbohydrates and nucleic acids. The chemical form of mineral elements is important because it determines their absorption in the intestine and their biological utilization. The mineral composition of milk is not constant

because it depends on lactation phase, nutritional status of the animal, and environmental and genetic factors.All essential mineral elements can be found in milk because by definition it contains the nutrients required for growth of the young (Bates and Prentice, 1996). Milk and dairy products are an important source of dietary minerals in many European countries, accounting for 10-20 % of daily dietary intake. However, the content of major and trace elements in milk depends upon the content of these elements in soil and cattle feed, which varies considerably among and within countries (Dobrzański *et al*., 2005) and (Malbe *et al*., 2010). The thermal treatment of milk may have influence on mineral composition in the way that concentration of dietary minerals in consumer milk is lower than concentration in raw milk, with the exception of iron, which is higher in consumer milk (Mable *et al*., 2010).

The ash of milk contains potassium, sodium, calcium, magnesium, chlorine, phosphorus, and sulfurin relatively large amounts .Beside other small amount of iron, copper, Zink, aluminum, manganese, cobalt and iodine and traces of silicon, boron, titanium, vanadium, rubidium, lithium strontium. The percentageof ash in the composition of milk is about 0.7(Eckles *et al.*, 2004).The ash content varies from 0.5 -0.72%, (Khalid and Joseph, 1976) and (Pearson, 1976).

2.3.1.6 Moisture

The water content of milkis about 87.20% and otheraverage about 87% pounds, thismilk water isnot different from ordinary water and serves to hold in solution thesoluble constituent of the milk (Johanson, 1980). The percentage of water varies from89.0% although occasionally, an individual sample of authentic milk mayexceed these limits .Any variation in the amount of other constituent is also reflected upon the water percentage (Eckles *et al.*, 2004).

2.3.1.7Vitamins

Levels of vitamin A, D and E are variable; depending on the season as there is a slight increase during the pasture season (spring-summer). They are fat-soluble, so it is found in fat and can be lost during skimming. Other vitamins are water soluble and are found in the serum. In the case of ascorbic acid (C), it is present in small quantities in fresh milk and is destroyed by contact with air and also during pasteurization (Schrdos, 1982). For cow milk, the milk processing techniques can significantly change the amount of vitamin C (Florence, 2010).

2.3.1.8 Enzymes

Enzymes are specific globular proteins produced by living cells. Each enzyme has its isoelectric point and is susceptible to various denaturing agents such as pH change temperature, ionic strength, organic solvent (Carole and Vignola, 2002)**.**

2.3.2 Physical components of raw milk

The common physicals components that indicate if the quality are pH, acidity, specific gravity and so on. The pH of normal raw cow milk is 6.7-6.8 and the natural (titratable) acidity is 0.16% - 0.18%, and samples with higher figures indicate developed acidity and the present study shows mean specific gravity of the milk from farms; cooperatives and cafeteria as were 1.0297, 1.0288 and 1.0126 g/ml, respectively (Abebaw, 2018).

2.3.2.1 PH

The pH orhydrogen-ion concentration of fresh milk was 6.5 to 6.6. (Eckles *et al.*, 2004).And (Mohamed, 2004) evaluated the quality of milk sold in Khartoum state found a pH value of (6.50).The pH of the rawmilk obtained from Khartoum North and Omdurman were notsignificantly different ($P>0.05$), milk from Khartoum significantly ($P\leq0.05$) different (6.3), within each collection area, rawmilk samples had consistently ($p<$ o.o5) lower pH values than pasteurizedone. However, there were no

significant differences (p>0.05) in the pH ofpasteurized milk between the three areas (Afrah, 2009). Milk acidity is an importantindicator of milk quality. In this study average mean pH for three sources were 6.68, 6.65 and 6.61, respectively (Abebaw, 2018).

2.3.2.2 Acidity

Titrable acidity plays a fundamental role andrepresents average high important parameter for technical evaluation ofthe quality of milk (Harris and Bachman, 1988). The milk from animals suffering from mastitis is frequently 13 much lower in acidity than that produced by animals having mammary glands free of the disease, (Eckles *et al.*, 2004).Titratable acidity is valuable as a guide manufacturing operation and for measuring the quality of dairy products (Smit, 2005).The mean value of acidity was obtained from milk collected from pick-up trucks 0.23%, followed by milk collected from vendors on donkeys cart and farms 0.22% and 0.20%, respectively. The acidity showed high significant variation (P<0.001) between different sources of milk. The high acidity in this study is affected by high ambient temperature and vendors transporting milk for long distance without cooling, (Nahla *et al.*, 2015). The mean titratableacidity of samples from farm, cooperatives and cafeterias were 0.19, 0.23 and 0.26, respectively (Abebaw, 2018).

2.3.2.3Specific gravity

The specific gravity value at (15.5 °C) for fresh whole mixed herdmilk, seldom lies outside the range of 1.030 to 1.035 and 1.032 is often quoted as an average value (Robert *et al.,* 1974). Highlighted that milk specific gravity is determined byits three major components: water, solid – non –fat and butter fat.Increased butterfat content decreases the specific gravity of milk while increased solids –non –fat increases milk specific gravity, (Siegentholer and Chulthess, 1977). Found that the specific gravity was ranges from 1.027 to1.035 and influenced by the relation of its

constituents, such as fat,lactose, protein, casein, and salts,(Eckles *et al.*, 2004).The mean values for specificgravity were found to be significant. The proportion of samples with specific gravity less than 1.028 for these three sources were 20%, 11.11% and 49.2%, respectively (Abebaw, 2018).

2.3.2.4 Boiling point of milk

Sudanese use boiling as mean of improving milk quality. Soboiling is a simple effective preservative method, but it must be doneunder good conditions, because Staphylococcus neurotoxin, it is foundheat resistant (Agoul, 1995).Milk is slightly heavier than water, and the boiling point of milk is (100.17°C) while water boils at (100 °C).The variation in the boilingpoint of milk are so slight that they are of little practical importance (Eckles *et al.*, 2004).

2.3.2.5 Milk color

The color of milk ranges from abluish- white to a golden – yellow, depending upon the breed of animal, the kind of feed and the amount of fat and solids present. Milk fromwhich the fat have been removed, or low in fat percentage, shows a bluish tint. The white color of milk is due to the reflection of light by thedispersed fat globules and the carotene pigment is responsible for theyellow color of milk, (Eckles *et al.*, 2004).

2.3.2.6 Milk flavor

Off –flavor and odors ofmilk and milk products can be placed in categories based on theircausative factors .The sour flavor (acid) is developed whenmicroorganisms ferment lactose and other carbohydrates. Lactic acid isthe primary acid in milk and milk products (Campbell and Marshal, 1975).Flavor of milk may be correlated with a high lactose and relativelylow chloride content, (Eckles *et al.*, 2004). The off –flavor may14persist, and render the milk under organoleptically, therebe lowering itscommercial value, (Oldanelsold, 2007).

2.3.2.7 Milk taste

The normal freshly drawn milktastes slightly sweet to most people, at the end of lactation period themilk often has such a salt taste, (Eckles *et al.*, 2004).

2.4 Milk production in Sudan

Sudan is the first among the Arab countries and the second in Africa with respect to animal population. According to recent estimates of the livestock, there are about 40 million heads of cattle, 50 million heads of sheep, 43 million heads of goat and 4 million heads of camel (MAR, 2008).Milk production in Sudan is estimated to be about 7.8 million tons per year of which 90% is produced by local breed in traditional sector and 10 % from cross bred by the modern sector (MAR, 2007 and FAO, 2010).The milk production is concentrated in three main sectors namely the traditional sector (nomads), the semi traditional sector and the urban sector (Hassan, 1985).Milk production potential in Sudan was estimated at 7.424 million tons and available consumable quantity is around 4.5 million tons coming up 60% of total production, (Ministry of Investment 2015).Among Sudanese cattle, Kenana and Butana are which under improved feeding and management in research stations yield on average 1500liters up to 4500 litersof milk per lactation (Musa *et al.,*2005). Examples are Butana, Kenana and Baggara; multipurpose breeds that are used for milk and meat production as well as draught power (Payne and Hodges, 1997). The Butana cow is considered to be the best milk producer of the Sudanese zebu breeds (Sudanimals, 2006). The milk production of Sudanese indigenous cattle breeds; Kenana and Butana *(B.indicus)* were found to be lower than that of Holstein and Friesian cattle *(B.taurus),* even under the same climatic conditions (Ageeb and Hayes, 2005).

2.5 Milk sources and distribution management systems

In Khartoum State, milk is distributed through irregular marketing channels such as venders on donkeys or by cars in addition to collection centers and some consumers buy milk directly from the farms. These informal channels make milk uncontrollable and could influence the nutritional value of milk in case of adulteration. The study is carried out to evaluate the physicochemical properties of raw milk produced and consumed in Khartoum State (Nahla *et al.*, 2015). Marketing of milk and milk products is of greatest importance, since successful operation of many farms is dependent upon in comefrom the milk sold, particularly when dairy is the major enterprise (Elaggab, 1996).

2.5.1 Dairy farms management

The dairy marketing is a complicatedbusiness because milk is a perishable product (Elaggab, 1996).Hygienic practices followed during milking: all of theinterviewed farm owners practiced hand milking. Cleaning the udderof cows before milking is important since it could have direct contactwith the ground, urine, dung and feed refusals while resting. In addition, about 74.57% of respondents wash their hands and cows' teatand udder before milking and 27. 43% of respondent do not wash (Abebaw, 2018).To know the status of hygienic milking practices and sees the entiremilk-chain from milking through transporting and marketing of milkand its impact on quality. To assess the quality of raw whole milk fromdifferent sources in milk value chain using milk quality tests such asorganoleptic test, clot on boiling test(C.O.B test), pH test, alcohol test, lactometer test, titratableacidity and methylene blue reduction test and,Raw milk quality has several aspects, the most important beinggross composition and hygienic quality. Compositional quality refers to the levels of total solids, milk fat and solids-non-fat or SNF (whichinclude

protein, lactose and minerals) in the milk. Milk hygienicquality, on the other hand, refers to the levels of various contaminantsin milk, whether bacterial, chemical or any other adulterants those aredetected (Howard and Ensminger, 2006).The management practices were different between herds that were vaccinated and herds that were not (Kalis *et al*., 2001).The facts explained the types of preventive measures that applied for eradication of some diseases like mastitis in the farms surveyed. So many health problems that might arise in those farms are due to the complete absent of veterinary supervision. Since higher correlation was noticed between mastitis and veterinary supervision which supported (Babiker, 2007).The most producers 97% handled their milk in stainless steel containers, while only 2.7% handled their milk in other containers (Nahid *et al*., 2015).Equipment used for milking, storage and transportation determine the quality ofmilk and milk products. In addition, about 88.13% of respondentsused plastic utensils and only 11.87% of respondents used metallicutensils as milking, storing and transporting utensil. The useof plastic containers can be a potential source for the contamination ofmilk by bacteria, because it allows the multiplication of bacteria onmilk contact surfaces during the interval between milking, and also he reported thatall the sources showed higher acidity with abig difference observed in between farms and cooperative milk. Thisbig difference is due to mixing of different milk from different farmswhere some of these milks were already acidic causing whole milk become acidic (Abebaw, 2018).The metal (aluminum) can are recommended to keeping the quality of milk, plastic cans have a negative impact on the bacteria content of milk and particularlybecause they have adhesive properties and therefore difficult to clean (Karuga, 2009).

2.5.2 Milkcollection centers management

The milk sold by milk venders in Khartoum area is usually produced and transported under bad hygienic conditions (Mohamedi, 1988). Within

each collection area, rawmilk samples had consistently (p< o.o5) lower pH values than pasteurizedone. However, there were no significant differences (p≥0.05) in the pH ofpasteurized milk between the areas.And the effect of collection area and milk type on the physicochemical composition of milk is found. Since the vendors take hours to transport raw milk by donkeys fromfarms or whole sales points to the consumers in cans without cooling, (Afrah, 2009).Possible reasons for high counts could be due to the traditional methodsof milk distribution and transportation (Elmagli and Elzuberir, 2006).In the milk cooperatives the raw milk is collectedin big utensil/container in which milk of different sources was mixed,and this kind of mixing may increase the acidity of milk because someof them are already acidic and can be the source of high acidity inwhole milk container (Abebaw, 2018).

2.5.3 Milk groceries management

Milk is mainly marketed through themiddle men and reaches the consumers via retail market or fromproducers directly to the consumers. Moreover, middlemen are numerousin numbers and each supplying one or two retailers (Mustafa, 1994). The quantities that go into shops of Khartoum State inthe morning are refrigerated for a short time before selling .Sellingusually takes place in the evening or a service of high efficiency in milkmarketing system in Khartoum State; this service is not available forproducers and for many selling centers which often resulted in losses dueto perish ability of the product (Mustafa, 1994).

2.6 Some factors affecting on milk quality

Different factors, suchas genetic, stage of lactation and environmental factors which can significantly affect on component and properties of milk (Bucci *et al*., 2002).The variation in milks and milk yield within a species depends on so many factors. Some of these factors

aregenetics, stage of lactation, daily variation, and parity, type ofdiet, age, udder health and season (Kilic, 1994) and(Haenlein, 2003).The milk yield of dairy cow depends on four factors including genetic ability, feeding program, herd management and health; nutrition and management must be improved to allow the cow to produce her inherited potential and that milk yield is affected by the interaction between genetic and environmental factors (Fawi, 1994) and (Wheeler, 2004).

2.6.1Genetic

Genetic correlations werenegative for milkyield withfat andprotein% in Red Sindhi andSahiwal asreported by (Chawla and Mishra, 1976).Genetic correlations (0.75±0.53) between milkyield and fat% was significant but negative in Hariana cows according to (Arora*et al.*, 1978). The genetic correlation of fat% with protein, snf, TS and lactose% were reported as 0.89, 0.77, 0.97,-0.97,-0.09 and-0.53 respectively; and with their yields as 0.67, 0.30, 0.67 and 0.07, respectively in HF cows (Sharma *et al.*, 1983). Genetic correlation between snf and protein hasbeen reported as 0.79 (Butcher*et al*., 1980).

2.6.2 Seasonal

The climatic conditions and lactation periods are known as seasonal changes which have influences on the milk composition. Especially, there is a negative correlation between environmental temperature and the amount of milk fat and protein. When temperature is increased the solid fat tends to decrease. (Ng-Kwai *et al*., 1982) and (Lacroix *et al*., 1996).The percentage of fat, protein, casein and all the fraction of nitrogen have been influenced by theseasonal variations. The light-to-dark ratio can also induce marked changes in milkyield and composition (Casati *et al.,* 1998).

Between the environmental factors the feeding of cows and season of the year has a considerable influence on milk components and properties. This seasonal variation in cows diets confirm that milk properties such as

taste, color, fat content and even kinds of fats differ by season for example milk will be richer in valuable fatty acids like omega 3's and antioxidants in the summer. The effects of the various season of the year have been studied by different authors for the reason that climate and geographic and conditions that cannot be affected should be considered. The different season of the year is often related to different food regimes for cows, (Rajeevie and Potoenik, 2003). Seasonal variation affects milk composition is associated with several factors, (Osama, 2015).Changes in milk component are more correlated to feeding than to genetic ones, so for better correlations among different composition the food regime is more pronounce than the level of nutrient in a diet. Nevertheless, the season of the year affects the food intake, (Lyatuu and Eastridge, 2003). The quality and quantity of milk production in difference month in year and revealed that the lowest in September (6.46%) and the highest milk production (10.01%) was in February and milk production increased from Septemberto February that was showed an especial production trend throughout the year. Solid not fat and fat content of milkwas little highest during December to April, (Leila *et al*. 2014).

2.6.3 Storage temperature

Raw milk is not cooled soon after milking, the inherent lactic bacteria will multiplywithin two to three hours, converting lactose into lactic acid and causing the milkto start souring. Such milk is unsuitable for processing and will be rejected atmilk collection centers and processing plants. If the milk is overly sour, it will beunacceptable to milk collection centers; processors as well as buyers of raw milk who invariably boil their milk before drinking it. Raw milk with high levels of acidity will also has high numbers of bacteria. Such milk will be rejected or down-gradedat milk collection centers or by processors (Lusato, 2006).

2.6.4 Nutritional

Cows have to be properly fed to produce a high volume of milk of good composition. If cows are fed a diet low in forages and high in starch, the butter fat content of themilk may fall below 2.5 percent. A good forage-to-concentrate ratio is importantto enable cows produce good quality milk to their potential (Lusato 2006). Feed intake kind and quality of fodder are connected to the food regime. This regime offers different possibilities to the breeder because using suitable diets that contain mineral and nutritional component according to the needs of the cows and the structure of the diets that enables good digestion, adequate intake and metabolism are enabled which on the other had effects on the milk composition (Rajeevie and Potoenik, 2003). Many factors influence the composition of milk; the major components are water, fat, protein, lactose and minerals, Nutrition or dietary influences readily fat and milk protein concentration. Fat is the most sensitive to dietary changes and can vary over a range of nearly 3.0 percentage units. Dietary manipulation results in milk protein concentration changes to approximately 0.60 percentage units. The ratio of lactose and minerals, the other solids constituents of milk, do not respond predictably to adjustments in diet (Looper, 1994). Nutritional factors associated with changing availability and quality of pasture through the year (Osama, 2015).

2.6.5 Lactation stage

When mammals give birth, their first secreted milk is called colostrums, and it differs greatly in composition from regular milk. Colostrums contain more mineral salts and protein and less lactose than normal milk. Also, fat content, calcium, sodium, magnesium, phosphorus and chloride are higher in colostrums than in normal milk. Whey content is about 11% in colostrums as opposed to 0.65% in normal milk. Colostrums contain extremely high immunoglobulin (Lg) content. Igs accumulate in

the mammary gland before parturition and transfer immunity to the baby cow. This immunoglobulin protects the baby cow until it can establish its own Immunity, The variation in milks and milk yield within a species depends on so many factors. Some of these factors are genetics, stage of lactation, daily variation, and parity, type of diet, age, udder health and season (Kilic, and Kilic, 1994) and (Haenlein, 2003).Immediately after calving, a cow produces colostrums during the first five days afterwhich the milk reverts to its normal composition. Colostrumsare heavier than normalmilk and contain 10 times more whey proteins. Colostrums is also more alkaline (pH 6.8–6.9) than normal milk. Hence, only the milk produced after five days fromcalving should be sold (Lusato, 2006).In the early lactation fat andprotein decrease and lactose concentration increases, whereas in the late lactation fat and protein increases andlactose decrease (Arora and Bhojak, 2013).The lactation stage associated with the physiological changes, (Osama*et al.*, 2015). Mentioned that the cows are usually milked twice a day, in the early morning and late afternoon. Most milk is produced after calving, and the production gradually decreases until it stops about ten months after calving (Tull, 1996). Lactation period moved forward progressing and when the environmental heat degree increased, the fat content decreased (Kilic, and Kilic, 1994), (Sekerden, 1999) and (Yetismeyen, 2000).

2.6.6Animal age

Osama *et al.,* (2015) reported that the animal age and other factors had direct impact on milk quality.The timing of first calving is a particular problem that affects milk production and long-term profitability. Delayed firstcalving increases the cost of rearing and decreaseslifetime milk production (Van Pelt *et al*., 2016). In Africancountries, delayed first calving is a serious problemwhere age at first calving (AFC) in excess of 3 years is common, (Mugerwa, 1989).

2.6.7 Animal health

Several publications have shown how milk from unhealthy cattle is not safe for consumptionunless processed accordingly. And concluded that human brucellosis occurs through ingestion of milk and milk products or bydirect contact with tissues and fluids of infected animal (Zvizdic *et al*., 2006) and (Makita *et al*., 2008).The zoonotic diseases such as tuberculosis, campylobacteriosis, Q fever and salmonellosis are acquired through drinking milk from infected animals. The quality of milk depends very much on the health of the animal. On the other hand, the health of an animal is assured by combined efforts of the farmer and the veterinarians. The farmer should be keen enough in reporting all the unhealthy conditions to theveterinarians and take up the advice (Weinhaupl *et al*., 2000) and (Shirima *et al*., 2003). Pathological factors associated with clinical and sub clinical mastitis, (Osama*et al.,* 2015). Although the teat cistern, teat canal and teat apex may be a colonized by variety of microorganisms, microbial contamination fromwithin the udder of health animals is not considered to contributesignificantly to the total numbers of microorganisms in the bulk tank orduring refrigerated storage (Murphy and Boor, 2000).Thepathogens in milk are derived from several sources including dairy animal, the handler andthe environment while the most common external source is contaminated water supply (Kaplan *et al*., 1990). Mastitis routine testing is very important because most of mastitis infection persist as subclinical, which will not be detected by herdmen (Mohamed *et al*., 1993 and El Zubeir *et al*., 2006). The subclincal mastitis, when the farmers were unable to recognize the disease public health hazards might occur due to consumption of infected milk that contains pathogenic bacteria or their toxins (Hamid *et al*., 2012).

2.6.8 Animal breeds

The US mostly uses milk from cows of the larger breeds, such as Holsteins and Brown Swiss' because of the lower fat content and greater milk production. Breeds such as the Guernseys and the Jerseys have higher fat contents in their milks. Both the Guernseys and the Jerseys have a fat content of 5.2%, where as the Holsteins and the Brown Swiss' have fat contents of 3.5%. (Kilic, and Kilic, 1994; Haenlein, 2003).

2.7 Some factors affecting milk management

Hygienic practices followed during milking: All of theinterviewed farm owners practiced hand milking. Cleaning the udderof cows before milking is important since it could have direct contactwith the ground, urine, dung and feed refusals while resting. In addition about 74.6% of respondents wash their hands and cows' teatand udder before milking and 27. 4% of respondent do not wash, (Vissers and Driehuis, 2009; Abebaw and Ephrem 2018).

Kalis *et al*., (2001) found that the owners of herds which were not vaccinated followed more preventive management procedures and practiced less feeding of raw milk to calves. They concluded that vaccination of calves with killed vaccine does not prevent transmission of some diseases and therefore, hygienic practices remain essential in herd management. Poor hygiene practices at the farm level have beenreported to be the main cause for poor productivity andincome losses for the smallholder sector (SNV and Zimbabwes Dairy 2012). Researchshows that high total bacteria count (TBC) is positivelycorrelated with unsanitary conditions associated with dirtyudders before milking, inadequate or poor teat sanitation,poor cleaning and sanitation of milking equipment, andinadequate cooling of milk (Pantoja*et al.*, 2009) and (Verdier*et al.*, 2009). Other elements thatinfluence TBCinclude health and hygiene of the cow, housingand management, cleaning and sanitizing procedures,

farmmilking environment, and quality of cleaning water (Nada *et al.*, 2012).The finding that large-scale and olderfarmers who had more years of experience in dairy farmingconsidered hygiene an important factor affecting milk qualityagreed with findings by several authors (Pantoja*et al.*, 2009), (Verdier*et al.*, 2009) and (Ellis *et al.*, 2007), theseauthors reported that the production of high quality milk ispositively correlated with maintenance of hygienic standardsin the milking facilities and cow cleanliness during milking.

Although both large-scale and smallscalefarmers ranked personnel as the least cause of spoilage, other findings indicate that that personnel cleanliness duringmilking and handling affects milk quality. The reason whyboth large-scale and small-scale farmer's ranked personnelhygiene as the least source of milk contamination could bethat the farmers in our study were reasonably confident withtheir personnel's hygiene and milking practices on farm butdid not necessarily have the same level of confidence withother players in the milk supply chain like the transportersor processors. Thus, they would attribute deterioration ofmilk quality to handling by others in the supply chain (Moffat*et al.*, 2016).

The education level of farmers hadno significant ($p < 0.05$) correlation with theacquired knowledge regarding dairy farmpractices whereas age was found to besignificantly ($p < 0.05$) correlated with knowledge about period of insemi nation, dairy management practices, foot andmouth disease and symptoms of Age, educational level effect on dairy farmers. In addition Milk production record was foundto be significantly correlated with theeducation level (Manoj, 2016). About 58.5% of dairy farmers were with secondary level, graduate level and post graduate level, while illiterate and primary education level represented a percentage of 41.4%. The dairy farming is an attractive and good investment for educated people (Amira, 2018).The dairy production appears to be an attractive

investment for educated people with ownership, management and supervision being in the hands of the farmer(Fawi and Osman, 2013).

The age of the majority of dairy farm owners in Mosay district ranges between 30-40 years (45%), then 41-56 years old (40%) and only one respondent was above 60 years old (5%).In the other hand, there 55% of the producer established their farms in a period more than 10 years, while 40% of the respondent claimed that they started investment in milk production in a period ranging between (3-8 years),(Abdalla, 2015).

2.8 Milk preservation

2.8.1 Chemical preservation

Hussain and Islam (1990) stated that majority of the dairy farmers in many countries have no ability to install cold room or to buy refrigerator. Similarly heated milk is not generally accepted by the public in the market, another alternative way is to preserve milk with chemical preservatives. They added that recently scientists are using various milk preservatives (H2O2, ethanoland boric acid) to overcome this problem.Ghibaudi *et al.,* (2000) Lactoferrin andLysosyme exist in milk and play an anti-microbial role in depriving bacteria from iron and may protect the dry udder from infection.

AbdElwahab (1993) suggested that to improve hygienic quality and to lengthen the shelf life of milk, some efforts have to be put on milk treatment like refrigeration, heat treatment and chemical preservation. She added that refrigeration and heat treatment are rather expensive to rely on in Sudan, thus leaving the chemical preservation as a possible alternative to adopt (Yuan, 2001). Found that protein and peptide such as lactoperoxidase, lactoferrin, bacteriocins,Lysosome and xanthine oxidation, occurring naturally in milk and have antimicrobial properties, FAO/WHO (2005) strongly discourages the preservation of milk by chemical means,

except the application of H2O2 at native LPS and in the case of H2O2; it must be completely destroyed before consumption (Ozer *et al.,* 2003).

2.8.2. Physical and Other methods preservation

Gould (1996) reported that preservation aims to delay orprevent microbial growth; it must therefore operate through those factors that most effectively influence the growth and survival of microorganisms. He noted that the major preservation techniques employed to prevent or delay spoilage are reduction in temperature, reduction in pH, reduction in water activity and application of heat. Janetschke (1992) reported that the most common preservation methods in the dairy industry include: drying, cooling, freezing, heating irradiation, salting pickling, smoking, preservatives and packaging. FAO/WHO (2005) mentioned that there are several ways in which the spoilage of milk may be controlled, including refrigeration, heat treatment, microfiltration (with or without pasteurization), bactofugation, high-pressure treatment and use of chemical preservatives (including salting at level of 3-12%). Some of these procedures require expensive equipment and are not widely applicable particularly in small – scale dairy production and processing system in developing countries where up to 80% of the milk produced may enter the informal market (Elwell and Barbano, 2006).

2.9 Milk adulteration

Adulteration is illegal because it alters the natural composition of milkand can introduce harmful bacteria and other dangerous substances into milk. Water adulteration lowers the specific gravity and increases the freezing point of milk; normal whole milk has specific gravity range of 1.026 to 1.032 while it's freezing point is minus 0.54°C (Lusato, 2006).Reported that different methods used by some milk producers and vendors for gaining more profit from the amount of milk which reduce the

milk value (Siegenthaler, and Schulthess, 1977). Adulteration of milk supplies may be deliberate addition of water, preservatives and neutralizers or it may arise from faulty methods of milk production particularly in the use of sterilizers and in the methods of rinsing milking equipment. Other methods of adulteration like to be resorted to addition of skim milk or extraction of some fat by skimming (Foley *et al*., 1999).

2.10 Milk contamination

Milk is such a delicately easily changes type of food where vigorous preservative method cannot be used without changing it in undesirable manner (Afrah, 2009).The chloramphenicol when consumed by humans through eatingcontaminated meat, eggs, or drinking milk is the reason of the cytologicaland hematological changes in the bone marrow and in the blood (Shaikh *et al*., 1985).

The dairy industry has not been spared from the adverse effects of drought and extreme temperatures. Despite these challenges the farmers are still expected by all stakeholders to produce good quality milk that is free from microbial, physical, and chemical contamination (Pantoja*et al.*, 2009).Contamination was therefore perceived to occur during storage or transportation. The major cause of poor milk quality for MCCs is expected to come from the use of unhygienic storage containers and during transportation (Moffat*et al.*, 2016).A number of environmental factors are associated with the hygiene of milk along the dairyvalue chain for example water sources, and soil. Bacteria are ubiquitous in air and can easilybe introduced into milk. The bacterial contamination of milk can originate from different sources such as air, feeds, milking equipment, soil, faeces and grass (Torkar, and Tegar, 2008).

2.10.1 Chemical contamination

Chemical contamination and taints from animalfeeds, barn odors, kerosene, smoke and tobacco can lower the quality of rawmilk so it is important to avoid exposing milk to these elements. Antibiotic drugresidues from cows undergoing treatment should be avoided by adhering tothe specified withdrawal periods. Milk transporters need to check with theirsuppliers on the status of exposure of the milking cows to these elements incase of any abnormal milk odor (Lusato, 2006).Found that over 800, 00 farmers who depend on dairy products fortheir income, the four organizations argued that, since formalin (used thepreservation of bodies) is not destroyed by pasteurization, although mostaccuses large – scale traders who transport milk over long distances ofusing formalin to preserve milk, most of which is sold to processors;processed milk presents the same risks to consumers if the preservative issued at all (Kwayera, 2003).The most likely preservatives to be found in milk are formaldehyde, boric acid and hydrogen peroxide (Foley *el at*., 1999).The antibiotics in milk cause reactionsvarying from mild allergic to complete anaphylactic shock and penicillinresidues are the most important in this respect (Ibrahim, 1990). Thepresence of antimicrobial substances in raw milk can have serioustoxicological and technical consequences. Moreover, the presence of chemicalresidues, particularly antibiotics, can delay, if not totally prevent, thebacteriological processes used in the manufacture of certain dairyproduct. (Dewdney *et al.*, 1991), (Currie *etal*., 1998) and (Kang *et al*., 2005).The levels equal to or greater than 0.015 I.U penicillin will affect cheese starter production and a level aslo as 0.005 I.U.had been known to inhibit strain of Streptococcus thermophilus used in yoghurt manufacture (Packham *et al*., (2001).The highest percentage of antibiotic residue in raw milk collected from vendors might be due to the use of antibiotics as preservation to increase shelf life of raw milk (Taj Elsir,

2001). The use of antibiotics inanimal food is incriminated as to be partly responsible for emergence of antibioticresistantbacteria with an importance in human medicine. The methicillin-resistant *S.aureus* (MRSA) strain was identified in animal companion and small dairy herds. TheMRSA in humans is wildly studied in nosocomial infections and home care patients (Cercenado andRuiz, 2008) and (López et al., 2015). The regulations of antibiotic and veterinary drug administration surveillancein animal food should be observed by agriculture department authorities (National Academy of Sciences, editor, 1992).

The milk market requires and offers safe and high-quality products, preventinga contamination source by good hygiene practices to reduce a possible exposure offood-borne pathogens and chemical milk residues. The mammary gland participatesin the excretion of numerous xenobiotic substances from veterinary drug milkresidues and contaminants originated from milk and other chemical residues toenvironmental pollutants on the grasslands, animal feedstuffs, and the field crops (Velzquez*et al*., 2011). The presence of residual concentrations of milk contaminants and pathogens an indicator of milk quality in cow dairy farms. In evaluating the raw milk bulktank at the dairy farms, quick information about udder health status, environmentalpathogens, milk chemical residues, and antibiotics is obtained (Simsek*et al*., 2000).

The relationship among dairy cow production and milk safety and dairy productquality is considered in different subjects: raw and pasteurized milk contaminationand microbial aspects of the quality of milk and dairy products, cow husbandry inanimal welfare influence, feeding conditions, and herd hygiene practices and milkcomposition. Also the environmental pollutants and chemicals from agriculture, pesticides residues, drug veterinary residues and management in dairy production.Those

relationships that exist in milk production are auditable and selectively regulated to prevent milk contaminants. The contaminants agents are tracking and monitored at milk parlor, in refrigerated milk tank and the milk bulk tank onplatform by the application of proper sampling methods required in the ControlAnalytical Methods for milk quality in Dairy Industry Management assurance thefood safety (Baumane*t al*., 2018).

The aflatoxin M1 contamination levels in milk appear to be a serious health hazard derivate from hepatotoxic and carcinogen effects of aflatoxin M1, which show a high risk on milk food safety. The milk contamination risk is established through the forages, corn and concentratedfeeds; those are contaminated by aflatoxin B1 (AFB1). There is an aim to watch overthe limit exposure to aflatoxins in dairy by imposing regulatory limits (Roussi*et al*., 2002). Thepresence of biotics from grazing cows and conserved pastures and feeding grains, like aflatoxins AFB1 and AFM2, has been usually monitored in milk (Tajik*et al.*, 2007). In dairyproduction, an important practice is oriented to reduce environment fungal contaminationand the proper conserving methods of silages, forages, and grains foranimal feed (Sugiyama*et al*., 2008).

2.10.2 Physical contamination

Addition of wateris the simplest way for increasing milk quantity, In addition to theeconomic part of the problem, watering milk may also cause public healthhazard since the available water added may be grossly contaminated. Incountries applying the pricing system, milk with high amount of waterreceives low price (Siegenthaler and Schulthess 1977).

2.10.3 Microbial contamination

The high nutritional value milk represents a good mediafor bacteria and other microorganisms, the main sources ofcontamination in the farm are cow's udder and body, utensil, milkingmachines, stable and the

transportation equipment (Hunderson, 1971).Milk is synthesized in specialized cells of the mammary gland andis virtually sterile when secreted in to the alveoli of the udder (Tolle,1981). Generally, contamination of raw milk occurs from three mainSources: within the udder, the exterior of the udder and from the skin ofthe handlers and the surface of storage equipments (Bramley andMckinnon, 1990).

The generalstandard of hygiene applied for milk production in developing countries are poor and hand milking is almost a common practice in developingcountries (Chye, et al., 2004). Milk is a magnificent medium for growth of microorganisms and therefore a risk of quick microbiological deterioration of quality ispresent from time of milking to the time of use (IDF, 1994). Also it includes preventionof contamination of milk by stable environment and milking equipmentas well as controlling temperature and time in order to minimize thegrowth of pathogens (IDF,1994) and (Murphy, and Boor,2000). Hygienic control in raw milk is that themilk should be obtained from healthy animals and from animals not beentreated with antibiotics or other veterinary drugs, which can betransferred to milk (Murphy, and Boor, 2000). Microbial load of raw milk being directly dependent on the hygienic conditions of the farm is a very importantparameter with respect to milk quality having great effect on its price,and suggesting that summer milk was produced under more favorable hygienicconditions.Regardingmicrobial load it was predicted that summer milk would show higher microbial load because of higher temperatures,but the results were the reverse of what had been expected as the microbial load of summer milk was significantlylower than winter milk,the reason is likely that animals are less frequently transferred to outside because of feedingon dry forage so contamination is developed in closed farms affecting milk microbial load (Leila *et al.,* 2014).Showed that raw milk in Khartoum and Omdurman has higher TBC than Khartoum

North.Again, comparisonof milk types in all collection areas tested reveals that pasteurized milk expectedly had lower TBC than raw milk (Afrah, 2009).

2.10.3.1Contamination from the udder

The infectious bovine mastitis in milk production is considered a disease with high economic impact reducing milk yield and the industrial dairy process and food safety. *S. aureus* and *Streptococcus agalactiae* are the most prevalent contagious pathogens in bovine mastitis from dairy herds around the world. The intramammary infection in dairy cows is relationship with infections by contagious pathogens and environmental pathogens as colifrom bacteria and *Streptococcus uberis* mostly are occurring in the dry period and the lactation in clinical casesregularly (Velzquez*et al*., 2005). In the dairy herd with low prevalence of subclinical mastitis, the milk losses could be estimated between 3 and 5 % of the milk yield production, comparing to a herd average within milk somatic cell counts about 200,000 cells/mL (Oliver, and Calvino, 1995). The change in milk yield and composition depends of the severity and duration of the mammary gland infection and somatic cells counts. In an uninfected mammary gland that contains <100,000 somatic cells/ mL, >200,000/mL, somatic cells counts suggest an incipient mammary gland inflammatory response (Damm*et al*., 2017) and (Frössling *et al*., 2017). The bovine mastitis in dairy herds affects milk composition and somatic cells counts, serum protein, and proteolytic enzymes. Other undesirable milk mastitis conditions are bacterial toxins and abnormal proteins derived from inflammatory tissular response, which influence milk flavor and taste as well as milk product stability in the dairy process (Oliver andCalvino, 1995). The teat cistern, teat canal and teat apex may be aColonized by variety of microorganisms, microbial contamination fromWithin the udder of health animals is not considered to contribute significantly to the total

numbers of microorganisms in the bulk tank orduring refrigerated storage (Murphy and Boor, 2000), they also statedthat a cow with mastitis has the potential to shed large numbers ofmicroorganisms in to the milk supply.

2.10.3.2 Contamination from the exterior of the udder

The exterior of the cow's udder and teats can contribute tocontamination of raw milk by microorganisms, these microorganisms are either naturally associated with the skin of animals or the environment in which the cow is housed and milked the teat skin is one of the main sources of the microbial contamination of raw milk as well as a source of mastitis infection (Brito *et al*., 2000).One of the major sources of contamination of milk is the use of equipment and storagevessels which cannot be easily cleaned and sanitized. These include jerry cans andbuckets made of non-foodgrade plastic. Metal containers such as aluminium and stainless steel cans are recommended under the code of hygienic practices (Lusato, 2006).

The good hygienepractices in the herd cow is an important fact for to reduce contamination fromproduction environment, feces, slurry, soil and mud those are microbial sourcesfor the udder contamination. The poor hygiene practices could occurs microbial milk contamination, pathogens dissemination, and udder contamination may beoccurred at milking time between cows, hands of milkier man and milk machinefrom others (Gillespie*et al*., 2009). The microbial analysis of raw milk is influenced by microorganisms present in the teat canal and the surface of teat skin (Adkins*et al*., 2018). The bad hygienepractices and poor cleanness procedure equipment, the surrounding air in the milk parlor, as well as other environmental factors including housing conditions, watersupply, and during feeding have an important effect on the milk contamination (Fox and Norell, 1994) and(Pangloli*et al*., 2008).

2.11 Type of bacteria found in milk

Milk is a complex fluid containing a mixture of carbohydrates, protein, fat, and minerals in different physio-chemical status and forms.Its comprehensive nutritional properties and high moisture content makeit an excellent medium for supporting microbial growth (FAO, 1997).Milk provides a favourable environment for the growth of microorganisms (O, Connor, 1995). Microbes can enter milk via the cow, air, feeds, milkhandling equipment and milker. Bacteria types commonly associated withmilk.

2.11.1 Lactic Acid Bacteria (L A B)

Frazier (1995) reported that the L. A. B. is a group of bacteria ableto ferment lactose of milk to Lactic acid and also used as starter culture inthe production of cultured dairy products such as yogurt. Examples ofthese microorganisms are:

(1) Streptococci: Strepto coccus Lactis and Streptococcus Cremoris.

(ii)Lactobacilli: Lactobacillus Casei, Lactobacillus Lactis and Lactobacillus Bulgaicus.

(iii)Leuconostoc: Leuconostoc Mesenteroides.

2.11 .2 Colifrom

These are indicator organisms associated with the presence ofpathogens and can cause rapid spoilage of milk (Frazier, 1995). He alsomentioned that they are killed by HTST treatment, their presence aftertreatment is indicative of contamination.

2.11.3 Spoilage microorganisms

The most common spoilage microorganisms of milk and dairyproducts are Gram negative rod –shaped bacteria, Gram positive sporeforming bacteria, Lactic acid producing bacteria and yeast and moulds (IDF, 1994). The defects that occur in milk due to microbial growth are off

flavour, lipolysis with development of rancidity, gas production, souring due to fermentation, coagulation of milk protein, viscous or ropytexture and discoloration (Banwart, 1981). In Brazil, Silveira *et al.*, (1999) evaluated the microbiological quality of raw type B milk kept under refrigeration at 3° C for a period of 15 days. A total of 180microorganisms were detected, of which 80 were Psychrotrphic. The ability of these microorganisms to produce lipolysis and /or proteolysis in milk was evaluated. The results of the initial counting were 2.7×10^4cfu/ml for psychrotrotrophic bacteria, with a predominance of Gram negative bacilli which had high lipolytic and proteolytic activities. Lactic acid producing microorganisms (*Streptococcus spp*, *Lactobacillus spp*. And *Leuconostoc spp*) spoil milk by fermenting lactose to produce acid (IDF, 1994). *Pseudomonas* spp are the most important group of*Psychrotrophs* associated with spoilage. They may however; produceextra cellular enzymes (for example proteases and lipases) which wereparticularly destructive if high numbers are present. These enzymes mayproduce flavours described as bitter, rancid, unclean, fruity and yeast –like (IDF, 1994).

2.11.4 Pathogenic microorganisms

Giovannini (1998) reported that variouszoonotic agents can be transmitted to human through milk. He reportedBrucella melitensis, Brucella abrtus, Mycobacterium bovis, Salmonellaspp, Listeria monocytogenes, Coxiella burnetti, yersinia entrocolitica, Campylobacter jejuni and E.Coli O157:H7 as an important zoonticorganisms. He also mentioned toxins of Clostridium perfringes, Clostridium botulinum and Corynebacterium diphtheria as zoonoticagents. Milk borne human infection and intoxication is due to*campylobacter spp*, *Listeria monocytogenes ,Salmonella spp,Staphylococcus spp , yersinia entercolitica ,Escherichia Coli ,Bacilluscereus ,Clostridium perfringes ,Clostridium botulinum and Streptococcuszooepidemicus* (IDF,1994).In Germany, Deutz et,al. (1999)

examined 133 raw cow's bulk milk from 3 dairies for the presence of Camplyabacter jejuni, C.Lari,E.Coli O157, Listeria moncytogenes and Salmonella. However, theyfound no Salmonella spp. was found but Camplyobacter spp, L.moncytogenes and EC.Oli O157 were found. In Zimbadwe, Gran (2002) studied the microbiological quality of bulk, cultured pasteurized milk, naturally soured raw milk and raw milk .He found that raw milk had the lowest numbers of S.aureus and E.Coil Bacterial types associated with milk are presented.

2.12 Raw milk bacteriological

2.12.1 Methylene blue test

Jacksonand Verschueren (1991) reported that milk drawn from the udder aseptically reduces methylene blue, indicating that its potential is more negative thanthat of the methylene blue system. Robert *et al*. (1974) claimed that neither cysteine nor glutathione in quantities present in milk is apparentlyable to reduce methylene blue. After an extensive study of differentbacterial test, Wilson *et al*., (1969) recommended the methylene bluereduction test, with inversion of the tubes every 30 min, as the mostaccurate method of determining milk quality. Ellenberger *et al* (1927).

Bacteria types commonly associated with milk.

***Bacteria**	***Effect on milk**
Pseudomonas	Spoilage
Burcella	Pathogenic
Eeterobacteriaceae	Pathogenic and spoilage
Staphyococcus aureus	Pathogenic
S. agalactiae	Pathogenic
S. thermophilus	Acid production
L. lactis	Acid production
L. lactis-diacelylactis	Flavour production

L. cremoris	Acid production
Leuconsotoc lactis	Acid production
Bacillus cereus	Spoilage
L. bulgaricus	Acid production
L. acidophilus	Acid production
Propainibacterium	Acid production

Mycobacterium tuberculosis Pathogenic International Livestock Research Institute. (ILRI, 1995) also found the methylene blue test as the most accurate measurement ofkeeping quality.

2.12.2 Total bacterial counting

The examination of foods of the presence, types and numbers ofmicroorganisms and /or their products is basic to food microbiology. In spite of the importance of this, none of the methods in common usepermit the determination of exact numbers of microorganisms in a foodproduct. Although some methods of analysis are better than others, everymethod has certain inherent limitation associated with its use. The mostwidely used test as a general indication of good hygienic milk productionis the standard plate count. Harding, (1999) report shows that total bacterial count of raw milk from individual producers should not exceed 100.000 cfu/ml and that for bulk milk should not exceed 300.000 cfu/ml , while for pasteurized milk the bacterial load should not exceed 20.000cfu/ml (FDA,2001). A total of 930 raw milk samples from 360 dairy farms in peninsular, Malaysia were collected at 40 milk collection centres (MCC) from four regions. The samples were analyzed for total bacterialcounts (TBC). Staphylococcus aureus, coli form and Escherichia Coli aswell as the prevalence of selected pathogens such as Listeriamonocytogenes, E.coli015:H7 and Salmonella spp. The mean counts Perml for TBC, Psychrotrophic and thermophilic were 12×10^6, 7.5×10^3 and 9.1×10^3, respectively and TBC less than 10^6 cfu/ml is used as basic standard by MCC in the price incentive program

(Chye *et al.*, 2004). Mahmood *et al.,* (2001) collected 150 samples during winter and 100 samplesduring summer from Khartoum State for the estimation of the totalbacterial counts. She found that the average total bacterial counts werelog 10 6.895±0.678 cfu/ml and log 10 5.563±0.575 cfu/ml in summer andwinter, respectively, Ahmed (2004) studied the physical, chemical and microbiogical quality of raw milk offered for sale through variousdistribution channels in Khartoum State. Her results revealed that rawmilk might cause hazards for humans if it is consumed withoutpasteurization or heat treatment .Similarly, Mohamed (2004) tested 120raw milk samples collected from supermarkets in Khartoum State .Shefound high average of total bacterial count (5.63×10 9±2.8×1010 cful /ml) in milk samples .Moreover she found that the total bacterial counts were (1.04 $\times 10^{10} \pm 0.401 \times 10^{10}$ cfu /ml) and ($9 \times 10^{8} \pm 2.51 \times 10^{9}$ cfu /ml) during summer and winter respectively.

2.12.3 Colifrom bacteria

They are groups of bacteria including the genera Escherichia, Citro bacter, Enterobacter and Klebsiella (Alashmawy, 1990).Theimportant source of these organisms is the intestinal tract of man andanimals and they are also found in mastitis udder, soil, air contaminatedequipment, feed and manure. In Egypt, Ahmed and Sallam (1991) foundthat all raw milk samples examined were proved to be contaminated withcoliform bacteria having a count of 3.8 $\times 10^{8}$ cfu /ml. in Kenya, Ombui *et al.,* (1994) investigated the rate of contamination with coli forms in rawmilk supplied by farmers to dairy farmer's cans and 10.3 % of samplesfrom cooperative cans were found to be free of coli forms. However, 89.5% of the samples from farmers cans and 50 % from cooperative canscould be considered to be of good quality with no more than 50.000coliforms /ml of milk. Aleksieva and Krusher (1981) reported that in1459 batches of raw cow milk investigated in terms of total bacteria and coli from counts. It was

found that the quality of milk was good. They found that the coli form count in about 27% of the samples was up to 1×10^4 cfu /ml and the highest coli form numbers were noted during the warm months. Hussein (2001) found that the coli form count of raw milk was high in Khartoum North (log 10 3.071 ± 0.689 cfu /ml) followed byKhartoum (log 10 3.071 ±0.749 cfu /ml) and Omdurman (log 10 3.051±1.01 cfu /ml). Ahmed (2004) tested 108 samples of milk collected from venders, groceries and collection centres in the three towns (Khartoum, Khartoum North and Omdurman for coliform test. The result showed that the highest coli from count was found in groceries (182.68MPN).The coliform count was higher in Omdurman (149.2 MPN) compared to the other two towns (Khartoum and Khartoum North).

2.12.4 Escherichia Coli

It's a member of the family Enterobacteriaceae, Gram negative nonspore forming straight rod bacteria (Rea and Fleming, 1994) .Theymentioned four pathogenic categories of E.Coli which includeenterophogenic (EPEC). Enterotoxigenic (ETEC), entroinvasive (EIEC) and entrohaemoragenic (EHEC). Padhye and Dayle (1992) statedthat E.Coli was recognized as an important human pathogen, and illnesscaused by E.Coli infection ranged from self-watery diarrhea to lifethreatening manifestations such as heamolytic uraemic syndrome.Dasilva, *et al*. (2001) isolated enterophathogenic E.Coli (EPEC) frompasteurized milk which may represent a potential risk for children. Taylor (1969) emphasized that Escherichia Coli was amore delicate indicatorthan the fecal streptococci for water supplies. Mohamed (2004) studied60 milk samples collected during summer and other 60 during winterfrom the same supermarkets. The Escherichia Coli was found only inmilk, collected from Khartoum North during summer with mean count of (7×10^5 ±6.94 cfu /ml). Lues, *et.al* (2003) reported that milk samplesfrom

60 randomly selected households in central South Africa werecollected. They found that E.Coli counts were between 0 and 101 cfu /mlin 76.6% of the samples and counts of up to 105 in some samples occurred. Al-Tarazi, *et al*. (2003) determined milk quality based onJordanian standards. A total of 160 raw milk samples were collected fromsupermarkets and retailers around northern Jordan during March to May1999. Coli forms were detected in 142 (88.75%) milk samples and they ranged from 2.5×10^4 to 1.4×10^6 cfu /ml.

2.12.5 Pseudomonas aeroginosa

Pseudomonas aeroginosa is not a common cause of mastitis, buthas been observed to be of major concern in some herds. (Schalm *et al*1971).Pseudomonas aeroginosa in milk was isolated by Mamoun andBakheit, (1992) from milk of many dairy farms in Sudan .in Egypt, Khalil, (1992) found that Pseudomonas aeroginosa isolated from rawmilk was resistant to penicillin, ampicilin, erythromycin streptomycin andsusceptible to polymixin. From 131 dairy herds in eastern South Dakotaand western Minnesota, a total of 116 isolates of Pseudomonas spp. Wereisolated from raw milk and Pseudomonas fluorescence was the mostpredominant species isolated from bulk tank milk 29.9% of all isolates examined (Wang and Jayarao,2001).

2.13Milk handling and storage equipment's

Cleaning of milking system influences the total bacteria count in milk at least as much as any other factor, milk residues left on equipment contact surfaces supports the growth of variety of microorganisms.Organisms are considered to be natural inhabitants of the teat canal apex, and skin generally does not grow significantly on soiled milk contact surfaces or during refrigerated storage of milk. In general, environmental contaminations (i.e., from bedding, manure, feed …etc) are more likely

togrow on soiled equipment surfaces than are organisms associated with mastitis (Olson *et al*., 1980).

2.14 Standard and grading limits of raw milk

Raw milk under tropical condition was graded according to many factors, such as numbers of microorganisms present in milk, odor or flavor, amount of sediment, appearance and temperature (Chandan and Hedrick, 1979). In Canada, milk is standardized at the processing plant to meet or exceed the minimum legal requirements and whole milk is defined in Canada as milk that contains at least 3.25% fat and 8.25% solids non fat (Salih, 2001). According to American law, milk must contain at least 3.25% fat, 8.25% solids not fat and 11.75% total solids (Abdelwahab and Mahmud, 1984). In Egypt milk must contain least 3% fat, 8.5% solids not fat and11.5% total solids for cow's milk (Ibrahim and Elhegrawi, 1987).

(Harding , 1999) report shows that totalbacterial count of raw milk from individual producers should not exceed $1X10^4$ cfu/ml and that for bulk milk should not exceed $3X10^4$ cfu/ml ,while for pasteurized milk the bacterial load should not exceed $2X10^3$cfu/ml (FDA,2001). The mean counts perml for TBC is 12×10^6, respectively and TBC less than 10^6 cfu/ml is used as basic standard by MCC in the price incentive program (Chye andAyoub, 2004). Raw milk under tropical condition was graded according to many factors which include the number of microorganisms present in milk, Odor or flavour, amount of sediment, appearance and temperature. And also milk was graded as good when it had total bacterial count (TBC) of 5.0×10^5 cfu/ml or less , satisfactory when the (TBC) ranged between 5.0×10^5 to 5.0×10^6 cfu /ml and bad when the (TBC) was more than 5.0×10^6 cfu/ml (ChandanandHedrick, 1979). Milk is graded as"A" when the plate count does not exceed 2×10^4 Colony forming units (CFU) / ml; grade "B" when it is 1×10^6 CFU/ml and grade "C" when the plate count is

higher than this. (U.S. Department of Health Education and Welfare, 1953).

CHAPTER III

Materials and Methods

3.1 Study area

The present study was conducted in Khartoum state during the period March 2018 – December 2020. Four localities from the seven localities in Khartoum state were randomly selected (Khartoum, Jabal Awlia, Khartoum North and Nile East).The data or samples were collected from dairy farms, collection centers and groceries.

3.2 Dairy farms

Almost all dairy farmers in the study area use traditional system. They milk their cows manually twice daily in iron and or plastic milking utensils. The barns are established by using local materials. The hygiene in most of the dairy farms is very poor. A structured questionnaire was distributed to the farms for collecting data. Milk for microbiological and physicochemical analysis. And swab samples were taken for microbiological analysis.

3.3 Collection centers

Milk collection centers receive milk from dairy farms. Collected a mixture of milk from more than one farm then be distributed to the retail sellers (groceries). Milk samples were collected from the mixed milk during summer and autumn for microbiological and physicochemical analysis.

3.4 Groceries

Groceries were receiving milk either from dairy farms and milk collection centers in Khartoum state for the purpose of milk selling.The shop keepers receive their milk in metallic equipments. Some of keepers heated their milk. Some of milk refrigerated for a short time before selling.

Some of keepers were in a poor hygiene condition. A structured questionnaire was distributed to shop keepers for collecting data. Milk samples were taken randomly for physicochemical analysis and bacteria count.

3.5 Questionnaires

3.5.1 Questionnaire (A)

Questionnaire(A)was distributed randomly to 60 dairy farms from four localities.The questionnaire form includes seven themes: personal information (live area, age, job, experience and educational levels), dairy housing management (direction of barns design, manure management, insecticide usage and antiseptic usage), milking management (times of milking per day, type of milking used, udder clean, suits usage and type of utensils), labours and manure management (labours healthy status, labors rotation check, hygiene evaluation andget rid of wastes), nutrition management (type and times of feed rendered, feed sources, feeders and tassels cleaning and farm water sources), animal diseases and healthy (diseases affected milk quality, get rid of death animals, periodic detection mastitis, antibiotic usage and resources of drugs) and milk distribution (means for milk distribution, milk store and receiving equipment cleaning). In addition to four factors education levels, job, age grouping and experience grouping.

3.5.2 Questionnaire (B)

Groceries questionnaire (B) was distributed to 60 groceriesin to localities (Khartoum, Jabal awlia,Khartoum bahari, Nile east = 60 questionnaires were distributed in to different milk groceries are as such as albrari, algereif west, albaghala, Jabel awlia, alkalakla, helat koko, alhaj yousif, alsamrab, alshigla).The questionnaire form includes four themes, personal information (live area, age, job, experience and educational

levels), milk sources (soures of milk, mediators, means are possessed by mediators, type of utensils and actions of milk receive), milk heating (milk wormed, type of equipments, milk cooled and actions for milk receiving) and milk marketing (milk additions, abnormal milk noticed, get rid of abnormal milk and system used for receiving and distribution).In addition to four factors education levels, job, age grouping and experience grouping.

3.6 Milk sampling

A total of 120 milk samples (125 ml) were collected fromdairy farms (40), collection centers (40) and groceries (40).Twenty samples from each source during summer and autumn season. Milk samples were takenin dry clean sterile containers and kept in ice box containers and transported to the laboratories forphysicochemical and microbial analysis, which was done at The College of Veterinaryand Animal Production Sciences and Technology – Sudan University of Science and Technology lab.

3.7 Swab sampling

A total of 48 swab samples were collected fromdairy farms (milkers hands(24) and milk utensils (24) during summer (12 from each) and autumn (12 from each) season.The swabsamples were taken in steriletubesand kept in ice boxcontainers and transported to themicrobiology lab.for total bacterial countheCollege of Veterinary Science – Sudan University of Science and Technology lab.

3.8 Milk Physicochemical analysis

Milk fat, protein, lactose, total solids, pH, and added water were determined by Lactoskan (12-14V DC50W, Bulgaria).

3.9 Microbial analysis (total bacteria count)

The plate agar medium was used to the determinate the total bacteria count according to (Ramakant, 2008).

3.8.1 The preparation of Nutrient broth (medium)

The medium was prepared by dissolving 13 g of Nutrient broth in one liter of distilled water, boiled to dissolve completely then autoclaved at121°C for 15 minutes. The medium was used for swab sample.The swab samples were inoculated in the medium for 24 hrs.

3.8.2 The preparation of Nutrient agar (medium)

The medium was formed by dissolving 28g of powder of plate agar mediumin a litter of distilled water, heated to boiling point and sterilized in an autoclave at 121 ºC for fifteen minutes.

3.8.3 Culturing

Five dilutions were made for each sample (milk and swab). From the 4^{th} and the 5^{th} dilution fifty micro millilitres (mml) were transferred in to sterile Petri dishes withagar medium (duplicate) after melted andcooled (45-46 ºC). By using a mixing tool, the sample was rotated in one direction and then in the opposite direction. When the medium has solidified, the dishes were incubated in an inverted position 37 ºC for 24 hours.

3.8.4 Counting

The number of colony-forming unites (cfu) in each dilution was obtained by multiplying the number of colonies in reciprocal of each dilution.

3.9 Statistical analysis

Statistical analysis was done by using, Statistical Package for Social Science (SPSS, version 16. 2007).The chi-square, factorial analysis 3X2, Independent T testand correlation analysis were used in data analysis.

CHAPTER IV

Results

4.1 Dairy farmer's topographic distribution

The topographic distribution of thedairy farmersshowed that about eighty five percent of them were educated (38.3% were graduated) and 15% of the farmers were uneducated. Eighty eight percent of them were breeders and the rest were employees. Fifty percent was percentages for both farmers aged below 40 years and above 40 years old. Farmers experience less than 10 years was about 22% and more than 10 years old were 78% (10-20 years represented 38% of farmers experience and above 20 years old represented 40%). These results were shown in (Tables 1).

Table (1) Dairy farmer's topographic distribution

	Educational level			Job		Age (years)		Experience (years)		
	Uneducated	Educated	graduated	Breeder	Employee	≤ 40	> 40	≤ 10	10 > 20	> 20
Farmers percentages	15%	46.7%	38.3%	88%	12%	50%	50%	22%	38%	40%

4.2 Housing management

4.2.1Description of housing management

The barns designed north/south was more than 46%.The usages of insecticides to spray barns more than 81%.The usages of antiseptics to spray barns were 45%.The usages of insecticide to spray animal were 88%.Breeders who cleaning and putting the manure inside the barns were 63%.Breeders who face problems in autumn were 68%.

4.2.2 Effect of topographic characteristic on dairy housing management

The results showed that the educational levels had significant effect on (barn design, Insecticides usage for barns anddisinfectants) as

following: barn design (P= 0.045) of uneducated with (33.3%), educated with (43.5%) and graduated with (76.2%) all were established their barns designed in (north/south) direction compared to (uneducated, educated and graduated) with (66.7%), (56.5%) and (23.8%) respectively of them established their barns design in (east/west).Insecticides usage for barns (55.6%, 75.0% and 100.0%) and disinfectants(11.1%, 39.3% and 65.2) were significantly affected (P<0.05) by educational levels (uneducated, educated and graduated).

The educational levels had no significant (P>0.05) effect on (usage of insecticides for animals, cleaning their barns andproblems that faced farmers) as following: usage of insecticides for animals, with (66.7%, 89.3% and 95.7%) of them usedinsecticides for animals. The educational levels had no significant (P>0.05) effect oncleaning their barns (44.4%, 64.3% and 69.6) and problems that faced farmersin autumn (77.8%, 89.3%and 73.9%) of the (uneducated, educated and graduated) (Table 2).

The study showed that the job had significant(P<0.05) effect on (the barns cleaning,the usage of insecticides for barns and thedisinfectants usage) as following: all employees (100.0%) cleaned the barns compared to breeders (58.5%).The usage of insecticides for barns (79.2% and 100.0%) and the disinfectants usage (41.5% and 71.4%) and insecticides for animals (88.7% and 85.7%) were significantly (P>0.05) affected by the job (breeders and employee) respectively.

The barnsdesign and theproblems faced farmers in particular season were no significantly (P>0.05) affected by the job (breeders and employee) with (51.2% and 43.4%) and (85.7% and 57.1%) respectively and they established their barns in (north/ south) direction. Thejob had no significant effect on problems facedfarms in particular season with percentages (84.9% and 57.1%) for (breeders and employee) (Table 2).

The study showed that the age grouping had no effect on (the barns design, the usage of insecticides to spray barns, the antiseptics usage, The usage of insecticides to spray animals and the problems that faced farmers) as follow details: the barns design (48.0% and 86.7%) in (east/west) and the usage of insecticides to spray barns (76.7% and 13.3%) of the (ages < 40 years old and ages> 40 years old) respectively. The antiseptics usage (41.5% and 71.4%) of the age grouping (ages < 40 years old and ages > 40 years old) respectively. The usage of insecticides to spray animals(86.7% and 90.0%), cleaning of barns weekly(56.7% and 70.0%) and farmers faced problems in autumn season(80.0% and 83.3%) were not significantly(P>0.05) affected by the age grouping (ages =<40 years old and ages >40 years old) respectively (Table 2).

The study showed that the experience grouping (≤ 10 years, 10 >20 and >20) had no effect on (the barns design, the usage of insecticides for barns, thedisinfectants usage, the insecticides usages to spray animalsand the problems faced farmers in dairy) as follow details: the barns design (58.3%, 50.0% and 30.0%) of (≤ 10 years, 10 >20 and >20) respectively had established their barns design in (east/west) direction. The usage of insecticides for barns (92.3%, 69.6% and 87.5%) of (≤ 10 years, 10 >20 and >20) respectively and disinfectants usage (69.2%, 34.8% and 41.7%) of (≤ 10 years, 10 >20 and >20) respectively. The insecticides usages to spray animals (84.6%, 91.3% and 87.5%) of (≤ 10 years, 10 >20 and >20) respectively, the barns cleaning (61.5%, 60.9% and 66.7%) of (≤ 10 years, 10 >20 and >20) respectively and the problems faced farmers in dairy (100.0%, 78.3% and 75%) of (≤ 10 years, 10 >20 and >20) respectively (Table 2).

Table (2) Effect of topographic characteristic on dairy housing management

Dairy activities	Educational level			Job		Age grouping		Experience grouping		
	Uneducated (%)	Educated (%)	graduated (%)	Breeder (%)	Employee (%)	≤ 40 yrs (%)	> 40 yrs (%)	≤ 10 yrs (%)	10 > 20 yrs (%)	> 20 yrs (%)
Barn designed	χ^2 = **06.2**, P = **0.045**			χ^2 = **02.9** P = **0.088**		χ^2 = **00.3**, P = **0.569**		χ^2 = **02.9**, P = **0.240**		
North/south	33.3	43.5	76.2	51.2	85.7	52.0	13.3	41.7	50.0	70.0
East/west	66.7	46.5	23.8	48.8	14.3	48.0	86.7	58.3	50.0	30.0
Insecticides usage	χ^2 = **10.1**, P = **0.006**			χ^2 = **01.8**, P = **0.182**		χ^2 = **01.0**, P = **0.317**		χ^2 = **03.8** P = **0.151**		
Yes	55.6	75.0	100.0	79.2	100.0	76.7	13.3	92.3	69.6	87.5
No	44.4	25.0	00.0	20.8	00.0	23.3	86.7	07.7	20.4	12.5
Antiseptics usage	χ^2 = **08.3** P = **0.015**			χ^2 = **02.2** P = **0.135**		χ^2 = **00.1**, P = **0.795**		χ^2 = **04.2** P = **0.125**		
Yes	11.1	39.3	65.2	41.5	71.4	46.7	43.3	69.2	34.8	41.7
No	88.9	60.7	34.8	58.5	28.6	53.3	56.7	30.8	65.2	58.3
Insecticides for animals	χ^2 = **05.3**, P = **0.070**			χ^2 = **01.1** P = **0.818**		χ^2 = **00.2**, P = **0.688**		χ^2 = **00.2**, P = **0.824**		
Yes	66.7	89.3	95.7	88.7	85.7	86.7	90.0	84.6	91.3	87.5
No	33.3	10.7	04.3	11.3	14.3	13.3	10.0	15.4	08.7	12.5
Barns cleaning	χ^2 = **01.8**, P = **0.411**			χ^2 = **04.6**, P = **0.032**		χ^2 = **01.1**, P = **0.284**		χ^2 = **00.2**, P = **0.908**		
Yes	44.4	64.3	69.6	58.5	100.0	56.7	70.0	61.5	60.9	66.7
No	55.6	35.7	30.4	41.5	00.0	43.3	30.0	38.5	39.1	33.3
Farms have problems in season	χ^2 = **02.1**, P = **0.350**			χ^2 = **03.2**, P = **0.074**		χ^2 = **00.1**, P = **0.739**		χ^2 = **03.8** P = **0.149**		
Yes	77.8	89.3	73.9	84.9	57.1	80.0	83.3	100.0	78.3	75.0
No	22.2	10.7	26.1	15.1	42.9	20.0	16.7	00.0	21.7	25.0

4.3 Milking management

4.3.1 Description of milking management

Twice milking per day 97%.Manual milking usage 97%.The removal of udder dust before start milking 48%.Washing hands and cow udder was 20%.Usage of grease before milking 82%.Usage ofmetallic equipment for milking 58%.Usage of soap and water for washing utensils 92%.Milk equipments are storing at dryer 98%.Rewashing ofutensil before milking 75%.

4.3.2Effect of topographic characteristicon milking management

The study showed that all parameters mentioned were not significantly (P>0.05) affected by the educational levels (uneducated, educated and graduated) respectively, as the following: the milking times per day (100.0%, 100.0% and 95.7%), the type of milking (100.0%, 96.4% and 95.7%) and the udder washing(55.6%, 27.0% and 43.5%). And alsowashing hands before milking (77.8%, 92.6% and 91.3%) and rewashing milk utensils before milking (77.8%, 64.3% and 87.0%) were not significantly affected by the education levels respectively (Table 3).

The study showed that the times of milking twice a day was significantly (P<0.05) affected by the job, all breeders (100.0%) were milking their cows twice a day while the percentages of employees were (85.7%).

The study showed thatthe job (breeders and employees) had no significant (P>0.05) effect on (the udder cleaning, the type of milking (manual), the workers hand washing andthe milk utensils rewashing before milking) respectively, as the following: the dust removing from udder by breeders represented (51.0%) while washing udder by employees represented (57.1%).the type of milking (manual)(96.2% and100.0%)of (breeders andemployees) respectively.the workers hand washing (88.5% and 100.0%)of (breeders and employees) respectivelyand the milk utensils rewashing before milking (71.7% and 100.0%) of (breeders and employees) respectively (Table 3).

The study showed that all parameters mentioned belowwere not affected by the age grouping (ages < 40 years and ages > 40 years): (the milking times per day,the type of milking (manual), the udder cleaning,the workers wash hands and the milk equipment rewashing) as following, the

milking times per day (96.7% and100.0%),the types of milking (manual) (100.0% and 93.3%), the udder cleaning (35.3% and 57.1%), the workers wash hands (93.3% and 86.2%) and the milk equipment rewashing (76.7% and 73.3%) respectively (Table 3).

The research showed that the experience grouping had no significant effect on the times of milking per day (100.0%, 95.7% and 100.0%) and the type of milking usage (manual) (100.0% 100.0% and 91.7%)of the experience grouping (≤ 10 years,10 > 20 yearsand > 20 years) respectively. The results of the study showed that the cows udder cleaning (61.5%, 30.4% and 31.8%) was not significantly ($p > 0.05$) affected bythe experience grouping. The workers had washing their hands (100.0%, 91.3% and 82.6%) and rewashing utensils before milking (76.9%, 69.6% and 79.2%) were not significantly affected by the experience grouping (≤ 10 years,10 > 20 yearsand > 20 years) respectively (Table 3).

Table (3) Effect of topographic characteristic on milking management:

Dairy activities	Educational level			Job		Age grouping		Experience grouping		
	Uneducated (%)	Educated (%)	graduated (%)	Breeder (%)	Employee (%)	≤ 40 yrs (%)	> 40 yrs (%)	≤ 10 yrs (%)	10 > 20 yrs (%)	> 20 yrs (%)
Times of milking	χ^2 = **01.6**, P = **0.451**			χ^2 = **07.6** P = **0.006**		χ^2 = **01.0**, P = **0.321**		χ^2 = **01.6** P = **0.451**		
Twice	100.0	100.0	95.7	100.0	85.7	96.7	100.0	100.0	95.7	100.0
Three times	00.0	00.0	4.3	00.0	14.3	03.3	00.0	00.0	04.3	00.0
Type of milking	χ^2 = **00.4**, P = **0.823**			χ^2 = **00.3** P = **0.601**		χ^2 = **02.1** P = **0.150**		χ^2 = **03.1**, P = **0.212**		
Manual	100.0	96.4	95.7	96.2	100.0	100.0	93.3	100.0	100.0	91.7
Automatic	00.0	03.6	04.3	03.8	00.0	00.0	06.7	00.0	00.0	08.3
Udder cleaning	χ^2 = **03.2**, P = **0.529**			χ^2 = **01.8** P = **0.403**		χ^2 = **04.1** P = **0.131**		χ^2 = **05.1** P = **0.280**		
No cleaning	11.1	11.5	13.0	13.7	00.0	03.4	20.7	07.7	08.7	18.2
Dust remove	33.3	61.5	43.5	51.0	42.9	55.2	44.8	30.8	60.9	50.0
Udder wash	55.6	27.0	43.5	35.3	57.1	41.4	34.5	61.5	30.4	31.8
Milkers hands washed	χ^2 = **01.7**, P = **0.425**			χ^2 = **00.9**, P = **0.343**		χ^2 = **00.8**, P = **0.365**		χ^2 = **02.8**, P = **0.242**		
Yes	77.8	92.6	91.3	88.5	100.0	93.3	86.2	100.0	91.3	82.6
No	22.2	07.4	08.7	11.5	00.0	06.7	13.8	00.0	08.7	17.4
Rewash eq. before milking	χ^2 = **03.5**, P = **0.173**			χ^2 = **02.6**, P = **0.104**		χ^2 = **00.1** P = **0.766**		χ^2 = **00.6**, P = **0.737**		
Yes	77.8	64.3	87.0	71.7	100.0	76.7	73.3	76.9	69.6	79.2
No	22.2	35.7	13.0	28.3	00.0	23.3	26.7	23.1	30.4	20.8

4.4 Labor and manure management

4.4.1 Description of labor and manure management

The health status of workers identified by looking 35%.The cards not produced for workers 73%.No periodic detection for workers 80%.The hygiene assessed by owners 62%. Bath rooms available for workers 73%. The manure gets rid by dug gather before selling 72%. The dairy farms are best cleaning in winter season 63%.

4.4.2Effect oftopographic characteristicon labour and manure management

The study showed that all the parameters below were not affected bythe educational levels (uneducated, educated and graduated).The healthy cards not produced for their workers (100.0%, 71.4% and 65.2%) respectively. In addition, theworkers had no periodic detection (100.0%, 75.0% and 78.3%) respectively. Also, the educational levels had no significant effect on the workers bathing (44.4%, 81.5% and 81.0%) of them hadused bathrooms.The manure get rid (dung gather) (66.7%, 71.4% and 73.9%) of (uneducated, educated and graduated) respectively had gathered their cows manure inside the farms (Table 4).

The study showed that the healthy cards produced were significantly affected by the job, about (77.4% and 42.9%) of (breeders and employee) respectivelyhad produced healthy cards for the workers. While the job grouping had no significant effect on the following parameters, the labors periodic detection (85.7% and 79.2%) and bathrooms are available (71.7% and 85.7%) of (breeders and employees) respectively had no periodically detection for workers and had bathrooms for milkers. The study showed that the worker hadspent their needed in bathrooms instead of outdoors (74.0% and 85.7%) and had dung gathered the manure inside the farms

(75.5% and 42.9%) were not significantly ($p > 0.05$) affected by the job grouping (breeders and employees) respectively (Table 4).

The study showed that the labors periodic detection was significantly ($p < 0.05$) affected by the age grouping about (90.0% and 70.0%) of (ages< 40 years and ages > 40 years) respectivelyhad no periodically detected for workers. While the followingresults showed that the age grouping had no effect on all following parameters. The age grouping (ages < 40 years and the ages > 40 years) had no significant effect on the healthy cards produced (83.3% and 63.3%) and bathrooms are available (66.7% and 80.0%) of (ages < 40 years andthe ages > 40 years) respectively had no healthy cards produced for workers and had bathrooms for milkers. Also the results showed thatthe workers bathing inbathrooms (71.4% and 79.3%) and manure get rid (73.3% and 70.0%) respectively spent their needed in bathrooms instead of outdoors and had dung gathered the manure inside the barns respectively (Table 4).

The experience grouping (≤ 10 years, 10 > 20 yearsand > 20 years) had no effect on all following parameters. The results showed thatthe produced healthy cards for worker (69.2%, 78.3% and 70.8%), no periodically detection for workers (76.9%, 87.0% and 75.0%) andbathrooms for milkers (69.2%, 73.9% and 75.0%) were not significantly ($p > 0.05$) affected by the experience grouping (≤ 10 years, 10> 20 yearsand > 20 years) respectively. The workers bathing in bathrooms (75.0%, 77.3% and 73.9%) and the manure get rid (46.2%, 78.3% and 79.2%) were no significantly ($p > 0.05$) affected by the experience grouping (≤ 10 years, 10> 20 yearsand > 20 years) (Table 4) respectively.

Table (4) Effect of topographic characteristic on labour manure management

Dairy activities	Educational level			Job		Age grouping		Experience grouping		
	Uneducated (%)	Educated (%)	graduated(%)	Breeder (%)	Employee (%)	≤ 40 yrs (%)	> 40 yrs (%)	≤ 10 yrs (%)	10 > 20 yrs (%)	> 20 yrs (%)
Health cards produced?	χ^2 = **04.1** P = **0.129**			χ^2 = **03.8**, P = **0.050**		χ^2 = **03.1**, P = **0.080**		χ^2 = **00.5** P = **0.789**		
Yes	00.0	28.6	34.8	22.6	57.1	16.7	36.7	30.8	21.7	29.2
No	100.0	71.4	65.2	77.4	42.9	83.3	63.3	69.2	78.3	70.8
Labors periodic detection	χ^2 = **02.7**, P = **0.255**			χ^2 = **00.2**, P = **0.688**		χ^2 = **03.8**, P = **0.050**		χ^2 = **01.1** P = **0.563**		
Yes	00.0	25.0	21.7	14.3	20.8	10.0	30.0	23.1	13.0	25.0
No	100.0	75.0	78.3	85.7	79.2	90.0	70.0	76.9	87.0	75.0
There bathroom?	χ^2 = **05.0**, P = **0.087**			χ^2 = **00.6** P = **0.431**		χ^2 = **01.4** P = **0.243**		χ^2 = **00.2** P = **0.928**		
Yes	44.4	75.0	82.6	71.7	85.7	66.7	80.0	69.2	73.9	75.0
No	55.6	25.0	17.4	28.3	14.3	33.3	20.0	30.8	26.1	25.0
Labors bathing in	χ^2 = **05.5**, P = **0.063**			χ^2 = **00.5**, P = **0.500**		χ^2 = **00.5**, P = **0.490**		χ^2 = **00.1**, P = **0.96**		
Outdoors	55.6	18.5	19.0	26.0	14.3	28.6	20.7	25.0	22.7	26.1
Bathroom	44.4	81.5	81.0	74.0	85.7	71.4	79.3	75.0	77.3	73.9
Manure get rid	χ^2 = **00.2** P = **0.919**			χ^2 = **03.2**, P = **0.072**		χ^2 = **00.1**, P = **0.774**		χ^2 = **05.3**, P = **0.070**		
Dung gather	66.7	71.4	73.9	75.5	42.9	73.3	70.0	46.2	78.3	79.2
Sell direct	33.3	28.6	26.1	24.5	57.1	26.7	30.0	53.7	21.7	20.8

4.5 Nutrition management

4.5.1 Description of nutrition management

The feed offered twice per day 98%.The feed source is companies 90%.The cleanliness for tassels and feeders if needed 47%.The season was more consumed feed was winter 78%.The farm water is available along time 90%. The dairy farms water was not check 92%.

4.5.2Effect oftopographic characteristic on nutrition management

The educational levels (uneducated, educated and graduated) had no effect on (The feed times offered, the feed source, the cleaning of (tassels and feeders) per week,the season that feed more consumed and abundance farm water).The feed times offered, the feed source and the cleaning of

tassels and feeders per week was no significantly ($p > 0.05$) affected by the educational levels (uneducated, educated and graduated) with the percentages (100.0%, 100.0% and 95.7%) had offered feed for their cows twice a day. The results showed that the educational levels had no significant ($p > 0.05$) effect on feed sources (companies) (77.8%, 89.3% and 95.7%) and cleaning of (tassels and feeders) once per week (42.9%, 33.3% and 18.2%)respectively. The educational levels had no significant effect on the season that feed more consumed (66.7%, 78.5% and 82.6%) and abundant farm water (77.8%, 89.3% and 95.7%) respectively (Table 5).

The study showed that the times of feed offered was significantly ($p < 0.05$) affected by the job (breeders and employees), about (100.0% and 85.7%) of (breeders and employee) respectively had provided fodder for their cows twice per day. The job grouping had no significant ($p > 0.05$) effect on the fodder source (88.7% and100.0%) and the cleaning of (tassels and feeders) (51.1% and 83.3%) of (breeders and employees) respectively. The results showed thatthe season (winter) that feed more consumed (79.2% and 71.4%) and available farm water (88.7% and 100.0%) were not significantly ($p > 0.05$) affected bythe job grouping (breeders and employees) respectively (Table 5).

Thestudy showed that the age grouping (ages < 40 years and> 40 years) had no effect on all following parameters. The times feed provide per day (96.7% and100.0%) was not significantly affected by the age groupingthe ages (< 40 years old and> 40 years old) respectively whichhad provided feed twice per day. The feed source (90.0% and 90.0%) and the cleaning of (tassels and feeders)(55.6% and 53.8%) were not significantly ($p > 0.05$) affected by the age grouping the ages (< 40 years old and> 40 years old) respectively had sold manufactured fodder from companies andhad cleaned the tassels and feeders in needed per week. The study

resulted that the age groupingthe ages (< 40 years old and> 40 years old) had no significant effect on the season (winter) that feed more consumed (83.4% and 73.4%) and farm water available (83.3% and 96.7%) respectively had more consumed fodder in winter season and the farm water was available (Table 5).

The research showed thatthe season that feed more consumed (69.2%, 91.3% and 70.8%) and the farm water available (69.2%, 91.3% and 100.0%) were significantly affected by the experience grouping (≤ 10 years, 10 > 20 yearsand > 20 years) respectively. While the experience grouping had no significant effect on the times of feed offered per day (100.0%, 95.7% and 100.0%), the fodder source (companies) (84.6%, 91.3% and 91.6%) and the cleaning of (tassels and feedersif needed) per week (33.3%, 60.0% and 62.0%) of experience grouping respectively (Table 5).

Table (5) Effect of topographic characteristic on nutrition management:

Dairy activities	Educational level			Job		Age grouping		Experience grouping		
	Uneducated (%)	Educated (%)	graduated(%)	Breeder (%)	Employee (%)	≤ 40 yrs (%)	> 40 yrs (%)	≤ 10 yrs (%)	10 > 20 yrs (%)	> 20 yrs (%)
Times feed offered	χ^2 = **01.6**, P = **0.441**			χ^2 = **07.7**, P = **0.006**		χ^2 = **01.0**, P = **0.313**		χ^2 = **01.6**, P = **0.441**		
twice	100.0	100.0	95.7	100.0	85.7	96.7	100.0	100.0	95.7	100.0
Three times	00.0	00.0	04.3	00.0	14.3	03.3	00.0	00.0	04.3	00.0
Feed source	χ^2 = **03.9**, P = **0.414**			χ^2 = **00.9**, P = **0.64**		χ^2 = **01.2**, P = **0.549**		χ^2 = **02.8**, P = **0.586**		
local	22.2	07.1	04.3	09.4	00.0	10.0	06.7	15.4	08.7	04.2
companies	77.8	89.3	95.7	88.7	100.0	90.0	90.0	84.6	91.3	91.6
unknown	00.0	03.6	00.0	01.9	00.0	00.0	03.3	00.0	00.0	04.2
Tassels&feeders clean weekly	χ^2 = **08.7**, P = **0.070**			χ^2 = **02.5**, P = **0.289**		χ^2 = **00.2**, P = **0.908**		χ^2 = **04.1**, P = **0.391**		
Once	42.9	33.3	18.2	29.8	16.7	29.6	29.6	50.0	25.0	19.0
Twice	28.6	25.0	04.5	19.1	00.0	14.8	19.2	16.7	15.0	19.0
If needed	28.5	41.7	77.3	51.1	83.3	55.6	53.8	33.3	60.0	62.0
feed more consumed	χ^2 = **02.7**, P = **0.609**			χ^2 = **00.8**, P = **0.682**		χ^2 = **01.0**, P = **0.604**		χ^2 = **10.8**, P = **0.029**		
summer	22.2	17.9	17.4	17.0	28.6	13.3	23.3	15.4	08.7	29.2
autumn	11.1	03.6	00.0	03.8	00.0	03.3	03.3	15.4	00.0	00.0
winter	66.7	78.5	82.6	79.2	71.4	83.4	73.4	69.2	91.3	70.8
Farm water	χ^2 = **02.3**, P = **0.313**			χ^2 = **00.9**, P = **0.348**		χ^2 = **03.0**, P = **0.085**		χ^2 = **08.9**P = **0.011**		
available	77.8	89.3	95.7	88.7	100.0	83.3	96.7	69.2	91.3	100.0
No available	22.2	10.7	04.3	11.3	00.0	11.7	03.3	30.8	08.7	00.0

4.6 Animal diseases and health

4.6.1 Description of animal diseases and health

The animals more mortality were calves 93%.The get rid of dead animal to outdoors 67%. No periodic detection of mastitis 78%.The mastitis signs are swelling and red colour of milk 57%.The antibiotic usage for dairy mastitis treatment 98%. Not use antibiotic mastitis for dry cows 65%.Most common seasons for diseases affecting milk quality are summer 43% and autumn 42%.Vaccination services provided once per year 47%.The source of drug and vaccination was governmental source 28%, organization source more than 3% and veterinary source 82%.The constraints of production in the region at flock barns were a diseases 67%, scarcity of food 30%, scarcity of water 5%, scarcity of labors 38%, insect effect 28% and absent of security 22%.The cow milk destroyed immediately 77% which affected with mastitis.

4.6.2Effect oftopographic characteristicon animal disease and health

The results showed that the educational levels had significant effect on periodic detection mastitis (P= 0.010), uneducated with (100.0%), educated with (85.7%) and graduated with (56.5%) were had no periodically detection mastitis. But the educational levels had no significant effect on the following parameters:The animals more mortality (calves) (100.0%, 92.6% and 95.7%), the dead animal get rid to (outdoors) (100.0%, 70.4% and 54.5%) and the mastitis signs (udder swelling)(66.7%, 55.6% and 59.1%) were not significantly ($p > 0.05$) affected by the educational levels (uneducated, educated and graduated) respectively had calves more mortality, had got of dead animals to outdoors and had diagnosis of mastitis by udder tumour. In additionthe educational levels had no significant effect on anti mastitis usage for dry cows and the season that disease more infected, about (88.9%, 67.9% and 52.2%) and (66.7%, 25.0% and 52.2%) of (uneducated, educated and graduated) respectively

had no used anti mastitis for dry cows and the autumn season more had infected diseases (Table 6).

The study showed that the job (breeders and employees) had significant effect on the dead animals get rid (74.5% and 28.6%) and the periodic detection of mastitis (17.0% and 71.4%) of (breeders and employees) respectively had got rid dead animals to outdoors and had periodically detected of mastitis. But the below of parameters were not effect by thejob (breeders and employees). The animals more mortality were calves (94.2% and 100.0%) and the signs of mastitis werethe milk changes(40.4% and 50.0%) were not significantly (P>0.05) affected by the job (breeders and employees) respectively. The usage of anti mastitis for dry cows (66.0% and 57.1%) andthe season (summer) that the diseases more infected (41.5% and 57.1%) were not significantly affected by the job (breeders and employee) (Table 6).

The study showed that the age grouping(ages< 40 years and ages > 40 years) had no effect on all below parameters.The more animals mortality (96.7% and 93.1%), the dead animals get rid (76.7% and 60.8%) and the periodic detection of mastitis (73.3% and 80.0%) of (theages < 40 years old andthe ages > 40 years old) respectively had the calves were more mortality, had got rid of death animals to outdoors and had no periodically detected of mastitis. The study showed thatthe mastitis signs (31.0% and 51.7%), the usage of anti mastitis for dry cows (70.0% and 60.0%)and the season that had more infected of diseases (36.7% and 50.0%) of (ages < 40 years and ages > 40 years) respectively, were no significantly affected by the age grouping (Table 6).

The research showed that the experience grouping (≤ 10 years, 10 > 20 years and > 20 years) had no significant effect on all below parameters.The more animals mortality (calves) (92.3%, 100.0% and 91.3%), the dead animals get rid (76.9%, 65.2% and 68.2%) and the

periodic detection of mastitis (76.9%, 78.3% and 75.0%) of experienced (≤ 10 years, 10 > 20 years and > 20 years) respectively. The mastitis signs(72.7%, 47.8% and 62.5%), the usage of anti mastitis for dry cows(76.9%, 69.6% and 54.2%) and the season that had more infected of diseases(15.4%, 43.5% and 58.3%) were not significantly ($p > 0.05$) affected by the experience grouping(≤ 10 years, 10 > 20 years and > 20 years) respectively (Table 6).

Table (6) Effect of topographic characteristic on animal disease and health:

Dairy activities	Educational level			Job		Age grouping		Experience grouping		
	Uneducated (%)	Educated (%)	graduated(%)	Breeder (%)	Employee (%)	≤ 40 yrs (%)	> 40 yrs (%)	≤ 10 yrs (%)	10 > 20 yrs (%)	> 20 yrs (%)
Animals more mortality	**χ^2 = 00.8 P = 0.667**			**χ^2 = 00.4 P = 0.514**		**χ^2 = 00.4, P = 0.533**		**χ^2 = 02.0, P = 0.361**		
Dairy cows	00.0	07.4	04.3	05.8	00.0	03.3	06.9	07.7	00.0	08.7
Baby calves	100.0	92.6	95.7	94.2	100	96.7	93.1	92.3	100.0	91.3
Dead animals get rid	**χ^2 = 08.3, P = 0.080**			**χ^2 = 07.7, P = 0.021**		**χ^2 = 03.1 P = 0.214**		**χ^2 = 00.9, P = 0.923**		
Outdoors	100.0	70.4	54.5	74.5	28.6	76.7	60.8	76.9	65.2	68.2
Bury	00.0	00.0	09.1	03.9	00.0	00.0	07.1	00.0	04.3	04.5
Burn	00.0	29.6	36.4	21.6	71.4	23.3	32.1	23.1	30.5	27.3
Periodic detect mastitis?	**χ^2 = 09.2, P = 0.010**			**χ^2 = 10.2, P = 0.001**		**χ^2 = 00.4, P = 0.542**		**χ^2 = 00.1 P = 0.965**		
Yes	00.0	14.3	43.5	17.0	71.4	26.7	20.0	23.1	21.7	25.0
No	100.0	85.7	56.5	83.0	28.6	73.3	80.0	76.9	78.3	75.0
Mastitis signs	**χ^2 = 00.3, P = 0.841**			**χ^2 = 00.2 P = 0.651**		**χ^2 = 02.6 P = 0.110**		**χ^2 = 02.2, P = 0.340**		
Tumor	66.7	55.6	59.1	59.6	50.0	69.0	48.3	72.7	47.8	62.5
Milk change	33.3	44.4	40.9	40.4	50.0	31.0	51.7	27.3	52.2	37.5
Ant mastitis for dry cows	**χ^2 = 04.0, P = 0.134**			**χ^2 = 00.2 P = 0.643**		**χ^2 = 00.7, P = 0.417**		**χ^2 = 02.3, P = 0.323**		
Yes	11.1	32.1	47.8	34.0	42.9	30.0	40.0	23.1	30.4	45.8
No	88.9	67.9	52.2	66.0	57.1	70.0	60.0	76.9	69.6	54.2
Season disease infection	**χ^2 = 07.0, P = 0.136**			**χ^2 = 01.5 P = 0.463**		**χ^2 = 01.1 P = 0.581**		**χ^2 = 07.1, P = 0.131**		
Summer	22.2	53.6	39.1	41.5	57.1	36.7	50.0	15.4	43.5	58.3
Autumn	66.7	25.0	52.2	41.5	42.9	46.7	36.7	69.2	39.1	29.2
Winter	11.1	21.14	08.7	17.0	00.0	16.7	13.3	15.4	17.4	12.5

4.7 Milk marketing and distribution

4.7.1 Description ofmilk marketing anddistribution

The farm milk distribution by mediators 72%.The means used for distribution of milk are cars 48%.No storing farms milk before distributed 75%.The complaints from mediators for milk changes of texture 13%.No regular visits from health and specification employee 68%.No problems of milk distribution 93%.The distribution and marketing of milk related to a particular season (winter) 57%.The winter season is the best for dairy investment 42%.

4.7. 2 Effect of topographic characteristic on milk distribution and marketing

The results showed that the educational levels (uneducated, educated and graduated) had significant ($P<0.05$) effect on (the milk storing andthe milk distributed affected) while the rest parameters were not affected.Themilk storing (83.3%, 100.0% and 100.0%) and the milk distributed affected (88.9%, 42.9% and 60.9%) of (uneducated, educated and graduated) respectively had no storing milk before marketing andtheir milk affected by (summer and autumn) and had changed quality. In additionthe educational levels had no significant effect on the milk equipment cleaned (with soap) (100.0%, 95.7% and 85.7%), had no specification employees visits to their farms (88.9%, 64.3% and 65.2%)and milk distribution problems (affected by some seasonal factors during marketing) (100.0%, 92.9% and 95.7%) of (uneducated, educated and graduated) respectively (Table 7).

The study showed that the job (breeders and employees) had no significant effect on all parameters below in this paragraph.The milk storing (97.6% and 100.0%), milk equipment cleaned (91.1% and 100.0%) and specification employee visits to their farms (67.9% and 71.4%) of

(breeders and employees) respectively had no stored their milk, had washed their milk utensils by water with soap and had no organized visits to their farm from specification directors. The milk distribution problems faced (94.2% and 100.0%) and the season that effect on milk distribution were not significantly (P>0.05) affected by the job (breeders and employees) respectively had noproblems faced the milk distribution and had the milk distribution affected by the seasonal factors during marketing (Table 7).

The study showed that the age grouping (ages < 40 years and ages > 40 years) had no effect on all followed.The milk storing (100.0% and 96.0%),milk equipment cleaned (95.7% and 88.9%) and specification employee visits to their farms (73.3% and 63.3%) of (the ages < 40 years old andthe ages > 40 years old) respectively had no stored their milk, had was hed their milk utensils by water with soap and had no organized visits to their farm from specification directors. The study showed thatThe milk distribution problems faced (93.3% and 96.6%) and the season that effect on milk distribution (66.7% and 46.7%) were not significantly (P>0.05) affected by the job (breeders and employee) and respectively had noproblems faced the milk distribution and had the milk distribution affected by the highly of temperature in summer and milk clouting in autumn during marketing (Table 7).

The research showed thatthe season that effect on milk distribution (69.2%, 69.6% and 37.5%) was significantly affected by the experience grouping (≤ 10 years,10 > 20 yearsand > 20 years)respectively had the milk distribution affected by the highly of temperature in summer and milk clouting in autumn during marketing. While the rest following parameters were not affected by the experience grouping. The milk storing (100.0%, 100.0% and 95.0%) and milk equipment cleaned (88.9%, 73.3% and 63.3%) of experienced (≤ 10 years, 10> 20 yearsand > 20 years)

respectively had no stored their milk and had washed their milk utensils by water with soap. More overthe experience grouping had no significant effect on thespecification employee visits to their farms (53.8%, 69.6%and 75.0%) andthe milk distribution problems faced (100.0%, 87.0% and 100.0%) of experienced (≤ 10 years, 10> 20 yearsand > 20 years) respectively had no organized visits to their farm from specification directors and the milk distribution affected by the highly of temperature in summer and milk clouting in autumn during marketing (Table 7).

Table (7) Effect of topographic characteristic on milk distribution and marketing:

Dairy activities	Educational level			Job		Age grouping		Experience grouping		
	Uneducated (%)	Educated (%)	graduated (%)	Breeder (%)	Employee (%)	≤ 40 yrs (%)	> 40 yrs (%)	≤ 10 yrs (%)	10 > 20 yrs (%)	> 20 yrs (%)
Do store milk?	**$\chi^2$06.8, P = 0.033**			**χ^2 = 00.1, P = 0.755**		**χ^2 = 00.9P = 0.354**		**χ^2 = 01.1, P = 0.573**		
Yes	16.7	00.0	00.0	02.4	00.0	00.0	04.0	00.0	00.0	04.5
No	83.3	100.0	100.0	97.6	100	100.0	96.0	100.0	100.0	95.0
Equipment cleaning	**χ^2 = 02.4, P = 0.654**			**χ^2 = 00.5P = 0.785**		**χ^2 = 01.1P = 0.575**		**χ^2 = 03.3P = 0.506**		
Water only	00.0	04.3	09.5	06.7	00.0	04.3	07.4	00.0	12.5	04.5
With soap	100	95.7	85.7	91.1	100.0	95.7	88.9	100	87.5	91.0
Antiseptics	00.0	00.0	04.8	2.2	00.0	00.0	03.7	00.0	00.0	04.5
Health and specification employee visits	**χ^2 = 02.1P = 0.355**			**χ^2 = 00.0, P = 0.851**		**χ^2 = 00.7, P = 0.405**		**χ^2 = 01.8, P = 0.413**		
Yes	11.1	35.7	34.8	32.1	28.6	26.7	36.7	46.2	30.4	25.0
No	88.9	64.3	65.2	67.9	71.4	73.3	63.3	53.8	69.6	75.0
Do milk distribution problems?	**χ^2 = 00.7, P = 0.705**			**χ^2 = 00.4, P = 0.514**		**χ^2 = 00.3, P = 0.594**		**χ^2 = 04.9, P = 0.084**		
Yes	00.0	07.1	04.3	05.8	00.0	06.7	03.4	00.0	13.0	00.0
No	100.0	92.9	95.7	94.2	100.0	93.3	96.6	100.0	87.0	100.0
Do milk distribution affect by season?	**χ^2 = 06.1, P = 0.046**			**χ^2 = 00.6, P = 0.433**		**χ^2 = 02.4, P = 0.118**		**χ^2 = 06.0, P = 0.050**		
Yes	88.9	42.9	60.9	58.5	42.9	66.7	46.7	69.2	69.6	37.5
No	11.1	57.1	39.1	41.5	57.1	33.3	53.3	30.8	30.4	62.5

4.8 Grocery keepers' topographic distribution

The topographic distribution of the grocery's keepers showed that the education levels include more than ninety six percent was educated (educated 68.3% and graduated 28.3%) and uneducated shoppers (3.3%). Sixty eight percent of them are employees. Their age groups are ≤35 years (55.0%) and >35 years (45.0%) and the experiences groups include ≤6 years (41.7%) and >6 years (58.3%).

Table (8) Grocery keepers' topographic distribution:

	Educational levels			job		Age group		Experience	
	Uneducated	Educated	Graduated	Shopper	Employee	≤ 35 years	> 35 years	≤ 6 years	>6 years
Groceries percentages	3.3%	68.3%	28.3%	32%	68%	55%	45%	41.7%	58.3%

4.9 Grocery milk source

4.9.1 Description of milk source

The sources of milk are mediators 88%.The milk transports were cars 62%.The mediators carry out their (milk on) by metallic utensils 55%. Choosing mediator to deal with by quality standard 72%.The measure equipments which are use to get or sell milk were toumans or pounds 88%.The mediators were committed to health control and specification 75%.The utensils use to collecting (milk in) ismetallic utensils 85%. Actions do during receive milk were cleaning then heating 90%.The season easier to managing and marketing milk was winter 47%.

4.9.2Effect oftopographic characteristic on grocery milk source

The study showed that the educational levels had significant ($p \leq 0.05$) effect on the shop keeper mediator committed to healthy with (00.0%, 88.6% and 87.5%) of (uneducated, educated and graduated) respectively. All the following parameters in this paragraph were not

affected by the education levels.The educational levels had no significant effect on the milk sources for shoppers (mediators) (100.0%, 85.4 and 94.1) and the means (cars) used for milk transportation (50.0%, 65.7% and 81.2%) of (uneducated, educated and graduated) respectively. More over the educational levels had no significant effect on the type of milk equipment did mediators carry out their milk on (plastic) (100.0%, 37.1% and 31.2), the type of milk equipment did groceries received their milk in (ironed) (50.0%, 85.4 and 88.2) and the season that milk easily to milk management (winter) (100.0%, 46.3% and 64.7%) of (uneducated, educated and graduated) respectively (Table 9).

The study showed that the job was significant ($p \leq 0.05$) effect on the type of milk equipment did mediators carry their milk on (ironed) andthe type of milk equipment did groceries received their milk in (ironed)). The type of milk equipment did mediators carry their milk on (ironed) (35.3% and 75.0%) and the type of milk equipment did groceries received their milk in (ironed) (68.4% and 92.7%) of (shopper and employee) respectivelyhad carried their milk in ironed utensils and had received their milk in ironed utensils also. The study showed that al the rest parameters in this paragraph were not affected by job.The milk sources (from mediators) (89.5% and 87.8%) and theshop keepers mediator committed to healthy (76.5% and 66.7%) were not significantly affected by the job (shoppers and employees) respectively. In addition, the means used for milk transportation (82.4% and 86.1%) and the season that milk easily to milk management (63.2% and 48.8) were not significantly ($p > 0.05$) affected by the (shoppers and employees) respectively (Table 9).

The study showed that the age grouping had significant ($p \leq 0.05$) effect on the milk sources (mediators) and the type of milk equipment did mediator carry their milk on (ironed).The milk sources (mediators) (97.0%

and 77.8%) of them had depended on mediators as the sources of their milk and the type of milk equipment did mediators carry their milk on (ironed) (75.0% and 72.9%) of them had carried their milk in ironed utensils. (Ages< 35 years and ages > 35 years) respectively. While the measurements left were not affected by the age grouping.The means used for milk transportation (cars)(68.8% and 71.4%) and theshop keepers mediators committed to healthy (87.5% and 81.0%) were not significantly ($p > 0.05$) affected bythe age grouping (< 35 years old and the ages > 35 years old).The study showed that the age was not significant ($p \leq 0.05$)effect onthe type of milk equipment did groceries receive their milk in (ironed)(84.4% and 85.2%) andthe season (winter) that milk easily to management (54.5% and 51.9%) of (the ages < 35 years old and the ages > 35 years old) respectively (Table 9).

The study showed that the experience had significant ($p \leq 0.05$) effect on the means (cars) used for milk distribution (50.0% and 83.9%) of experienced (=<6 years and >6 years) respectively. While the measurements left were not affected by the experiences.The milk sources adopted to mediators as the sources (88.0% and 88.6%), the type of milk equipment (ironed) did mediators carry their milk on (68.2% and 58.1%) and theshop keepers mediators committed to healthy (81.8% and 87.1) of experienced (=<6 years and >6 years) respectively. The experience had no significant ($p \leq 0.05$) effect onthe type of milk equipment (ironed) did mediators carry their milk in (88.0% and 85.7%) and the season (winter) that milk easily to management (64.0% and 45.7) of experienced (=<6 years and >6 years) respectively had used utensils to receive their milk in and the winter season more safety for exchanger milk (Table 9).

Table (9) Effect of topographic characteristic on groceries milk source:

Groceries activities	Educational levels			job		Age group		Experience	
	Uneducated (%)	Educated (%)	Graduated (%)	Shopper (%)	Employee (%)	≤ 35 years (%)	> 35 years (%)	≤ 6 years (%)	>6 years (%)
Milk source	χ^2 = **01.2**, P = **0.558**			χ^2 = **00.0**, P = **0.851**		χ^2 = **05.3** P = **0.021**		χ^2 = **00.0**, P = **0.946**	
farms	00.0	14.6	05.9	10.5	12.2	03.0	22.2	12.0	11.4
mediators	100	85.4	94.1	89.5	87.8	97.0	77.8	88.0	88.6
Milk transported by	χ^2 = **01.6**, P = **0.439**			χ^2 = **00.5**, P = **0.468**		χ^2 = **00.0**, P = **0.835**		χ^2 = **07.0**, P = **0.008**	
cart	50.0	34.3	18.8	23.5	33.3	31.2	28.6	50.0	16.1
car	50.0	65.7	81.2	76.5	66.7	68.8	71.4	50.0	83.9
Milk equipment carry on	χ^2 = **03.6**, P = **0.166**			χ^2 = **07.7**, P = **0.005**		χ^2 = **05.6**, P = **0.018**		χ^2 = **00.6**, P = **0.454**	
Ironed	00.0	62.9	68.8	35.3	75.0	75.0	42.9	68.2	58.1
Plastic	100.0	37.1	31.2	64.7	25.0	25.0	57.1	31.8	41.9
Mediator committed to health?	χ^2 = **11.7**, P = **0.003**			χ^2 = **00.1**, P = **0.721**		χ^2 = **00.4**, P = **0.515**		χ^2 = **00.3**, P = **0.597**	
Yes	00.0	88.6	87.5	82.4	86.1	87.5	81.0	81.8	87.1
No	100.0	11.4	12.5	17.6	13.9	12.5	19.0	18.2	12.9
Milk equipment collecting in		χ^2 = **02.1**	P = **0.356**	χ^2 = **06.0**	P = **0.014**	χ^2 = **00.0**	P = **0.971**	χ^2 = **00.0**	P = **0.855**
Ironed	50.0	85.4	88.2	68.4	92.7	84.8	85.2	84.0	85.7
Plastic	50.0	14.6	11.8	31.6	07.3	15.2	47.8	16.0	14.3
Season easier to milk manage		χ^2 = **05.2**	P = **0.516**	χ^2 = **04.3**	P = **0.229**	χ^2 = **00.4**	P = **0.939**	χ^2 = **05.3**	P = **0.153**
Summer	00.0	24.4	23.5	26.3	22.0	21.2	25.9	24.0	22.9
autumn	00.0	14.6	00.0	10.5	09.8	09.1	11.1	00.0	17.1
winter	100.0	46.3	64.7	63.2	48.8	54.5	51.9	64.0	45.7
unrelated	00.0	14.6	11.8	00.0	19.4	15.2	11.1	12.0	14.3

4.10 Grocery milk treatment

4.10.1 Description of milk treatment

Milk was heating directly before selling 90%. Kind of utensils which used for heating were metallic utensils 93%. Milk spent in heating about 60 minute 28%.No measuring the milk temperature before and after heating 98%.No cooling the milk immediately after heating 77%.The heating milk done inside the room 50% and done outside the room 50%.The actions are taken to prepare milk similar in all seasons 85%.

4.10.2Effect oftopographic characteristicon groceries milk

The milk heating (boiled) (100.0%, 87.8% and 94.1%) and the milk temperature measuring (not taken) (100.0%, 97.6% and 100.0%) of (uneducated, educated and graduated) respectively. The place where milk heating (outside grocery) (50.0%, 46.2% and 58.8%) and the milk management in different seasons (100.0%, 85.4% and 82.4%) were not significantly affected bythe educational levels respectively (Table 10).

The type of milk heating (boiled) (84.2% and 92.7%) and the milk temperature measurement (94.7% and 100.0%) respectively. The place where milk heating (63.2% and 43.6%) and the milk management in different seasons (84.2% and 85.4%) were not significantly affected by (shopkeepers and employees) respectively had heated their milk inside of the grocery build and their milk in different management in different seasons (Table 10).

The milk boiled with (90.9% and 88.9%) and the milk temperature measured (not take) with (97.0% and 100.0%) were no significantly affected by the age grouping (< 35 years old and > 35 years old) respectively. The place where the milk heating (out side of grocery) (56.2% and 42.3%) and the milk management in different seasons (at the same

management) (81.8% and 88.9%) were not significantly affected by the age grouping respectively, (Table 10).

The study showed that all parameters were not affected by the experience (< 6 years and > 6 years). The milk heating (84.0% and 94.3%) and the milk temperature measurement (96.0% and 100.0%) were not measured. The place where milk heated (in side of grocery) (47.8% and 51.4%) and the milk management in different seasons (84.0% and 85.7%) were in the same, (Table 10).

Table (10) Effect of topographic characteristic on groceries milk heating:

Groceries activities	Educational levels			job		Age group		Experience	
	Uneducated (%)	Educated (%)	Graduated (%)	Shopper (%)	Employee (%)	≤ 35 years (%)	> 35 years (%)	≤ 6 years (%)	>6 years (%)
Milk heating	χ^2 = **00.8**P = **0.683**			χ^2 = **01.0**, P = **0.309**		χ^2 = **00.1**, P = **0.795**		χ^2 = **01.7**, P = **0.190**	
By bathing	00.0	12.2	05.9	15.8	07.3	09.1	11.1	16.0	05.7
By boiling	100	87.8	94.1	84.2	92.7	90.9	88.9	84.0	94.3
Milk temperature measured?	χ^2 = **00.5**, P = **0.790**			χ^2 = **02.2**, P = **0.139**		χ^2 = **00.8**, P = **0.362**		χ^2 = **01.4**, P = **0.233**	
yes	00.0	02.4	00.0	05.3	00.0	03.0	00.0	04.0	00.0
No	100.0	97.6	100.0	94.7	100.0	97.0	100.0	96.0	100.0
Where heating milk	χ^2 = **00.8**, P = **0.684**			χ^2 = **02.0**, P = **0.162**		χ^2 = **01.1**, P = **0.291**		χ^2 = **00.1**P = **0.788**	
inside	50.0	53.8	41.2	63.2	43.6	43.8	57.7	47.8	51.4
outside	50.0	46.2	58.8	36.8	56.4	56.2	42.3	52.2	48.6
Milk manage similar in all	χ^2 = **00.5**, P = **0.798**			χ^2 = **00.0**, P = **0.907**		χ^2 = **00.6**P = **0.445**		χ^2 = **00.0**, P = **0.855**	
yes	100.0	85.4	82.4	84.2	85.4	81.8	88.9	84.0	85.7
No	00.0	14.6	17.6	15.8	14.6	18.2	11.1	16.0	14.3

4.11 Grocery milk marketing and distribution

4.11.1 Description of milkdistribution and marketing

Selling heated milk from grocery to consumers 90%.Not store milk but directly distribution 68%.Period more consumption of milk was winter season 45%.There were no additions to milk after heating treatment 93%.No abnormal milk noticed before heating 57%.There were more changes of milk colour noticed 18%.No abnormal milk noticed after heating 58%. There were more changes in milk texture as curd 33%.The abnormal milk gets rid before or after heating is discarding 35%.There was

no affixed system used from reception milk till even distribution 52%.Equipments that used to reception milk and store was metallic 95%.The equipments were used to milk refrigeration were metallic 80%.The common method used to heating was boiling 93%.Type of equipments were used to milk distribution were metallic 68%.No complaints from milk consumers 55%.All breeders know that the safety milk which selling was linked with the safety of communities 100%.

4.11.2 Effect of topographic characteristic on grocery milk distribution and marketing

The study showed that the educational levels had significant ($p \leq 0.05$) effect on the abnormal milk get rid (100.0%, 48.0% and 90.0%) of (uneducated, educated and graduated) respectively and both of the (educated and graduated) had made (yogurt and discarded). The educational levels had no significant effect on all measurements left.The keepers sell milk (not fresh) (100.0%, 87.8 and 94.1) and the season that milk was more consumed (winter) (50.0%, 41.5 and 52.9) of (uneducated, educated and graduated) respectively.The milk additions (100.0%, 95.1% and 88.2%) of them not added andthe abnormal milk noticed (before or after) treated (100.0%, 39.0% and 47.1%) respectively. More over the educational levels had no significant effect on the milk changes (100.0%, 50.0% and 37.5%) had seen (colours, clouting and added water), the milk refrigeration equipments used (100.0%, 85.4% and 94.1%) had used ironed utensils for refrigeration their milk and the customer complaints about (50.0%, 56.1% and 52.9%) of (uneducated, educated and graduated) respectively had no customer complains (Table 11).

The study showed that the job had significant ($p \leq 0.05$) effect on the additions to milk, about (84.2% and 97.7%) of (shopper and employee) respectively had no additions to their milk. While all the following

measurements left were not affected. Thekeepers had sold their milk after heated (84.2% and 92.7%) and more milk consumed in winterseason (47.4% and 43.9%) were not significantly ($p > 0.05$)affected bythe (shopper and employee) respectively. The job (shopper and employee) had noticed that more changes in milk texture during receiving and heating with (52.6% and 58.5) respectively. Themilk changes (clouting) (44.5% and 41.2%) and the abnormal milk get rid (discard) (71.4% and 47.8) were not significantly ($p > 0.05$) affected bythe (shopper and employee) respectively. The job had no significant ($p > 0.05$) effect onthe type of milk refrigeration equipments used (78.9% and 92.7%) and the customer complaints (57.9% and 53.7%) of (shopper and employee) respectively (Table 11).

The results showed that the age grouping had significant ($p \leq 0.05$) effect on the abnormal milk get rid (discard) with (71.4% and 37.5%) of (ages < 35 years and ages > 35 years) respectively.While the following measurements left were not affected. The keepers had sold their milk after heated with (90.9% and 88.9%) of (ages < 35 years old and ages > 35 years old) respectively. The season (winter) that milk was more consumed (48.5% and 40.8%) and no additions to milk (90.9% and 96.3) were not significantly ($p > 0.05$) affected by the age grouping (the ages < 35 years old and the ages > 35 years old) respectively. The abnormal milk noticed during milk receive (57.6% and 55.6%) and no milk changes (50.0% and 33.3) were not significantly ($p > 0.05$) affected by the ages grouping respectively had no noticed any changes during milk receive from mediators andtheir milk been clouting during heated. The data resulted that (the ages < 35 years old and the ages > 35 years old) had no significant ($p > 0.05$) effect onthe milk refrigeration equipments used (ironed)(93.9% and 81.5%) and the customer complaints (54.5% and 55.6%) respectively had

used ironed utensils during refrigeration their milk and they had no customer complains (Table 11).

All the following measurements in this paragraph were not affected by experience. Thekeepers had sold their milk after heated (84.0% and 94.3%), the season (winter) that milk more consumed (52.0% and 40.0%) and no additions to milk (92.0% and 94.3)were not significantly ($p > 0.05$)affected by the experience grouping (< 6 years and > 6 years) respectively.The abnormal milk noticed during milk receive (56.0% and 57.1%), milk changes (45.4% and 40.0%) and the abnormal milk get rid (53.3% and 59.1%) were not significantly ($p > 0.05$) affected by experienced (< 6 years and > 6 years) respectively had no noticed any changes during milk receive from mediators andthey had discarded the abnormal milk.The data resulted that experienced (< 6 years and > 6 years) had no significant ($p > 0.05$) effect onthe milk refrigeration equipments used (84.0% and 91.4%) and the customer complaints (52.0% and 57.1%) respectively had used ironed utensils during refrigeration their milk and they had no customer complains (Table 11).

Table (11) Effect of topographic characteristic on groceries milk distribution:

Groceries activities	Educational levels			job		Age group		Experience	
	Uneducated (%)	Educated (%)	Graduated (%)	Shopper (%)	Employee (%)	≤ 35 years (%)	> 35 years (%)	≤ 6 years (%)	>6 years (%)
Keepers sell fresh milk?	χ^2 = **00.8**, P = **0.683**			χ^2 = **01.0**, P = **0.309**		χ^2 = **00.1**, P = **0.795**		χ^2 = **01.7**, P = **0.190**	
Yes	00.0	12.2	05.9	15.8	07.3	09.1	11.1	16.0	05.7
No	100.0	87.8	94.1	84.2	92.7	90.9	88.9	84.0	94.3
Milk more consumption	χ^2 = **02.8**, P = **0.830**			χ^2 = **00.7**, P = **0.862**		χ^2 = **00.5**P = **0.925**		χ^2 = **01.2**, P = **0.762**	
summer	50.0	19.5	17.6	15.8	22.0	18.2	22.2	20.0	20.0
autumn	00.0	14.6	05.9	15.8	09.8	12.1	11.1	08.0	14.3
winter	50.0	41.5	52.9	47.4	43.9	48.5	40.8	52.0	40.0
Not related	00.0	24.4	23.6	21.1	24.4	21.2	25.9	20.0	25.7
Additions to milk	χ^2 = **01.1**, P = **0.588**			χ^2 = **03.7**, P = **0.050**		χ^2 = **00.7**, P = **0.405**		χ^2 = **00.1**, P = **0.726**	
Yes	00.0	04.9	11.8	15.8	02.4	09.1	03.7	08.0	05.7
No	100.0	95.1	88.2	84.2	97.6	90.9	96.3	92.0	94.3
There abnormal milk noticed	χ^2 = **03.0**, P = **0.221**			+		χ^2 = **00.0**, P = **0.875**		χ^2 = **00.0**, P = **0.930**	
Yes	100.0	39.0	47.1	47.4	41.5	42.4	44.4	44.0	42.9
No	00.0	61.0	52.9	52.6	58.5	57.6	55.6	56.0	57.1
Milk change are	χ^2 = **07.0**, P = **0.137**			χ^2 = **00.2**, P = **0.908**		χ^2 = **00.8**, P = **0.684**		χ^2 = **02.8**, P = **0.245**	
added water	00.0	06.2	37.5	11.1	17.6	14.3	16.7	27.3	06.7
curd	00.0	50.0	37.5	44.4	41.2	35.7	40.0	45.4	40.0
coloured	100.0	43.4	25.0	44.5	41.2	50.0	33.3	27.3	53.3
Abnormal milk get rid		χ^2 = **10.5**	P = **0.033**	χ^2 = **04.0**	P = **0.142**	χ^2 = **05.8**	P = **0.050**	χ^2 = **04.1**	P = **0.130**
yogurt	100.0	32.0	10.0	28.6	30.4	14.3	50.0	20.0	36.4
discard	00.0	48.0	90.0	71.4	47.8	71.4	37.5	53.3	59.1
return	00.0	20.0	00.0	00.0	21.8	14.3	12.5	26.7	04.5
Customer complains?		χ^2 = **00.1**	P = **0.966**	χ^2 = **00.1**	P = **0.759**	χ^2 = **00.0**	P = **0.938**	χ^2 = **00.2**	P = **0.693**
Yes	50.0	43.9	47.1	42.1	46.3	45.5	44.4	48.0	42.9
No	50.0	56.1	52.9	57.9	53.7	54.5	55.6	52.0	57.1

4.12Some physicochemicalcomposition of cow's milk

4.12.1Description of some physicochemical

The results showed that the(fat %) ranged from (3.51±0.6) to (4.63±0.6),the(protein%) ranged from (3.04±0.2), to (3.32±0.3), the (lactose%) ranged from (4.56±0.3) to (5.00±0.5), the (total solids %) ranged from (11.79±0.7) to (13.34±1.1) and pHranged from (6.60±0.2) to (6.70±0.2).The (added water %) ranged from (0.00±0.0) to (2.72±6.3).The results shows that 16 % (n=20) of milk samples were adulterated with water. Water adulteration as percent in farms, collection centres and groceries were 10.0%, 12.5% and 27.5% respectively. While the water adulteration as percent in summer and autumn were 21.7% and 11.7%, respectively.The total bacterial count (log) ranged from (2.92±0.2) to (3.42±0.3) (Table, 12& 13).

4.12.2Effect of source on some physicochemical of cow milk

The protein ($P<0.009$), lactose ($P<0.007$) and added water ($P<0.024$) were significantly ($P<0.05$) affected by the source, while the fat, total solids, pH and total bacteria count were not significantly affected.

4.12.3Effect of season on some physicochemical of cow milk

The results showed that the season had not significant effect on pH and added water, while the fat, protein, lactose, total solids and total bacteria count were significantly affected.

4.12.4Effect of interaction between source and season on some physicochemical of cow milk

The fat, pH, added water and total bacteria count were not significantly affected by the source and season, but the protein, lactose and total solids were significantly affected.

Table (12) the effect of sources and seasons on some physicochemical composition of cow's milk:

source	Season	Fat	protein	Lactose	TS	pH	A. water	TBC
Dairy farms	Summer(n=20)	3.68±1.0	3.13±0.1	4.69±0.1	12.22±1.1	6.67±0.2	0.16±0.7	2.92±0.2
	Autumn(n=20)	4.25±0.6	3.10±0.2	4.66±0.2	12.71±0.6	6.70±0.2	0.82±2.3	3.10±0.2
Coll. centres	Summer(n=20)	3.51±0.6	3.04±0.2	4.56±0.3	11.79±0.7	6.64±0.2	1.63±5.1	2.99±0.1
	Autumn(n=20)	4.63±0.8	3.20±0.1	4.80±0.2	13.34±1.1	6.60±0.2	0.00±0.0	3.36±0.2
groceries	Summer(n=20)	3.57±0.5	3.09±0.3	4.63±0.4	11.98±0.9	6.63±0.1	2.72±6.3	2.98±0.2
	Autumn(n=20)	4.12±0.9	3.32±0.3	5.00±0.5	13.19±1.4	6.69±0.3	1.33±3.3	3.42±0.3
source	Farms(n=40)	3.96±0.9	3.12±0.1	4.67±0.2	12.46±0.9	6.69±0.2	0.49±0.4	3.17±0.3
	Coll.cen.(n=40)	4.07±0.9	3.12±0.2	4.68±0.3	12.57±1.2	6.62±0.2	0.82±0.4	3.17±0.3
	Groceries(n=40)	3.84±0.7	3.21±0.3	4.81±0.5	12.59±1.3	6.66±0.2	2.03±0.4	3.20±0.3
	Sig.	(0,169)	(0,009)	(0,007)	(0,713)	(0,094)	(0,024)	(0,520)
Season	Summer(n=60)	3.58±0.7	3.08±0.2	4.63±0.3	11.99±0.9	6.65±0.2	1.50±0.3	3.00±0.2
	Autumn(n=60)	4.33±0.8	3.21±0.2	4.82±0.4	13.07±1.1	6.66±0.2	0.72±0.3	3.40±0.3
	Sig.	(0,000)	(0,000)	(0,000)	(0,000)	(0,520)	(0,101)	(0,000)
Interaction	**Sig.**	0.026	0.000	0.000	0.004	0.186	0.103	0.243

coll. Centre = collection centre / sig. = significant/ *Mean values bearing different superscripts within columns are significantly different ($p<0.05$).

4.13 Effect of added water on some physicochemical of cow milk

From the table 13 the results showed that the milk components (fat, protein, lactose and total solids) were significantly affected by added water. In other hand, the added water had not significant effect on the (pH and total bacteria count).

Table (13) Effect of added water on milk compositions and total bacteria count:

	No A. water (n=100)	A. water (n=20)	Significant
Fat %	4.06 ± 0.9	3.48 ± 0.6	.000
Protein%	3.21 ± 0.2	2.83 ± 0.2	.000
Lactose %	4.82 ± 0.3	4.26± 0.3	.000
T.S %	12.81 ± 1.1	11.23 ± 0.7	.000
PH	6.66 ± 0.2	6.63 ± 0.2	.324
logtbct (cfu)	3.20 ± 0.3	3.11 ± 0.3	.115

NS = not significant, ** significant at $P<0.01$)

4.14Correlation of total bacteria counts (log) and milkadded water with milk physicochemical and swab total bacteria count

The correlation coefficients of the total bacteria count with (Bacterial count (labors hands (R = -0,031)) and utensils (R = -0,068)), protein(R = -0,077), lactose(R = -0,052), and pH(R = -0,150)) respectively, were in a weak relationship among the variables were no significant ($p>0.05$) affected by bacteria count, while the correlation coefficients of the total bacteria count with (fat (R = -0,396) and total solids (R = -0,341)) respectively, were had a relationship between the variables and were significantly ($p\leq0.05$) affected by bacteria count (Table 14).

The correlation coefficients of the added water with (fat (R = 0,061) and total solids (R = -0,261)) respectively, were in a weak relationship between the variables and were not significantly ($p>0.05$) affected by milk added water, while the correlation coefficients of the added water with (protein (R = -0,870), lactose (R = -0,860) and pH (R = -0,574)) were had strong relationship among the added water with the physicochemical and were highly significantly ($p<0.05$) affected by milk added water (Table 14).

Table (14) Correlations of total bacterial count (log) and added water with some of milk physicochemical and total bacteria count (hand & utensil):

	TBC of milk	Added water
Bacterial count (hands 3.1±.2)	R = -0,031 , sig. (0,833)	
Bacterial count(utensils 3.2±.2)	R = -0,068 , sig (0,648)	
Fat	R = 0,396 , sig (0,005)	R = 0,061 , sig (0,678)
Protein	R = -0,077 , sig (0,602)	R = -0,870 , sig (0,000)
Lactose	R = -0,052 , sig (0,725)	R = -0,860 , sig (0,000)
TS	R = 0,341 , sig (0,018)	R = -0,261 , sig (0,073)
pH	R = -0,150 , sig (0,309)	R = -0,574 , sig (0,000)

CHAPTER VI

DISCUSSION

5.1 Effect of education, job, age and experience on dairy housing management

The results showed that the education level had significant ($p<0.05$) effect on the direction of barns designed (north/south) ($p<0.045$), the usage of insecticides ($p<0.006$) and antiseptics ($p<0.015$). All pervious parameters were tended to increase with the level of educational increased.This might be due to the educated people being able to easily understand the extension massages,these results were in line with (Fawi and Osman 2013)and(Amira 2018). Although the farm drainage and the cleaning of barns were not significantly affected by the education level, however, it can be seen that, about (22.2% and 44.4%) of uneducated farmers frequently had drainage in their barns and cleaned respectively compared to (52.2% and 69.6%) of the graduated farmers.

Cleaning barns was significantly ($P<0.032$) affected by the job. All employee (100.0%) in this study had cleaned their barns compared to breeders with (58.5 %.). This might be due to awareness of the employee for hygiene importance and in line with, other elements that influence TBC include health and hygiene of the cow, housing and management, cleaning and sanitizing procedures, farm milking environment, and quality of cleaning water(Nada et al., 2012). However, there was no significant effect of owner job on barns design, (51.2% and 85.7%) of (breeders and employee) had cared to build their barns in (north/ south) direction. The farmers justified that the shaded part of the farm area can be easily exposed to sunlight for disinfection. Insecticidesand disinfectant of employee with

(100.0% and 71.4%) to spray barns compared to breeders with (79.2% and 41.5%).

The results showed that the age grouping had less influence on the studied parameters but it could see that (the ages > 40 years old) presented (86.7%) designed their dairy barns in (east/west) direction compared to (the age's ≤ 40 years old) which presented (48.0%) for good ventilation. The ages > 40 years old (86.7%) had no used for insecticides to spray their barns compared to (23.3%) of (the ages ≤ 40 years old) which the highly percentages needed more extension to correct their inherited and traditional management, this result not agreed with reported by (Manoj, 2016) the adoption of various management practices was found to be higher in elder than the young age group.

The data resulted that the experience grouping had no significant effect but it could seen that the experience had positive influence on problems faced farmers in summer and autumn which was decreased with the years of experience increase with percentages (100.0%, 78.3% and 75.0%) of (the experienced < 10 years, 10 < 20 yearsand > 20 years) respectively.

5.2 Effect of education, job, age and experience on milking management

The results showed that the education level had no significant effect on all milking management parameters (the times of milking per day (p=0.451), the types of milking used (manual and automatic) (p=0.823), the udder cleaning before milking (p=0.529), the milkers hands washed before milking (p=0.425) and rewashed equipment before milking (p=0.173)). This due to all farmers in different educated levels in the same diary management system. Moreover, the udder cleaned by milkers (55.6%), (27.0%) and (43.5%) with different levels of education (uneducated,

educated and graduated) respectively. Milkers hands washed before milking (77.8%), (92.6%) and (91.3%) of different levels of education (uneducated, educated and graduated) respectively near to Abebaw (2018) who reported that about (74.57%) of respondents wash their hands and the cows' udder before milking.

The results showed that the job had significant (P<0.05) effect on the times of milking per day (p=0.006) all farmers with (100.0%) milked their cows twice compared to (85.7%) ofthe employee and only (14.3%) of employees had milked their cows three times a day. Although there was no significant effect on, but it could see that all employees did not clean the udder this may be lead to milk and milk products contaminated with microorganisms, this results conform with, high total bacteria count (TBC) is positively correlated with unsanitary conditions associated with dirty udders before milking, inadequate or poor teat sanitation, poor cleaning and sanitation of milking equipment, and inadequate cooling of milk (Pantoja et al., 2009) and (Verdier *et al*., 2009), the practise ofudder dust removing with (42.9%) and with udder washing (57.1%) before milking compared to breeder no cleaning (13.7%), dust removing with (51.0%) and udder washing with (35.3). Breeders let their labors to wash their hands with (88.5%) before milking while all milkers of employee washed their hands (100.0%), this result not agreed with Mohamed and El zubeir (2014) whom reported that cleaning of milkers hands (20%).All employee labors rewashed their milk utensils with (100.0%) before milking compared to breeder labors with (71.7%). The owner job had no significant (P>0.05) effect on the type of milking (manual and automatic), the present study showed that all employee used manual method for milking with (96.2%) of breeders had milked their cows manually and only (3.8%) of them used machine milking, may this type of milking more safety than manual, this

result in contrast with, the cow housing system and the environment from which milking activities were done have a greater impact on the safety of milk (Kivaria *et al*. 2006).

5.3 Effect of education, job, age and experience on labours and manure management

Although there was not significant effect but it could seen that all uneducated farmers did not produce healthy cards for their workers compared to educated and graduated with (28.6% and 34.8%) respectively had get healthy cards for their workers.From the study results the responds healthy programs for their farms and workers is very weak because they not much attention for importance of health, these in line with Nada et al., (2012) who reported thatother elements that influence TBC include health and hygiene of the cow, housing, management, cleaning and sanitizing procedures, farm milking environment, and quality of cleaning water. Uneducated farmers, educated and graduated with (44.4%, 75.0% and 82.6%) respectively had bathrooms for their workers. The study showed that the gathered of farm manure (66.7%, 71.4% and 73.9%) of uneducated, educated and graduated farmers respectively had gathered their farms manure inside. In the other hand, the usage of bathroom and the farm manure get rid the educated respondents much attention for cleaning and housing management, this conforming to (Nada et al., 2012).

The study showed that the job had significant ($P<0.05$) effect on the healthy cards produced for workers, about (57.1%) of employee had more attention to that produced cards compared to farmers (22.6%). Although there was no significant effect on the labors periodic detection and where workers bathing but it could seen that, about (85.7% and 79.2%) and (74.0% and 85.7%) of breeders and employee respectively had no periodically detection for their workers and had bathroom for their workers.

From the present data the age group had significant (P<0.05) effect on the labors periodic detection, (30.0%) of the ages more than 40 years old had done periodic detection for their labors compared to the ages less than 40 with (10.0%). Although there was no significant effect on the labors healthy cards produced and the founded of bathroom but it could seen that the age less than 40 years old and the ages more than 40 years old with (83.3% and 63.3%) and (66.7% and 80.0%) respectively had no produced healthy cards for their workers and had bathrooms.

There was no significant associate with manure get rid but it could see that the farmersexperienced =<10 years, experienced 10>20 years andexperienced>20 years at (46.2%, 78.3% and 79.2%) respectively had got rid the farms manure by dung gather inside barns before selling, this might cause diseases to their animals.

5.4 Effect of the education, job, age and experience on dairy nutrition management

Although there was no significant effect due to education level, but it could be seen that all respondents such as uneducated, educated and graduated bought feed for their cows from companies, at (77.8%), (89.3%) and (95.7) respectively, compared to other feed source like local feed and unknown sources. Most of the uneducatedfarmers (66.7%), educated (78.5%) and graduated (82.6%) agreed that winter season had more feed consumption compared to other seasons, this results confirm with Osama et al., (2015) reported that any seasonal variation affects milk composition is associated with several factors. According to the farm water availability the graduated farmers were cared to most water available and cleaning in the farm.

Results found that times of feed offers was significantly ($p < 0.05$) affected by the owner job, were all Breeders fed their cows twice while (85.7%) of employee fed their cows twice and (14.3%) of them fed their cow three times a day. These might be due to the employee going to development their milk production by increasing the times of milking per day with times of feeding. In spite of there was no significant effect on the season that cows more eating but it could seen that the breeders (79.2%) and employee (71.4%) respectively had fed their cows a lot of feed in winter season. This might be due to in cold climate cows more consumed feed compared to other weathers.

The experience as a factor had affected the winter season and had found that feed was more consumed ($p = 0.029$) in winter and farm water status ($p = 0.011$).The frequency of farmers showed that in different experiences cows consumed more feed in winter, with (69.2%) of experienced =< 10 years, about (91.3%) of experienced 10 to 20 years and at (70.8%) of experienced more than 20 years of experienced respectively. This might be due to most of farmers had consumed feed in winter season in different experiences years.

5.5 Effect of education, job, age and experience on animal diseases and health

The results showed that the education level significant ($p<0.05$) effect on the periodic detection of mastitis, at (100.0%, 85.7% and 56.5%) of uneducated, educated and graduated respectively had no periodically detection of mastitis and their frequency had tended to decrease as the level of education increases. Educated people can easily understand the extension massages. The results were in line with (Fawi, and Osman, 2013) and (Amira, 2018). And the results in contrast with that reported by Mohamed *et al*., (1993) and El Zubeir *et al*., (2006)mastitis routine testing

is very important because most of mastitis infection persist as subclinical, which will not be detected by herd men. Although there was no significant effect due to education level, but it could be seen that (100.0%) and (70.4%) of uneducated and educated respectively farmers had got rid their dead animals to outdoors compared to graduated (54.5%), these results mean that the educated and graduated sometimes get rid by other methods like bury and burn dead animals. And also it could be seen that (11.1%), (32.1%) and (47.8) of the uneducated, educated and graduated farmers respectively had done of ant mastitis to dry cows. Generally, the farmers should be keen enough in reporting all the unhealthy conditions to theveterinarians and take up the advice (Weinhaupl *et al*., 2000) and (Shirima *et al*., 2003).

The job of the farmers had significant ($P<0.05$) effect on the way farm owners get rid (outdoors, burn and bury) of dead animal and Periodic detection of mastitis, with (74.5% and 28.6%)of breeders andemployees respectively had got rid their dead animals to outdoors compared to (21.6% and 71.4%) of them burn the dead animals. And about (83.0% and 28.6%) of (farmers and employees) respectively had periodically detected mastitis for their cows; these indicated that there was thePathological factors associated with clinical and sub clinical of mastitis (Osama et al., 2015). Although there was no significantly affected by the job but it could seen that employeemore loss their baby calves (100.0%) compared tobreeders (94.2). And also the employee had cared to use ant mastitis for dry cows (42.9%) compared to breeders (32.0%). It was well known that employees had better perception for knowledge and information actively.

The age had no significant effect on the following parameters but they could seen the ages more than 40 years old (40.0%) had used the anti mastitis while the ages less than 40 years old (70.0%) had no used the ant

mastitis and only (30%) of them had used. And also all farmers in different ages agreed that period more diseases infected was in summer and autumn season.

Although there was no significantly affected by the experience group but it could seen that the experienced more than 20 years (45.8%) had used ant mastitis for dry cows compared to the experienced less 20 years (30.4%). Also it could seen that the highly proportion of infective diseases in autumn (69.2%) of the experienced less than 20 years compared to the experienced more than 20 years (12.5%) had infected in winter.

5.6 Effect of education, job, age and experience on milk distribution and marketing

The results showed that the educational levels had significant ($P<0.05$) effect on the milk store before selling and if the milk distribution related to particular season. From the results there were all educated and graduated farmers had no stored their milk before selling compared to uneducated (16.7%), these due to the educated more milk powerful selling and more awareness of the milk store hazard. And at (88.9%) of uneducated farmers had faced problems such as poor hygiene among the seasons during they distributed and marketed their milk compared to educated (42.9) and graduated (60.9%), this due to the educated had good milk, more committed to specification and healthy controland the hygiene an important factor affectingin dairy products. These results agreed with findings by several authors Pantoja *et al.*, (2009); Verdier *et al.*, (2009); and Ellis *et al.*, (2007) they finding that in dairy farming considered hygiene an important factor affecting milk quality. Although there was no significantly ($P>0.05$) affected by the uneducated, educated and graduated on the equipment cleaning and the regular visits of (specification and healthy) control employee to dairy farms but it could seen that, (100.0%,

95.7% and 85.7) and (88.9%, 64.3% and 65.2%) respectively had cleaned their milk utensils by water with soap and had no regulated visits. The most educated farmers more acceptable and practise to what make milk be quality compared to uneducated (11.1%).

Although there was no significantly (P>0.05)affected by the breeders and the employee on the cleaning of utensils, milk distribution problems and if milk distribution related to a particular season, but it could seen that, about (91.1% and 100.0%), (94.2% and 100.0%) and (58.5% and 42.9%) respectively had washed their milking utensils using soap to sure that all dusts and microorganisms were killed, had no faced problems during milk marketing compared to breeders (05.8%) had faced and had milk distributed differ from season to another.

The age group had no significant ($p > 0.05$) effect on the milk store before selling, equipment cleaning, regular visits of (healthy and specification) employee to their farms and if the milk distribution faced problems. In spite of there was no significantly ($p > 0.05$) affected by the agesless than 40 years old and the ages more than 40 years old on if the milk distribution and marketing related to particular season, (66.7% and 46.7%) respectively had affected. The results were contrast with reported that milk is more widely influenced by environmental factors than any other biological fluid (Mohamed and Elzubeir, 2007).

the effect of the experience on the milk marketing which was related to a particular had significantly ($p =< 0.05$) affected this seen (37.5%) of the who worked than 20 years their milk distribution related to a particular season compared to whom worked less than 20 years (69.2%), the results not agreed with, the poor transportation and distribution may affected milk quality due to bacterial growth in raw milk (Afrah, 2009).

5.7Effect of education, job, age and experience on grocery milk source

From the results the educational levels had significant ($p \leq 0.05$) effect on the shop keepers mediators committed to healthy and specification control. On the way the most of the educated (88.6%) and graduated (87.5%) grocery seller committed to choose good mediator than uneducated one (00.0%). Educated people were more aware to importance of good mediators. Although there was no significantly affected but it could seen that the keepers transportation their milk by carts (50.0%, 34.3% and 18.8%) which had decreased with educational levels increased compared to by cars (50.0%, 65.0% and 81.2%) respectively (uneducated, educated and graduated). The previous results in line with Afrah, (2009) who reported that in Sudan to transport milk, farmers use donkeys, donkey - trucked cartsand pickup trucks depending on availability cost and the distancesinvolved. The results showed that there was no significant effect but it could seen that the milk equipment that mediators carry on (100.0%, 37.1% and 31.2%) of (uneducated, educated and graduated) respectively had used plastic utensils and the equipment that keepers collected in (50.0%, 85.4% and 88.2%) of (uneducated, educated and graduated) respectively had used ironed utensils . The results of the educated and graduated respondents were in line with Nahid *et al*.,(2015) reported that most producers (97%) handled their milk in stainless steel (plastic) containers, while only (2.7%) of them handled their milk in other containers.

According to the job there had significant (P=<0.05) effect on the type of milk equipment that mediators carry their milk on (35.3% and 75.0%) of (shopper and employees) not be careful to use plastic utensils. The type of milk utensils that keepers receive their milk in (68.4% and

92.7%) of (shopper and employees) respectively had been careful to used ironed. The employee more attention to avoid the risk of the plastic cans which have a negative impact and also plastic cans help bacteria to multiplication on the cans surfaces and lead to contamination which reduce in milk quality, the results in the same direction with mentioned below,the metal (aluminum) can are recommended to keeping the quality of milk and plastic cans have a negative impact on the bacteria content of milk (Karuga, 2009) andthe used of plastic containers can be a potential source for the contamination of milk by bacteria, because it allows the multiplication of bacteria on milk contact surfaces during the interval between milking (Abebaw, 2018).

From the data the age group in groceries had significant ($P<0.05$) effect on the milk source (97.0% and 77.0%) of the (ages $\leq$ 35 years old and ages $\geq$ 35 years old) respectively much be depended onmediators for their milk sources. The type of utensils that mediators carry their milk on (75.0%) of the ages $\leq$ 35 years old had used ironed utensils to carry their milk compared to (57.1%) of the ages $\geq$ 35 years had used plastic utensils to carry their milk, this might be the younger respondents believe that the metals utensils more safety and easily to cleaning and sanitized, the results contrast with findings by several authors Pantoja *et al.*, (2009); Verdier *et al.*, (2009); and Ellis *et al.*, (2007) the finding that large-scale and older farmers who had more years of experience in dairy farming considered hygiene an important factor affecting milk quality . In the other hand there no significant affect on the type of milk transportation, mediators committed to (health and specification) control, the type of milk equipment that shoppers to collected milk in and the season that the milkeasily marketing and management.

5.8 Effect of education, job, age and experience on grocery milk heating

From the results the educational levels (uneducated, educated and graduated) had no significant (P>0.05) effect on the milk heating (100.0%, 87.8% and 94.1%) of them had heated their milk by boiling method and heating milk was done inside the grocery (50.0%, 53.8% and 48.2%) respectively. The most of the shoppers had wormed their milk before sold to avoid from healthy hazard. The results confirm with Afrah,(2009) who reported that to avoid healthy hazard forhumans if it is consumed without pasteurization or heat treatment.The milk marketing management not similar at all seasons (100.0%, 85.4% and 82.4%) of the educational levels respectively had no similar action to management milk among the seasons.

5.9 Effect of education, job, age and experience on grocery milk distribution and marketing

The education levels had significant (25%) ($P \leq 0.05$) effect on the way how shoppers get rid of abnormal milk, about (100%) of uneducated shoppers had got rid their abnormal milk by making yogurt compared to (90%) of the graduated who tend to discard it. Educated people are aware about the risk of using abnormal milk than uneducated. In the other hand, the keepers sell fresh milk, more season milk was consumed, do the keepers noticed abnormal milk, what kinds of milk changes do keepers found and if the customer had complains were not significantly ($P \leq 0.05$) affected by educational levels. Although, there were not significantly ($P \leq 0.05$) affected by educational levels but it could seen that the graduated keepers were (11.8%) added additions to their milk and about (04.9%) of educated also had added compared to uneducated (00.0%). The educated and graduated keepers had additions to their milk due they try to satisfy their customers and increasing milk selling powerful.

According to job (shoppers and employees) of the grocery's owner had significantly ($p \leq 0.05$) affected by additions to the milk (84.2% and 97.6%) of the (shoppers and employees) respectively had no added. The job had no significant effect on (that season was more milk consumption, abnormal milk noticed and changes and customers complains). However, the job had no significant effect but it could showed that few of employee (07.3%) sold their milk as the raw milk compared to shoppers (15.8%), these results might be due to employee more awareness to risk health of unheated milk consumed.

The age grouping (≤ 6 years old and < 6 years old) of the owners had significant ($P<0.05$) effect on the way they get rid of the abnormal milk. The present percentages (71.4%) of the younger owners discarded the abnormal milk while about (50.0%) of the elders owners convert it to yogurt. In the other hands, the age grouping had less influence on the following parameters (do the keepers sell fresh milk, the season that milk more consumed, there were noticed abnormal milk changes and customers complains). On the way, the age had no significant effect on, but it could seen that the younger ones (09.1%) much attention to added additions to their milk than the elder (03.7%). And also seen that the younger shoppers much attention to use ironed utensils to refrigeration their milk (93.9%) than the elders (81.5%).

In the other hand, the experience had no significant ($p > 0.05$) effects on the keepers sell fresh milk? But it could seen that shopper experienced > 6 years were sold their milk in raw (05.7%) compared to whomexperienced ≤ 6 years (16.0%).These due to the experience hadworked less term more aware by risk healthy raw milk to customers.

5.10 Effect of source on physicochemical characteristics of cow's milk

The protein (P<0.009), lactose (P<0.007) and added water (P<0.024) were significantly affected by the source. The protein, lactose and added water were significantly higher in milk collected from groceries compared to that collected from farms and collection centres, this might be due to addition of water, ice (Tasci, 2011) and skimmed milk (Foley *et al*., 1999) which alter the proportion of milk constituents. A cumulative effect of the added water can be seen in the present study as it increases from (0.49±0.4) at dairy farms to (0.82±0.4) at collection centres and reach maximum (2.03±0.4) at groceries, these results are in line with that reported by (Nahla, *et al,*. 2015).

5.11 Effect of season on physicochemical characteristics of cow's milk

The fat, protein, lactose, total solid and total bacteria count were significantly higher in milk collected in autumn compared to that collected insummer. It can be seen that the milk added water during summer (1.50±0.3%) was higher than that added during autumn (0.72±0.3%), this lead to low values in all samples chemical composition collected during summer, as shown in table 2. In addition to the decrease feed intake during summer due to increase in temperature (Elvan and Sebnem 2008) and Cziszter *et-al.,* 2012). The total bacteria countin the present study was significantly higher in milk collected during autumn compare to that collected during summer? In autumn the highly humidity and wet waste fibrous good condition for multiplication of housefly which played important role in milk contamination. In addition in Sudan the dairy farmers use donkeys, donkey - trucked carts and pickup trucks to milk transportation. The long time and poor transportation and distribution may

cause, milk “spoiled” due to bacterial growth in raw milk, resulting from absence of sanitary system of milk production by producers and many selling centers (Afrah, 2009). Justify that the microbial load of summer milk was significantlydue to the animals are less frequently transferred to outside because of feeding on dry forage so contamination developed in closed farms affecting milk microbial load (Leila *et al.,* 2014).

5.12 Effect of interaction between source and season on physicochemical characteristics of cow’s milk

The interaction between source and season resulted to all chemical composition of milk fat ($p<0.026$), protein ($p<0.000$), lactose ($p<0.000$)and Total Solids ($p<0.004$) were significantly affected. This might be due to affect by a lot of factors season, lactating period (Elvan and sebnem 2008) and added water in summer season at collection centre from hawkers.

5.13 Effect of added water on physicochemical composition of cow’s milk

The data showed that all the chemical composition as fat, protein, lactose and total solids were significantly ($p<0.000$) affected by added water, while the PH and total bacteria count were not significantly ($p<0.050$) affected by added water. The results in line with reported by following researchers (Tasci, 2011), who stated that addition of water and ice affect the physiochemical of milk by altering the proportions of different constituents and (Siegen haler, and schulthes,1977) reported that watering milk may cause common health hazard since the available water added may be grossly contaminated.

5.15 Correlation of total bacteria counts (log) and Added water with milk physicochemical and swab total bacteria count

The correlation coefficients of the total bacteria count with (Bacterial count (labours hands and utensils)), protein, lactose, and pH) were in a weak relationship between the variables and no significantly ($p>0.05$) affected as values, while the correlation coefficients of the total bacteria count with (fat and total solids) were had a relationship between the variables and significantly ($p\leq0.05$) affected as values. The results not in line with researchers, (O, Connor, 1995), Microbes can enter milk via the cow, air, feeds, milkhandling equipment and milker. (Kandpal *et al.,* 2012) Bacteria types commonly associated with milk.Such contaminated milk can be harmful to consumers if consumed raw and if it is processed, the products have reduced shelf life.

The correlation coefficients of the added water with (fat and total solids) were in a weak relationship between the variables and no significantly ($p>0.05$) affected as values, while the correlation coefficients of the added water with (protein, lactose, and pH) were had strong relationship between the variables and high significantly ($p<0.05$) affected as values, the result confirm with the following reports, addition of water to milk reduces its nutritive value and if the water added is contaminated, there is a health risk posed to consumers (Kandpal *et al*., 2012). The mean values of added water in milk samples collected were higher significantly, (Nahla, *et al.,* 2015).

6. Conclusion and Recommendation

6.1 Conclusion

Education, job and experience are more factors had significant effect on hygienic milk production in dairy farms,while education, job and age in groceries.The education level had no significant ($p>0.05$) effect on all milking management parameters (times of milking per day ($p=0.451$), types of milking ($p=0.523$), udder cleaning ($p=0.529$), milkers hands washing ($p=0.425$) and rewashing equipment ($p=0.173$)).The major components of cow's milk (fat, protein, lactose, total solids, and pH) were affected by seasonal changes and added water and all were lower in summer. The milk collected from the dairy farms was higher quality compared to milk collected from other sources (milk collecting centers and grocery). The contamination was found during milking and from the environmental factors such as (dust, mood, temperature, general hygiene, and milkers healthy status …. etc), animal health and milk utensils cleanness ….. etc.

6.2 Recommendation

1-More milk quality studies in winter season.

2-Extension is needed for dairy farmers powerful legislations should be adopted and practice in dairy sectors.

3-Milk should be cooled immediately after milking duringstorage and transportation to reduce the growth of microorganismsto raise the levelof hygiene.

4-Aware dairy producers about the dangers of randomly using of drugs, especially antibiotics for dairy animals and if it is necessary to exclude dairy (even those affected with mastitis), must be not distribute infected milk to consumers.

5-Establishing dairy collecting centers and requiring all dairy breeders to delivery their milk production to the milk collection centers only to checked and cooled.

6-Requiring all distributors and milk sellers to produce health cards firstly and obligating them to buy milk from milk centers only before distributing they must have cards ensuring that they have milk from centers only and on today's date.

7-Aware consumers and shop keepers of the risk ofun safety milk

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Appendixes

Sudan University of Science and Technology

Post Graduate College

Milk quality survey

Personal information:

1- Live area = 1/ Khartoum ... ( ) 2/ Omdurman… ( ) 3/ Khartoum north ().

2- The age = …….....……..

3- The job = 1/ Breeder …..... ( ) 2/ Employee …..... ( ).

4- Experience = …….....……..

5- Educational levels = 1/ Uneducated… ( ) 2/ Educated… ( )

3/ University… ( ).

Dairy housing management:

1-Barns design direction? ……

2-Do you clean the barns by putting the manure inside the farm? .....

3- Is there drainage in farms and barns? ……

4- Do you use insecticides to spray barns? ……

5- Do you use antiseptics to spray barn? ……

6-Do you use insecticides for animals? ……

7-Do you have problems in barns in a particular season? ……

Milking management:

1-How many circuits per day? .....

2- What is the kind of milking is used on farm?……

3- When using the manual milking, how udder cleaning?.....

4- Do labors know the importance of hands and udder cleaning? …….

5- Do the labors hands cleaned before the milking? ……..

6- Do you use suits during milking?…… what are?……and where store? ……..

7- What are the equipments do you use? ……..

8- How to cleaning the equipments? 1/ water washing ( ), 2/ water with soap washing ( ) 3/ sanitary washing ( ).

9- Where and how to store the equipments? ……and do rewashing the equipments before milking?.....

10- Do the milking procedures at the same in all season? ……

Labors and manure management:

1- How to identify the labors healthy status? ……..……..

2- Do the labors have the healthy cards? ……

3- Do the labors have the rotation check? ……..

4- How to evaluation the general hygiene?.....

5- There is a bath room...and where labors watering circulation?.....

6- How to get rid the wastes in different seasons?.....

7- In which season the farm be in best hygiene?.....

Nutrition management:

1- What the kind of feed which rendered for animal? ……..……..

2- Times feed rendered per day?.....

3- What are the concentrate resources? ……

4- When the feeders and the tassels are cleaned? ……

5- Which season the feed is more consumed?.....

6- Farm water available? 1/ a long time ……. 2/ sometimes ……..

7- Water resources? 1/ Khartoum state water lines ……..2/ irrigation channels ……. 3/ others …….....

8- Is the water checked?.....

Animal disease and health:

1- Diseases are infest the dairy cows and affecting the milk quality?.....

2- What are the animals is most mortality? 1/dairy cows…. 2/ baby calves ……3/ dry cows……..

3- How to get rid the death animals? ……..

4- Is periodic detection mastitis?.....

5- How to identify the mastitis? …….

6- How to treatment the mastitis disease?.....

7- Do you use ant mastitis for dry cows? ……

8- Which is most diseases spread and affected on milk quality? ……

9- Treatment and prevention of diseases? ……..…….

10- Do you receive health serves for your flock?.....

11- When vaccination services are provided? ……..

12- What are the resources of drugs?.....

13- What are the constraints of the production in the region? ……

14- How to get rid of milk cows are defected with mastitis? ……

Marketing and distribution:

1-How to distributed your farm milk? ……..

2-If you have mediators, what are means which are used to marketing their milk? …….

3-If you store your milk how long the time?.....

4-Have you received complaints from the abusers?.....

5- How to cleaning the equipments of store and distribution? ……

6-Do there are regular visits from health and specification to your dairy farm?.....

7-Do you have problem to distribution your farm milk?.....

8-Do have problem faced you? …….

9-Do the milk marketing and distribution related to a particular season?

Sudan University of Science and Technology

Post Graduate College

Milk quality survey

Personal information:

1-Live area = 1/ Khartoum ... ( ) 2/ Omdurman… ( ) 3/ Khartoum north. ( ).

2-The age = …….....……..

3-The job = 1/ shopper …. ( ) 2/ Employee … ( ).

4-Experience = …….....……..

5-Educational levels = 1/ Uneducated ( ). 2/ Educated ( ).3/ University ( ).

Milk resource:

1-Do milk comes directly from the production area? …….

2-Do you buy milk from roving mediator? ……

3-What kind of means are possessed by mediators?.....

4-What kind of utensils do they carry milk on?.....

5-How to choose the mediator you are dealing with?.....

6-What are the equipments do you get milk from mediator?.....

7-Is your mediator committed to health control and specification?.....

8-What kind of utensils do you have to collecting milk?.....

9-what to do immediately when you receiving milk?.....

10-Which season is easier to manage of consumed milk?.....

Milk heating:

1-If you are warming up milk before selling, how is it?.....

2-What kind of utensils are used for milk heating?.....

3-How much milk spend in heating?.....

4-Do you measure the milk temperate during heating?.....

5-Is it cooled immediately after heating?.....

6-Is the heating done inside or outside room?.....

7-Are the actions you are taking to prepare the milk similar in seasons?.....

Milk store:

1-Do you sell fresh milk to consumers?.....

2-Periodic of milk spend ready for distribution?.....

3-More consumed period of milk as related to seasons?.....

4-Are there additions to milk after heating?.....

5-Do you sometimes notice abnormal milk before heating?.....

6-Do you sometimes notice abnormal milk after heating?.....

7-How to get rid of abnormal milk before or after heating?.....

8-Is there affixed system used by the receipt and even to distribution milk to consumers?.....

9-What are the equipments do you use to collecting and storing milk in?.....

10-Whatare the equipments used in milk refrigeration?.....

11-What are the methods used to milk heating?.....

12-What are the type of measure equipments used to milk selling?.....

13-Do you receipt complains from citizens about the changes?.....

14-Are prices a factor for milk storing to spend a long term?.....

15-Do you know that the safety of milk you sell related with the safety of community?.....