



# COMPARISON STUDY OF QUALITY CONTROL OF RAW MILK BETWEEN PRODUCERS, SELLERS, AND CONSUMER IN GEZIRA STATE-SUDAN

Amna Y. Elemam<sup>1</sup>, Mohamed A. Dafalla<sup>2</sup>, Asma A. Tameem<sup>2</sup> and Nasir, A. Ibrahim<sup>3\*</sup>

<sup>1</sup>Department of Milk Production and Technology, Faculty of Animal Production, University of Gezira, Wad Madani, Sudan

<sup>2</sup>Department of Animal Nutrition, Faculty of Animal Production, University of Gezira, Wad Madani, Sudan.

<sup>3</sup>Biochemistry and Physiology Department, Faculty of Veterinary Medicine, University of Al-butana, Ruffaa, Sudan.

Corresponding author; [nasir.adm@yahoo.com](mailto:nasir.adm@yahoo.com)

## KeyWords

Quality Control, Raw Milk , Producers, Sellers, Consumer Gezira State -Sudan.

## ABSTRACT

This study aims to comparison the quality control of raw milk and the awareness of producers, sellers, and consumers about application of quality control measures in Gezira state -Sudan. The primary data were collected by descriptive using questionnaire instrument to measure the different factors leading to milk quality selected producers, sellers, and consumers in the study area. Chemical analysis of milk was used approximate analysis according to AOAC standard method and minerals determination by atomic absorption Spectrophotometry (Perkin Elmer, 2380). The present study showed that there are significant differences ( $P \geq 0.01$ ) between producers for explaining the availability of milk distribution centers in milk quality in Gezira state. The study showed there are highly significant differences between those who use plastic and steel milk containers in milk quality, and they also explained that they distribute milk inside the state using runs (Donkeys) as means of transportation and distribution. The majority of producer and sellers were not aware about the measures applied in quality control and most of them were not believed on the importance of application of quality control measures. Chemical analysis in summer of milk samples taken from producer's containers showed higher record for moisture, ash and fat, K and Fe and higher PH at winter. Seller milk samples showed higher records in total solid material and Na and Ca at summer and protein, carbohydrate, and density in winter. The study recommended that Manufacturing of Aluminum and steel containers are recommended, and Participants must be equipped in the different techniques of quality control measures.

## INTRODUCTION:

The Sudan is an East Central African country. Livestock provide a significant nutritional supplement to vulnerable groups, increase the resilience of smallholder households in the face of food crises, and help to maintain traditional social safety nets<sup>[1]</sup>. Milk and milk products play a very important role in feeding the rural and urban population and have a high nutrition value and is daily produced, sold for cash or readily processed. It is a cash crop in the milk-shed areas that enables families to buy other foodstuffs, contributing significantly to the household food security<sup>[2]</sup>. Increased urbanization and expected growth in incomes<sup>[3]</sup>. The milk from ruminants' animals plays an important role in the nutrition for most people in Sudan in rural and urban areas. Milk production system in Sudan depends largely on the traditional sector, which produces about 80% of the milk consumed in Sudan. Other system includes dairy co-operative societies, private sector farms and modern dairy farms<sup>[4]</sup>. Because organized dairy establishments are scarce in Sudan, most urban milk comes from village cows, and it is sold by milk vendors who deliver raw milk to residences.<sup>[5]</sup>The improper handling of raw milk, problems of transportation and distribution, high temperature, lack of principles of quality control, poor cooling facilities and neglecting of sanitary standards by the distributors are the major impediments<sup>[6]</sup>. Also, the importance of the human factors in explaining variations in farm performance are stressed<sup>[7]</sup>. Production of milk in small quantities for family needs is traditionally the beginning of dairy development everywhere because as milk production increase the surpluses are usually sold in the nearby Areas<sup>[8]</sup>. While based on market orientation, scale, and production intensity, dairy production systems can be categorized as traditional smallholders, privatized state farms, and urban and peri-urban systems<sup>[3]</sup>. Based on a field survey, the study conceptualizes and analyzes the elements impacting customers' buy intent for liquid milk, including Health Consciousness, Perceived Knowledge, and Belief. To our knowledge, the study is a first in consumer behavior analysis because it includes these three factors exclusively for the first time to explain their role in forming attitude and purchase intent, to gain a deeper understanding of consumer per-

ceptions of liquid milk as a functional food, and to help formulate an effective dairy policy.<sup>[9]</sup> Most of the producers set price according to supply and demand, they pay great, use promotion as a strategy to increase sale which indicates poor participation of farmers in marketing efforts. The study reached some conclusions include the necessity of establishing milk collection centers to assist lowering milk consumer price and creating marketing awareness in the producers' sector through implementing extension workshops and seminars Key words: marketing; producers; dairy products; Khartoum<sup>[10]</sup>. Most traded milk is sold to middlemen/traders, who sell the milk directly to consumers or to milk bars<sup>[11]</sup>. 17.3 percent of respondents bought processed milk; 60.7% bought it based on brand; 82.7% bought fresh raw milk. Most consumers, 79.8%, preferred fresh raw milk over processed milk for its great quality, while just 20% preferred it for its low price. 100 percent paid attention to post-purchase milk treatment; 50.7% were not happy with Khartoum's milk safety. 61.5% of consumers trust raw milk. Education level had no effect on milk type, purchasing location (grocery store or street vendor), utensil type (plastic or stainless steel), or product label reading<sup>[12]</sup>. Producers and dairy staff should be trained in pen design, husbandry, herd management, biosecurity, and health care.<sup>[13]</sup> The milk value chain starts with intermediaries collecting the milk from the dairy holdings. The milk is collected in containers and transported by car to the informal milk marketplace (suq or dakat ellaben). From there, the milk is distributed by cars to shops or sold to men with donkeys who in turn sell it to consumers in residential areas. Despite improved milk collection containers, hygiene is generally poor. Producers and distributors are often accused of adding water to milk to increase its volume and adding hazardous substances to overcome spoilage during shipping and delivery in the absence of cold chain technology<sup>[14]</sup>.

## MATERIALS AND METHODS

### Study area:

The present study was conducted in Gezira State. Information regarding dairy management was obtained through questionnaire and direct interview with farm owners to define constraints and identify weaknesses. Data was collected on quality control methods in the study area.

### Sampling and data collection:

The study relied significantly on primary data obtained by questionnaire, field survey, personal interview, and professional enumerators. State milk producers, sellers, and consumers were studied. We used structural-stratified sampling. Targeted groups received 360 questionnaires. Producers, sellers, and consumers received surveys. El Managil, Great Madani, Huda, and south of Gezira were selected.

### Raw Milk Samples

Besides the trial data analysis from questionnaire, raw milk samples from the study area were collected and analyzed in laboratory to Assess and measure the milk quality. The samplings of milk from each locality were collected from the producers and sellers.

### Chemical composition

Proximate analyses were done according to AOAC standard method (2000)<sup>[15]</sup>.

### Determination of mineral content

Minerals content of each samples were determination by atomic absorption Spectrophotometry (Perkin Elmer, 2380) for determine Na, K, Ca, Fe and P.

### Statistical analysis

Various methods of data analysis were conducted according to the nature of data collection. Simple descriptive method, matrix correlations, regression, and the General Linear Model (GLM) using the SPSS (Statistical Package for Social Sciences, version17). Differences between means were separated by Duncan's Multiple Range Test (DMRT) when the significant differences existed. A P-value of  $\leq 0.05$  was considered indicative of a statistically significant difference.

## RESULTS AND DISSICION

Figure 1. shows the availability of milk collection centers in the *study area in Gezira* state. The general overlook about the availability of milk collection centers in the study areas in Gezira state, producers pointed out that, there are many collection centers available for distribution of milk with a rate of 10.83%, that who explained that no available distribution centers are giving the rate of 89.17% of the targeted respondents. The present study showed that there are significant differences ( $P \geq 0.01$ ) between producers for explaining the availability of milk distribution centers in milk quality in Gezira state.

The study showed that, producers depend on other transportation means for dairy products distribution with a rate of 48.34%. Producers explained that, runs (Donkeys) are considered as economical means of transportation for milk with a rate of 40.83% compared to the other means. Elmagli and El Zubeir<sup>[5]</sup> confirm this conclusion. In Sudan, urban milk supply originates mostly from village cows and is marketed by milk vendors on donkeys. 71.7 percent of Khartoum North farmers sold their produce at the farm gate. According to this study, milk supply and marketing are affected by environmental (season), farm location in relation to marketing points, and transportation.

The study showed that, 66.67% of milk producers depend on plastic containers for packing and transporting milk to distribution centers and consumers and steel containers came second with a rate of 32.50%. These results are not agreed with that reported by

Karuga<sup>[17]</sup>. Plastic cans have a detrimental impact on the bacteria content of milk since they are sticky and difficult to clean. This is consistent with the findings of Yitaye et al<sup>[18]</sup>, who found that 83% of urban dairy farms in Bahir Dar and Gondar, 75% of farms in Dire Dawa Town, and 87.5 to 97.5 percent milk producers, collectors, transporters, and merchants in Eastern Ethiopia used plastic containers. Leftover milk and dirt might contaminate subsequent milk. Lack of formal training and use of plastic containers contribute to the low quality of raw milk sold by producers and informal milk traders, according to Omore et al. Since metal milk containers are expensive, milk producers utilize plastic containers that are hard to clean and disinfect, which may affect milk quality. Milk cannot be stored or transported in non-food quality plastic cans, buckets, or jerry cans<sup>[20]</sup>. Aluminium containers are easier to clean than plastic because they don't stick. Amistu et al<sup>[21]</sup> reported that 98% of Holetta, Sebeta, and Sululta farmers market whole milk. The study found milk quality disparities between plastic and steel containers.

The study showed that, there is limited practicing of mechanical milking method with a rate of 4.17% from the respondents (Producers) and the majority milking their animals manually with a rate of 95.83%. The study showed that there are highly significant differences between producer's feed-back in practicing milking methods in milk quality.

The comparison between producers, sellers and consumers with regard to their awareness about application of quality control measures. The study showed that, the majority of producers and seller's respondents were well aware about the measures applied in quality control with 56.7 and 63.3% respectively, but the consumers were claimed that they were not aware about these measures applied in quality control with a rate of 73.3%. These finding agree with that reported by Mustafa<sup>[22]</sup>. Zelalem,<sup>[23]</sup> reported that, quality insurance measures were not applied in the study area related to their lack of awareness about these hygienic and quality precautions which in line with this study. The present study showed that there are highly significant differences between the three categories of respondents about their awareness of application of quality control measures in milk products.

The comparison between producers, sellers, and consumers regarding their believe on the importance of application of quality control measures to milk handling practices. The study showed that, most producers and sellers respondents believing in the importance of application of quality control measures to milk handling practices, with a rate of 56.7 and 63.3% respectively, but many consumers stated that they are not believing on the importance of application of quality control measures to milk handling related to their lack of awareness about the importance and procedure how to detect these,<sup>[5]</sup> Reported that, the performance of sanitary procedures on daily basis is important since the dairy industry is faced with several problems including improper handling of the milk, transportation and distribution problems, high temperature, lack of quality control principles, poor husbandry practices and neglecting of sanitary standards by the distributors. Furthermore, the obtained results are in line with Barbuddhe and Swain<sup>[24]</sup>. who reported that absolute cleanliness of personnel is required specifically - milking should be carried out under good personal hygiene of the milker., these results clearly indicates that producers and sellers had good awareness of the importance of using modern technology to improve milk production as according to ILRI (2003)<sup>[25]</sup>. packaging technologies could enhance milk quality, sanitization, and increase covering distant traders are able to cover with milk products.

The study present showed that, there are highly significant differences between the three categories of respondents about their believing on the importance of application of quality control measures to milk handling practices.

The comparison between producers, sellers and consumers with regard to their awareness about cheating practices as quality control measures to milk. The study showed that, most producers and consumers respondents showed that they were not aware about cheating practices in milk which retard the quality control measures of milk, with a rate of 86.7 and 56.7 respectively for each category, on the other hand many sellers stated that they were aware about cheating practices followed in milk and milk products with a rate of 80% from the total targeted respondents. The study present showed that, there are highly significant differences between the three categories of respondents about their awareness of cheating practices, which with stand against the quality control measures needed.

#### **Chemical analysis for milk samples collected in two seasons (Summer & Winter)**

Chemical analysis (mean  $\pm$  SD) % of moisture, Ash, Fat, protein, carbohydrates, PH, density, and total solid materials according to milking seasons. Table. 1 describes the chemical analysis (mean  $\pm$  SD) of moisture, Ash, Fat, protein, carbohydrates, PH, density and total solid materials content in milk samples taken from producer and sellers' containers in Summer & Winter, there was no significant differences between milk components samples for the two seasons. Summer sample taken from producer's containers represents higher records mainly in moisture, ash and fat, 85.07 $\pm$ 1.18, 0.81 $\pm$ 0.72 and 5.18 $\pm$ 0.91 respectively, compared to that taken from sellers' containers. PH records were presented higher at winter for producers' samples. Sellers milk records samples performed better in total solid materials at summer with a rate of 46.21 $\pm$ 1.16 and Carbohydrates and Density in winter. In current study showed that decrease of PH and density in tow season from standardization issued by Sudanese standard and metrology. This decrease justifies poor practices in quality control,

#### **Chemical analysis (means $\pm$ SD) of Na, K, Ca, Fe and P.**

Table.2. describes the chemical analysis (mean  $\pm$  SD) of Na, K, Ca, Fe and P elements content in milk samples taken from producer and sellers in Summer and winter. K and Fe showed higher percentage in samples that taken from the producer containers at summer compared to those records presented by Sellers which performed higher for Na and Ca in winter and higher rates in P for winter. All parameters were showed no significant differences. The most important criteria for milk and dairy products consumption are quality, composition, price, durability, and nutrition data. Nutrition information is becoming more and more noticeable to consumers

when choosing dairy products, which we consider to be an important aspect in the direction of rational nutrition<sup>[26]</sup>.

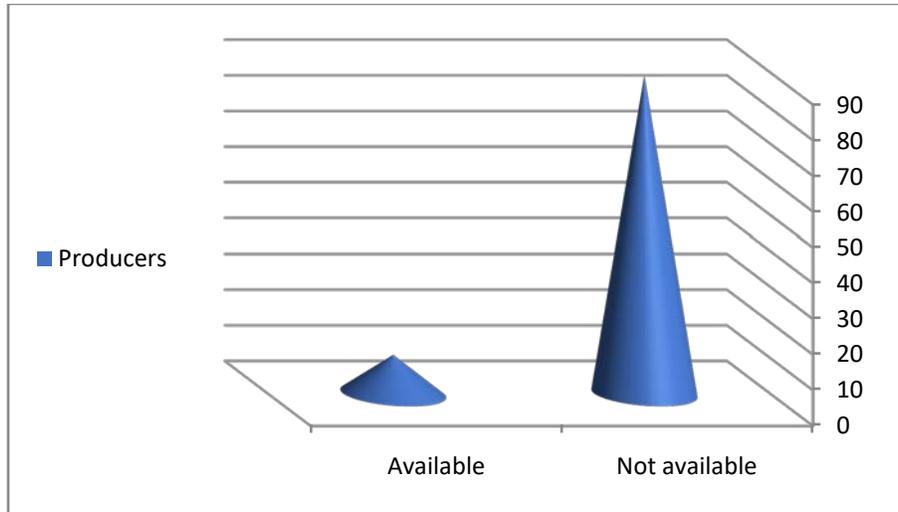


Figure 1. The availability of milk collection centers in the study area in Gezira state.

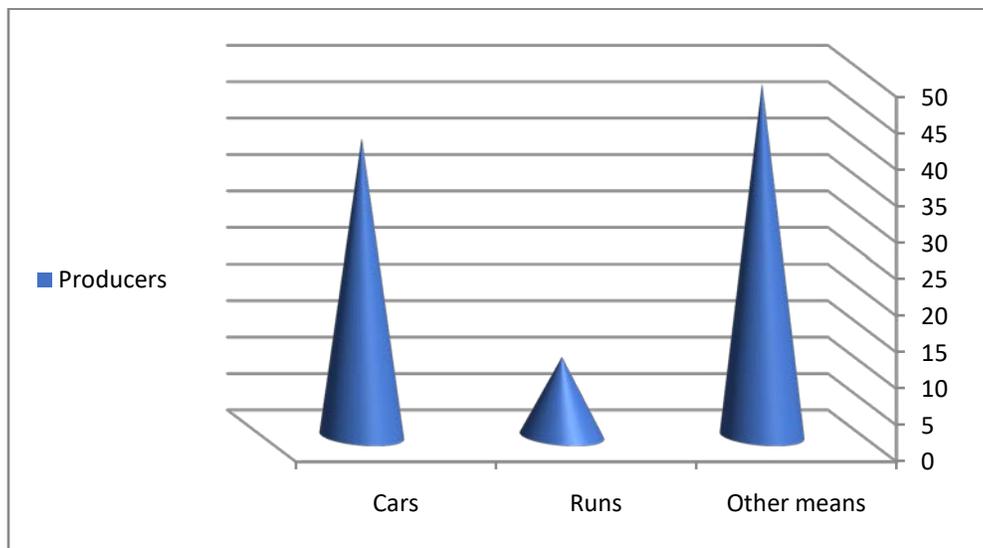


Figure 2. The availability of milk transportation means in Gezira state.

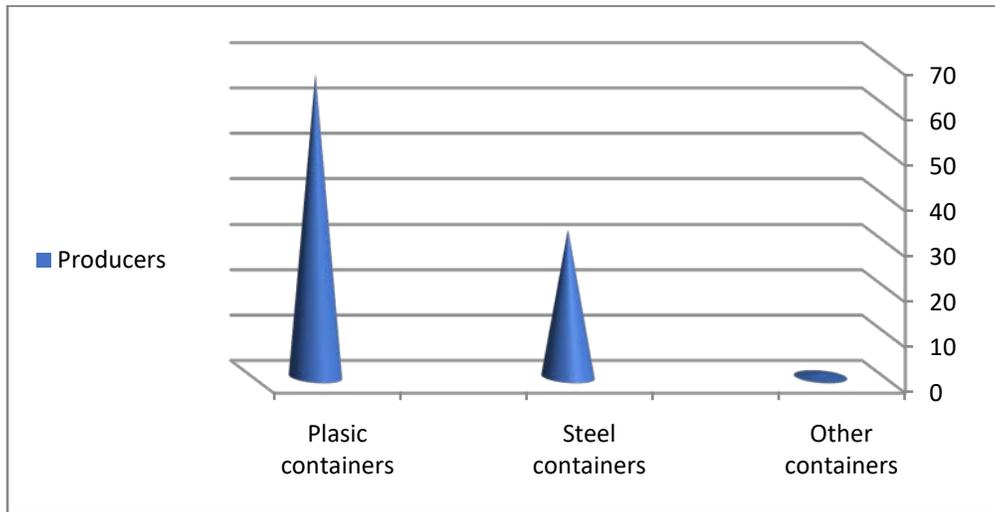


Figure 3. Materials from which milk containers (Utensils) was made in Gezira state.

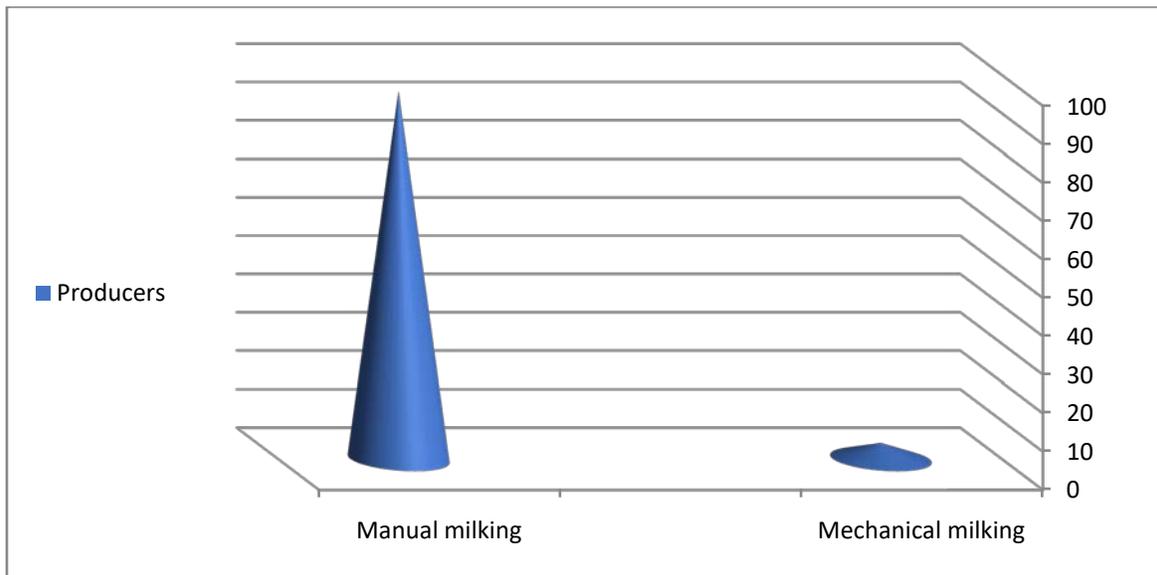


Figure 4. The milking methods practiced by producers in Gezira state.

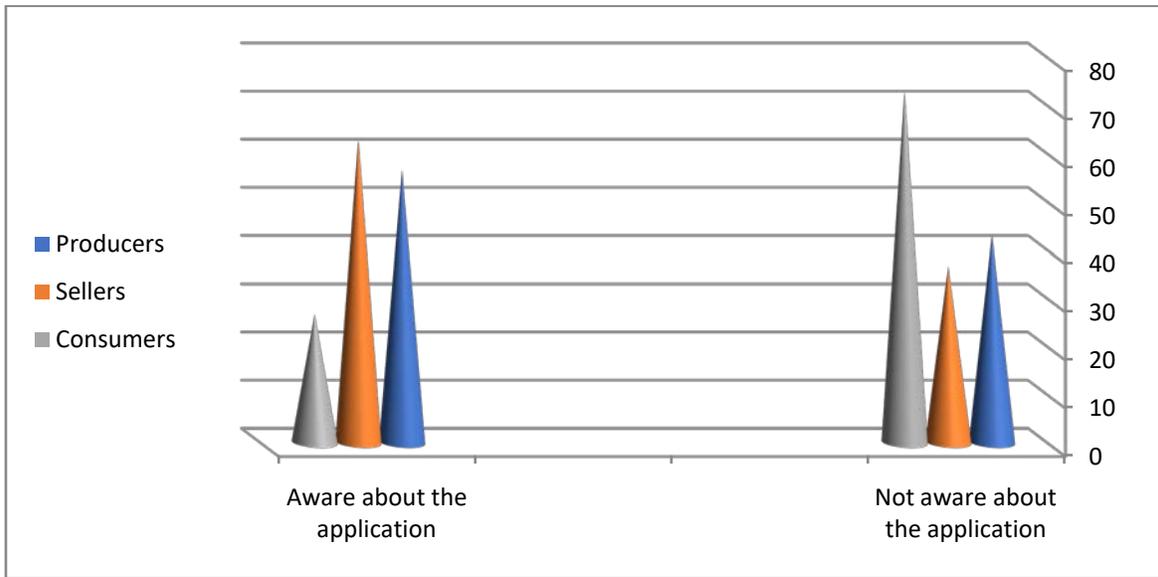


Figure 5. The comparison between producers, sellers and consumers with regard to their awareness about application of quality control measures

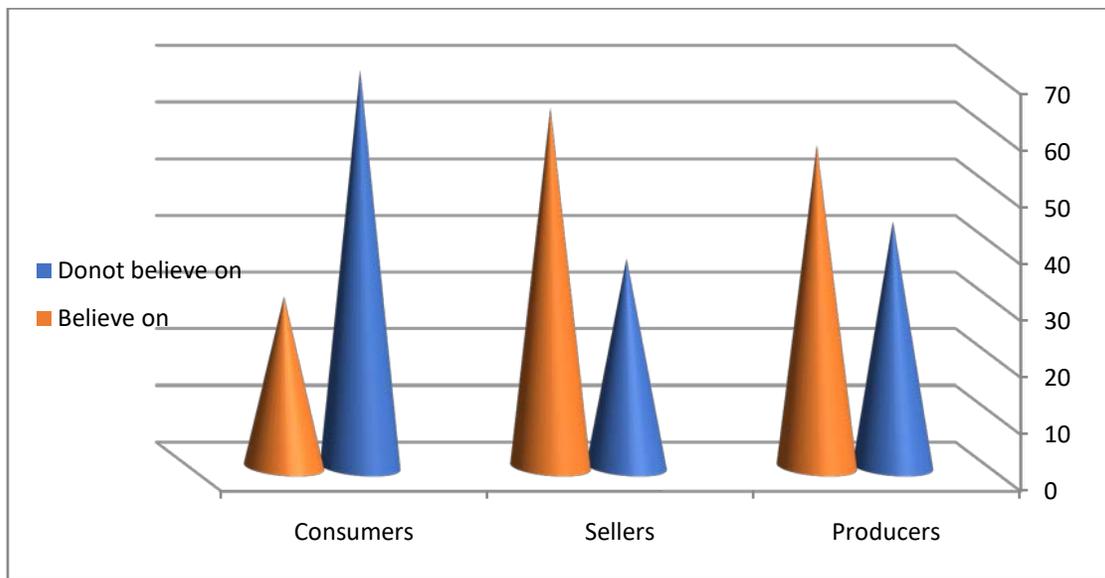


Figure 6. The comparison between producers, sellers and consumers with regard to their believe on the importance of application of quality control measures to milk handling practices.

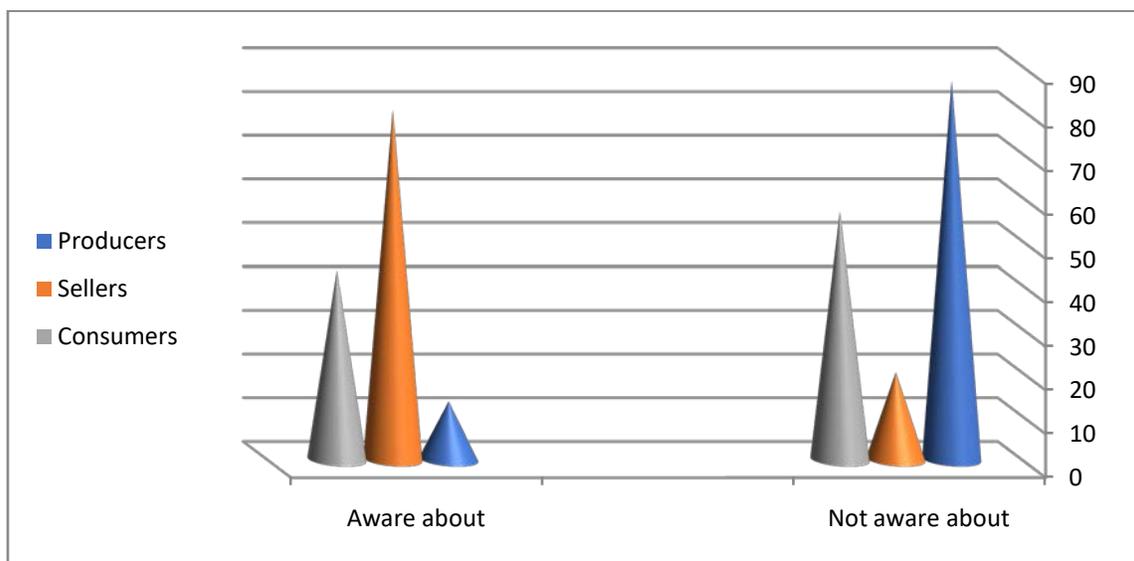


Figure 6. The comparison between producers, sellers and consumers with regard to their awareness about cheating practices as quality control measures to milk.

Table (1) Comparison between milk samples taken from producers and sellers containers (Two Seasons) Concerned with moisture, Ash, Fat, Protein, Carbohydrates, PH, Density and total solid materials contents (mg/l)

Items	Categories					
	Producers			Sellers		
	Summer	Winter	LS	Summer	Winter	LS
	Means± SD	Means± SD		Means ±SD	Means± SD	
Moisture	85.07±1.18	84.19±0.84	NS	84.25±0.61	84.19±0.70	NS
Ash	0.81±0.72	0.79±0.53	NS	0.68±0.09	0.71±0.04	NS
Fat	5.18±0.91	4.96±0.16	NS	3.43±0.89	3.31±0.64	NS
Protein	4.09±0.81	4.02±0.65	NS	4.11±0.39	4.28±0.63	NS
Carbohydrates	4.85±0.63	3.95±0.93	NS	5.3±0.71	4.93±0.15	NS
PH	2.81±0.68	2.95±0.80	NS	2.63±0.19	2.91±0.23	NS
Density	0.38±0.19	0.34±0.73	NS	0.36±0.05	0.39±0.08	NS
Total solid materials	42.58±0.13	44.38±0.07	NS	46.21±1.16	45.9±1.32	NS

Table (2) Comparison between producers and sellers about chemical analysis for Na, K, Ca, Fe, and P contents (Two seasons) in milk taken from their milk containers (mg/l)

Items	Categories	
	Producers	Sellers

	Summer	Winter		Summer	Winter	
	Means ±SD	Means± SD	LS	Means± SD	Means ±SD	LS
Na	34.19±1.86	34.07±1.85	NS	36.29±0.59	36.07±0.85	NS
K	26.18±0.63	25.85±0.19	NS	25.88±1.78	24.71±1.32	NS
Ca	46.18±0.71	45.5±0.86	NS	46.84±1.05	45.96±0.06	NS
Fe	0.08±0.02	0.06±0.04	NS	0.06±0.01	0.07±0.08	NS
P	31.15±0.80	31.08±0.04	NS	30.86±0.40	31.16±0.63	NS

## Conclusion

The study concluded that the majority of producer and sellers were not aware about the measures applied in quality control and most of them were not believed on the importance of application of quality control measures. Summer milk samples taken from producer's containers showed higher record for moisture, ash and fat, K and Fe and higher PH at winter. Seller milk samples showed higher records in total solid material and Na and Ca at summer and protein, carbohydrate, and density in winter. Over all the samples of milk were taken it does not meet quality control criteria according to standardization issued by Sudanese standard and metrology.

**Funding:** Not applicable

**Conflict of interest**

**None**

**Ethics Statement:** This work was approved by the Ethics Committee of, University of Gezira, Wad Madani, Sudan. The data obtained from this work were analyzed according to guidelines of ethical standards of the Declaration of Helsinki.

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