**Sudan university of Science and Technology**

**College of Graduate Studies**

# Safety and Quality of manufactured feed for Dairy Cows in sale centers in River Nile State

# سلامة وجودة الأعلاف المصنعة لأبقار الألبان بمراكز بيع الأعلاف بولاية نهر النيل


**By**

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**B.V.Sc Faculty Of Veterinary medicine**

**University of Khartoum(2002)**


**Dissertation submitted partial fulfillment of requirement for the master Degree In Preventive veterinary Medicine(MPVM)**


**Supervisor:**

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**Department of Preventive Medicine and Public Health, College of Veterinary Medicine, Sudan University Science and Technology**


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# Dedication

I dedicated this work with great gratitude to:

The spirits of my father

My mother

My husband

My daughters

My brother and sisters

Whom offer me guidance, strength, hope and

I owe to them very much

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After great thanks to almighty Allah for giving me the ability and patience to complete this work, I would like to thank and appreciate all of; My supervisor prof. Mohammed Abdelsalam Abdalla for his help and advice. My husband Dr. Nasser Mohammed Osman who my study stood aside me with assistance and advice. Technician Rawda Hassan in national centre for researches for her effort in laboratory analysis and skilled technical assistant with patience. Finally my family for continuous support, encouragement and pleasant surrounding atmosphere to complete my work.

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# Abstract

The present study was conducted in feed sale centers of River Nile State for dairy cows manufactured feed to investigate the safety and quality of manufactured feed for dairy cows according to Sudanese standards and metrology organization. The study made a trial to identify the current situation of storage status, ventilation, labeling, hygiene and control of insect and rodents which influence the safety and quality of feed. Also crude protein, crude fat, ash and moisture were determined. The study covered (12) sale centers in Atbara and Eldamer towns. The total number of total feed samples were (52) sample. This study constituted questionnaire survey which was done to determine the current conditions that involved in identify the level of safety and quality of manufactured dairy feed in sale centers. Fifty two samples from the twelve centers were collected for laboratory investigations to determine the crude protein, crude fat, ash and moisture. The results of the present study showed that eleven of twelve (91.7%) of the sale centers covered fail to ensure more than one conditions needed for the safety and quality of manufactured feed for dairy cows according to Sudanese standards and metrology organization. Feed samples analysis showed that the mean value of crude protein in feed samples analyzed was (16.9288%), the mean value of ether extract (crude fat) in feed samples analyzed was (3.6808), the mean value of moisture in feed samples analyzed was (7.9608) and the mean value of ash content in feed was (6.1988)

In conclusion the present study showed that there are many challenges facing safety and quality of manufactured feed for dairy cows in sale centers River Nile State and feed must be kept in safe and healthy environment in the sale centers according to the Sudanese standards and instructions of local authorities, because nutritional diseases milk quality and milk marketing

# ملخص الأطروحة

أجريت هذه الدراسة بمراكز بيع الأعلاف المصنعة لتغذية أبقار الألبان بولاية نهر النيل لمعرفة مدى سلامة وجودة هذه الأعلاف وفقا للمواصفات القياسية السودانية. وهدفت الدراسة إلى التعرف على الحالة الراهنة لظروف التخزين والتهوية والصحة العامة والالتزام بوضع البيانات على عبوات البيع بالمراكز المستهدفة و السيطرة على الحشرات والقوارض التي توثر على جودة وسلامة الأعلاف' كما عملت الدراسة على تحليل وقياس البروتين الخام والدهون الخام والرماد والرطوبة في عينات علف مصنع لتغذية الأبقار. غطت الدراسة (12) مركز وتم اخذ (52) عينة من الأعلاف للتحليل. اعتمدت الدراسة على استبيان واخذ عينات أعلاف. أوضحت الدراسة أن عدد أحد عشر مركزا من الإثني عشر مركز (91.7%) فشلوا في التقيد بأكثر من اشتراط من الاشتراطات وفقا للمواصفات القياسية السودانية . كما أن تحليل عينات الأعلاف التي تم أخذها بين أن متوسط نسبة البروتين الخام (16.9288%) ومتوسط نسبة الدهون الخام بلغ (3.6808%) ومتوسط نسبة الرطوبة (7.9608%) ونسبة الرماد (6.1988%). وخلصت هذه الدراسة لأن هناك العديد من التحديات تواجه صحة وسلامة الأعلاف بمراكز بيع الأعلاف المصنعة لأبقار الألبان بولاية نهر النيل ويجب أن يتم مراعاة حفظ الأعلاف في بيئة صحية وآمنة بمراكز بيع الأعلاف وفقا للمواصفات والمقاييس السودانية واشتراطات السلطات المختصة لأن صحة وسلامة الأعلاف تلعب دور هام في إنتاج الألبان والوقاية من أمراض التغذية وجودة الألبان وبالتالي تسويق الألبان.

## Introduction

Quality assurance of food products requires an integrated approach that assures safety and quality at all stages of the production chain. The safety and quality of milk and dairy products depend on the quality of raw milk produced at dairy farms, the quality of any other ingredients, processing conditions, and distribution and storage conditions. As suppliers of raw milk, dairy farms have an important role in the dairy production chain. Therefore, milk production at dairy farms needs to meet the demands and criteria with respect to animal health, feed quality and milking hygiene. The objective of dairy farm quality assurance is to prevent contamination of raw milk by residues of veterinary medicines and agricultural chemicals, environmental contaminants for instance feed or soil and by harmful micro-organisms arising from feed, the housing system or the animals themselves. Feed is an important source of chemical and microbiological contaminants of milk (Vissers and Driehuis 2009). The diet of high-yielding dairy cattle consists of two main classes of feedstuffs: forages and concentrates. Fresh, dried or ensiled forages generally constitute the largest fraction of the diet, usually 50 to 75%. Forage preserved as silage is the most popular form of forage in many countries (Driehuis. *et al*. 2008). The increasing effective demand for livestock products such as milk, meat and eggs drives farmers to supplement their livestock with concentrates to improve on their productivity (EADD, 2010). Over the past few years large and medium scale livestock feed producers have been reducing but with an increasing number of small scale 'backyard' feed mixers. The 'liberalization' of the feed market has allowed many small processors to penetrate the market supplying the concentrate cattle feeds to farmers. The emergence and growth of small scale feed producers in the chain have induced changes in feed value chains providing small producers with opportunities but on the other hand introducing new challenges into the concentrate feeds value chain. These changes

and emerging challenges need to be thoroughly understood if appropriate action in improving concentrate feed production, delivery and use by smallholder consumers is to be taken. (Graffham et al., 2003).

**Objectives:**

1- To determine the safety and quality of manufactured feed for dairy cows according to Sudanese standards and metrology organization.
2- To investigate the current situation of storage status, ventilation, labeling, hygiene and control of insect and rodents which influence the safety and quality of feed.
3- To identify feed moisture, crude protein, crude fat and ash .

# Chapter one

## literature review

### 1.1- Dairy production:

Sudan is the first in the Arab region and the second among African countries with respect to animal population.. Milk production in the Sudan is estimated to be about 7.8 tons per year (MA, 2007), of which 90% is produced by local breed in traditional sector and 10 % from cross bred by the modern sector (FAO, 2010). The traditional cattle production sector based on extensive grazing and cattle external feed input does not cover the increasing milk demand of urban areas. In spite of the existence of some very promising local dairy breeds (Kenana and Butana) a fast response to increase market oriented milk production was carried out through the importation of special dairy breeds from temperate regions. Most of milk production in local markets around the main urban centers is mainly comes from crossbred cattle. Dairy cows of smallholders are characterized by low productivity levels due to genetic and nutritional constraints, so improving feeding management is important to increase dairy cow productivity (Khan, *et al*,2009).

### 1.2-Nutrition:

Sufficient quantity of good quality of feeds help dairy cows to be more productive. The challenge smallholder dairy farmers face is how to give enough feed with sufficient nutrients in the right quality and quantity at the least cost (Feeding Dairy Cattle in The Tropics,2014). The nutritional needs of dairy animals with respect to energy, protein, minerals and vitamins have long been known, and these have been refined in recent decades. Various requirement determination systems exist in different countries for ruminants and non-ruminants, which were originally

designed to assess the nutritional and productive consequences of different feeds for the animal once intake was known (Dumas, *et al*, 2008). Most of the world's livestock, particularly ruminants in many developing countries, suffer from permanent or seasonal nutritional stress (Bruinsma, 2003). Poor nutrition is still remain the major production challenges in smallholder systems, particularly in Africa. Much research has been carried out to improve the quality and availability of feed resources (McIntire, *et al*, 1992). The animal's food needs are governed by the metabolic demand, and thus supplies of carbohydrates, fats, and proteins from the environment are required to obtain enough energy needed by the animal (Toates, 1986)

## 1.3-Animal Feed:

### 1.3.1-Animal Feed Industry

According to the FAO (2004), there are three definitions for animal feed industry, one of them is "commercial operations producing feed for sale", the second is "integrated operations where large producers in particularly produce their own feedstuff" and the third definition is "the cooperative operations where farmers jointly own the feed mill or production plant that produce the feed they use". On the other hand Cheeke (2005) used the term "animal feed manufacturing" rather than animal feed industry and defined it as the process of converting ingredients raw materials "feedstuffs" Into balanced diets that are sold to producers of livestock and other animals.

### 1.3.2-Animal Feed Industry in Sudan:

Animal feed manufacturing in Sudan was initiated in the early 1960's and it's becoming increasingly important since natural pastures in Sudan suffered significantly from drought, desertification, fires, and overgrazing. This industry is mainly present in the capital town "Khartoum" with some factories in Gezira, Kassala and Gedarif States. Twenty seven animal feed factories and mixers were found in Khartoum State, only 19 of them is working (SMAAI, 2001) . In River Nile State there is two animal feed mixers found in Atbara and Aldamer towns ( Annual report of livestock department,2018).

### 1.3.3-Feed importance:

Feed is very importance factor in livestock production and food security, income and livelihoods and the environment. Adequate feed (quantity and quality) is the types of feed to obtain the various nutrients for maintenance, growth, reproduction and production. In fact all animals, including people, need balanced diets, because diets supply both the right variety and amount of the different type of nutrients the body needs. Diets of cattle are usually called rations. The challenge for dairy farmers is to obtain a ration for their cattle supplies all the animals' nutritional requirements, does not cause any health problems, enables the cow to produce as much milk as it is capable of. A balanced ration should provide protein, energy, minerals and vitamins from dry fodders, green fodders, concentrates, mineral supplements etc., in appropriate quantities to enable the animal to perform optimally and remain healthy (RMargaret, *et al* , 2007).

### 1.3.4- Feed intake:

Feed intake is one of the most important factor for the productivity in dairy production. It is important to sustain the balance between requirements for maintenance and production which help in increasing production due to good efficiency of feed conversion (Forbes, 1995). The feed intake of ruminants can be is influenced by feed characteristics, animals behavior and the environmental

conditions (McDonald, *et al*, 1995). Regulation of feed intake and dietary choices combine short-term control of feeding behavior related to the body's homeostatic and long-term control that depends on nutritional requirements and body reserves (Faverdin, *et al*, 1995). Feed quality and physical characteristics , such as a dry matter (DM) content, fibre content, particle size, and resistance to fracture are known to affect intake rate (Inoue, *et al*, 1994).

### 1.3.5- Importance of concentrate ingredients :

The animal's feed selection and the amounts eaten are controlled by the metabolic demand, therefore supplies of carbohydrates, fats, and proteins are required to cover the energy expenditure (Toates, 1986). Ruminants need to be fed according to their nutrient requirements to reach their optimum performance in milk and meat production. However, providing an adequate amount of nutrients in terms of energy and protein to dairy cows is a challenging task due to many complex factors. Accurate estimation of dry matter intake (DMI) is important for the formulation of diets to optimize milk production without compromising animal welfare (National Research Council, 2001). Dietary ingredients can greatly affect the composition of milk of dairy cows. Among milk components (fat, protein, lactose, minerals, and vitamins), fat and protein are the two most subjected to changes due to dietary manipulation.( Santos, 2002.)

### 1.3.6-Feed safety:

Food safety hazards associated with animal feed can be biological, chemical or physical. Each hazard is associated with particular sources and routes of contamination and exposure. Risk management must be based on good understanding of each source of hazards. The role of water as a potential source of hazards should not be overlooked. Hazards may be introduced with source

materials or via carryover or contamination of products during handling, storage and transportation. The presence of a hazard may also associated with accidental or deliberate human intervention. Risk management should be based upon prevention rather than reaction after detection of the problem (FAO, 2010).

### 1.3.7-Feed composition:

Feed ingredients affects the absorption of nutrients to the blood and thereby the amount of nutrients which can be useful in milk formation (Madsen, *et al*, 2005). Feed intake is an important factor for the productivity of small ruminants. Efficiency of food conversion to production is depend on the voluntary intake the balance between requirements for maintenance and production (Forbes, 1995).

#### 1.3.7.1-Water:

Water is the most important dietary essential nutrient. Loss of about 20% of body water is fatal. larger proportions of water relative to body weight (BW) is important for lactating dairy cows than other livestock species because water comprises 87% of milk (David, 1993). Factors influencing daily water intake include physiological state, milk yield (MY), dry matter intake (DMI), body size, rate and extent of activity, diet composition including types of feedstuffs (e.g., concentrate, hay, silage or fresh forage), ambient temperature, and other environmental factors (e.g., humidity and wind velocity). Water functions as a medium for processes of digestion (hydrolysis), absorption, metabolism, milk and sweat secretion, and elimination of urine and feces. Also, it provides a medium for transport of nutrients, metabolites, hormones, and gases and it is a lubricant and support for various organ systems and the fetus. Dairy cattle obtain requirements water requirements from drinking water, feed consumed and water resulting from metabolic oxidation of body tissues (David, 1993).

#### 1.3.7.2-Protein:

Lactating dairy cows require protein determined by the requirement for amino acids (AA) for protein synthesis and rumen degradable protein (RDP) to sustain the microbial protein synthesis in the rumen. (Kalscheur, *et al*, 2004), protein available for absorption for the ruminant mainly comes from microbial synthesis in the rumen. The microbial protein, together with the rumen-under gradable protein (RUP) from feed, passes into the small intestine where an additional degradation and absorption takes place. Undersupply of protein may limit the microbial activity in the rumen and impair digestion and thereby affect feed intake negatively (Olmos Colmenero and Broderick, 2006).

**1.3.7.3- Fat:**

Fats and oils in dairy cow rations has developed to the point where it now is a standard practice. Fats added to rations to increase energy density, which result in increased energy intake. Increased energy intake should improve energy balance and benefit body condition, milk production, and reproduction.( James, 2004)

**1.3.7.4- Carbohydrate:**

Dairy cattle diets have two major carbohydrate fractions which are the neutral detergent fiber (NDF) and the nonfibrous carbohydrate (NFC). NDF comprises the fibrous material that is slowly digested, partially available for the microbes in the rumen and large intestine. NFC are composed starch, pectin, β-glucan, fructans, sugars, and organic acids. The NFC fraction components are rapidly digested by the rumen microflora, and some of them (starch, sugars, and fructans) can be digested by mammalian enzymes in the small intestine. ( Santos, 2002.)

**1.3.7.5- Minerals and Vitamins:**

Cows requires to be fed the proper amounts of available minerals and vitamins For good health and high milk yields. Numerous factors (many of which are unknown)

influence the requirements and availability of minerals and vitamins . Minerals and vitamins concentrations in feeds can be extremely variable. Newer data plus the substantial uncertainty regarding the quantity of minerals and vitamins consumed, the quantity absorbed (or available), and the quantity needed by cows under different situations mandates appropriate adjustments to NRC requirements ( Weiss, *et al*,2010) .

**1.4-Feed selling centers:**

feed market has allowed many small processors to enter the market supplying the concentrate cattle feeds to farmers through selling centers. The emergence and growth of small scale feed centers in the chain have induced changes in feed value chains providing small producers with opportunities but on the other hand introducing new challenges into the concentrate feeds value chain. These changes and emerging challenges need to be thoroughly understood if appropriate action in improving concentrate feed production, delivery and use by smallholder consumers is to be taken. Many assurance schemes want their members to purchase feed only from assured sources. Sale process in feed market must be done under the law and instructions with local authority. (Graffham, *et al*, 2003).

**1.4.1- Feed storage:**

Type of animal feed products , source of feed materials, and feed additives, production, storage, transport and distribution of feed products are essential feed safety related elements to be covered in any code of practice applied for the safety of feed for animals to ensure human as well as animal health. Storage equipments must be maintained in a clean, tidy condition and be free from accumulated waste. Layout, design and the operation of all facilities and equipment must be lead to minimize the risk of error, permit effective cleaning and maintenance, minimize contamination and carry-over, ensure dry condition and minimize condensation, allow the disposal of waste and rain water without

contamination. Storage areas must be free of chemicals, chemical fertilizers, pesticides or other potential contaminants. Procedures should be established to keep to a minimum the proportion of out-of-date stocks (e.g. first-in-first-out principle) by applying a careful stock rotation. Materials must be stored in such a way that they are clearly identifiable, and that their intake identification is easily visible. The effectiveness of the stock rotation must be monitored by the Feed centre manager (EFMC, 2014).

### 1.4.2- Cleaning:

Cleaning program is important to ensure completely emptied and regularly cleaned of all storage facilities according to the type and condition of incoming or finished feed stored. Reasonable precautions must be taken against dust accumulation and other residual materials where incoming and finished feed are stored (EFMC, 2014).

### 1.4.3- Ventilating:

Air movement must be controlled to give conveying or cooling and avoid the risk of this air to become a vehicle for pathogens. Contamination through weather, birds etc. must be avoided (EFMC, 2014).

### 1.4.4- Waste management:

Waste should be collected and stored in dedicated waste covered containers away from storage areas. Waste must be disposed of legally at frequent intervals (EFMC, 2014).

### 1.4.5- Pest Control :

Pest control procedures must be takenfor avoidance of contamination. Any actions taken must be compatible with feed products (EFMC, 2014).

### 1.4.6- Personal hygiene :

There must be adequate washing facilities and protective clothing must be worn. The staff must be healthy and have appropriate hygiene training for the handling of feed (EFMC, 2014).

### 1.4.7- Labeling:

One of the most important requirements in food safety protection policy is labeling feeds with declarations and in retail stores. Feed labeling is very important in order to protect the rights of consumers, which want to know contents of feed they buy on the market, its origins and how to preserve it and prepare it properly, as well as its shelf-life (Cheeke, 2005).

## 1.5- Feed analysis:

Knowledge of the nutritive value of feeds ingredients is very important to insure and protect the feed value (AOAC, 1975).

### 1.5.1- Feed moisture:

feed ingredients are provided to animals according to the weight of the feed. Although nutrients in ration formations are often described in terms of a percentage, animals require actual amounts of nutrients. Feeding individual feed ingredients according to weight is only accurate if the moisture content of the feed is the same as it was during the ration formulation period. Changes in the weight of a feed due to changes in moisture alter the nutrient concentrations supplied to the animal if appropriate adjustments are not made to accurately reflect the actual nutrient concentration of the feed ingredient. In general terms, the weight of a specific feed ingredient comes from either the moisture in the feed or from the dry matter (DM) portion. Dry matter refers to material remaining after removal of water, and the moisture content reflects the amount of water present in the feed ingredient. The nutrients in feeds, required by the animal for maintenance, growth, pregnancy, and lactation, are part of the DM portion of the feed. Knowing the

moisture content of a feed ingredient is important because the moisture content affects the weight of the feed, but does not provide nutrient value to the animal. Although animals do have a requirement for water, providing water through an actual water source, instead of through feed ingredients, is necessary.(Cozzolino and Labandera, 2002).

### 1.5.2- Crude protein:

Like all mammals, the dairy cow must meet its protein needs ultimately from the diet. Unlike non-ruminants, however, which can only utilize amino acids from true protein, the dairy cow can utilize non-protein nitrogen as well as true protein. This is because rumen microbes can synthesize amino acids from non-protein nitrogen (eg urea) as well as true protein. Thus, the basic unit of protein nutrition in dairy cows is nitrogen, although this is normally expressed as CP, which is nitrogen times 6.25 (Huhtanen and Hristov, 2009).

### 1.5.3 Crude fat:

Energy in cattle feed is essential to keep the animal alive and productive . Insufficient energy lead to drop in health and production. Sources of energy for dairy feeding include starch, carbohydrates, sugar, fiber and fat.. Fat from oilseed by-products such as soybean meal, palm kernel meal, sunflower cake provides energy to dairy rations (FAO Bangkok, 2014).

### 1.5.4 Ash (Inorganic matter):

Ash is the inorganic residue remaining after water and organic matter have been removed by heating in the presence of oxidizing agents, which provides a measure of the total amount of minerals within a feed analytic techniques for providing information the total mineral content in a sample. Ash contains the minerals. Minerals are very important for building-up the body as in the bones and teeth. Minerals are needed as a part in proteins to make-up the soft tissues of the body (Alimuddin, 2000 ) .

# Chapter two

# Materials and methods

## 2.1: Area of study :

Area of study is animal feed selling market in Atbara and El Damer towns as a sample for River Nile State.

## 2.2: Methodology:

1- Questionnaire to collect data about the current status of safety and general health, storage , and labeling of animal feed in sale centers.
2- Laboratory investigation to identify feed moisture, crude protein, crude fat and ash .
3- Statistical analysis of results.

## 2.3: Sale centers :

In this study data were obtained from dairy feed sale centers in River Nile State in the years 2018. The study was covered 12 centers and 52 feed samples in Atbara and Eldamer towns. centers were visited to collect data due to a questionnaire .

## 2.4: Questionnaire data:

The questionnaire data was designed to collect data during the survey covered sale centers in the area of study. The collected data include the current situation of storage status, ventilation, labeling, hygiene and control of insect and rodents which influence the safety and quality of feed.

### 2.4.1: The current situation of storage status:

These information were obtained by direct observations and reply of owners.

### 2.4.2: Ventilation:

Data concerning ventilation were collected by direct observation.

### 2.4.3: Labeling:

Labeling of dairy cows feed packages was recorded using observation.

### 2.4.4: Hygiene:

Hygiene conditions were determined and recorded due observations, records and owners reply**.**

### 2.4.5: Control of insect and rodents:

Control of insect and rodents data were determined by observations, records and reply of owners.

## 2.5 : feed sampling:

feed samples was collected from 52 packages and 0.5 kilos were taken from each package for measure level of crude protein, crude fat, ash and moisture.

## 2.5.1:Crude protein:

The crude protein content in the samples was determined by the micro-kjeldahl method following the method of AOAC (2003). The feed samples were digested with concentrated sulphuric acid so that the sample releases its nitrogen content which can be determined by a suitable titration technique. A conversion factor of 6.25 (equivalent to 0.16 g nitrogen per 100 grams of protein content). The kjeldahl method is divided in three steps, first step was transfer 0.2 g of a feed sample into a digestion flask and then heated for 3 hours in 3.5N sulphuric acid. The digestion process was catalyzed by a mixure of 0.4 of 10 part $K_2SO_4$ to one part of $CuSO_4$. The heating was continued till the black colour turned to pale blue and the fumes disappeared. In the second step the digestion flask was cooled and transferred to a distillation unit .Twenty four ml of sodium hydroxide (40%) was added to the digestion flask to turn alkaline to release ammonia. The released ammonia was distilled into 20 ml of 2% nboric acid in a conical flask with three drops of promocresol methyl red as indicator. In the third step the nitrogen content in the sample was estimated by titration of ammonium borate formed with

a standard hydrochloric acid (0.01N). Titrations continued till the colour of the solution turned to red pink. Then the following formula was used to determine the protein concentration as percent:

$$\text{Crude protein \%} = \frac{(TV \times N \times 1400 \times F)100\%}{1000 \times \text{sample weight (g)}}$$

Where

TV : actual volume of HCL used for sample titration (ml.HCL-ml.blank).

N: normality of HCL.

F : protein conversion factor=6.25.

**2.5 .2:Fat content:**

The oil in the sample was determent by using continuous extraction apparatus (Soxhlet type), as described by Pearson (1970). The five grams (5 +/-1) samples were weighted and transferred to extraction thimple covered with a piece of glass wool and then placed in the soxhlet apparatus. Then the soxhlet flask and the extraction process was continued for about six hours. After that the samples were dried in an oven (carblite, sheffield, England) for 30 minutes to eliminate any remaining amount of the solvent and the flask reweighted. The fat percent was calculated by using the following calculation:

$$\text{Crude fat \%} = \frac{(W2-W1)100\%}{\text{sample weight (g)}}$$

Where

W1 : the weight of empty soxhlet flask (g).

W2 : the weight of soxhlet flask with oil (g).

**2.5.3:Ash content:**

According to the method of AOAC (2003) the ash was determined. The empty crucibles were accurately weighted and two grams of each feed sample were transferred to a crucible by using sensitive balance. Then the cruciles and their content placed in amuffle furnace (LEF- 103S, watts:KW10A serial number 07033002, Korea) at 550 to 700 c for 6-7 hours until white to gray ash was obtained. After that, the crucibles were transferred from Furnas to a desiccator to cool to room temperature and reweighted. The ash content was calculated as percent by using the following calculation:

$$\text{Ash content \%} = \frac{(Wt1-Wt2)100\%}{\text{sample weight (g)}}$$

Where

Wt1 : the weight of the crucile with the remaining ash sample (g).

Wt2 : the weight of empty crucile (g).

**2.5.4: Moisture content:**

The moisture content was determined according to the standard method described by AOAC (2003). Two grams of well mixed sample was weighted accurately in cleaned dried Petri dishes using a sensitive balance (Item NO:AR2104 made for OHAC, SCORO, USA) . Then the samples were placed in an oven (carblite, sheffield, England) and transferred to a desiccator to cool to room temperature and reweighted. Again, the dishes were returned to the oven and weighted after two hours and this was repeated until constant weight was obtained.

After that, the moisture content was calculated as percent by using the following calculation:

$$\text{Moisture content \%} = \frac{(Ws-Wd)100\%}{\text{sample weight (g)}}$$

Where

Ws : the weight of the sample before drying (g).

Wd : the weight of the sample after drying (g)

## 2.6 :Statistic analysis:

Extracted data were analyzed in SPSS version 19 .Calculation of descriptive statistics and compare means with one sample T.test. T.Test was performed for feed samples results .The distribution of questionnaire data was evaluated using chi-square statistical methods.

# Chapter three

## Results

## 3.1:Current situation of sale centers:

In this study, 91.7% of the sale centers covered fail to ensure all conditions needed for the safety and quality of manufactured feed for dairy cows according to Sudanese standards and metrology organization. This fail due absence of ability to cover all instructions mentioned by Sudanese standards and metrology organization in the current situation of storage status, ventilation, labeling, hygiene and control of insect and rodents, although the lab analysis of feed samples shows results within the range mentioned by Sudanese standards and metrology organization except results of ash contents.

## 3.2: Storage status:

### 3.2.1: Corridors:

Table 1 showed that 58.3 of the sale centers have corridors between feed while 41.7% of the sale centers have no corridors between feeds.

### 3.2.2:Material for sale:

The sale centers presenting feed for sale were 41.7% , while the sale centers presenting feed and other substances related to dairy farms for sale were 58.3%)as showed in table 2.

### 3.2.3:Distance from wall :

Table 3 showed that 91.7% of the sale center didn't have distance from wall and only 8.9% of the sale centers have distance from wall.

### 3.2.4: Storage on metal and wooden plates :

In table 4 There was 16.6 of sale centers put feed far above floor on metal or wooden plates, while the rest (83.3%) put feed on floor without distance .

Table.1: Percentage of the presence of corridors between feeds structure in sale centers (n=12) in Atbara and Eldamer

| | | | present of corridors between feeds | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storge | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within present of corridors between feeds | 14.3% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 6 | 5 | 11 |
| | | % within condition storage | 54.5% | 45.5% | 100.0% |
| | | % within present of corridors between feeds | 85.7% | 100.0% | 91.7% |
| | | % of Total | 50.0% | 41.7% | 91.7% |
| Total | | Count | 7 | 5 | 12 |
| | | % within condition storage | 58.3% | 41.7% | 100.0% |
| | | % within present of corridors between feeds | 100.0% | 100.0% | 100.0% |
| | | % of Total | 58.3% | 41.7% | 100.0% |

Table.2: Percentage of sale centers (n=12) present feed only for sale in Atbara and Eldamer

| | | | material for sale | | |
|---|---|---|---|---|---|
| | | | feed only | feed and other | Total |
| condition storge | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within material for sale | 20.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 4 | 7 | 11 |
| | | % within condition storage | 36.4% | 63.6% | 100.0% |
| | | % within material for sale | 80.0% | 100.0% | 91.7% |
| | | % of Total | 33.3% | 58.3% | 91.7% |
| Total | | Count | 5 | 7 | 12 |
| | | % within condition storage | 41.7% | 58.3% | 100.0% |
| | | % within material for sale | 100.0% | 100.0% | 100.0% |
| | | % of Total | 41.7% | 58.3% | 100.0% |

Table.3: Percentage of the presence of Distance from wall in sale centers (n=12) in Atbara and Eldamer

| | | | distance from wall | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storge | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within distance from wall | 100.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 0 | 11 | 11 |
| | | % within condition storage | 0.0% | 100.0% | 100.0% |
| | | % within distance from wall | 0.0% | 100.0% | 91.7% |
| | | % of Total | 0.0% | 91.7% | 91.7% |
| Total | | Count | 1 | 11 | 12 |
| | | % within condition storage | 8.3% | 91.7% | 100.0% |
| | | % within distance from wall | 100.0% | 100.0% | 100.0% |
| | | % of Total | 8.3% | 91.7% | 100.0% |

Table.4: The percentage of the presence of storage on iron and wooden plates in sale centers (n=12) in Atbara and Eldamer

| | | | storage on iron and wooden plates | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storge | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within storage on iron and wooden plates | 50.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 1 | 10 | 11 |
| | | % within condition storage | 9.1% | 90.9% | 100.0% |
| | | % within storage on iron and wooden plates | 50.0% | 100.0% | 91.7% |
| | | % of Total | 8.3% | 83.3% | 91.7% |
| Total | | Count | 2 | 10 | 12 |
| | | % within condition storage | 16.7% | 83.3% | 100.0% |
| | | % within storage on iron and wooden plates | 100.0% | 100.0% | 100.0% |
| | | % of Total | 16.7% | 83.3% | 100.0% |

### 3.3:Ventilation:

Corridors between feeds were found in 58.3% of the sale centers and 41.7% of these centers have no corridors between feeds as table 5 showed.

### 3.4: Hygiene:

#### 3.4.1: Cleaning:

Only 33.3 of the sale centers had routine clean programs to keep these centers clean and safe, while these routine clean programs was absent in (66.7%) of the centers as showed in table 6 .

#### 3.4.2:Presence of cleaning baskets:

In table 7 presence of cleaning baskets which needed to put cleaning waste was found in 33.3 of the sale centers and was absent in 66.7% the centers .

#### 3.4.3: Using disinfectant :

Disinfectant to keep hygienic environment and feed safe was used in (41.7) of the sale centers while 58.3% of the centers didn't use as table 8 showed.

#### 3.4.4: presence of labour for hygienic activities only :

As showed in table 9 presence of labour for hygienic activities only was found in 16.7% of the sale center , while 83.3% of the centers didn't have labour for hygienic activities only and depend on the same labour whom deals with feed..

### 3.4.5: Pet and rodents control :

Table (10) showed that pet and rodents control plans was found in(41.7) of the sale centers and the rest (58.3%) didn't have.

Table.5: The percentage of the presence of good ventilation in sale centers (n=12) in Atbara and Eldamer

| | | | good ventilation | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within good ventilation | 33.3% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 2 | 9 | 11 |
| | | % within condition storage | 18.2% | 81.8% | 100.0% |
| | | % within good ventilation | 66.7% | 100.0% | 91.7% |
| | | % of Total | 16.7% | 75.0% | 91.7% |
| Total | | Count | 3 | 9 | 12 |
| | | % within condition storage | 25.0% | 75.0% | 100.0% |
| | | % within good ventilation | 100.0% | 100.0% | 100.0% |
| | | % of Total | 25.0% | 75.0% | 100.0% |

Table.6: The percentage of the presence of good clean in sale centers (n=12) in Atbara and Eldamer

| | | | good clean | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storge | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within good clean | 25.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 3 | 8 | 11 |
| | | % within condition storage | 27.3% | 72.7% | 100.0% |
| | | % within good clean | 75.0% | 100.0% | 91.7% |
| | | % of Total | 25.0% | 66.7% | 91.7% |
| Total | | Count | 4 | 8 | 12 |
| | | % within condition storage | 33.3% | 66.7% | 100.0% |
| | | % within good clean | 100.0% | 100.0% | 100.0% |
| | | % of Total | 33.3% | 66.7% | 100.0% |

Table.7: The percentage of the presence of cleaning baskets in sale centers (n=12) in Atbara and Eldamer

| | | | presence of cleaning basket | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storge | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within presence of cleaning basket | 25.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 3 | 8 | 11 |
| | | % within condition storage | 27.3% | 72.7% | 100.0% |
| | | % within presence of cleaning basket | 75.0% | 100.0% | 91.7% |
| | | % of Total | 25.0% | 66.7% | 91.7% |
| Total | | Count | 4 | 8 | 12 |
| | | % within condition storage | 33.3% | 66.7% | 100.0% |
| | | % within presence of cleaning basket | 100.0% | 100.0% | 100.0% |
| | | % of Total | 33.3% | 66.7% | 100.0% |

Table.8: The percentage of the presence of using disinfectant in sale centers (n=12) in Atbara and Eldamer

| | | | using disinfectant | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storge | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within using disinfectant | 20.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 4 | 7 | 11 |
| | | % within condition storage | 36.4% | 63.6% | 100.0% |
| | | % within using disinfectant | 80.0% | 100.0% | 91.7% |
| | | % of Total | 33.3% | 58.3% | 91.7% |
| Total | | Count | 5 | 7 | 12 |
| | | % within condition storage | 41.7% | 58.3% | 100.0% |
| | | % within using disinfectant | 100.0% | 100.0% | 100.0% |
| | | % of Total | 41.7% | 58.3% | 100.0% |

Table.9: The percentage of the presence of labour for hygiene work only in sale centers (n=12) in Atbara and Eldamer

| | | | Presence of labour for hygiene work only | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within presence of labour | 33.3% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 2 | 9 | 11 |
| | | % within condition storage | 18.2% | 81.8% | 100.0% |
| | | % within presence of labour | 66.7% | 100.0% | 91.7% |
| | | % of Total | 16.7% | 75.0% | 91.7% |
| Total | | Count | 3 | 9 | 12 |
| | | % within condition storage | 25.0% | 75.0% | 100.0% |
| | | % within presence of labour for hygiene work only | 100.0% | 100.0% | 100.0% |
| | | % of Total | 25.0% | 75.0% | 100.0% |

Table.10: The percentage of the presence of control of pet and rodent in sale centers (n=12) in Atbara and Eldamer

| | | | control of pet and rodent | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within control | 20.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 4 | 7 | 11 |
| | | % within condition storage | 36.4% | 63.6% | 100.0% |
| | | % within control | 80.0% | 100.0% | 91.7% |
| | | % of Total | 33.3% | 58.3% | 91.7% |
| Total | | Count | 5 | 7 | 12 |
| | | % within condition storage | 41.7% | 58.3% | 100.0% |
| | | % within control of pet and rodent | 100.0% | 100.0% | 100.0% |
| | | % of Total | 41.7% | 58.3% | 100.0% |

### 3.5: Labeling:

#### 3.5.1: present of labeling on products:

Table 11 showed that 91.7% of the sale centers have labels on Feed packages.

#### 3.5.2: Labeling content -manufacture name:

The sale centers which had labels include manufacture name on feed packages were 91.7% as table 12 showed.

#### 3.5.3: Labeling content - feed ingredients :

In table 13 there was 91.7% of the sale centers had labels include feed ingredients on feed packages.

#### 3.5.4: Labeling content - production and expire date :

The sales center had labels include date of production and expire date on feed packages were 91.7% as showed in table 14.

Table.11: The percentage of the presence of of labeling on products in sale centers (n=12) in Atbara and Eldamer

| | | | present of labeling on products | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 0 | 1 | 1 |
| | | % within condition storage | 0.0% | 100.0% | 100.0% |
| | | % within present of labeling on products | 0.0% | 100.0% | 8.3% |
| | | % of Total | 0.0% | 8.3% | 8.3% |
| | bad | Count | 11 | 0 | 11 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within present of labeling on products | 100.0% | 0.0% | 91.7% |
| | | % of Total | 91.7% | 0.0% | 91.7% |
| Total | | Count | 11 | 1 | 12 |
| | | % within condition storage | 91.7% | 8.3% | 100.0% |
| | | % within present of labeling on products | 100.0% | 100.0% | 100.0% |
| | | % of Total | 91.7% | 8.3% | 100.0% |

Table.12: The percentage of the presence of labeling content-manufacture name in sale centers (n=12) in Atbara and Eldamer

| | | | labeling content manufacture name | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 0 | 1 | 1 |
| | | % within condition storage | 0.0% | 100.0% | 100.0% |
| | | % within labeling content manufacture name | 0.0% | 100.0% | 8.3% |
| | | % of Total | 0.0% | 8.3% | 8.3% |
| | bad | Count | 11 | 0 | 11 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within labeling content manufacture name | 100.0% | 0.0% | 91.7% |
| | | % of Total | 91.7% | 0.0% | 91.7% |
| Total | | Count | 11 | 1 | 12 |
| | | % within condition storage | 91.7% | 8.3% | 100.0% |
| | | % within labeling content manufacture name | 100.0% | 100.0% | 100.0% |
| | | % of Total | 91.7% | 8.3% | 100.0% |

Table.13: The percentage of the presence of feed ingredients on labels in sale centers (n=12) in Atbara and Eldamer

| | | | feed ingredients | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 0 | 1 | 1 |
| | | % within condition storage | 0.0% | 100.0% | 100.0% |
| | | % within feed ingredients | 0.0% | 100.0% | 8.3% |
| | | % of Total | 0.0% | 8.3% | 8.3% |
| | bad | Count | 11 | 0 | 11 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within feed ingredients | 100.0% | 0.0% | 91.7% |
| | | % of Total | 91.7% | 0.0% | 91.7% |
| Total | | Count | 11 | 1 | 12 |
| | | % within condition storage | 91.7% | 8.3% | 100.0% |
| | | % within feed ingredients | 100.0% | 100.0% | 100.0% |
| | | % of Total | 91.7% | 8.3% | 100.0% |

Table.14: The percentage of the presence of production and expire date on labels in sale centers (n=12) in Atbara and Eldamer

| | | | production and expire date | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 0 | 1 | 1 |
| | | % within condition storage | 0.0% | 100.0% | 100.0% |
| | | % within production and expire date | 0.0% | 100.0% | 8.3% |
| | | % of Total | 0.0% | 8.3% | 8.3% |
| | bad | Count | 11 | 0 | 11 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within production and expire date | 100.0% | 0.0% | 91.7% |
| | | % of Total | 91.7% | 0.0% | 91.7% |
| Total | | Count | 11 | 1 | 12 |
| | | % within condition storage | 91.7% | 8.3% | 100.0% |
| | | % within production and expire date | 100.0% | 100.0% | 100.0% |
| | | % of Total | 91.7% | 8.3% | 100.0% |

## 3.6: Labour :

### 3.6.1: personal hygiene:

Personal hygiene was found in 58.3% of the sale centers and absent in 41.7% as table 15 showed .

### 3.6.2: present of health certificate:

Table 16 showed that the sale centers which had health certificate for labour were 16.7%, while 83.3% of these centers didn't have.

### .3.6.3: Enough number of labour to work :

Sale centers which had enough number of labour to cover the activities were 41.7% , where 58.3% of these centers didn’t have as shown in Table 17.

### 3.6.4: Training before work :

In table 18 there were only 8.3% of the sale centers follow training programs for labour before start work, where 91.7 of these centers didn't have any programs.

Table.15:The percentage of the presence of personal hygiene in sale centers (n=12) in Atbara and Eldamer

| | | | personal hygiene | | |
|---|---|---|---|---|---|
| | | | yes | 1.00 | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within personal hygiene | 20.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 4 | 7 | 11 |
| | | % within condition storage | 36.4% | 63.6% | 100.0% |
| | | % within personal hygiene | 80.0% | 100.0% | 91.7% |
| | | % of Total | 33.3% | 58.3% | 91.7% |
| Total | | Count | 5 | 7 | 12 |
| | | % within condition storage | 41.7% | 58.3% | 100.0% |
| | | % within personal hygiene | 100.0% | 100.0% | 100.0% |
| | | % of Total | 41.7% | 58.3% | 100.0% |

T Table.16: The percentage of the presence of health certificate for labour in sale centers (n=12) in Atbara and Eldamer

| | | | present of health certifecate | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within present of health certificate | 50.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 1 | 10 | 11 |
| | | % within condition storage | 9.1% | 90.9% | 100.0% |
| | | % within present of health certificate | 50.0% | 100.0% | 91.7% |
| | | % of Total | 8.3% | 83.3% | 91.7% |
| Total | | Count | 2 | 10 | 12 |
| | | % within condition storge | 16.7% | 83.3% | 100.0% |
| | | % within present of health certificate | 100.0% | 100.0% | 100.0% |
| | | % of Total | 16.7% | 83.3% | 100.0% |

Table.17: The percentage of the presence of enough number of labour to work in sale centers (n=12) in Atbara and Eldamer

| | | | enough number of labour to work | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within enough number of labour to work | 14.3% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 6 | 5 | 11 |
| | | % within condition storage | 54.5% | 45.5% | 100.0% |
| | | % within enough number of labour to work | 85.7% | 100.0% | 91.7% |
| | | % of Total | 50.0% | 41.7% | 91.7% |
| Total | | Count | 7 | 5 | 12 |
| | | % within condition storage | 58.3% | 41.7% | 100.0% |
| | | % within enough number of labour to work | 100.0% | 100.0% | 100.0% |
| | | % of Total | 58.3% | 41.7% | 100.0% |

Table.18: The percentage of the presence of training for labour before work in sale centers (n=12) in Atbara and Eldamer

| | | | training before work | | | |
|---|---|---|---|---|---|---|
| | | | 1 | 1.00 | 11.00 | Total |
| condition storage | good | Count | 1 | 0 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 0.0% | 100.0% |
| | | % within training before work | 100.0% | 0.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 0.0% | 8.3% |
| | bad | Count | 0 | 10 | 1 | 11 |
| | | % within condition storage | 0.0% | 90.9% | 9.1% | 100.0% |
| | | % within training before work | 0.0% | 100.0% | 100.0% | 91.7% |
| | | % of Total | 0.0% | 83.3% | 8.3% | 91.7% |
| Total | | Count | 1 | 10 | 1 | 12 |
| | | % within condition storage | 8.3% | 83.3% | 8.3% | 100.0% |
| | | % within training before work | 100.0% | 100.0% | 100.0% | 100.0% |
| | | % of Total | 8.3% | 83.3% | 8.3% | 100.0% |

### 3.7: Safety precautions :

#### 3.7.1: Safety requirements for labour:

Table (19) showed that safety requirements for labour is not available in 75% of the sale centers and available only in 25% of the sales.

#### 3.7.2: Type of selling:

In table 20 there were 16.7of the sale centers sell in full packages where 83.3% of the centers sell feed in both types full packages and part of package (in kilos).

#### .3.7.3: Protection from sun light and dust :

The sale centers follow precaution to protect feeds from sun light and dust were 91.3 as table 21 showed.

#### 3.7.4: Take sample for analysis to ensure safety and quality :

Table 22 showed that 91.7% of the sale centers take samples for analysis to ensure safety and quality at least four times per a year.

#### 3.7.5: Presence of an area allocated for expired feeds :

In table 23 there were 83.3%% of the sale centers had separated areas for expire feeds .

#### 3.7.6: Disposal of expired under local authorities:

Disposal of expired done under supervision of local authorities was recorded in 83.3% of the sale centers (table 24) .

#### 3.7.7: License:

Valid license was found in 75% of the sale centers as table 25 showed.

Table.19: The percentage of the presence of safety requirements in sale centers (n=12) in Atbara and Eldamer

| | | | safety requirements | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within safety requirements | 33.3% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 2 | 9 | 11 |
| | | % within condition storage | 18.2% | 81.8% | 100.0% |
| | | % within safety requirements | 66.7% | 100.0% | 91.7% |
| | | % of Total | 16.7% | 75.0% | 91.7% |
| Total | | Count | 3 | 9 | 12 |
| | | % within condition storage | 25.0% | 75.0% | 100.0% |
| | | % within safety requirements | 100.0% | 100.0% | 100.0% |
| | | % of Total | 25.0% | 75.0% | 100.0% |

Table.20: The percentage of sell full packages in sale centers (n=12) in Atbara and Eldamer

| | | | sell | | |
|---|---|---|---|---|---|
| | | | sell in packages | sell in packages and kilo | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within sell | 50.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 1 | 10 | 11 |
| | | % within condition storage | 9.1% | 90.9% | 100.0% |
| | | % within sell | 50.0% | 100.0% | 91.7% |
| | | % of Total | 8.3% | 83.3% | 91.7% |
| Total | | Count | 2 | 10 | 12 |
| | | % within condition storage | 16.7% | 83.3% | 100.0% |
| | | % within sell | 100.0% | 100.0% | 100.0% |
| | | % of Total | 16.7% | 83.3% | 100.0% |

Table.21: The percentage of the presence of protection from sun light and dust in sale centers (n=12) in Atbara and Eldamer

| | | | protection from sun light and dust | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within protection fromsun light and dust | 9.1% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 10 | 1 | 11 |
| | | % within condition storage | 90.9% | 9.1% | 100.0% |
| | | % within protection from sun light and dust | 90.9% | 100.0% | 91.7% |
| | | % of Total | 83.3% | 8.3% | 91.7% |
| Total | | Count | 11 | 1 | 12 |
| | | % within condition storage | 91.7% | 8.3% | 100.0% |
| | | % within protection from sun light and dust | 100.0% | 100.0% | 100.0% |
| | | % of Total | 91.7% | 8.3% | 100.0% |

Table.22: The percentage of take samples for analysis to ensure feed safety in sale centers (n=12) in Atbara and Eldamer

| | | | take sample to ensure safety | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within take sample to ensure safety | 9.1% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 10 | 1 | 11 |
| | | % within condition storage | 90.9% | 9.1% | 100.0% |
| | | % within take sample to ensure safety | 90.9% | 100.0% | 91.7% |
| | | % of Total | 83.3% | 8.3% | 91.7% |
| Total | | Count | 11 | 1 | 12 |
| | | % within condition storage | 91.7% | 8.3% | 100.0% |
| | | % within take sample to ensure safety | 100.0% | 100.0% | 100.0% |
| | | % of Total | 91.7% | 8.3% | 100.0% |

Table.23:The percentage of the presence of an area allocated for expired feeds in sale centers (n=12) in Atbara and Eldamer

| | | | presence of an area allocated for expired feeds | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within presence of an area allocated for expired feeds | 10.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 9 | 2 | 11 |
| | | % within condition storage | 81.8% | 18.2% | 100.0% |
| | | % within presence of an area allocated for expired feeds | 90.0% | 100.0% | 91.7% |
| | | % of Total | 75.0% | 16.7% | 91.7% |
| Total | | Count | 10 | 2 | 12 |
| | | % within condition storage | 83.3% | 16.7% | 100.0% |
| | | % within presence of an area allocated for expired feeds | 100.0% | 100.0% | 100.0% |
| | | % of Total | 83.3% | 16.7% | 100.0% |

Table.24: The percentage of disposal of expired feeds under supervision of competent authorities in sale centers (n=12) in Atbara and Eldamer

| | | | disposal of expired under authorities | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within disposal of expired under supervision | 10.0% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 9 | 2 | 11 |
| | | % within condition storage | 81.8% | 18.2% | 100.0% |
| | | % within disposal of expired under supervision | 90.0% | 100.0% | 91.7% |
| | | % of Total | 75.0% | 16.7% | 91.7% |
| Total | | Count | 10 | 2 | 12 |
| | | % within condition storge | 83.3% | 16.7% | 100.0% |
| | | % within disposal of expired under supervision | 100.0% | 100.0% | 100.0% |
| | | % of Total | 83.3% | 16.7% | 100.0% |

Table.25: The percentage of the presence of license in sale centers (n=12) in Atbara and Eldamer

| | | | license | | |
|---|---|---|---|---|---|
| | | | yes | no | Total |
| condition storage | good | Count | 1 | 0 | 1 |
| | | % within condition storage | 100.0% | 0.0% | 100.0% |
| | | % within license | 11.1% | 0.0% | 8.3% |
| | | % of Total | 8.3% | 0.0% | 8.3% |
| | bad | Count | 8 | 3 | 11 |
| | | % within condition storage | 72.7% | 27.3% | 100.0% |
| | | % within license | 88.9% | 100.0% | 91.7% |
| | | % of Total | 66.7% | 25.0% | 91.7% |
| Total | | Count | 9 | 3 | 12 |
| | | % within condition storage | 75.0% | 25.0% | 100.0% |
| | | % within license | 100.0% | 100.0% | 100.0% |
| | | % of Total | 75.0% | 25.0% | 100.0% |

### 3.8: Feed samples:

#### 3.8.1: Crude protein :

The crude protein mean value in feed samples was 16.9288 (Table 26) and the value was not significant.

#### 3.8.2: Ether extract (fat):

The ether extract (fat) mean value in feed samples was 3.6808 (Table 27) and the value was not significant.

#### .3.8.3: Moisture :

The moisture mean value in feed samples was 7.9608 (Table 28) and the value there was not significant.

#### 3.8.4: Ash :

The ash mean value in feed samples was 6.1988 (Table 27) and the value was significant .

Table.26: The mean value of crud protein in feed samples (n=52) in sale centers (n=12) in Atbara and Eldamer

| | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| crude protein | 52 | 16.9288 | 1.38537 | .19212 |

Sig. (2-tailed) : 065

Table.27: The mean of ether extract (fat) in feed samples (n=52) in sale centers (n=12) in Atbara and Eldamer

| | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| ether extract | 52 | 3.6808 | .70747 | .09811 |

Sig. (2-tailed) : 072

Table.28: The mean value of moisture in feed samples (n=52) in sale centers (n=12) in Atbara and Eldamer

| | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| moisture | 52 | 7.9608 | 1.86039 | .25799 |

Sig. (2-tailed) : 061

Table.29: The mean value of ash in feed samples (n=52) in sale centers (n=12) in Atbara and Eldamer

| | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| ash | 52 | 6.1988 | 1.82283 | .25278 |

Sig. (2-tailed): 000

# Chapter four

## Discussion

In this study, eleven of twelve (91.7%) of the sale centers covered fail to ensure more than one conditions needed for the safety and quality of manufactured feed for dairy cows according to Sudanese standards and metrology organization. This failure due absence of ability to cover all instructions mentioned by Sudanese standards and metrology organization in the current situation of storage status, ventilation, labeling, hygiene and control of insect and rodents, although the lab analysis of feed samples shows results within the range mentioned by sudanese standards and metrology organization except results of ash contents. This agree with Getu ea al (2012) whom recorded that failure in cover instructions lead to challenges facing safety and quality of feed in the local market. Questionnaire data analysis showed that 58.3% of the sale centers have corridors between feed while 41.7% of the sale centers have no corridors between feeds. The sale centers presenting feed only for sale were 41.7% while 58.3% of the sale centers presenting feed and other substances related to dairy farms for sale. The study mentioned that 91.7% of the sale center don't have distance from wall and only (8.9%) of the sale centers have distance from wall.(16.6%) of sale centers put feed far above floor on metal or wooden plates, while the rest (83.3%) put feed on floor without distance. (58.3%) of the sale centers have corridors between feeds and (41.7%) of these centers have no corridors between feeds These results showed that the storage environment and ventilation of feed in the majority of sale centers don't follow the conditions needed for feed storage said in the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) which focus on feed should be in good storage status and good ventilation and disagree with EFMC (2014) Golob (2004) whom mention that storage precautions play a major role in determining the quality of stored feed and determine quantities of feed that

can be available to the consumers. Also questionnaire data mentioned that only 33.3% of the sale centers have routine clean programs to keep these centers clean and safe, while these routine clean programs is absent in 66.7% of the centers. Clean baskets, which needed to put cleaning waste in, were found in 33.3 of the sale centers, while there is no clean baskets in 66.7% of the centers. Disinfectant to keep hygienic environment and feed safe was used in 41.7 where 58.3% of the centers don't use. Sale centers have labour for hygienic activities were 16.7 of the centers, while 83.3% of the centers don't have and depend on the same labour whom deals with feed. Pet and rodents control plans was found in 41.7 of the sale centers and the rest (58.3%) don't have These results showed that the hygienic requirements are absent in many sale centers (58.3-83.3%) which disagree with the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) which said that feed should be kept under clean conditions without any presence of insects or rodents and disagree with Makate (2010) who said that the greatest setback during feed storage is that susceptible to attack by pests, , moulds and rodents. In addition to, data collected recorded that 91.7% of the sale center have labels on feed packages include manufacture name on feed packages, feed ingredients on feed packages and date of production and expire on feed packages. These records showed that the majority of sale centers(91.7%) follow the instructions said by the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) which require many items should be mentioned in a label putted on the feed package include manufacture name, feed ingredients and date of production and expire and agree with COPA (2018) which indicate that the labeling of all types of compound feed shall also include the general instructions for proper and appropriate use. The study reported that 41.7% of the sale center didn't have personal hygiene, 83.3% of the sale center didn't have health certificate for labour, 41.7% of the sale center didn't have enough number of labour needed to cover activities in centers, 91.7% of the sale center don't follow

training programs for labour before start work and the safety requirements for labour was not available in 75% of the sale center . Data about labour showed that precautions needed to ensure qualified and healthy labour are not available in the most of the centers. This is not agree with the good handling and keeping of feed mentioned in the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) and disagree with Tyler (2004) who said that workers' productivity is related to the knowledge and skills they posses. Beside that 83.3%.of sale centers don't follow sell in full packages only as recommended by the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) and that is disagree with Lamb *et al* (2004) whom mentioned that The four most important functions of packaging are to contain and protect products, promote products, and facilitate the storage, use, and convenience of products. A fourth function of packaging that is becoming increasingly important is to facilitate recycling and reduce environmental damage. Also recorded that precautions to protect feeds from sun light and dust was present in 91.3% of the sale centers. The study mention that routine feed sampling (at least four times per a year) for analysis to ensure safety and quality was found in 91.7% of the sale centers, Separated areas for expire feeds were available in.83.3% of the sale centers, disposal of expired feed done under supervision of local authorities was found in 83.3% of the sale centers and the sale centers have valid license were 75%. Safety precautions recommended to deal with prevention from light and sun, feed analysis, disposal of expired feed and validity of license in the majority of the sale centre agree with the instructions mentioned in by the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) and agree with Graffham, *et al*, (2003) whom mentioned that sale process in feed market must be done under the law and instructions with local authority so any person, wishes to sale animal feed have to apply for a relevant license for the control and maintenance of animal feed quality. Feed samples analysis results showed that the

mean value of crude protein in feed samples analyzed was (16.9288%) which agree with the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) that said the value of the lower margin of crude protein is (15%) and agree with Shaver and Kaisaider (2004) whom said that highest productivity of milk was recorded at 16.5-17.1 and over-feeding protein (over 18%) actually appeared to depress production. The results recorded that the mean value of ether extract (crude fat) in feed samples analyzed was (3.6808%) which resemble the range mentioned in the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) that said the value of the upper margin of crude fat is (4.8%) and agree with Wu and Huber whom said that feeding high levels of supplemental fat to dairy cows (more than 8–9% of total fat in the diet) can result in a depression in the concentration of fat and/or protein in milk due to its effect on dry matter intake and fiber digestion in the rumen. In addition, results showed that the mean value of moisture in feed samples analyzed was (7.9608%) and this is below the upper margin (12%) that mentioned by the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) and below the result recorded by Muinga *et al* (1995) in which was 11.5% moist in dairy feed sample. Also results mentioned that the mean value of ash content in feed was (6.1988%) and this above the upper margin (4%) that mentioned by the sudanese standard for manufactured concentrated feed for dairy cows nutrition (2008) and disagree with Nicostratus (2016) who found that the percentage of ash is 4.17% . The mean values of crude protein, crude fat, moisture showed good content of these elements in the feed and this lead to good quality . While the mean value of ash content mentioned presence of undesirable materials in the feed.

# Conclusion

The safety and quality of manufactured feed for dairy cows in sale centers is an important factor facing the insurance of feed and milk safety and quality in River Nile State. There are many challenges facing safety and quality of manufactured feed for dairy cows in sale centers River Nile State need more attention. Storage environment and safety precautions are the most risk factors face feed safety and quality in sale centers

# Recommendations

1- Routine assessment and check for feed sale centers should be adapted.
2- Appropriate action must be done to prevent hazards facing the feed market.
3- Sale process in feed market must be done under extreme supervision through the law and instructions by local authority.
4- Feed must be kept under hygienic and safety environment.
5- Extension and awareness activities should be done for feed sale centers owners and labour .
6- More studies and researches are needed to obtain information help in understanding and managing the process in feed market and feed chain in dairy production .

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# Appendix

**Safety and Quality of Dairy Cows manufactured feed in sale centers**

**in River Nile State**

**Questionnaire**

1- License:

Valid expired no license

2-Materials for sale:

Feeds only feeds and others:

Sell in packages sell in packages and kilos

3-Storage:

storage at distance from walls:

Yes: no

Storage at distance off the floor

Yes: No:

Store on wooden or iron plates

Yes: No:

Presence of corridors between feeds:

Yes: No:

Good Ventilation :

Yes: No:

Protection from direct sunlight and dust:

Yes: No:

4-Quality and safety:

Take periodic samples to ensure safety:

Yes: No:

Presence of separated area for expired feeds

Yes: No:

Disposal of expired feeds under supervision of the competent authorities :

Yes: No:

5-Hygiene:

good cleaning:

Yes: No:

Presence of cleaning baskets:

Yes: No:

Using disinfectant :

Yes: No:

Control of pests and rodents:

Yes: No:

Presence of Labour for hygienic work only :

Yes: No:

6-L labeling:

Presence of labeling on products:

Yes: All Some NO:

Labeling contents:

Manufacture name:

Yes: All Some NO:

Feed ingredients:

Yes: All Some NO:

Feed chemical components:

Yes: All Some NO:

Production date:

Yes: All Some NO:

Expire date:

Yes: All Some NO:

7-Labour:Enough number for work:

Yes : No:

Presence of health certificate :

Yes: All Some NO:

Personal hygiene:

Yes: All Some NO:

Safety requirements:

Yes: All Some No:

Training before working:

Yes: All Some No: