CHARACTERIZATION OF MILK AND VEAL PRODUCTION CHAINS OF BUFFALO UNDER CROP-LIVESTOCK PRODUCTION SYSTEM IN EGYPT

By

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B.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2004
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APPROVAL SHEET

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ABSTRACT

This thesis includes four parts to characterize Buffalo milk and veal chains at different chain levels, the objectives of the first part were to identify the diversity of different chains and more deeply to determine main actors along the milk value chains in three villages to understand how these chains work. Also, milk analysis was applied to study the effect of location on milk composition, milk urea nitrogen (MUN) and somatic cell count (SCC). Field visits and interview are used to collect data. Milk samples were collected from farmers through 2013/14. Results indicated that there were a short chain and a long chain. Short chain achieved higher profit for farmers and reasonable price for consumers compared to long chain. While long chain provides a lot of jobs. MUN, SCC and milk composition could be used as diagnostic tools for different regions to identify the most priority services and extension needs at village level.

The aim of the 2nd part was to suggest a methodology to characterize the diversity of dairy farming systems in Egypt to understand the traditional dairy sector. Data were collected from 65 farmers in three villages through three consecutive seasons. Based on multiple factorial and cluster analyses, six farmers' group were identified. Milk production was a major activity in very small land farms, the sustainability of this sector facing the lack of technical support and lack of pricing system for milk and feedstuffs, more governmental and NGOs projects needed to supply farmers with high quality forage seeds, high producing animals and veterinary services. So, considering the diversity of farming systems, one agricultural policy will not fit all farmers' categories taking into account the region and the season.

The objective of the 3rd part was to apply a SWOT analysis on a traditional milk chain, particularly buffalo skimmed milk chain around greater Cairo, which considered as one of the main dairy markets in Egypt. Main stakeholders of the chain were farmers, milk collection points, milk collection center, and dairy processing units. SWOT analysis allowed highlighting the major role of social network to explain the flexibility and adaptation of this sector to the major constraints in linked with international competitiveness and national constraints, mainly on land access. These elements could help decision makers and developers to prioritize sustainable development activities in link with agriculture global agenda.

The aim of fourth part was to characterize the veal supply chain using survey analysis for different actors along the chain and to understand the preference of some meat consumers to veal meat through comparing meat quality parameters of buffalo meat categories in Egyptian market including meat quality analysis of veal, fattening males and culled females. Survey analysis results indicated that 65 % of Egyptian farmers sold veal as early as possible. About 61 % of these farmers sold their animals for economic reasons, 14 % for technical reasons and 25 % for both reasons. Fat content and cholesterol levels were lower in veal meat compared with fattening calves or culled females; the same trend was observed for shear force values and cooking loss percentage. These results explained why the veal meat is regularly consumed by elders, sick peoples and employees with limited physical activities, veal showed high tenderness and more attractive color, in contrast veal contained lower fat and cholesterol levels.

Key words: Buffalo, chain, crop/livestock production system, SWOT, skimmed milk, veal.

DEDICATION

I dedicate this work to whom my heartfelt thanks; my mother, my wife, my brothers, my sister, my friends and my lovely sons Ahmed, Omer and Ali for their patience, encouragement and help, along the course of my study.

ACKNOWLEDGEMENT

LIST OF ABBREVIATIONS

ADG	Average daily gain
CFM	Concentrate feed mixture
Cfu	Colony forming unit
CIE	Commission International de l'E´clairage
CLS	Crop/livestock system
CP's	Collection points
DPU's	Dairy processing units
GDP	Gross domestic product
GPS	Global Positioning System
Ha	Hectare
IR	Infra-red
Kgf	Kilogram force
L. dorsi	*Longissimus dorsi* muscle
MCC	Milk collection center
MCPs	Milk collection points
MFA	Multifactorial analysis
MPUs	Milk processing units
MUN	Milk urea nitrogen
NGOs	Non-governmental organization
NRL	Newly reclaimed land
OLs	Old land
SCC	Somatic cell count
SCS	Somatic cell score
SNF	Solids not fat
TBC	Total bacterial count
TS	Total solids
TVBC	Total Viable bacterial count
WHC	Water holding capacity

CONTENTS

CONTENTS (continued)

GENERAL INTRODUCTION

Agriculture is a key sector in the Egyptian economy, providing livelihoods for 55 % of the population and provides about 30 % of employing (FAO WFP "IFAD", 2012). Cultivated areas are limited and represent about 3.5 % of total land areas in Egypt (8.9 million feddan= 3.74 million hectares).

According to FAO statistics (FAO, 2015) in 2013 Egypt produced about 5.9 million liters/ year fresh milk, about 2.6 million liters produced by buffalo (represents 44.1 % of milk production) and about 3.17 million liters produced by cattle (represents 53.73%). The total numbers of buffalo were 4.2 million heads and the cattle number was 4.95 million heads.

The present study were done in three villages located in Giza (ElAtf and Reka villages) and El-Beheira (ElEmam Malik village) governorates. Traditional sector is considered the main dairy sector in Egypt. This traditional sector is characterized by the absence of recording system, no quality control, unprocessed, unpackaged products, no contract and no statistics was available. Moreover, the traditional sector offers a lot of jobs for people. Also the majority of demands depend on traditional milk and milk products. Furthermore, approximately 85 % of milk sold as loose milk[1] (Oxford report 2012) which was higher than the quantity of loose milk in India, represents 19 % of milk production (Banerjee, 2007). There is a big difference between

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[1] **Note: Loose milk= fresh unpacked, unpasteurized milk**

the price of raw milk and the price of milk products, good pricing system provide sustainability of the whole dairy chain including small dairy farming system.

Dairy industry in Egypt occupies an important place in food supply and represent about 47 % of food and agriculture enterprises (RAC/CP, 2002). The dairy industry involves the production of raw milk and it is products such as drinking milk, butter, cheese and yogurt (LACTIMED, 2014). Dairy marketing channels for smallholders are blocked with mediators and lack transparency (ACDI/VOCA Egypt, 2007). Furthermore, the dairy sector in Egypt has historically suffered from inefficient marketing channels, a lack of reliable market information, and weak agribusiness management skills.

Regarding the current situation of milk sector in Egypt, most of the buffalo milk produced were collected through unsafety ways and Egyptian consumers are preferred raw milk and its products (cheese, butter and yoghurt) because of its favorable characterization, buffalo milk is white color, high fat content around 7 % and flavor (Abdel Aziz and Sadek, 1999). Big dairy companies use cow milk which produced by large and medium farms under quality control and also use the powder milk (20-50 % of volume) which imported from outside country. The average milk consumption in Egypt was 61.8 kg per capita per (FAO, 2015), but still lower than the average world consumption (100 kg/capita/year).

In Egypt, the veal refer to buffalo calves that are slaughtered at early age with low weight. Slaughtering veal at early age and small weight was

led to a decrease in the contribution of buffalo in the national meat production.

The problem statement is there is a shortage of information about traditional milk sector and its contribution to milk supply were observed. Huge amount of milk is produced by smallholders through informal milk chain. There is no estimation about the daily milk circulated on greater Cairo pathways. Around 80% of the milk demand is provided by the traditional and informal sector. Traditional milk chain in greater Cairo is based on raw milk and processing the traditional cheese. The cheese consumption in Egypt is estimated by 10.4 kg/capita/year (CDIC, 2015). There is a lack of knowledge about this traditional sector which could help in better planning for this sector. There is a scarcity of data available about the veal chain that is often considered as a secondary product of milk production while there is a high demand.

The main hypothesis of the four parts of the present thesis were: the traditional milk chain characteristics were non-similar in different villages in Egypt, also the properties of different crop/ livestock production system were not equal, while skimmed milk chain was not similar as traditional whole milk chain and veal selling decision was not due to similar reasons and veal demand was not related to meat quality.

The objectives of this study were

1. The main objective of this part was to characterize buffalo milk chains in three different villages.

2. To characterize the diversity of dairy farming systems in the selected villages and to understand milk marketing strategies of

farmers regarding livestock products according to internal (family size, herd size and land size) and external factor (seasonality and pricing system), which could help in making proposals for policy makers, NGOs working in dairy sector and developers accounting for livestock farming systems diversity in Egypt and in other tropical and subtropical countries that have similar integrated crop/livestock farming system.

3. To monitor the dynamic of traditional skimmed milk chains and applying SWOT analysis of this sector to propose recommendations for policy makers and even researchers to improve the whole dairy production system. This analysis was based on the supply chain approach that gives us the framework for identification and characterization of the actors involved in this value chain.

4. To identify the stakeholders along the veal chain, main characteristics of the whole chain and to characterize different interpret the huge demand of veal meat through quality analysis traits related to preference of buffalo meat consumer, and finally to identify the interaction between veal and dairy chains at farm level and the effect of veal on availability of buffalo milk in the market.

Part I: Characterization of buffalo milk value chain in three different villages

INTRODUCTION

The value chain could be defined as the full range of activities which are required to bring products or services from conception, through different phases of production, delivery to final consumers, and final disposal after use (Kaplinsky and Morris, 2001). In rural areas, farmers are considering livestock as a living-bank that helps as a financial backup to cope with emergency status (Perera and Jayasuriya, 2008).

Milk production is a livestock enterprise in which small scale farmers can successfully involve to improve their livelihoods. Regular milk sales also allow them to move from subsistence to a market based income. Smallholder's dairy farming are producing milk for family consumption and for daily income through selling milk and milk products, moreover manure is used as nutrient fertilizer to produce crops. Dairy animal had an important role in social insurance and financing emergency cash needs (Chinogaramombe *et al.,* 2008).

Value chain approach is a favorable approach to understand the function of milk supply chain due to its nature that takes into account all actors along the chain. All relations between actors and different internal and external factors affecting the whole chain system.

Mastitis disease causes a huge economic loss in dairy cattle farms because of dropping milk production, increasing culling rate and

increasing veterinary cost, mastitis led to increase somatic cell counts (Němcová *et al.,* 2007 and Sharif *et al.,* 2007). Somatic cell count (SCC) is a parameter that used to judge the management programs farm level and a good indicator of udder health and milk quality produced in different production systems.

Roy *et al.* (2003) mentioned that high level of milk urea nitrogen (MUN) is a reflection of unbalance energy and protein in animal's diet, which regularly followed by low fertility, high feeding cost and low production efficiency. The MUN is considered as a tool for monitoring the dietary efficiency in terms of protein energy ration (Hof *et al.,* 1997). Characterization of the dominant value chains and milk quality analysis of different locations could help to propose more realistic strategies that improve the sustainability of the whole dairy sector.

The main objective of this part was to characterize buffalo milk chains in three different villages.

REVIEW OF LITERATURE

1. Buffalo

Buffalo is considered as backbone of the farmers economics of in 40 countries all over the world, especially in India, South-Asia, Egypt, also for animals raised in European and American countries (Singh *et al.,* 2015). Buffalo providing farmers with milk, meat, manure and draft power (Mourad, 1997 and Ahmed and Hassan, 2007). Buffalo is the main dairy animal to the majority of smallholder farmers in many developing countries (Perera, 2008). Buffalo plays a vital role through contribution in social and cultural aspects (Desta, 2012). Borghese (2010) reported that in India, the majority of the buffalo milk is produced by smallholder farmers where the herd size consists of 1-5 heads of buffalo/farmer.

In Egypt, water buffaloes are the main source for milk and contribute more than 70% of the annual milk production (Borghese, 2010 and Arefaine and Kashwa, 2015). The buffalo population was around 4 million head in year 2013 (FAOSTAT, 2015). Around 42 % of the buffalo population is dairy cows, 32 % heifers, 6 % bulls and 20% male calves (Ibrahim and Abdelrazek, 2012). Eltawil *et al.* (1976) found that milk yield of first and second buffalo lactations were around 1004 and 1553 kg/305 day, respectively. Borghese (2010) reported that Egypt have about 1,650,000 buffalo cows, with an average milk yield per lactation around 1850 kg/180 day in traditional system, while in commercial farms the average milk yield was around 2250 kg/250 day. Fahim (2009) found that the buffalo milk yield was around 1849 kg/213

day. CISE (2012) reported that the average milk production of buffalo under commercial farming system was about 1960 kg/lactation period (7.1 kg/day), while in small herds the average milk production was around 1850 kg/lactation period (6.3 kg/day).

2. Value chain "filiere" approach

Khoi and Dung (2014) reported that value chain study should involve key actors in different chain points who provide the economic activity with inputs, participate in production, processing, distribution, and marketing.

Beyene (2015) reported that the value chain is an innovation that enhances or improves an existing product or introducing new products or new product uses. Also, value chain analysis could play a vital role in recognizing the distribution of benefits to different actors along the chain. In this value chain, the processing firms hold the decision and become the main actor, which receives most of the profit. The farmers who spend a lot of effort, time and investment receive a small proportion of the profit which considered one of the threats for the whole production system sustainability.

Traditional milk chain in terms of small scale milk production, trading fresh milk and traditionally dairy processing products is important in most of the developing countries. Moreover, 80 % of milk marketing in India supplied by traditional chain (Kumar and Staal, 2010).

In Ethiopia, Beyene (2015) observed that the dairy products reach to consumers through informal and formal marketing systems. The main market is informal (traditional system) which represent 98% and the rest comes through the formal chain which represent 2 % of fresh milk supply.

Traditional or informal milk marketing chains often provide the main outlet for smallholder dairy producers and major source of fresh milk supply for consumers. They have been playing a vital role between growing demands among consumers and increasing production by producers.

Hemme and Otte (2010) concluded that milk production in small-scale farms not only improves the food security of households, but also helps to create several employment opportunities along the dairy chain.

3. Milk quality

Milk quality is very important aspect of dairy production (Dekkers *et al.,* 1996). Sraïri *et al.* (2009) reported that the quality of fresh milk is an important factor for judging the performance of dairy chains. Quality is normally defined by milk chemical components such as fat, lactose and protein content which are affected by feeding practices, breeds and stage of lactation. The authors found also that fat and protein substances are key components affecting milk possible uses through industrial sector.

a. Milk composition

Milk composition of mammalian species varies widely with reference to genetic, physiological status, nutritional factors and environmental conditions (Sabahelkhier *et al.,* 2012 and Claeys *et al.,* 2014). Claeys *et al.* (2014) explained that milk of all mammals has the same basic components, such as moisture, protein, fat, carbohydrate, vitamins and minerals, but milk component percentages widely varies especially between ruminant and non- ruminant animals.

Many factors are affecting milk composition such as animal genotype, stage of lactation, diseases especially that related to udder health (mastitis), and seasonality (Lujerdean *et al.,* 2007)

Hashmi and Saleem (2015) reported that milk composition can be affected by region, climate circumstances and lactation period. There is an inverse relationship between ambient temperature and protein- fat contents of milk. Thus, with seasonal changes most of milk components (Fat, protein, casein and all fractions of nitrogen) are affected. Also, they found that high environmental temperature led to a decrease in fat %.

Milk composition (Fat, protein and lactose) could be used as a diagnostic tools for the herd management in particular the health of lactating animals (Forsbäck *et al.,* 2010)

Buffalo milk is one of the highest mammalian milk in the level of constituents. Mainly, fat content is the main fraction of buffalo milk and it is responsible for high nutritive value (Ménard *et al.,* 2010).

Park and Haenlein (2006) reported that season affects buffalo milk composition. Fat and lactose were increased in summer by (8.4% and 5.2 %, respectively) than in spring (7.3% and 5.1 %, respectively) and winter (6.7% and 3.6 %, respectively). Most of milk components (fat, protein, lactose, SNF and TS) increased by advancing lactation period.

Han *et al.* (2007) found that the average milk composition of fat, protein, lactose, total solids and ash of River Nile buffalo in China was 6.53, 4.16, 4.56, 17.14 and 0.81 %, respectively.

b. **Somatic cell count (SCC)**

Somatic cell count is defined as the number of milk-secreting epithelial cells that have been shed from the lining of the gland and white blood cells (leukocytes) that have entered the mammary gland in response to injury or infection (Sharma *et al.,* 2011). Mastitis causes changes in milk composition, which leads to decrease coagulation and produce lower cheese quality (Tripaldi *et al.,* 2010).

Determination of SCC could be useful to predict the mastitis which causes a great economic loss due to decreasing milk yield and quality (Cerón-Muñoz *et al.,* 2002 and Patil *et al.,* 2015).

Fagiolo and Lai (2007) observed that mastitis commonly led to inflammation of one or more quarters of the mammary gland and it is frequently affecting not only the individual animal, but also the whole herd or some animals within the herd. The authors reported also that SCC can be changed due to animal age, stage of lactation, season and milking frequency. Bansal *et al.* (2007) reported that mastitis affects milk

composition which led to decrease in fat, protein, lactose and solids not fat content; however, there is an increase in some other components such as somatic cells, salt, whey proteins and bacterial count. The frequency of infection by mastitis is higher in bovine cows compared to buffalo cows (Mohamed *et al.,* 2013).

The SCC was transformed to somatic cell score (SCS), where the lactation period started with high SCS then decreased to minimum at third month of lactation and increased again with the advancement in lactation period (Němcová *et al.,* 2007).

Bytyqi *et al.* (2010) recorded that SCC in normal cases is lower than $1\text{x}10^5$ cells/ml, but in the case of infection with mastitis, the SCC is higher than $1\text{x}10^6$ cells/ml. So, an elevated SCC had negative impact on milk quantity, quality and the manufacturing properties of milk.

Patil *et al*. (2015) found that SCC in buffalo milk lower than $2 \text{ x } 10^5$ cells/ml is normal cases, ranged from $3.2 \text{ x } 10^5$ cells/ml to $1 \text{ x } 10^6$ cells/ ml is subclinical mastitis and the count higher than $1 \text{ x } 10^6$ cells/ ml is clinical mastitis. So, Somatic cells are used as indicator of both resistance and susceptibility of buffalo cows to mastitis and can be used to monitor the occurrence of subclinical mastitis in herds or individual cows.

The studies on buffaloes (Dhakal, 2006 and Syed *et al.,* 2009) indicated that SCC in normal milk produced from healthy udder is less than 200,000 cells/ml, but quarters that tested and gave higher than 200,000 cells/ml is considered as subclinical mastitis (infected quarters).

c. Milk urea nitrogen (MUN)

MUN is used for monitoring the protein/ energy status of lactating cows and consequently is useful for reducing loss and maximizing efficiency of nitrogen utilization as reported by Roy *et al.* (2011).

In Indian traditional farms, buffalo diets didn't estimated according nutritional requirements which were led to negative effects on milk production, reproduction and health status as reported by Roy *et al.* (2003). High levels of milk urea nitrogen (MUN) reflect unbalance between energy and protein in animal's diet that followed by low fertility, high feed cost and low production efficiency. So, MUN is considered as a tool for monitoring the dietary efficiency in terms of protein energy ration (Hof *et al.,* 1997). Many authors found that there was a negative correlation between MUN and milk protein production especially casein which affecting cheese yield (Godden *et al.,* 2001 and Johnson and Young, 2003).

Yoon *et al.* (2004) found that MUN increased during the first two months of lactation and decreased after fifth months of lactation until the end of the lactation, also reported that there was 3 categories of MUN where low MUN less than 12 mg/L, normal MUN ranged 12-18 mg/L and high MUN more than 18 mg/L.

Martin *et al.* (1997) reported that MUN could have an effect on cheese production and suggested that the cheesemaker should measure the MUN before processing.

MATERIALS AND METHODS

Three different villages have been selected; ElEmam Malik is located 120 km north of Cairo El-Beheira governorate, represents the newly reclaimed land and the two other villages are; ElAtf and Reka located at 50 and 80 km south of greater Cairo Giza governorate, respectively, represent the traditional system in the Nile Valley. Milk pathways were followed by each chain in the three villages. The starting points were traders, milk collection centers and dairy key persons. Field visits and personal interview with semi-open questionnaires (Appendices) were used to collect data from farmers and mediators. The questionnaire covered farmers activity towards dairy production and marketing also, mediator's activists.

Milk samples were collected from farms in winter, spring and summer in the three studied villages through the year 2013-2014. Milk composition and milk urea nitrogen were analyzed by Bentley 150, USA and somatic cell count was measured by Nucleo Counter® SCC-100™ where applied in department of Mastitis and Neonatal Diseases, Animal Reproduction Research Institute (ARRI), Agricultural Research Center, Giza, Egypt. The somatic cell count (SCC) was log-transformed into somatic cell score (SCS) as: SCS= log10 SCC (Mrode and Swanson, 1996). The differences among villages were tested using Proc Glm SAS (SAS, 2016) to identify the effect of the village on milk quality traits in terms of moisture, fat, protein, total solids (TS), solids not fat (SNF), lactose, ash, milk urea nitrogen (MUN) and somatic cell score (SCS). The statistical analysis of data was performed using the following model:

$$Y_{ijk} = V_i + S_j + e_{ijk}$$

where

Y_{ijk} =the measured trait

V_i = effect of village (i= 1, 2 and 3 where 1= ElAtf, 2=ElEmam Malik and 3=Reka)

S_j = effect of season (j= 1, 2 and 3; where 1= winter, 2=spring and 3=summer).

e_{ijk} = Random error

RESULTS

1. Chain maps of buffalo milk

ElEmam Malik village is located in the west of delta, where the zone of the newly reclaimed lands which reclaimed at 1980's. The buffalo cows are reared basically for home consumption and the extra milk and dairy products (cheese and butter) were sold to neighbors or/and in village market as shown in Figure 1. No buffalo milk collection centers were found in this area, so farmers tended to keep the buffalo milk due to the low price offered by traders.
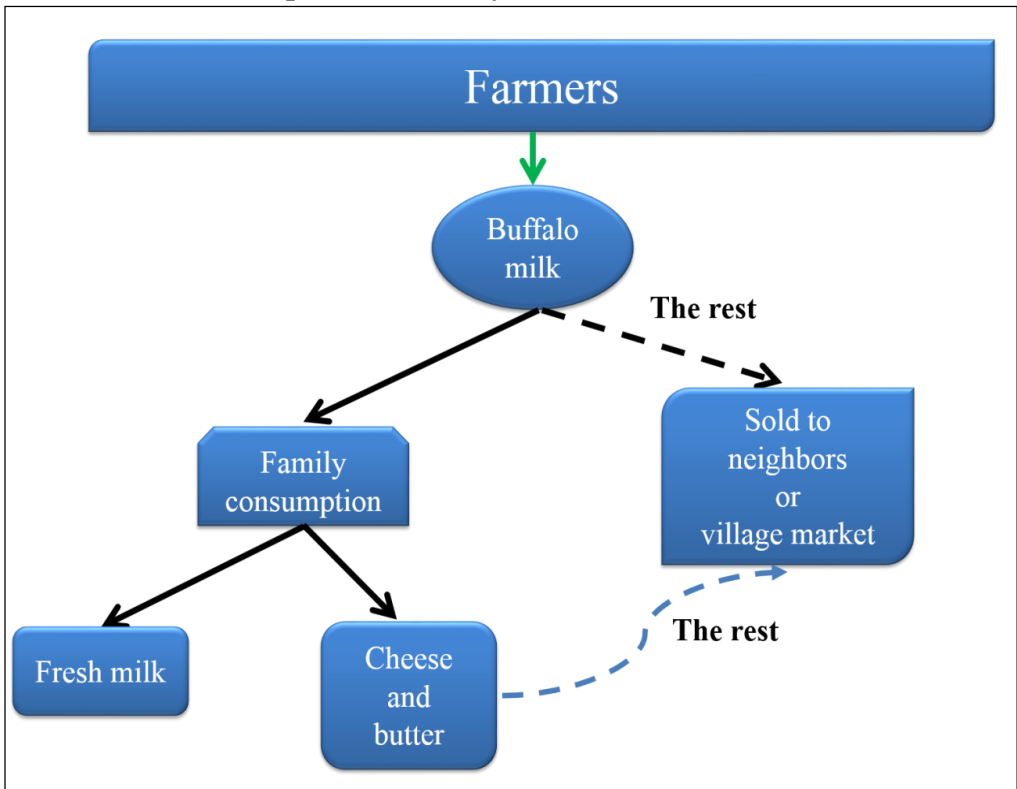
Fig. 1. The Buffalo milk chain in ElEmam Malik village (newly reclaimed land).

ElAtf village is located at the middle of Giza governorate, where milk production is mainly comes from buffalo.
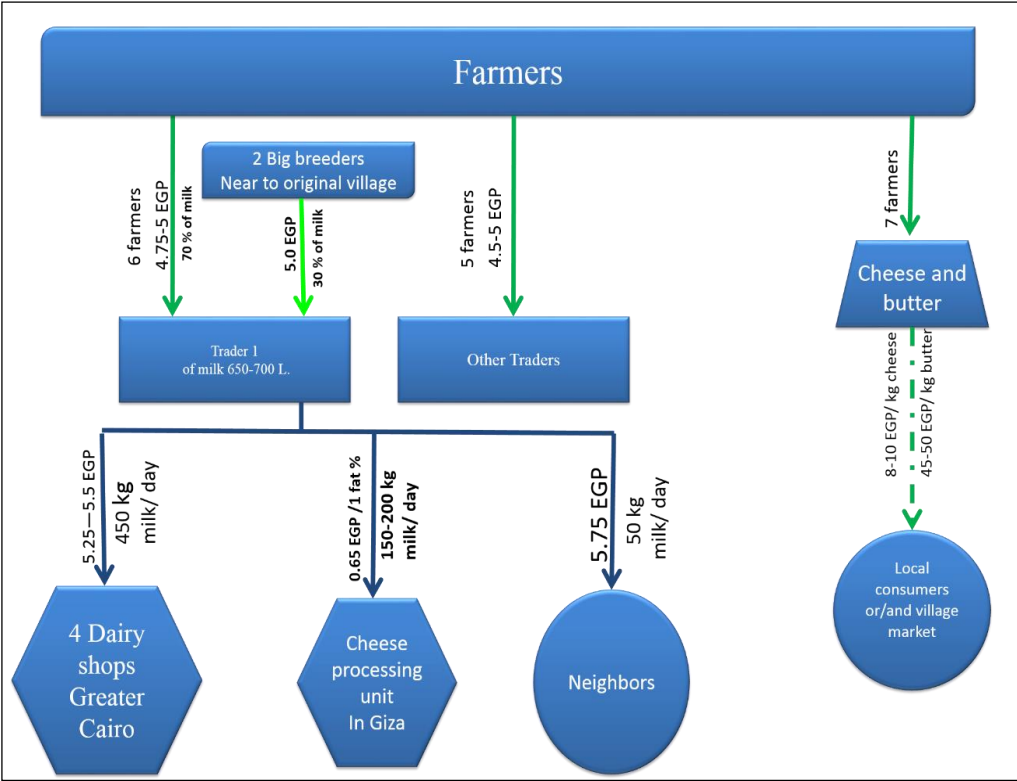
Fig. 2. The Buffalo milk chain in ElAtf village (Nile Valley).

Reka village is located in the south, it's the last village of Giza governorate and at the border of Beni Sweif governorate. Most of producers reared buffalo and few numbers of cattle. So, in this village the majority of milk produced was buffalo milk. Moreover, the farmers skimmed milk for getting butter and using skimmed milk for producing Qarish cheese.
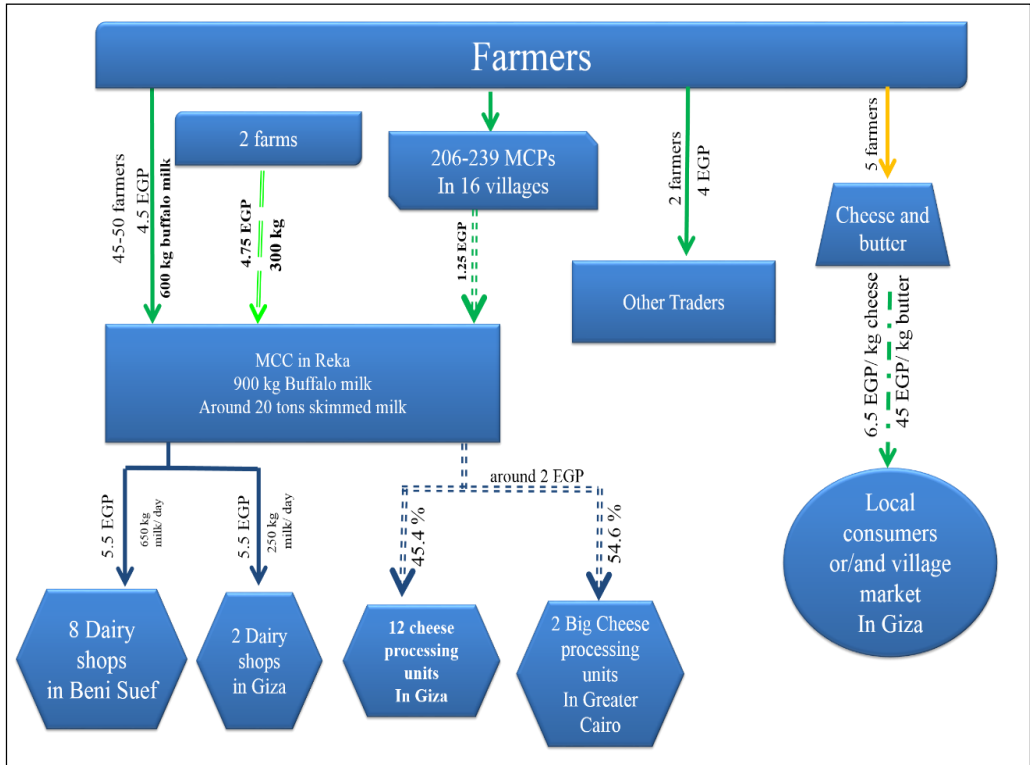
Fig. 3. The Buffalo milk chain in Reka village (Nile Valley).

2. Comparison among the three studied villages
a. At farmer level

The average number of dairy buffalo was affected by village. The high number was observed in ElAtf village (3.1 head/ farmer) compared to ElEmam Malik (1.5 head/ farmer) and Reka (1.4 head/ farmer). The same trend was found in the average quantity of milk production per farmer and average daily quantity of milk sold. High differences in all studied variables were found in ElAtf village compared to the other two villages (Table 1). The percentage of sold milk was lower in ElEmam Malik than ElAtf and Reka villages, while the percentage of drinking milk was higher in ElEmam Malik than Reka and ElAtf villages.

Table 1. Mean (± SE) and coefficient of variability for number of dairy buffalo, average quantity of milk production per farmer, daily quantity of milk sold, average price of milk per liter, daily drinking of milk (liter) and % of drinking milk per production for the three different villages (ElAtf, ElEmam Malik and Reka).

Village	ElAtf			ElEmam Malik			Reka		
No. of farmers	20			21			21		
Variable	Mean	SE	C.V %	Mean	SE	C.V%	Mean	SE	C.V%
No. of dairy buffalo	3.1[a]	0.52	103.9	1.5[b]	0.14	63.3	1.4[b]	0.12	56.3
Daily milk yield/farmer (kg)	26.2[a]	5.14	124.1	7.6[b]	0.72	60.6	9.2[b]	0.87	64.4
Daily milk yield sold/farmer (kg)	22.4[a]	5.09	144.2	0.4[b]	0.28	415.8	5.8[b]	1.00	117.3
Price per liter (EGP)	4.7[b]	0.06	7.8	5.3[a]	0.06	6.7	4.4[b]	0.03	4.3
Daily drink milk (kg)	0.9[b]	0.08	54.3	1.4[a]	0.14	59.4	0.7[b]	0.06	55.3

SE: Standard Error and C.V.: Coefficient of Variability.

As shown in Figure (4) ElAtf village farmers sold more milk than the quantity of milk processed (66 *vs.* 27 %) and the same trend was found in Reka village (54 *vs.* 37%).

On the other hand, in ElEmam Malik village, the quantity of processed milk was the highest (72 %), 24 %, consumed as fresh milk and the rest (4%) was sold.

b. At trader's level

In ElEmam malik village there was no traders to collect buffalo milk, however farmers have ability to rear buffalo in terms of technical and economical possibilities. More than one trader in ElAtf and Reka villages collect buffalo milk from farmers and deliver it to milk shops and milk processing units. The price of buffalo milk was higher in ElEmam Malik compared to ElAtf and Reka village (Table 1).

3. Milk composition

Most of milk quality traits were affected by location as shown in Table 2. Moisture % of milk was higher in Reka village compared to ElAtf village (83.9 vs. 82.2 %). Also, protein and SNF were affected by village with higher levels in Elatf. Fat %, lactose % and SCS were insignificantly differed among villages. The milk urea /nitrogen was higher in Reka as presented in Figure 5, the normal range of MUN (12-18) with higher proportion was found in ElEmam Malik village (52%) than in Reka and ElAtf villages (31 and 23 %, respectively).
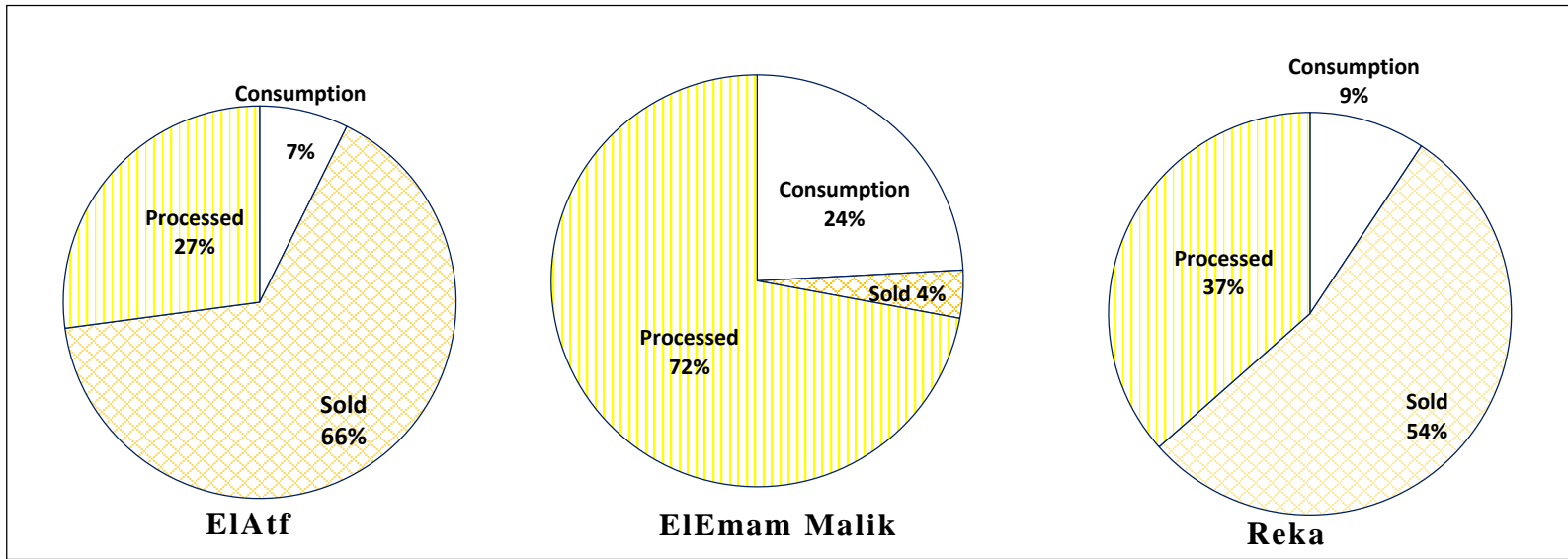
Fig. 4. The proportion of consumed, processed and sold buffalo milk at farmer's level in the three studied villages (ElAtf, ElEmam Malik and Reka).

ElAtf village had lower level of MUN (less than 12) (65 %) compared to ElEmam Malik (38 %) and Reka (30%). The high level of MUN was observed in Reka (39%) followed by ElAtf and ElEmam Malik village (12 and 10 %, respectively).

The percentage of normal animals (free from mastitis) was less than 50 % of buffaloes in the three studied villages (Figure 6). Estimating SCC in milk samples reflect possibility of infection with subclinical mastitis.

Table 2. Mean (± SE) of milk composition traits among the studied villages.

Village	ElAtf			ElEmam Malik			Reka		
No. of samples	34			29			72		
Variable	Mean	SE	C.V%	Mean	SE	C.V%	Mean	SE	C.V%
Moisture	82.2^b	0.38	2.7	83.0^{ab}	0.35	2.3	83.9^a	0.28	2.9
Fat	7.1	0.22	17.8	7.5	0.28	20.3	7.1	0.18	20.5
Protein	4.2^a	0.15	20.8	3.5^b	0.11	18.2	3.5^b	0.08	19.1
TS^A	17.7^a	0.39	13.1	17.0^{ab}	0.37	11.9	16.1^b	0.28	14.9
SNF^B	10.8^a	0.33	18.0	9.5^b	0.23	18.1	9.0^b	0.20	18.9
Lactose	4.9	0.15	17.7	4.7	0.11	13.3	4.7	0.07	13.8
Ash	1.8^a	0.12	41.8	1.4^b	0.13	53.0	1.0^c	0.07	63.3
MUN^C	11.5^b	0.63	32.2	12.4^b	0.76	32.7	15.2^a	0.53	29.3
SCS^D	5.4	0.07	7.8	5.5	0.07	7.2	5.1	0.07	10.9

[A] TS: Total Solids, [B] SNF: Solids not fat, [C]MUN: Milk Urea Nitrogen and [D] SCS: Somatic cell score.

SE: Standard Error and C.V.: Coefficient of Variability.
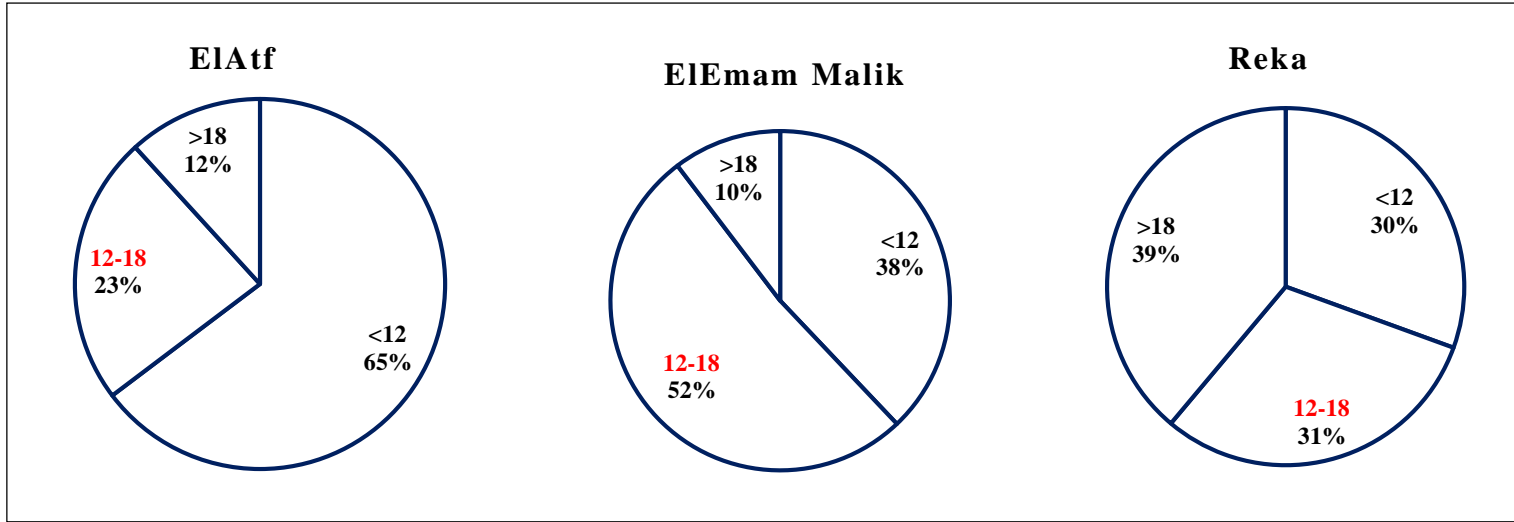
Fig. 5. The level of milk urea nitrogen (less than 12, 12-18 and more than 18 mg/dl) in the three studied villages.
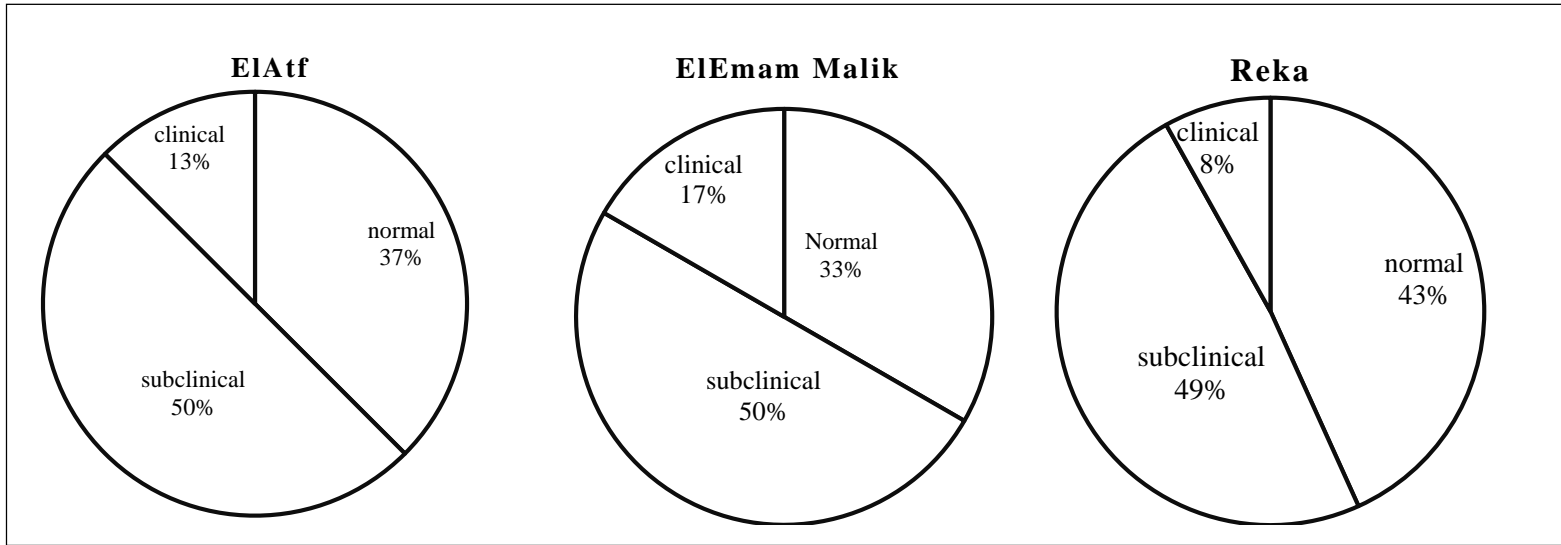
Fig. 6. The proportion of normal, subclinical and clinical mastitis of buffalo in the three studied villages (ElAtf, ElEmam Malik and Reka).

DISCUSSION

In the three studied villages, buffalo milk provides farmers with food security and considered as a source of cash income, which matched with the results obtained by (Hemme and Otte, 2010). In ElEmam Malik village there were no traders for buffalo milk which may be responsible for a few numbers of buffalo reared to cover only family consumption and the rest was sold to neighbors and consumers in village market. This kind of chain, which called (short chain) was shown in Figure 1 without mediators between producers and consumers.

In short chain producers receive a relatively good price (Table 1), and less job opportunities. On the other hand, the two chains that showed in Figure 2 and 3 for ElAtf and Reka villages were (long chain) included producers, traders, milk shops, milk processing units and consumers. In this kind of chain, farmers were gotten lower prices in a regular payment (weekly payment). Moreover, more jobs opportunities offered along the chain. Also, the price of milk is increased regarding to the distance between production area and milk marketing area. The price of buffalo milk was higher in ElAtf village compared to Reka village.

Large quantities of milk collected in ElAtf from few farmers help traders to control milk quality and collect milk in short time. The average buffalo milk production was based on the average number of lactating animals. Fresh milk consumption was higher in new lands compared to old lands that might be due to high level of life style in new lands compared to old lands. So, if marketing of fresh milk is weak, the milk

processing was increased as an alternative solution to extend shelf life of milk as a reason to explain the situation in three villages (Figure 4).

Buffalo milk fat was not affected by location, which was around 7 % (6.5-7 %, Ibrahim and Abdelrazek, 2012). The protein % of buffalo milk was higher in ElAtf village compared to the other two villages. This may be due to MUN level which agree with Godden *et al.* (2001) and Johnson and Young (2003) who found negative correlation between MUN and protein %. High level of MUN was negatively associated with cheese yield as a reason for poor protein coagulation (Martin *et al.,* 1997). Also, MUN level reflects the level of nutrition where the good nutrition ratio was found in ElEmam Malik because the normal level of MUN was the highest followed by Reka and ElAtf village (Figure 5).

Somatic cell count is considered as an indicator to management practices in terms of health (Dhakal, 2006, Syed *et al.,* 2009 and Bytyqi *et al.,* 2010). In the present study, the SCS was not differed among villages ranged from 5.1 to 5.5 which indicated that most animals were infected (subclinical mastitis). Thus, normal buffalo milk was less than 50 % (Figure 6) which reflects the bad management condition practices towards buffalo in rural areas. Generally, MUN, SCC and milk composition could be used as a routine analysis for sampling small dairy farms in different regions to identify the most priority extension services needs in the area that should be introduced in different villages and regions.

Results of the present part could help in building up more realistic traceability and food security plans along dairy chains through

controlling management practices at different production points or at
starting point in the chain by setting a new milk pricing standards based
on quality. Controlling programs could be used to prevent some diseases
like mastitis.

PART II: Characterization of the diversity of dairy farming systems and milk marketing strategies in three villages

INTRODUCTION

Crop/livestock system is the main system at the international scale, provides around 75% of dairy, 60% of meat and up to 50% of cereals production (Herrero *et al.*, 2010). Hahlani and Garwi (2014) reported that, milk production in small scale provides rural employment and cash income while at the same time helping in diversifying, intensifying and stabilizing agricultural production system.

Multi factorial analysis (MFA) was applied to characterize the diversity of farming systems (Alary *et al.,* 2002). Cluster analysis is allowed to identify different farming systems in terms of structure (family size, herd and land size) and function (the practices and strategies). This analysis helps in developing target interventions through policies or advices for different types according to their assets and their functioning (Perrot and Landais, 1993 and Faye and Lhoste, 1999).

In Egypt, crop-livestock production system is considered as the main farming system including about 95% of bovine population (cattle and buffaloes); in this system, 84% of farmers had <3 feddans (1.3 ha) with 2-3 heads of animals; buffaloes, native and crossbred cattle (Census, 2010). Crop-livestock production system provides about 75% of milk production at the national scale, while 25% produced by commercial farms (Abdel Aziz and Sadek, 1999).

In Egypt, most of the studies focused on the differentiation between intensive production system which linked with modern dairy industry and small scale production systems (crop/livestock production system) which connected with traditional dairy sector. There is no available studies about the diversity of crop-livestock production systems and milk marketing strategies of small and medium dairy enterprises.

The main goals of the present part were to characterize the diversity of dairy farming systems in the selected villages and to understand milk marketing strategies of farmers regarding livestock products according to internal (family size, herd size and land size) and external factors (seasonality and pricing system). This work will help to make proposals for policy makers, NGOs working in dairy sector and developers to fit livestock farming systems diversity in Egypt and in other tropical and subtropical countries that have similar properties.

REVIEW OF LITERATURE

The term system comes from the Latin word *systēma*, which means "to aggregate" (Sorenson, 1998). System is defined as a number of related components that interact and cooperate for achieving a certain goal and respond to both internal and external stimuli (Ghosh, 2005 and Gammack *et al*., 2006).

Zwald *et al*. (2001) reported that production systems changed from one country to another, among herds within the same country and over time.

Farming system is considered as encompassing the totality of production and consumption decisions occupied by a farm-household, including the choice of crop, livestock and off-farm enterprises, and food consumed by the family (Byerlee and Collinson, 1980). Also, Mahapatra (1994) reported that farming system is the result of complex interactions among a number of inter-dependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, namely land, labor, capital and management to which they have access.

Kaine *et al.* (2004) reported that the diversity in farming led to creates pressure to classify farms into typologies which can be used to help set priorities and directions for research. The authors also reported that the farms diversity into farming systems led to assisted to recognize constrains that faced farms.

Kremen *et al.* (2012) defined a diversified farming system as a system of agricultural production that, included a range of practices, incorporates agro biodiversity across multiple spatial and/or temporal scales. Diversified farming system is important to sustain and to secure the global food system.

Morton (2007) reported that smallholders term usually used to describe rural producers, predominantly in developing countries, characterized by family labor and for whom the farm provides the principal source of income.

Ngongoni *et al.* (2006) recorded that smallholder in developing countries have numerous aims for their cattle enterprise. Under this system, cattle play many roles, these roles such as, essential part of meat and milk production, livestock are narrowly linked to the social and cultural lives. Moreover, livestock is considered as security assets influencing access to informal credits and loans to aid smallholders in crises and events (like bride price payments). In many smallholder systems in developing countries, manure is considered as important as milk, meat or draught power.

Phiri *et al.* (2010) found that smallholder dairy farms in eastern and southern Africa produce more than 80% of the milk production. Subsequently considering them a significant part of the dairy enterprise.

Salami *et al.* (2010) showed that smallholder farmers is defined based on land and livestock holding, where the cultivated lands were less than 2 hectares and own only a few heads of livestock. More than 75 % of the total agricultural income in the four countries (Uganda, Ethiopia,

Kenya and Tanzania) comes from smallholder farmers. Munthali *et al.* (1992) reported that the average land size that cultivated by smallholder farmers ranges from less than 0.5 to 2.5 hectares.

In Vietnam, Suzuki *et al.* (2006) found that the popular farmers were owned small cultivated land with average 0.51 hectare (range 0.03-2.76 hectares) and small numbers of buffalo with average 1.4 head (range 1–5 heads) and non-dairy cattle with average 1.4 head (range 1-4 heads).

In India, Kumar e*t al*. (2011) reported that the majority of milk producers are smallholders and contribute about 70 % to the total milk production. Also, they found that smallholders hold a few heads of buffalo or cattle, within a system integrated with crop production where used crop residues such as straw of rice and wheat. Moreover, cattle and buffalo are very significant for smallholders to provide milk and milk products for family food security not only for selling to get cash money.

Mhone *et al.* (2011) reported that in Zimbabwe the dairy farming system was generally classified into commercial and smallholder sectors. Smallholders characterized by low input and low output. Chatikobo *et al.* (2013) informed that in Zimbabwe, the smallholders holding about 80-90 % of total population of livestock and count around 75% of the food security.

In Pakistan, dairy animals were kept under different production systems including: 1) grazing systems, 2) mixed farming system and 3) pre-urban dairy clusters (Devendra *et al*., 1997; Devendra, 2001 and Sarwar *et al*., 2002).

In Egypt, Abdel Aziz and Sadek (1999) reported that there are two major systems of dairy production; 1) traditional crop/livestock system and 2) industrial system (commercial farms). Also, there are another system established to cover demands in big cities, this is called flying herds.

Most milk produced by smallholders in the developing countries comes from one of the following production systems:

1. Crop/livestock production system

Dairying is often part of a mixed farming system in which manure is used for fertilizing cash crop production. Dairy animals are fed on grass, crop residues and cultivated fodder. Supplementary feeding is practiced only when feasible.

This system was dominant in Pakistan characterized by herd size ranged 2-15 animals, milk production is the main component of farm income and feeding system included fodders, crop residues, agro-industrial by-products, weeds in cropland after harvesting are used as animal feed and with additional input like mixed concentrate feeding. Some of the milk produced was used for home consumption, but most of it is sold directly by the farmer or to middlemen. This production system holds about 59.3% of total cattle and 45.5% of the total buffalo population.

In Egypt, the traditional system is considered the main system containing about 95 % of bovine population (cattle and buffalo). The system is characterized by small-herd size less than 50 head of animal,

less than 5 feddans and keep native and crossbred animals. The feeding system depends on Egyptian clover in winter and maize and sorghum in summer, supplemented with limited amount of ingredients (corn, wheat bran, cotton seed cake, etc.) or concentrate feed mixture. This system provides about 75 % of milk production on the national scale as reported by Abdel Aziz and Sadek (1999).

2. Pastoral/agro-pastoral dairying (Grazing system)

These systems are based on land and milk which are often the most significant maintenance items. Dairy production is normally linked with cropping, but nomadic pastoralists practice slight or no agriculture and roam the land in search of grazing grounds and water.

In Ethiopia, this system represents 30 % of livestock population, also represent 50-60 % of total area in Ethiopia. The system was characterized by poor land depends on rainfall pattern and have shortage of feed availability; so the milk production is low and highly seasonality dependent. Also, both the pastoralist and Agro-pastoral systems represent 98% of the national milk production and 75% of the commercial milk production (Tegegne *et al.,* 2013). In both systems, the production is based totally on low input, with little milk yield, and lack of market orientation. The main sources of milk in these systems are native cattle, camels and goats, while the contribution of sheep is small.

In Pakistan, this system is especially important for small ruminant (goat and sheep) and less significant to the dairy animals (buffalo). In this system, animals depend on grazing in open grasslands or lands not

suitable for cropping. Only 8.7% of cattle and 6.3% of buffaloes in Pakistan completely raised on grazing and around 40.8 % of grazing cattle and 49.3 % of grazing buffaloes were kept in less than 10 animals/herd.

3. **Urban and peri-urban milk production system**

This is a purely market-oriented production system placed within and closed to the borders of cities. Dairy producers in peri-urban areas get advantage from their closeness to markets, but their production is depend on bought inputs and may meet problems of feed supply and waste disposal. In last decades, a peri-urban dairy sector has developed very fast around the bigger cities of many developing countries, in response to enlarging market demand (Bernet *et al.,* 2000). One of the disadvantages of urban farms threaten human health.

Abdel Aziz and Sadek (1999) found that in Egypt, the flying herds are concentrated around the big cities. In this system buffaloes are keeping and feeding intensively to produce high fat milk which sold directly to consumers. The buffaloes are purchased as a dairy and sold to slaughter after finishing lactation period. The stakeholders under this system selected the high yielders and subsequently loss these animals. Fahim (2009) found that landless buffalo production system was dominate in flying herds in Giza governorate. The author stated that in flying herds system most of producers sold milk to middlemen and some of herdsmen sold milk directly to consumers which achieved high profit.

4. Intensive dairy farming (Commercial farming system)

Abdel Aziz and Sadek (1999) recorded that commercial farms system provide about 25 % of milk production in Egypt, which keep the pure dairy animals (mainly Holsteins). Using high technology for milking animal and feeding is practiced. The feeding system depends on good ingredients (maize, soybean, cotton seed cake, etc...) and mixed with green fodder or silage as TMR. The farms provide a good atmosphere for animals to achieve the target production.

Duncan *et al*. (2013) reported that dairy production systems in developing countries continue to intensify due to increasing inhabitant's density, scattering land and increasing demands for animal source foods.

MATERIALS AND METHODS

1. Area of study and sampling

Three different villages have been selected; ElEmam Malik is located 120 km north of Cairo (El-Beheira governorate), represents the newly reclaimed land and the other two villages are ElAtf and Reka villages that are located, respectively, at 50 and 80 km south of Cairo (Giza governorate), represents the old system in the Nile Valley (Figure 7). The objective of this part was to differentiate farmer' categories according to their farming systems, their livestock orientations (meat or milk), their animal marketing systems and their localization regarding Cairo markets. In each village, around 21 farmers were selected according to their milk strategies; farmers who sell milk to private traders, milk collection units or keep milk for home consumption.
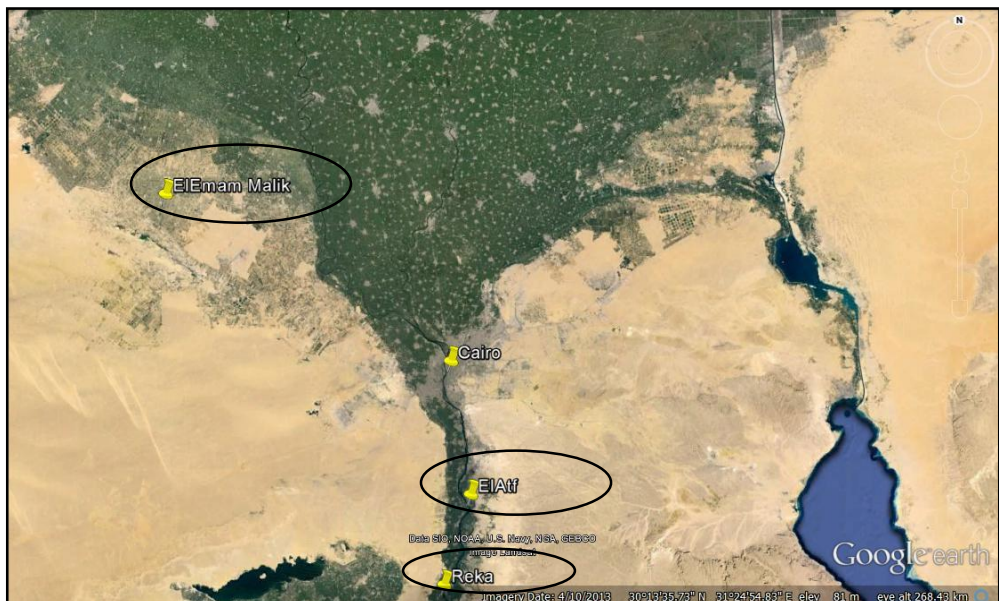
Fig. 7. Villages location in the Egypt map (ElEmam Malik, ElAtf and Reka). Source: GoogleEarth scale 189.77 km.

2. Data collection

A total number of 65 farmers in the three villages have been followed each season from winter 2013 to summer 2014. A small semi structure questionnaire (Appendices) was developed to approach the farm structure (land and crop allocation, herd structure and composition, milk and veal marketing strategies). This questionnaire was applied during the three consecutive seasons (winter, spring and summer) to record the changes in crop allocation, herd composition and animal products marketing pathways.

3. Data analysis

A multiple factorial analysis (MFA) has been done using the 65 farmers that have been followed over the 3 consecutive seasons. Based on a multiple factorial analysis, a cluster analysis was applied using an ascendant hierarchical classification (Manly 1994). All calculations were performed using R software (R core team 2012) and the additional package ade4 (Thioulouse *et al.* 1997).

In order to understand the link between the functioning system of the family farms including the family, the crop land system, the livestock system and the integration of crop-livestock system and the animal marketing system (related to milk and meat products and the reasons), data were classified into 7 themes (Table 3). The functioning of the mixed crop-livestock system was approached by 3 themes of variables: 1) 'family': included the main structural variables related to family size, external labor, land size and cropping system; 2) 'Herd': included all variables related to the herd structure and composition by species for the

three seasons; and 3) 'feed': included all variables related to the feeding supplementation by season with corn, concentrates feed mixture, wheat bran and cotton seed cake that are the four main feedstuffs. Also, four other themes of variables were related to animal marketing orientation: 4) 'Milkcons': including all variables related to family consumption of milk and milk products like cheese, butter, and yogurt; 5) 'Milksale': including all variables related to marketing quantity of all milk and milk products like cheese, butter and yogurt; 6) "veal": included all variables related to veal management practices like, suckling practice , age at weaning, veal slaughtering age and selling price; and 7) 'reasons": contain 3 variables related to the choice of operators in the markets and the preferences of milk or meat marketing. The percentage of milk consumed by calf was estimated by the number of udder quarters available for feeding calves; 4 quarters meaning that calf consumed 100% of milk, while one quarter means that calf consumed 25% of the dam's milk.

Table 3. List of variables per theme used in the present study.

Theme	Variables	
Family size 'family'	Family size	No. of hectares rented by farmer
	Occasional labor	Total cultivated area by farmer
	Permanent labor	No. of hectares cultivated by forage crop
	No. of hectares owned by farmer	
Herd size 'herd'	No. of dairy animals in winter, spring and summer per farmer	No. of buffalo in winter, spring and summer
	No. of dry animal in winter, spring and summer per farmer	No. of bovine in winter, spring and summer
Feeding 'feed'	Quantity of CFM* in winter, spring and summer kg/day	Quantity of wheat bran in winter, spring and summer kg/day
	Quantity of corn in winter, spring and summer kg/day	Quantity of cotton seed cake in winter, spring and summer kg/day
Milk consumption 'milkcons'	Buffalo milk production / farmer in winter, spring and summer kg/day	Bovine milk consumption / farmer family in winter, spring and summer kg/day
	Cattle milk production / farmer in winter, spring and summer kg/day	Buffalo milk consumed by drinking / farmer family in winter, spring and summer kg/day
	Buffalo milk consumption / farmer family in winter, spring and summer kg/day	
Milk sale 'milksale'	Quantity of buffalo milk sold / farmer in winter, spring and summer kg/day	Quantity of buffalo milk sold to trader kg/day
	Quantity of cattle milk sold / farmer in winter, spring and summer kg/day	Quantity of cattle milk sold to collection point kg/day
	Quantity of buffalo milk sold to collection point kg/day	Quantity of cattle milk sold to milk collection center kg/day
	Quantity of buffalo milk sold to milk collection center kg/day	Quantity of cattle milk sold to neighbor kg/day
	Quantity of buffalo milk sold to neighbor kg/day	Quantity of cattle milk sold to trader kg/day

Table 3. Continued

Theme	Variables	
Veal 'veal'	Veal age through winter, spring and summer season	Proportion of veal through winter, spring and summer (first 10 day after birth)
	Veal price through winter, spring and summer seasons	Proportion of milk consumed veal through winter, spring and summer (after first 10 day after birth)
Reason 'reasons'	The reason to deal with trader	The reason to keep veal or sold
	The reason to sell milk or keep it	

*CFM= concentrate feed mixture.

The main interest of the MFA is to observe and analyze the links between the characteristics of the functioning and both of milk &veal marketing strategies.

RESULTS

1. Diversity of crop-livestock systems

a. Multiple factorial analyses

The first factorial plan shows that milk marketing strategies were mainly linked to herd size and family milk consumption and this explained the first axis of differentiation (23.2%) in Figure 8A. The second axis differentiates farmers according to veal management practices in link with marketing opinions of farmers (16.1%). Feed and family appear significant only on third axis of the factorial plan (Figure 8B).
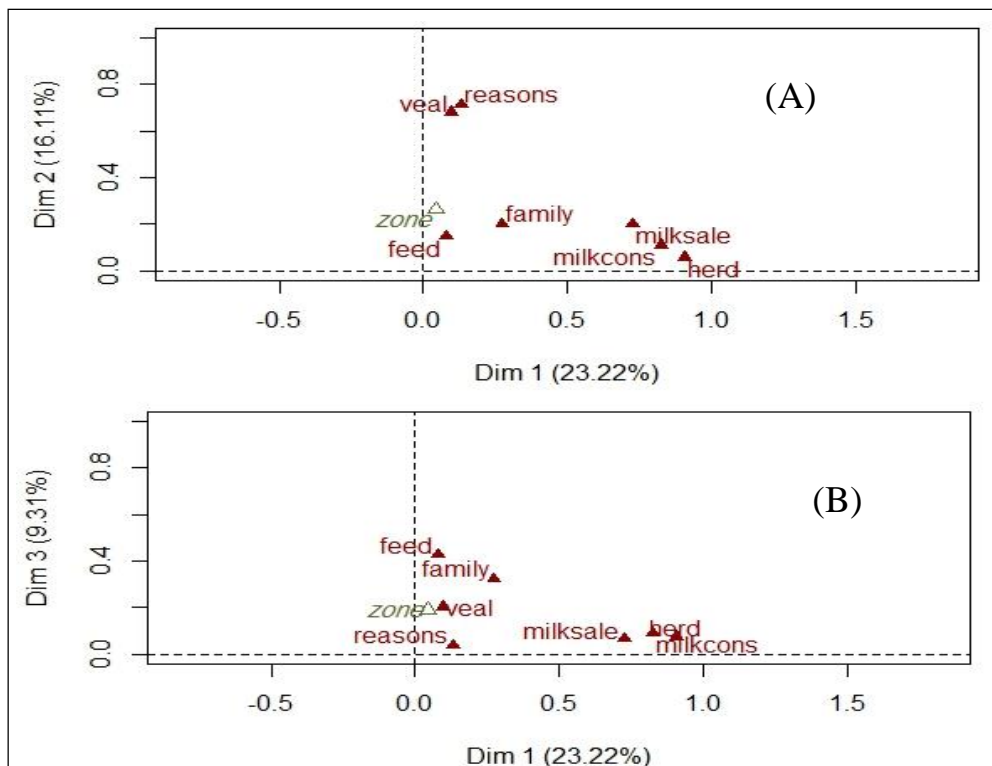
Fig. 8. Factorial analysis output, A: the relation between Dim 1 and Dim 2; B: the relation between Dim 1 and Dim 3.

The links among the themes illustrated the main characteristics of traditional farming systems in the irrigated zones. Supplemental feed system was mainly explained by the land and crop system; and there were some fluctuations for the small farmers due to the strong land constraints. The orientations of animal products marketing between self-consumption or selling milk products were linked to the herd size. At opposite, the strategies of veal marketing were more related to economic status.

b. Cluster analysis

Based on a hierarchical cluster analysis, four main groups and two very little groups were identified. Figure 9 shows the cluster projections on the first factorial plan (1*2) and table 4 presents the classification of farms in each cluster according to their location.
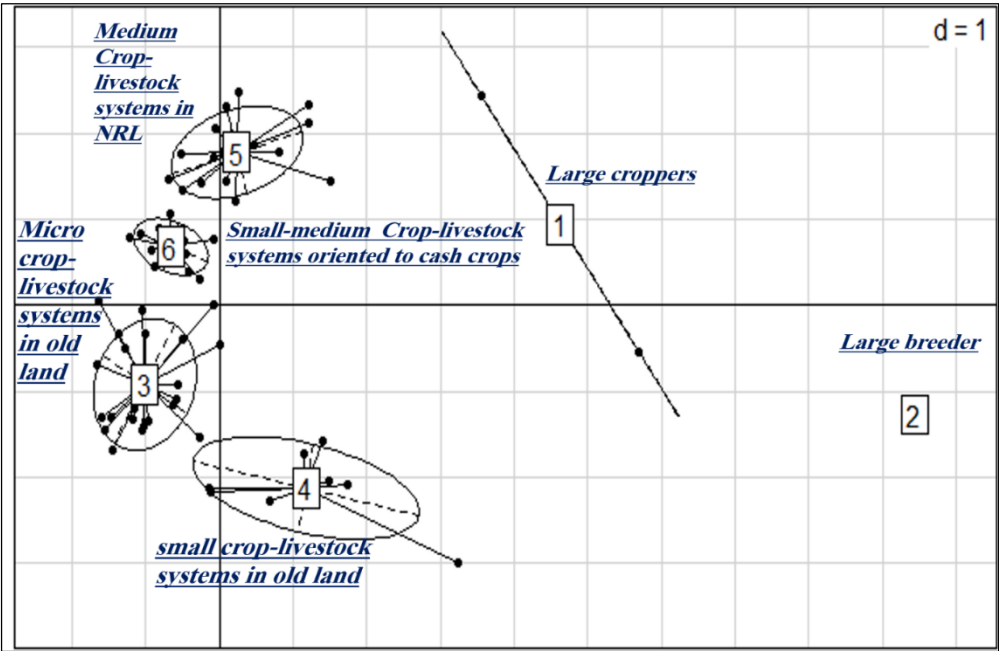
Fig. 9. Clusters projection on the first factorial plan (1*2).

Table 4. Cluster group and number of farmers in each group.

Cluster Groups	Large croppers	Large breeder	Micro CLS[a] in old land	Small CLS in old land	Medium CLS in NRL[b]	Small-medium CLS oriented cash crops	Total
Group No.	1	2	3	4	5	6	
Village:							
Elatf	1	1	8	4	4	1	19
Reka			16	4	1	4	25
ElEmam Malik	1		1		13	6	21
Total	2	1	25	8	18	11	65

[a] CLS: crop/livestock system; [b] NRL: Newly reclaimed land.

The three farmers belonging to the group 1 and 2 represent the profile of the largest scale with more than 2.5 hectares and 5-6 dairy animals. In order to reflect the diversity of farming systems and to understand milk/veal marketing strategies according to farm size, we have preferred to keep these 2 groups that contain only 3 farmers.

Groups 3 and 5 that gather more than 66% of farmers in our sample represent the contrasting situation in the two villages, Reka and ElAft, in the old lands (group 3) and the village of ElEmam Malik that reflected the situation in newly reclaimed lands (group 5). The main difference between these two types was the land access and crop cultivation that influenced the herd size. Group 4 could be considered as a variant of the type 3 with milk oriented strategies based on buffalo. The herd size around 4 buffaloes and more than 65% of the land was allocated to forage crops. Finally, group 6 (16.9%) is a farm type that oriented mainly on cash crops production instead of animal products. The main characteristics of these groups are presented in Table 5.

Table 5. Mean (±SE) of the main variables characterizing each cluster group (average of three seasons).

Item	Cluster Group					
	Large croppers	Large breeder	Micro CLS[a] in old land	Small CLS in old land	Medium CLS in NRL[b]	Small-medium CLS oriented cash crops
	1	2	3	4	5	6
Family size (person)	10.5 (4.5)	7.0	7.9 (0.9)	10.4 (1.2)	9.8 (1.2)	7.5 (0.2)
Cultivated land (hectare)	3.6 (1.1)	2.9	0.6 (0.2)	0.9 (0.2)	2.3 (0.4)	1.0 (0.3)
Fodder area (% cultivated land)	38.4 (17.5)	60.4	46.9 (4.1)	64.3 (6.4)	29.7 (7.2)	35.4 (7.9)
Cereals area (% cultivated land)	33.0 (21.8)	30.1	28.7 (4.1)	23.7 (5.4)	20.8 (4.6)	24.9 (8.3)
Vegatables area (% cultivated land)	14.4 (13.5)	9.5	23.7 (5.0)	11.9 (3.2)	37.5 (7.2)	29.5 (7.3)
Owned land (% cultivated land)	100 (0)	100	26.1 (7.7)	40.6 (7.2)	54.0 (9.9)	42.6 (14.3)
Rented land (% cultivated land)	0 (0)	0	73.9 (38.5)	59.4 (30.7)	40.1 (42.0)	57.4 (47.3)
Landless (% in the sample)	0	0	(7.7)	(7.2)	(9.9)	(14.3)
Herd size (No. of heads)	17.0 (3.0)	32.0	2.2 (0.5)	5.7 (0.8)	5.4 (0.8)	2.8 (0.6)
Buffalo[c] (No. of heads)	10.0 (1.7)	22.3	1.4 (0.4)	4.2 (0.4)	2.4 (0.4)	1.2 (0.2)
Cattle[c] (No. of heads)	7.0 (3.8)	9.7	0.8 (0.4)	1.5 (0.6)	3.0 (0.9)	1.6 (0.6)
Lactating animals (No. of heads)	6.5 (0.8)	8.3	1.5 (0.2)	3.4 (0.4)	2.4 (0.4)	1.5 (0.3)
Dry animals (No. of heads)	3.0 (1.2)	3.5	1.4 (0.1)	2.0 (0.4)	1.3 (0.2)	1.3 (0.2) Conti.

Table 5. Continued

Item	Cluster Group					
	Large croppers	Large breeder	Micro CLS[a] in old land	Small CLS in old land	Medium CLS in NRL[b]	Small-medium CLS oriented cash crops
Total feeding animal (kg/head/day)	4.3 (0.9)	5.2 -	4.9 (0.4)	4.8 (0.3)	5.0 (0.4)	4.6 (0.3)
CFM[d] (kg/head/day)	4.0 (1.1)	5.2	2.8 (0.3)	2.7 (0.2)	2.1 (0.4)	2.1 (0.2)
Corn (kg/head/day)	0	0	1.7 (0.2)	2.0 (0.2)	2.2 (0.3)	1.8 (0.3)
Wheat bran (kg/head/day)	0.5	0	2.1 (0.3)	1.8 (0.1)	2.5 (0.3)	2.0 (0.2)
Buffalo milk production (kg/day)	27.9 (11.6)	46.0	8.9 (1.4)	21.3 (2.3)	8.1 (1.2)	6.6 (0.8)
Buffalo milk production (kg/head)	6.2 (1.3)	9.2	6.7 (0.3)	7.4 (0.2)	5.9 (0.4)	6.3 (0.6)
cattle milk production (kg/day)	12.3 (1.3)	30.7	5.2 (0.5)	6.9 (0.8)	7.4 (0.6)	4.6 (0.4)
cattle milk production (kg/head)	5.0 (0.6)	6.3	4.2 (0.4)	5.9 (0.8)	5.8 (0.3)	4.4 (0.3)
% of buffalo milk sold	56.8 (40.2)	97.3	48.6 (8.2)	83.8 (3.7)	11.9 (7.5)	23.6 (10.0)
% of cattle milk sold	71.3 (28.8)	98.4	88.0 (8.6)	53.1 (11.9)	44.1 (10.2)	59.7 (5.8)
Veal marketing age (day)	0	0	41.2 (1.3)	37.0 (1.6)	41.7 (0.7)	44.5 (5.2)
Proportion of milk consumption by calf (%)	75.0 (5.0)	50.0	94.0 (2.7)	86.2 (3.4)	82.5 (4.1)	94.8 (2.8)

[a] CLS: Crop/Livestock System; [b] NRL: Newly Reclaimed Land; [c] Including all categories (dairy, dry, heifer, calf, fattening animals); [d]CFM: Concentrate Feed Mixture. Values between brackets = the standard error (SE).

Group 1 and 2 differed by their structural characteristics, notably the land ownerships (more than 2.5 hectares) and the herd size with 5-7 dairy animals. The cultivated forage area is used to cover part of the animal nutritional requirements. The green fodder was berseem (Egyptian clover) in winter and horse grass and/or corn fodder in summer for all farmers.

(1) Group 1: Large croppers (3%)

This group gathered the large family size (10.5 persons in average). Farmers owned the largest cultivated lands (3.6 hectares). The herd composed of around 10 buffalo heads and 7 cows on average. The forage crops were represented 38.4% of cultivated lands over the year. Farmers depend on CFM by 93% of total feeding.

Herds included 6-7 lactating animals and 3 dry animals through studied seasons. Around 50% of buffalo milk and 70% of cow's milk production were sold. The farmers kept calves for breeding or fattening and consumed or sold about 25% of milk production, while the rest milk consumed by calf.

(2) Group 2: Large breeder (1.5%)

This group included only one farmer, which characterized by a family size of 7 persons. This farmer cultivated around 2.9 hectare of his own land. Forage crops represent 60.4% of cultivated lands over the year. The areas cultivated with cereals and vegetables represent 30.1% and 9.5% of total lands. CFM account 100% of total animal feedstuffs.

The herd size was the largest (up to 32 heads) composed of 22 heads of buffalo and 10 heads of cows. Dairy herd contained 8-9 heads while dry animals were around 3-4 heads. More than 97% of produced milk are sold. Veal calves were raised and consumed 50% of dam milk production through suckling period.

(3) Group 3: Micro CLS in OLs (38%)

This group was characterized by medium family size (7-8 persons). The cultivated area was the smallest (0.6 hectare), where owned land represented only 26.1% of the cultivated lands and the rest was rented. Forage crops represented near half of cultivated lands, while the areas cultivated with cereals and vegetable accounted for 28.7% and 23.7% of total lands. Farmers used CFM <50% of total feed.

Herd size didn't exceed 3 heads per farm, composed of 1-2 heads of buffaloes and one cow. Half of animals were lactating animals, where <50% of buffalo milk and 88% of cow's milk production were sold. Also, Farmers tended to sell veal calves at early stage of lactation (on average 41 days), and calf consumed about 94% of dam milk production through suckling period.

(4) Group 4: Small CLS in OLs (12%)

This group was characterized by large family size (10-11 persons) and considered as a subgroup of group 3 due to similarity of land size, proportion of rented land and feeding system. They had small cultivated lands (0.9 hectares) and the rented land accounted 59.4% of total lands. Forage crops area represented two third of the cultivated lands, contrary

to only 46.9% in group 3 and the other crops like cereals and vegetables accounted for 23.7% and 11.9% of total cultivated lands.

Herd size was about 5-6 heads with 4-5 buffalo heads and 1-2 cattle heads with a dairy herd counting 3-4 lactating animals and 2 dry animals. Farmers in this group tended to sell buffalo milk compared to cow milk (83.8% *vs*. 53.1% of total milk production). Veal are sold at 36-37 days old and at which the calf consumed around 85% of dam milk.

(5) Group 5: Medium CLS in NRL (28%)

This group was characterized by a large family size (9-10 persons). Cultivated around 2.3 ha owned land while some farmers extended cultivated lands through renting more lands (<50% of total lands). Forage crops represented around 30% of cultivated lands while the cereals and vegetables represented 20.8% and 37.5% of total lands. Farmers feeding animals with corn and wheat bran while CFM represent lower quantity (< 30% of total feeding).

Herd size was about 5-6 heads composed of 2-3 buffaloes and 3 cows, with 2-3 lactating and 1-2 dry animals. Farmers consumed the big quantity of the milk produced and sold only 12% and 44% of buffalo and cow milk, respectively. Farmers are sold veal with an average age of 41 days and the average milk consumption was 82% of dam milk.

(6) Group 6: Small-medium CLS oriented to cash crops (17%)

This group was characterized by a medium family size (7-8 persons). This group gathered farmers from North and South villages. In the North, they cultivated around 1.0 ha and in the south they rented

around 57.4% of total cultivated lands. Forage crops were about one third of total lands, cereals and vegetables represent around 25% and 30% of total lands.

Group 6 had a small herd size around 2-3 heads composed of 1-2 buffaloes and 1-2 cows, with 1.5 lactating animals. 23.6% and 59.7% of milk production from buffalo and cattle were sold. Farmers sold veal with an average age of 44-45 days which consumed 95% of dam milk.

This first description of dairy farming systems showed a large diversity of dairy orientation according to the location, the herd composition (buffalo or cattle) and the land constraint. These factors could be contributed to explain the diversity of milk production and valorization.

2. Milk seasonality and milk marketing

a. Milk production as affected by seasonality and species

The rate of buffalo calving increased in winter season and decreased in spring and increased again by the end of summer season (Figure 10). There was a similarity between cows and buffaloes in calving frequency pattern. Milk production was affected by season where the peak milk yield was registered in cold season and a fall in hot season (Lambertz *et al.*, 2014).

Buffalo produced more milk in winter 7.3 kg/day/head compared to in spring that 6.5 kg/day/head and in summer that 5.2 kg/day/head. The same trend was found in most cluster groups, except in group 2 (large breeders, Table 6). Table 7 represent the cow milk production

which record the highest level in winter (7.7 kg/day/head), followed by summer (5.2 kg/day/head) and spring season (4.7kg/day/head).

This trend was matched with results in Figure 10 where the high calving occurred in winter and summer season. Cluster groups represent the same trend except for small CLS in OLs (group 4) and small CLS oriented cash crops group (group 6) where cattle milk production decreased in summer.
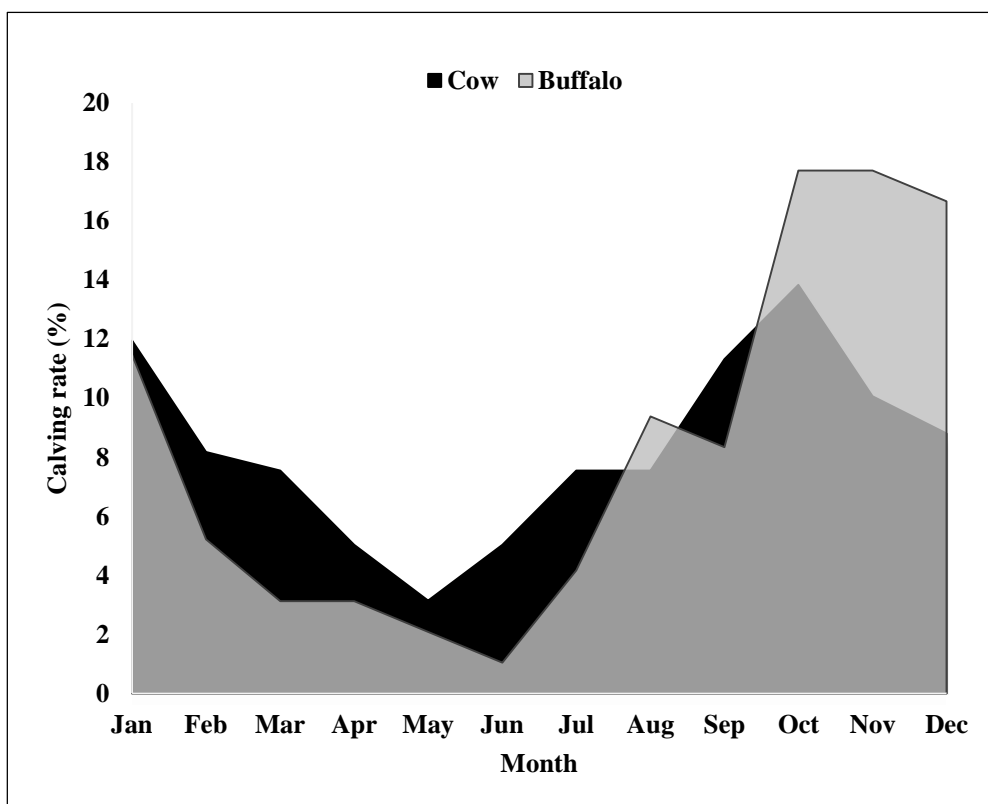
Fig. 10. The proportion (%) of buffalo and cattle calving per each month.

Table 6. Daily milk production (kg) per lactating buffalo (Mean ± SE) for different cluster groups through winter, spring and summer seasons.

Cluster groups	Group No.	Milk production (kg/head/day)					
		Winter	±	Spring	±	Summer	±
Large croppers	1	7.6	1.6	6.1	1.1	4.7	1.3
Large breeder	2	9.5	--	11.4	--	6.7	--
Micro CLS[a] in old land	3	7.7	0.4	6.3	0.3	5.2	0.4
Small CLS in old land	4	7.4	0.4	7.3	0.3	6	0.3
Medium CLS in NRL[b]	5	6.4	0.5	5.9	0.6	4.6	0.3
Small CLS oriented cash crops	6	6.7	0.6	6.6	0.7	3.5	0.5
Over all mean		7.3	0.2	6.5	0.2	5.2	0.2

[a] CLS: crop/livestock system; [b] NRL: Newly reclaimed land.

Table 7. Daily milk production (kg) per lactating cow (Mean ± SE) for different cluster groups through winter, spring and summer seasons.

Cluster groups	Group No.	Milk production (kg/head/day)					
		Winter	±	Spring	±	Summer	±
large croppers	1	5.0	--	3.2	--	5.3	0.3
Large breeder	2	--	--	3.0	--	7.0	--
Micro CLS[a] in old land	3	5.0	--	3.1	0.4	3.5	0.4
Small CLS in old land	4	6.5	1.7	6.5	--	2.2	0.3
Medium CLS in NRL[a]	5	8.3	0.3	3.9	0.5	6.6	0.5
Small CLS oriented cash crops	6	8.0	--	5.3	0.6	3.2	0.4
Over all mean		7.7	0.4	4.7	0.4	5.2	0.4

[a] CLS: crop/livestock system; [b] NRL: Newly reclaimed land.

b. Milk marketing seasonality

Quantity of milk collected and sold in summer was lower than those in spring and winter. Table 8 shows that this trend is confirmed for all groups and the peak of selling buffalo milk was in spring after calving and suckling, and before the hot climate at summer (Figure 11). Amount of selling milk was decreased to <50% in summer for all cluster groups except small CLS in OLs group and large breeders group.

Figure 11 showed the different places of milk in the farming system between the OLs in the south and the new lands in the north.

Table 8. The quantity of buffalo milk sold (kg) per day in each cluster groups through winter, spring and summer seasons.

Season	Cluster groups					
	Large croppers	Large breeder	Micro CLS[a] in old land	Small CLS in old land	Medium CLS in NRL[a]	Small-medium CLS oriented cash crops
Winter	36	37	67.5	142	--	7
Spring	59.5	79.5	63	167.8	46.5	12
Summer	17.5	19	15	65.3	18.5	--

[a] CLS: crop/livestock system; [b] NRL: Newly reclaimed land.

	1	2	3	4	5	6
winter	73.5	97.4	51.5	85.0	0.0	14.9
spring	85.0	99.4	53.8	87.6	36.3	22.4
summer	50.0	95.0	27.8	88.2	33.3	0.0
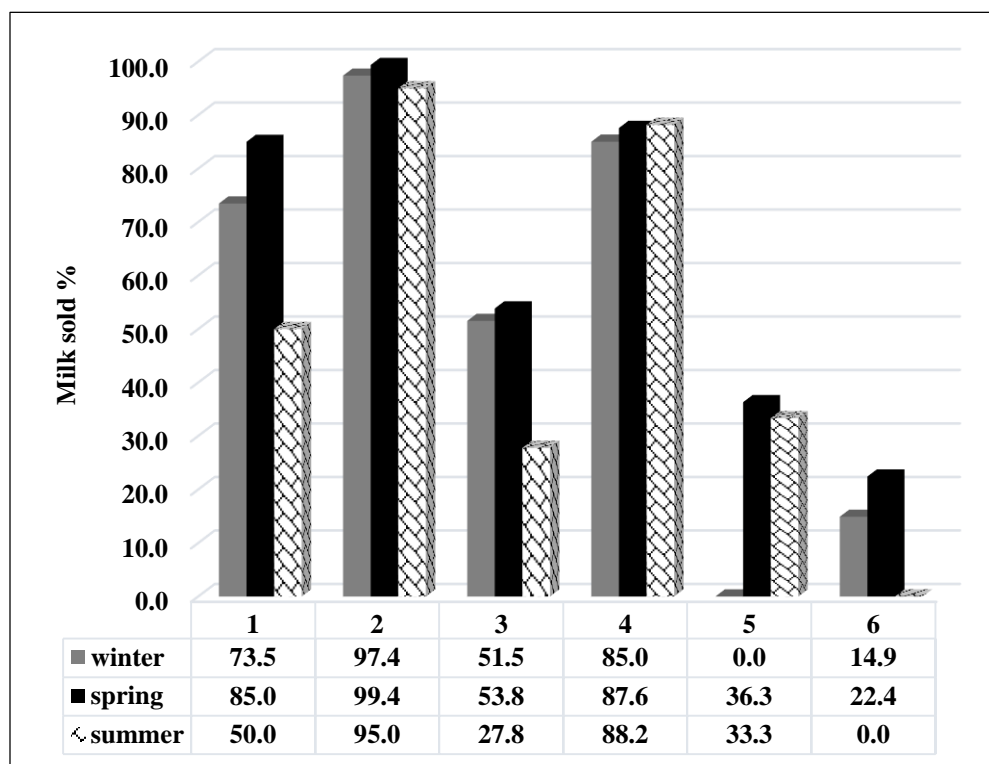
Fig. 11. The percentage of buffalo milk sold per production for each cluster groups (1: large croppers, 2: large breeder, 3: micro CLS in OLs, 4: small CLS in OLs, 5: medium CLS in NRL, and 6: Small CLS oriented cash crops) per season (winter, spring and summer).

3. Different marketing strategies of milk according to different farming systems

a. Internal and external factors of milk marketing strategies

Quantity of fresh milk available in the markets varies in function of farmers' tradition and endogenous knowledge. Data collected confirmed that during cold temperature, milk is usually processed in cheese and butter during winter and stored for the whole year especially in small scale farms. (Figure 12).

In NRLs, milk traders deal frequently with cheese processing units didn't valorize well the buffalo milk compared to cow milk with lower fat %; so farmers prefer to sell cow's milk and keep buffalo milk for family consumption and/or for consumers in the village (short chain). This explains partially the decrease of the buffalo population in these NRLs. In Reka village, the activity of one milk collection center changed the milk valorization at the family level; now skimmed milk is collected with reasonable price and women keep the cream to produce butter and cheese for the family or village market. Milk traders are the common buyers of fresh milk for both in ElAtf and ElEmam Malik villages, while in Reka, MCPs and MCC are common. However, local market and neighborhood are considered as a good outlet with a good valorization.

b. Veal and milk marketing strategies

Figure 13 show that farmer's behavior tend to sell more veal in summer (87%) than in winter and spring (73%) as a strategy to save milk for human demand. Moreover, the selling percentage increased in summer season because the shortage of buffalo milk.
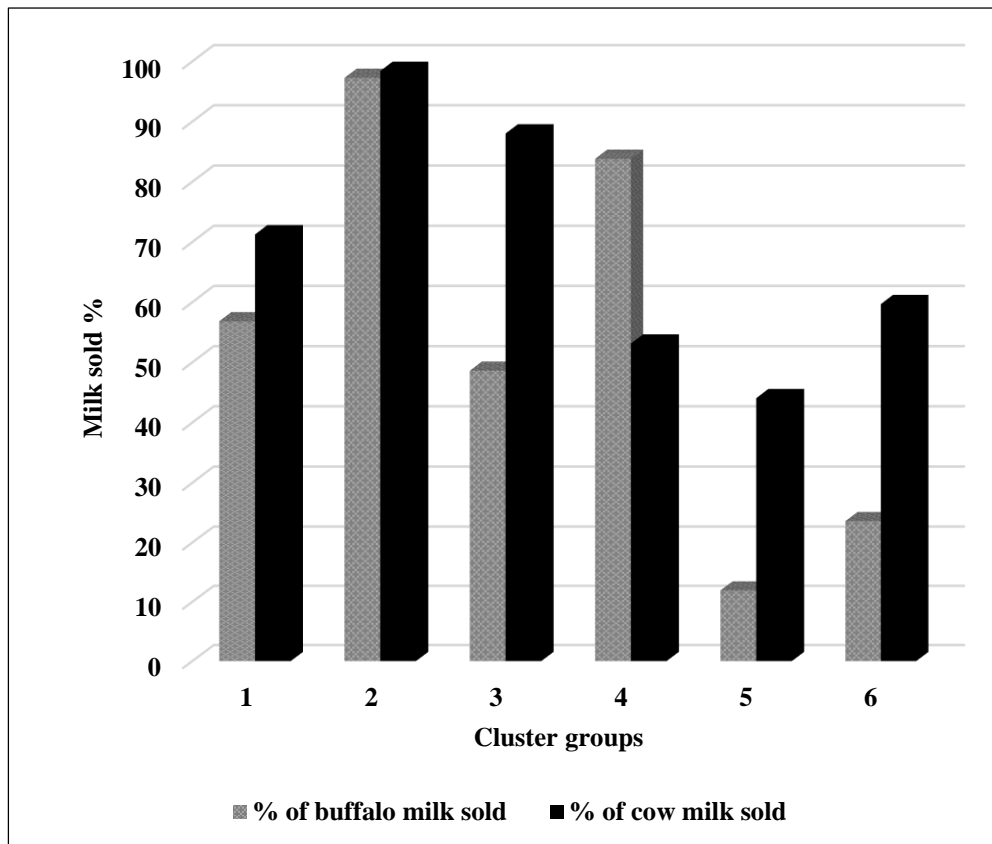
Fig. 12. Percentage of buffalo and cattle milk sold per cluster groups (1: large croppers, 2: large breeder, 3: micro CLS in OLs, 4: small CLS in OLs, 5: medium CLS in NRL, and 6: Small CLS oriented cash crops).

Raising veal could be viewed as a competitor with milk marketing due to the milk consumption by calves during the more productive seasons like winter and at the beginning of spring. This clearly appeared in the traditional mixed crop-livestock systems representing in the groups 3 to 6 where the milk consumed by the veal represented around 80 to 95% of milk production. In the medium dairy farms representing in groups 1 and 2, farmers keep the veal.
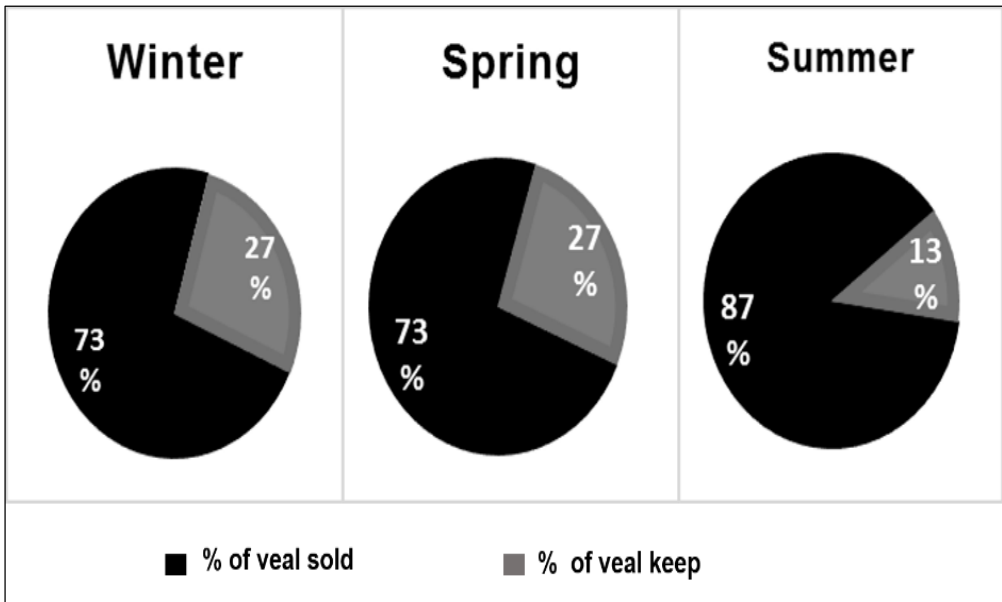
Fig. 13. The proportion of farmers sold veal *vs.* who keep veal in three seasons.

So, we can see clearly that farmers' practices regarding suckling calves and/or storing cheese and butter affect directly the availability of milk in the markets through the year.

DISCUSSION

The factorial analysis shows clearly the dominance of the mixed crop-livestock systems in the old lands (Nile Valley) and in the new reclaimed lands in the west Delta. This system is based on the allocation of lands between fodder and food crops; green fodder (Clover, horse grass and corn) and grain (corn) are the main components of the feed ration of the herd, plus crop residues from food and cash crops. Wheat bran as industrial byproduct is intensively used in new and old lands because it's reasonable price and its larger volume of the same unit weight of other alternatives like grains.

 Manure is directly applied to the land; and veal value used to finance annual expenses like rent land or animal investment.

However, it is clearly observed a regional diversity between old land and new reclaimed land due to the land access. The traditional CLs in the old lands don't exceed 1 ha, while the majority of graduates who have benefited of land in the NRL get around 2.28 ha. So the animal charge per ha is between 3 and 11 animal by ha in old lands, compared to 2-3 animals/ha in the NRL. These variations will affect the needs of each group and each region for services and development projects. Newly reclaimed land may need a balance services for both livestock and other agriculture activities. Old land needs more low cost services to be sustained and very tight vaccination and bio security programs to protect the main source of income and the main protein source for families.

More studies are needed to identify the optimum animal units load per hectare in both new and old lands to sustain different production systems that surrounded with different circumstances. The second criterion of differentiation is the herd composition between buffalo and crossbred cattle. In old land, farmers tended to rear more buffaloes for milk that is well valorized on the market, compared to farmers in new reclaimed land that they prefer raising crossbred cattle because buffalo milk is not well valorized on the local market. Also, the significant forage production of old land encouraged farmers to supply buffalo with sufficient nutrients to produce milk with high fat and protein percent that has high value and less quantity compared to crossbred cow. For the two villages of old lands, this can be explained by the proximity of Cairo where buffalo milk can be sold by 7-8 EGP/liter in 2014, while milk traders acting in the village of the NRL sold traditionally cow milk to a cheese processing units with lower price. Another criterion of differentiation is the crop allocation between fodder crops, cereal crops, vegetables and trees that depends on the size of cultivated area and cash crop orientation.

Many farmers in new land tended to increase the number of livestock especially cattle to deal with the high fluctuation of vegetables and fruits price in the local market , also to provide daily income and high quality organic fertilizer for land which will decrease the need for buying more chemical fertilizers.

Most of buffalo breeders sold young calves (veal) to save milk and to get a quick source of money. Cattle breeders, mainly breeders of

Baladi (native) cattle, prefer to valorize the veal. Sometimes, certain use the crossbred or Baladi cows is to suckle buffalo veal, which will decrease the cost of rearing buffalo calves and increasing the revenues of selling more buffalo milk. The marketing decision between veal and milk can vary from one year to another according to family needs. For land renters they usually rear and sell their calves to cover the cost of renting land. More generally, most of them were depending on milk as family food and as a daily cash income (Ngongoni *et al.,* 2006).

One common characteristic for milk selling strategy is marketing seasonality, where the peak of milk marketing was spring for all groups and this in link with the calving and suckling periods in winter and the reduction of milk production in summer due to hot temperatures; where less availability of forage quality and quantity and most lactating animals at the end of lactation or started to be dried. Moreover, winter season corresponds to the period of transformation of milk in butter and cheese to cover the family needs along the year.

Two types of dairy chains could be identified: the first one is the very short chain where farmers sold directly to consumers; the second one is medium chain where farmers sold milk to middle men who will sell to cheese processing units, retailers like dairy shops or consumers. In 13/2014, the highest milk price was observed when farmer sold directly to consumer in a very short dairy chain.

There are many financial and institutional constraints that affect the sustainability of these crop-livestock systems. Financial constraints like no loans especially for farmers as an aid to rent the lands. Selling

veal is one strategy to deal with financial constraint; farmers tended to sell veal to earn money to cover part of land rent cost. Instead of selling veal that could be kept as a capital source to cope with financial crisis. Moreover, this study showed that most farmers in Nile Valley cultivated land mainly with forage to feed livestock, so high quality forage seeds should be introduced by cooperatives to cover both quality and quantity nutritional gap of dairy cattle.

There is a gap of energy in winter, where the main forage is Egyptian clover, while protein supplement or legume forage is needed to cover the protein gap in summer. Also, most farmers are not adding minerals and vitamins for cattle. Fertility management and AI programs should be conducted in winter and spring seasons, where most dairy cattle are inseminated at these seasons. Vaccination programs for dry cows and buffaloes should be introduced in summer where most cattle are dry. Feeding extension services for transition cattle should be introduced by the beginning of winter, where most cattle calved at this time. Women training for milk processing should be introduced in winter where most of milk processed. It is very vital for dairy farming sustainability to introduce new economic activities such as poultry raising, traditional food processing or some simple home made goods especially in summer, where no or low income of dairy enterprise available.

Part III: SWOT analysis of traditional skimmed milk chain
INTRODUCTION

A supply chain is a network of retailers, distributors, transporters, storage facilities and suppliers involved in the production, transportation and marketing of a specific product (Bacarin *et al.,* 2004). Webber and Labaste (2010) reported that value chain approach is used to guide and to enhance impacts of sustainable initiatives focused on improving productivity, competitiveness, entrepreneurship, and the growth of small and medium enterprises. In the dairy chain, milk collection center (MCC) is a "logistic" link between farmers and processing industrials (Demirbas *et al.,* 2009). Also, MCCs play intermediary roles for smallholder farmers to enable them to enter the commercial selling of milk through the processors and to get market access. Also, MCCs were very important intermediaries to control milk quality and to guarantee food safety (Sayin *et al.,* 2011).

Skimmed is a term that describes the milk after remove most of fat, which less than 0.5 % (Black, 2009).

A SWOT analysis is a term that used to describe a tool that is effective in identify Strengths and Weaknesses, and for examining the Opportunities and Threats that face. SWOT Analysis (one of many possible strategic planning tools) is used to assess the Strengths, Weakness, Opportunities and Threats involved in a project, or any other situation requiring a decision (Hay and Castilla, 2006).

In Egypt, cheese is an important component of the daily Egyptian meals (Todaro *et al.,* 2013), which mainly made from skimmed milk. Karish cheese (is a popular Egyptian cheese (white cheese) made from buffalo or mixed buffalo and cattle skimmed milk). Cheese yield is around 20-30 %, also, it is the most popular cheese in Egypt, especially in rural zones, and it is produced from buffalo or cattle or mixed skimmed milk (Awad *et al.,* 2014). Egypt is the largest cheese producer in the Middle East and it is ranked the sixth on the world with a production of 720,000 tons in 2012. This production is expected to reach 980,000 tons in 2020 (Mikkelsen, 2014). The cheese consumption in Egypt was about 7 kg/capita/year (Rome, 2006).

However, there is a shortage in the data about skimmed milk chain in Egypt. The objectives of this part were: monitoring the dynamic of traditional skimmed milk chains around greater Cairo and applying SWOT analysis of this unique sector to propose recommendations for policy makers and even researchers to improve the whole dairy production system. This analysis was based on the supply chain approach that gives us the framework for identification and characterization of the actors involved in this value supply chain.

REVIEW OF LITERATURE

In Egypt dairy industry plays important role in Egyptian agriculture. Milk production has provided approximately one third of the total agricultural gross income (Hofi, 2011). Also, dairy sector is considered as a cornerstone of Egyptian industry and take a worthy place in food supply. Dairy is the only product that provides a daily income for farmers (OECD-FAO, 2014).

1. Traditional dairy sector

In Ethiopia, milk and dairy products to consumers are through both formal and informal dairy marketing systems. Bandara (2001) found that in Sri Lanka milk collecting organizations and private milk collectors play an important role in the formal milk collection network; while small scale processors, restaurants, hotels, cafeterias, neighboring consumers etc. were dominated in the informal milk market. Also, the increased domestic milk production has not been reflected in the formal milk market and most of the growth in the domestic production has gone to the informal milk market.

In terms of marketing, 71 % of the producers sell milk directly to consumers (Redda, 2001). Ahmed *et al*. (2004) found that about 73 % of the total urban milk production was sold, 10 % was left for household consumption, 9.4 % for calves feeding and 7.6 % was processed into butter and cheese.

The traditional system is mainly depends on smallholders in Egypt, that main part of milk goes directly to family consumption and

the surplus was sold in market. Milk consumed as fresh milk and big part processed into cheese and butter for home consumption and the rest was sold. Local or village markets was common under the traditional system, while the consumers or /and mediators bought from farmers directly. On the other hand, the commercial system sold milk directly to dairy plans (Abdel Aziz and Sadek, 1999).

Cheese is an important component of the daily Egyptian meals (Todaro *et al.,* 2013). Karish cheese is one of the most popular traditional cheese and the oldest type is consumed in Egypt (Abou Donia, 2008). Karish cheese is produced from skimmed milk of buffalo or cow milk or both of them especially in rural zones (Todaro *et al.,* 2013 and Awad *et al.,* 2014). Karish cheese yield around 20-30 % of the milk amount used (Awad *et al.,* 2014). Egypt is the largest cheese producer in the Middle East and it is ranked the sixth in the world with a production of 720 thousand tons in 2012. This production is expected to reach 980 thousand tons in 2020 (Mikkelsen, 2014). The cheese consumption in Egypt was about 7 kg/capita/year (Rome, 2006). Growing of Karish demand by Egyptian consumers is due to its high protein content and low price (Osman *et al.,* 2010). Furthermore, Karish cheese is a promising food in the prevention of health problems linked to fat, recommended for elder people (Todaro *et al.,* 2013).

2. The main challenges faced traditional dairy chain

In Ethiopia, Tassew and Seifu (2009) and Seifu and Doluschitz (2014) reported that dairy smallholders meet numerous limitations such as shortage of milk quality control, low milk production, insufficient

skilled/trained staff, difficulty to land access, high feed cost, poor genetic merits of native animals, shortage of farm labors, animal diseases, lack of artificial insemination services, scarcity of milk processing plants, insufficiency of cooling & storage facilities, absence of dairy cooperatives, lack of milk collection centers and lack of authoritative information, up-to-date and regular information.

Mhone *et al.* (2011) reported that in Zimbabwe the dairy farms were faced several challenges that include lack of resources for improving management and milking hygiene, and for controlling livestock diseases. Also, due to the low profitability each farmer has limited investment for enhancement of milking hygiene, proper storage and processing of milk. Furthermore, in Zimbabwe, Chatikobo *et al.* (2013) mentioned that the common constraints included lack of feeding and water, high diseases prevalence and lack of veterinary extension and services.

Al-Atiyat (2014) investigated that in Jordan, the small dairy sector have some constraints that lead to delayed improving this sector such as, no logistic support of disease control and sustainable veterinary services, no regulations for animal health, lack of recording system, low milk quality, shortage of technical knowledge (Know-How), no pricing policy but more monopolization, no support of marketing or trading products, poor hygienic measures and high cost of technology (including cost of training, implementation & sustainability).

In Bangladesh, Ali *et al.* (2013) concluded that many constrains faced dairy farmers like: poor fertility performance of cows, delayed age

at first calving, and high production cost due to low milk to concentrate ratio. In Bangladesh, the main constraints faced dairy cattle production were poor feed quality, poor management practices, lack of veterinary care and disorganized marketing systems. In addition, there is a lack of institutional support, research and training (Rangnekar and Thorpe, 2001).

Markelova *et al.* (2009) reported that in developing countries, it is difficult for smallholders in rural area to access and compete in the market. Also, cooperatives were inefficient enough to help smallholders.

In Egypt, Abdel Aziz and Sadek (1999) found that the milk production through smallholders faced many constrains such as; lack of veterinary service, AI services, extension services and animal insurance. Also, the local breeds suffering from poor genetic improvement (low productivity and low reproductive efficiency). Moreover, no direct connections through milk chain. Daburon *et al.* (2014) found that the small dairy farming system in Egypt, especially buffalo were facing many constraints such as high cost of agricultural inputs, land pressure and low availability of agricultural land. Also, Hofi (2001) reported that bad milking practices at farm level is one of the challenges that faced traditional dairy chain in Egypt, where farmers did not care about washing the udder before milking, avoid milk from animals that take treatment (antibiotic) and atmosphere of milking that adversely influence milk quality and safety consequently human health hazard.

Food quality and safety have become an important topic in the Agri-food sector (Grunert, 2005 and Curzi *et al.,* 2015). Food safety can

be defined as the opposite of food risk, i.e. as the probability of not contracting a disease as a consequence of consuming a certain food (Grunert, 2005).

Total viable bacterial count (TVBC)

World's loss is about 25% of food along the chain was due to microbial activities that led to a global economic problem as reported by Losito *et al.* (2014) and Kuma *et al.* (2015). Milk is a good media for microorganisms multiplication especially buffalo milk due to its high nutritional value (Fagiolo and Lai, 2007; Han *et al.,* 2007 and Hashmi and Saleem 2015).

Count of microorganisms is used as indicator of milk handling from production till consumption and the quality of milk (Deepika *et al.,* 2015). Milk can be easily contaminated and spoiled when it is produced under non-hygienic environment (Hashmi and Saleem 2015). Clinical or sub-clinical mastitis and/or environmental contaminations taking into account at different steps of the milk chain are considered as the main sources of milk contaminations (Cortesi and Murru, 2007). Also, the authors reported that the total bacterial count of buffalo milk at 30ºC should not exceed 500,000 cell/ml.

Park and Haenlein (2006) reported that the total bacterial count is one of the important indicators for microbial status and safety in the milk. Also, they found, that the bacterial count was increased in warm months. Moreover, the total viable bacterial count (TVBC) in raw buffalo milk in Cairo was ranged from 10^3 to 10^8/ml in summer season.

Doyle *et al.* (2015) found that TBC in raw milk was higher in milk shops than that in MCCs than that in milk transporters ($0.98 * 10^7$, $0.15 * 10^7$ and $0.93 * 10^6$ CFU/ml, respectively). The authors also concluded that the increases in TBC which observed along the value chain may be due to several factors, such as contamination on the farm, storage and transport in unclean milk utensils, and lack of controlling temperature along transportation.

3. The main opportunities of traditional dairy chain

In Ethiopia, Seifu and Doluschitz (2014) found that the opportunities of dairy sector were attractive milk price and cheap farm labor, high demand for traditional milk with low competitors in the dairy chain.

Hemme and Otte (2010) reported that the strengths of smallholder dairy systems are low input costs; high outputs; low liabilities; low risk; and flexibility to increasing feed prices strengths that enable smallholders to attend as a competitive source of milk supply. The major opportunities for smallholder dairy production sector are growing demand for dairy products in developing countries; probable milk price increase; potential to increase milk yields through relatively few supplementary inputs; potential to increase dairy labor productivity; and employment generation in the dairy value chain.

In India, the main strengths of dairy farm sector were directly increasing crop production by making available draught power, manure and cash income on day-today basis. Also, provide employment to rural population mainly women, Regular income to the farmer, usage of crop

residues and by-products to feed animals, appropriate to the mixed farming system, (Gupta, 2007).

4. Recommendations for improving dairy sector in developing countries

Hahlani and Garwi (2014) observed that the Zimbabwean government has been of the view that developing smallholder dairy farming system will not only improve the availability of milk and its products to the country, but will also improve the standards of living for the rural communities. Moreover, recognized that dairy development is not only important for nutrition, but can also lead to the social and economic improvement of smallholder families.

Belli *et al.* (2013) recommended that introducing training programs for farmers becomes necessary to improve hygienic level of traditional milking. A specific effort should be made to increase the awareness of farmers about the significant effects of microbial contamination of milk on dairy yield and on safety and durability of dairy products. These training programs need some good practices such as, identifying a clean milking area, avoiding calf suckling during milking operations, tying the tail, cleaning the udder (washing and drying) and washing of hand's of milker, removing the first milk outflows (stripping), cleaning the containers and decreasing the time between milk collection and delivery. The use of hygienic milking procedures and hygienic storage are of utmost importance in reducing the levels of contamination of milk by microorganisms.

Improving productivity of dairy animals is crucial for increased output and family welfare, this achieved through improving management in terms of feeding, breeding and disease control as reported by Urassa and Raphael (2004). Also, the authors suggested that establish co-operative unions to collect milk with reasonable price (establish milk collection centers), provide feed supplementation, drugs, extension services, loans or credits to support smallholders, establish processing plants and cold rooms in milk collection centers towards modernization of production and marketing, and provide a good heifers with a good husbandry training.

Rathod *et al.* (2011) reported that establishment of co-operatives will help the smallholders through improving or facilitating access to market information, reduce costs of marketing and can increase producers' access to technology, extension and related services, and thereby enhance efficiency in the process of production and marketing of dairy. Also, dairy marketing co-operatives can help to decrease transaction costs and price risks, and enhance negotiating power of dairy producers.

Training programs for farmers on good milk practices will lead to improve the milk quantity and quality, for instance; Ng *et al.* (2010) in Nepal found that the dairy animal of small farmers suffering from mastitis disease that led to high loss, but when training programs were applied for farmers, the rate of mastitis disease was decreased.

Bebe *et al.* (2003) reported that smallholders production system in developing countries recommended to use small dairy breed frame

size (Guernsey and Jersey); because the large breed frame size (Holstein and Ayrshire) need high nutritional demand, poor adaptation, low productive efficiency under this system.

In Egypt, Abdel Aziz and Sadek (1999) recommend that to improve milk production trough stimulate private sector investment, strengthen existing service systems, set well-defined breeding policy, improve supervision and control on private dairy processing units and establish the Egyptian dairy federation.

MATERIALS AND METHODS

Our case study focused on the dynamic of one MCC specialized in skimmed milk collection. This study was carried out in Reka village located at the south of Giza governorate, the border of Beni Suef governorate. The MCC in Reka village is one of the main hubs of skimmed milk in Greater Cairo with a capacity of around 20 ton/day. This study started in March 2013 till August 2015. A total number of 21 farmers, 8 milk collection points (MCPs) owners, one milk collection center (MCC) owner and 4 milk processing units (MPUs) owners were visited regularly and the interviews were based on semi-structure questionnaires (Appendices). Also, MCC skimmed milk records from 2013 to 2015 were collected and registered. The GPS check points for each point of the value chain were collected and used to draw maps by Arc GIS software (Arc Map 10.2.2). The data of the international prices of skimmed powder from 2010 to 2015 were collected through Global Dairy Trade Holdings Limited (2015).

The analysis of milk marketing strategies (selling buffalo milk, selling skimmed milk plus butter and selling Karich cheese plus butter) were based on the primary data collected from a farm follow up from winter 2013 till summer 2014. This follow-up included data regarding quantity of daily milk, milk marketing quantity and prices of fresh milk and dairy products (like skimmed milk, Karish cheese and butter). The technical coefficient that used to estimate the receipt from each milk marketing strategies were the average percentage of skimmed milk that produced from whole milk around 74.5%, the average percentage of

karish cheese produce from skimmed milk around 24% and average of butter produce from buffalo milk around 12 %. Return percentage of price for buffalo milk, cattle milk and skimmed milk was calculated on data records that collected from 1994 to 2015 at MCC level using this formula:

Return %= (selling price - purchasing price)/purchasing price*100.

Complementary milk quality tests in terms of total bacterial count analysis were applied for milk samples (50 ml) that have been collected from 15 farmers per village in 16 villages which supplied the MCC and from 3 tanks (stored skimmed) located at the MCC, to count the total bacterial count at months of January, May and August, 2015. These three periods represent the three main seasons: winter, spring and summer. This analysis was applied to judge the hygienic conditions at farm level, at village level and through transportation to the MCC. The test was carried out in Microbiology Research Lab at Cairo University Research Park (CURP) Faculty of Agriculture, Cairo University, Giza, Egypt. Simple descriptive statistics analysis were conducted at farm level, village level and processing level. The employment created by skimmed milk value chain has been estimated on the quantity of skimmed milk collected divided by the total number of labors and owners per each MCPs and MCC through three seasons (winter, spring and summer).

All the qualitative and quantitative data collected during the follow up and interviews along the chain have been used to apply SWOT analysis. SWOT analysis principles starts with defining current situations (pro SWOT) followed by analysis of external environment to

define the opportunities and threats, then analysis of internal environment to define the strengths and weaknesses (Bernroider, 2002). The results of SWOT analysis is usually used to elaborate the recommendations. The diagnostic of the current situation and the identification of the variables of the external and internal environment were based on the value chain approach.

RESULTS

1. Main actors along the skimmed milk value chain

The identification of the main actors along the chain and the links among them are considered as the basic step for the value chain approach. The main actors along the chain are shown in Figure 14. This approach allows representing the links between the different actors and the role of milk collection points in scattered villages and the central milk collection as a main hub for milk collection. In this value chain, the MCC is like a transition point for all milk collected to cool milk and to reload it again for milk processing units.
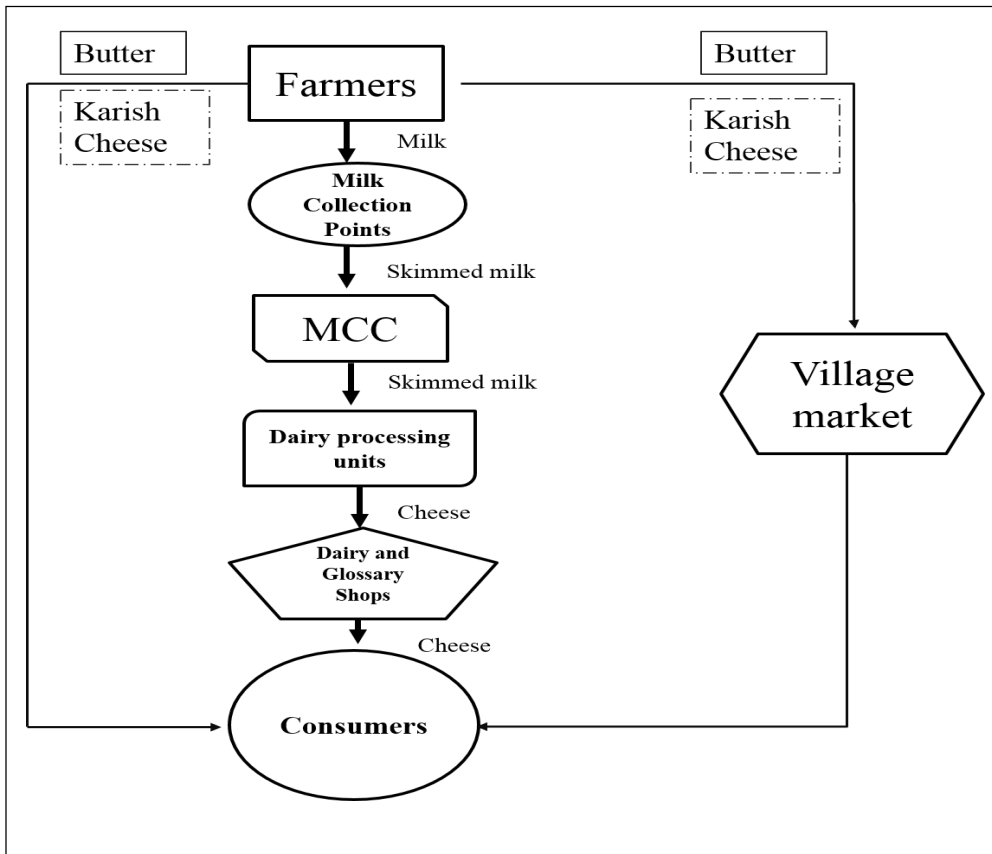
Fig. 14. Map of skimmed milk chain.

a. Farmers

The smallholders' type dominated in this area is based on crop-livestock system with local buffaloes and crossbred cattle. All characteristics of this system are presented in (Table 9).

Table 9. Mean (±SE) and Coefficient of Variability (%) of the studied characteristics of crop/ livestock farming system.

Item	Mean	SE	C.V	Min	Max
Family size	7.2	0.6	35.8	4.0	14.0
Total farm size (hectare)	0.6	0.2	135.3	0.1	4.0
cultivated area by forage (hectare)	0.3	0.04	79.3	0.1	0.7
Owned land (%)	23.9	7.8	149.7	0.0	100.0
Rented land (%)	76.1	7.8	46.6	0.0	100.0
Forage land (%)	57.0	5.6	44.8	17.1	100.0
Cereal land (%)	19.2	4.9	114.9	0.0	54.5
Vegetables land (%)	23.8	5.6	108.0	0.0	75.0
Herd size (heads)	3.1	0.6	92.6	1.0	13
Lactating animal (heads)	2.0	0.3	67.3	1.0	5.7
Milk production (kg/farmer/day)	8.9	1.2	63.4	4.0	25.5
Proportion of milk consumed as fresh from production %	9.1	0.9	47.0	0.0	15.4
Veal age at selling (day)	38.0	1.9	22.7	25	80

SE: Standard Error, C.V: Coefficient of Variability.

Farmers had different strategies for milk marketing as presented in Figure 15. They have a possibility for selling the whole buffalo milk by 4.5 EGP/liter or skim Milk process to get skimmed milk and cream. Cream is used to produce butter that can be sold by around 45 EGP/kg. Skimmed milk can be used to produce karish cheese that will be sold by 6 EGP/kg. Skimmed milk could be sold to MCC by 1.25 EGP/liter.
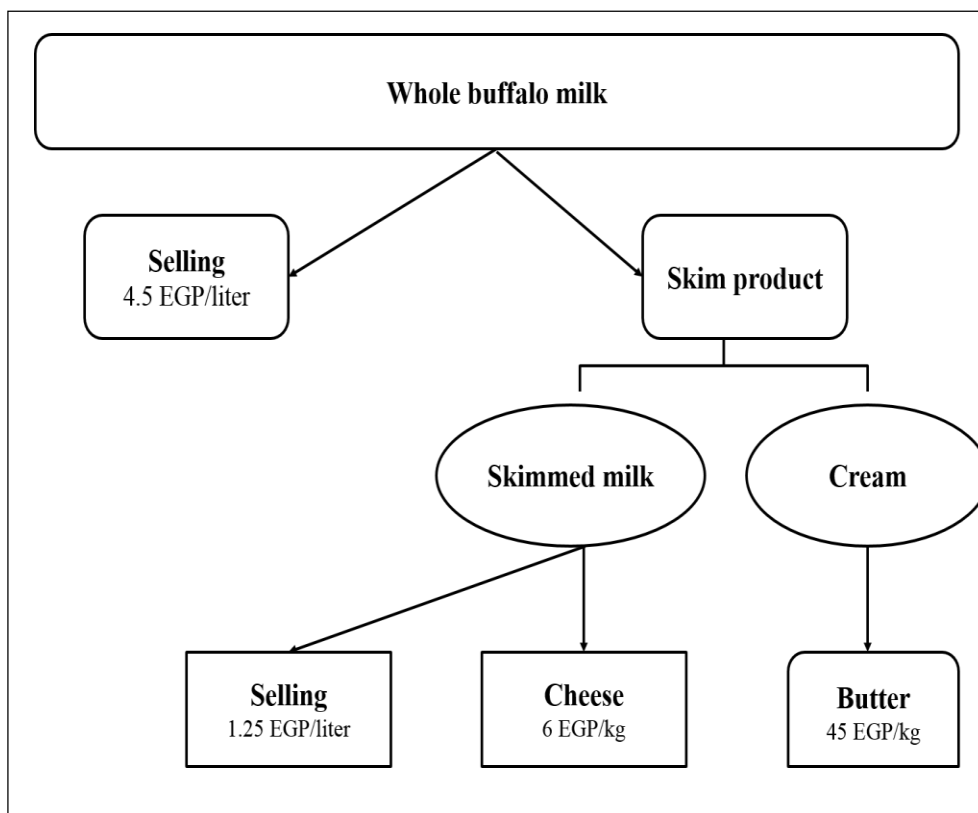
Fig. 15. Description of buffalo milk marketing at farm level (price of 2014).

In Figure 16, we have estimated the milk receipt for the different strategies per day per farmer (based on average 8.9 liter/day/farmer). Selling whole milk generates lower income compared to selling skimmed milk plus butter or selling Karish cheese and butter (149 and 153 % of income relative to sale whole milk, respectively). The third scenario needs a lot of efforts to process cheese and the marketing is highly risky due to technical and economic reasons like high fluctuation of cheese price and demand that lead to irregular income.
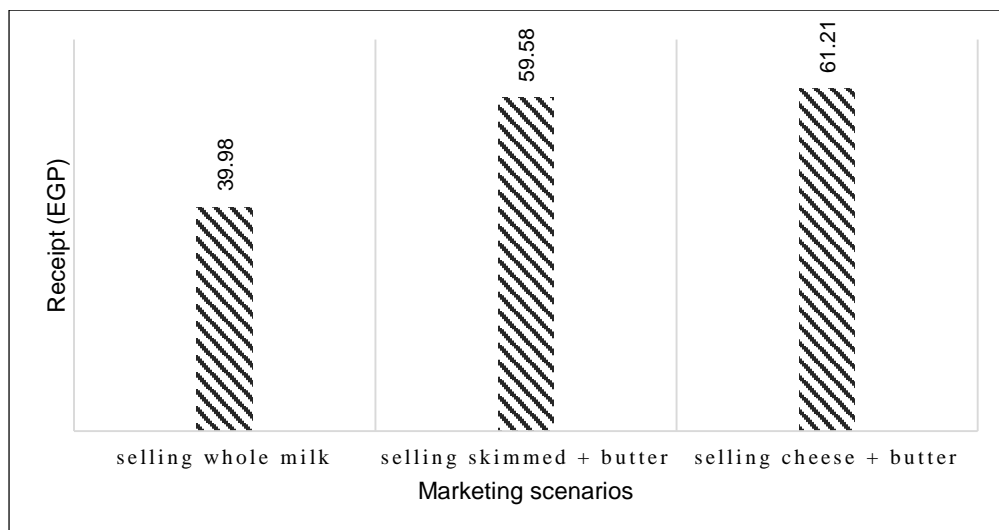
Fig. 16. The Expected milk receipt from different milk marketing scenarios (as average daily receipt /farmer).

b. Milk collection points

MCPs basically belong to MCC. The MCPs have milk separators to produce milk fat and skimmed milk. The majority of owners of the MCPs are women. After milking animals, women goes to MCPs to get the cream and skimmed milk which is used to produce butterfat and Karish cheese. The cost of separation is 2-3 EGP/ head/week.

The first MCP has started dealing with the MCC since 15 years ago. Now, 239 MCPs distributed in 16 villages deal with the MCC of Reka village. Table 10 shows the number of MCPs and number of farmers and Table 11 showed the quantity of skimmed milk collected per each village through the three seasons in 2015. The highest number of MCPs was registered in Qmn Elaros village with 46 MCPs that collected 22,461 liter/week from 633 farmers. At the opposite, Ezbet Shiha village had only 1 MCP which collected about 709 liter/week from 24 farmers.

The peak of milk collection was done in spring (38% of annual collection); followed by summer season (33%). The lowest amount of skimmed milk was registered in winter season (29%) as shown in Table 11.

c. Milk collection center (MCC)

The Reka MCC dealt with around 3381 farmers through MCPs in 2015. The MCPs sent weekly records that were checked by the MCC. In return the MCC paid directly to farmers through MCPs. The price of one liter skimmed milk was ranged 1.10 - 1.40 EGP for the farmers through the studying period.

The MCC sent its laborers (permanent workers without contract) twice a day to collect the skimmed milk by vehicles. The collectors measured the specific gravity for each MCP by Lactometer, and then the MCC sold the skimmed milk by 1.60-2.20 EGP/liter according to the outlets distance and quantity. Sometimes, the MCC got extra quantity of skimmed milk from other traders, especially when the demand increased and this in order to keep strong relationships with all available outlets. Social network plays an important role in this chain.

Table 10. Number of milk collection points (MCPs), number of farmers per each village through winter, spring and summer seasons of 2015 and mean (± SE) through the year.

Village	Winter		Spring		Summer		No. MCPs		No. farmers	
	No. MCPs	No. farmers	No. MCPs	No. farmers	No. MCPs	No. farmers	Mean	SD	Mean	SD
Abu-Ghazaleh	8	87	9	87	7	74	8	0.6	83	4.3
Atwab	14	206	15	244	16	248	15	0.6	233	13.4
Al Jazeera	14	131	15	146	15	177	15	0.3	151	13.6
El-Atf	2	16	2	25	2	43	2	0.0	28	7.9
El-Nagh	7	84	3	46	5	77	5	1.0	69	11.7
Bane Haded	8	149	9	195	8	204	8	0.3	183	17.0
Deraga	6	54	7	86	10	206	8	1.2	115	46.2
Saad El-Den	11	263	14	275	15	230	13	1.2	256	13.5
Saft MIDOM	17	182	19	189	18	178	18	0.6	183	3.2
Midom	31	273	35	310	33	298	33	1.2	294	10.9
Ezbet Shiha	1	18	1	32	1	23	1	0.0	24	4.1
Qmn Aros	42	509	48	621	47	769	46	1.8	633	75.3
Azab	10	144	13	202	13	190	12	1.0	179	17.7
Kafr Atwab	20	319	21	306	23	331	21	0.9	319	7.2
Buwayt	6	58	12	89	15	188	11	2.7	112	39.2
Kom Idrijah	9	62	11	107	11	145	10	0.7	105	24.0
Total	**206**	**2555**	**234**	**2960**	**239**	**3381**	**226**		**2965**	

SE: Standard Error

Table 11. The quantity of skimmed milk (liters/week) per each village through winter, spring and summer seasons of 2015 and mean (± SE) through the year.

Village	Winter	Spring	summer	Mean	SD
Abu-Ghazaleh	4510	4425	2888	3941	527
Atwab	5364	6522	6282	6056	353
Al Jazeera	3504	3872	3575	3650	113
El-Atf	397	582	1148	709	226
El-Nagh	3542	3378	3778	3566	116
Bane Haded	3807	7085	5894	5595	958
Deraga	1482	2590	4697	2923	943
Saad El-Den	8834	12316	7809	9653	1364
Saft MIDOM	6727	5152	5295	5725	503
Midom	11426	14874	11072	12458	1213
Ezbet Shiha	638	1032	503	724	159
Qmn Aros	17336	26169	23877	22461	2646
Azab	4849	7430	4714	5664	884
Kafr Atwab	10420	11487	9077	10328	697
Buwayt	1630	2948	4821	3133	926
Kom Idrijah	2042	2924	4657	3208	768
Total	86,508 (29%)	112,786 (38%)	100,087 (33%)		

SE: Standard Error

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MCC uses many practices to keep the relations with farmers and MCPs and to protect their enterprise, notably through participation in social events and through introducing loans in financial crisis. Also, the MCC owner provided separators with equipment's, scales and money for maintenance and regular visits especially in occasions to strength the social network with MCPs owners. When the demand increases, the MCC may find other sources of skimmed milk like private traders to secure the milk sourcing and engagement regarding the outlets. Moreover, one of the pillars of the MCC is the use of family labors: the MCC depends on a large social network and relatives to sustain the enterprise.

C. Dairy processing units (DPUs)

According to the volume of skimmed milk obtained through the studied MCC, two types of dairy processing units have been identified: 1) the small processing units (n= 12) that received 75.4 tons/week (45.4 % of total milk collected by the MCC) with an average of 6.3 tons/week for each DPUs; and 2) the large processing units (n=3) that received 90.8 tons/week (54.6 % of total milk collected by the MCC) with an average of 30.3 tons/week, as shown in Table 12. Dairy processing units prefer to use skimmed milk because of its lower price compared to whole milk. Most of small processing units produce Karish cheese and white cheese (Feta, Istanboly, Baramily and Talaga)[1]. The main season of producing

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[1] **Feta, Istanboly, Baramily and Talaga are considered traditional white cheese produced in Egypt from whole or skimmed milk.**

white cheese is between November and May and it may be extended to July according to market needs.

Small DPUs are characterized by limiting technologies, few numbers of labors (1-4 labors), with no specific background about dairy technology, a limited equipment and production. Also, according to the cheese makers, each 100 liters of skimmed milk produces around 26-30 kg Karish cheese (26-30%). The price of 10 kg Karish cheese is sold to shops or distributors with around 100 EGP. Consumers (majority from Greater Cairo) purchase Karish cheese from shops (dairy or glossary shops) with around 12-18 EGP/kg.

Table 12. Quantity of skimmed milk (tons/week), no. of Dairy processing units (DPUs), percentage of total skimmed milk that MCC collected, (Mean ± SE) and C.V for small and large DPUs.

DPU	No. DPUs	Skimmed milk (tons/week)	% of total	Mean /unit (tons/week)	SE	C.V (%)
Small	12	75.4	45.4	6.3	0.7	38.2
Large	3	90.8	54.6	30.3	2.1	12.2

SE: Standard Error; C.V: Coefficient of Variability

Most of skimmed milk collected from villages of Beni Suef governorate and cooled through the Reka MCC, before being transported to different outlets (small and large DPUs) in Greater Cairo as shown in Figure 17.
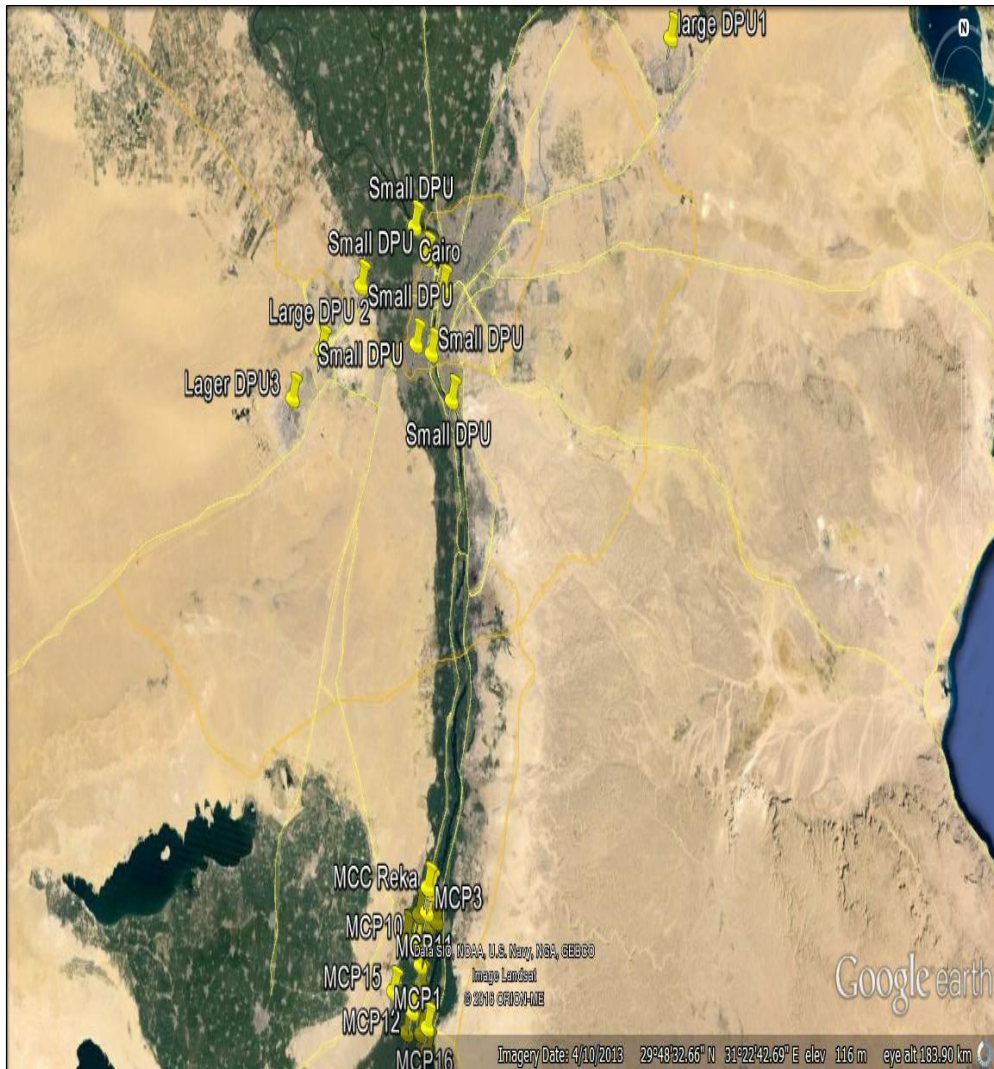
Fig. 17. Map of the milk collection points (MCPs) in 16 villages, milk collection center (MCC) in Reka village and small and large dairy processing units (DPUs). Source Google Earth scale 183.9 km.

2. Dynamics of skimmed milk at MCC level

The MCC owner in Reka village had started to collect buffalo milk in 1994 with few amount of milk (20 liters/ day from family relatives). Quantity of buffalo milk increased slowly till year 2000; the amount reached to 300 liters/day and, in the same year, the MCC had started to collect skimmed milk (around 500 liters/day). In 2008, the collection of skimmed milk has dramatically increased to reach 5.5 tons/day. In 2015, the quantity of milk collected reached around 20 tons/day. Buffalo milk collected did not increase and still fix with an average quantity of 500-600 liters/day. Cattle milk collected was increased and it was estimated by 3 tons in 2013 collecting from three big farms (Figure 18).
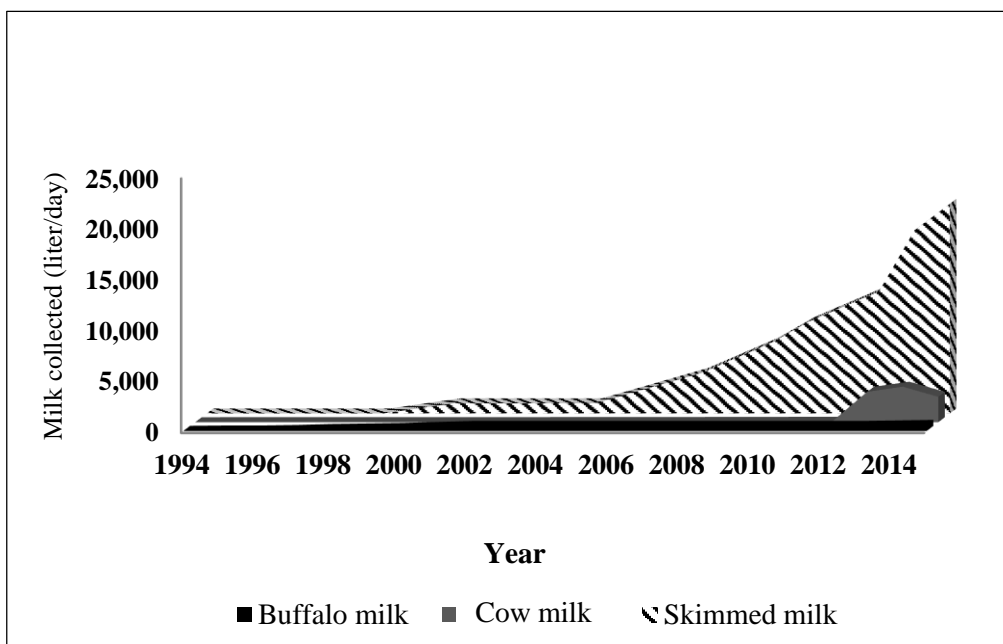
Fig. 18. Development of collecting milk (buffalo, cattle and skimmed milk) by the milk collection center (MCC) in Reka village from 1994 to 2015.

There was also a dynamic trend for price. Figure 19 shows the relation between the purchasing and selling price per buffalo, cattle fresh milk and skimmed milk. Buffalo milk recorded the highest price for selling and purchasing comparing to cattle or skimmed milk.
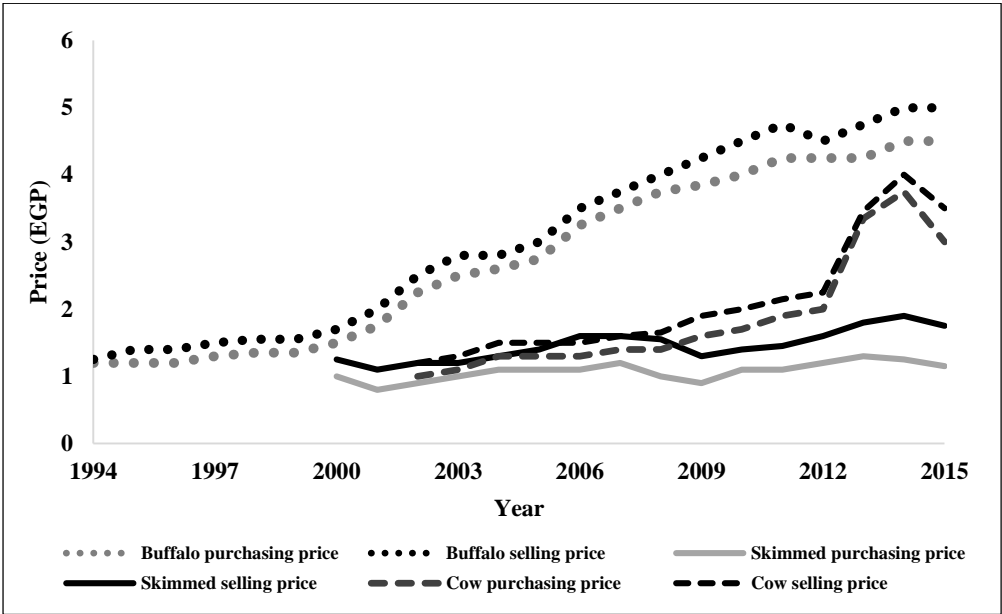
Fig. 19. Development of MCC price of purchasing and selling (EGP) of buffalo, cattle fresh milk and skimmed milk during the period from 1994 to 2015.

The high return % was achieved through skimmed milk enterprise. Cattle and buffalo milk enterprise achieved low return % (Figure 20). Moreover, the overall return trend of skimmed milk was going up while the trend of buffalo and cattle fresh milk was going down (Figure 20).
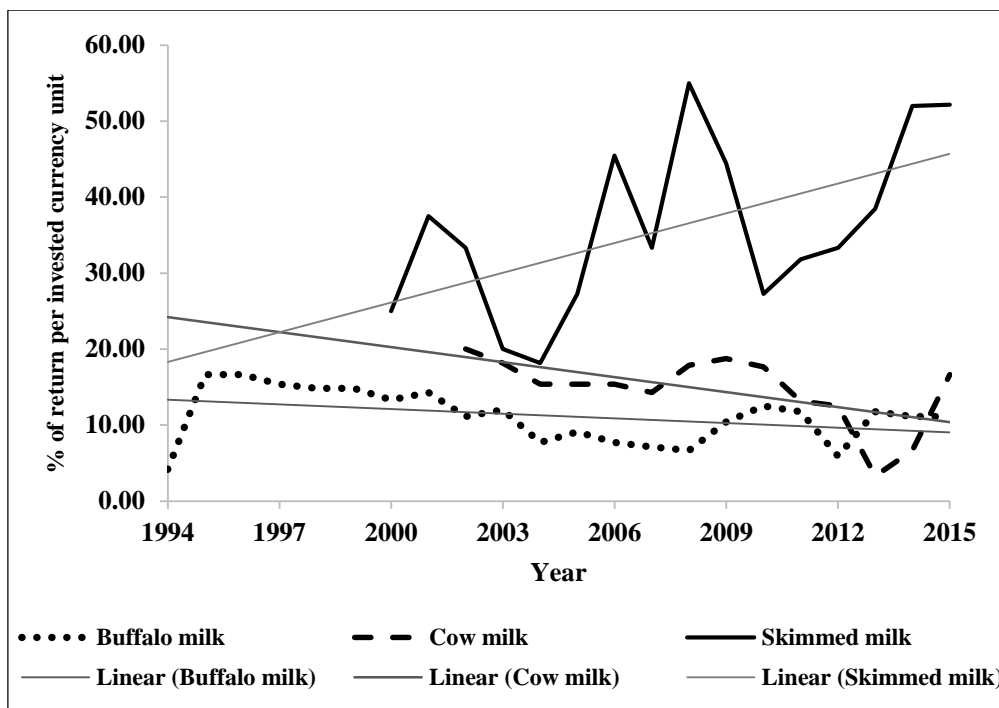
Fig. 20. The percentage of return of MCC per invested currency unit (return %) for buffalo, cattle and skimmed milk during the period from 1994 to 2015.

We can note that the rapid change in skimmed milk collected by MCC was due to increase the number of farmers, number of MCPs and quantity of skimmed milk collected per each milk collection point (Table 13).

Table 13. Trend of increasing number of farmers, number of collected points, quantity of skimmed collected milk and number of villages between 2013 and 2015 for the Reka MCC.

Item	2013	2015	Percent of increase
No. of farmers	1729	2965	171.5
No. of CPs[*]	129	226	175.2
Quantity of skimmed milk (liter/week)	47110	99794	211.8
No. of villages	9	16	177.8

[*]CPs: Collection points

In Figure 21, it can be observed that many villages were added in the year 2015 to south of MCC compared to year 2013. Also, the cycle size reflects the increase of milk collection capacity in many villages during the studying period. Moreover, in 2013 there was only one village collected more than 10,000 liters/week but in 2015 there were 3 villages collected more than 10,000 liters/week (as overall mean of three seasons).
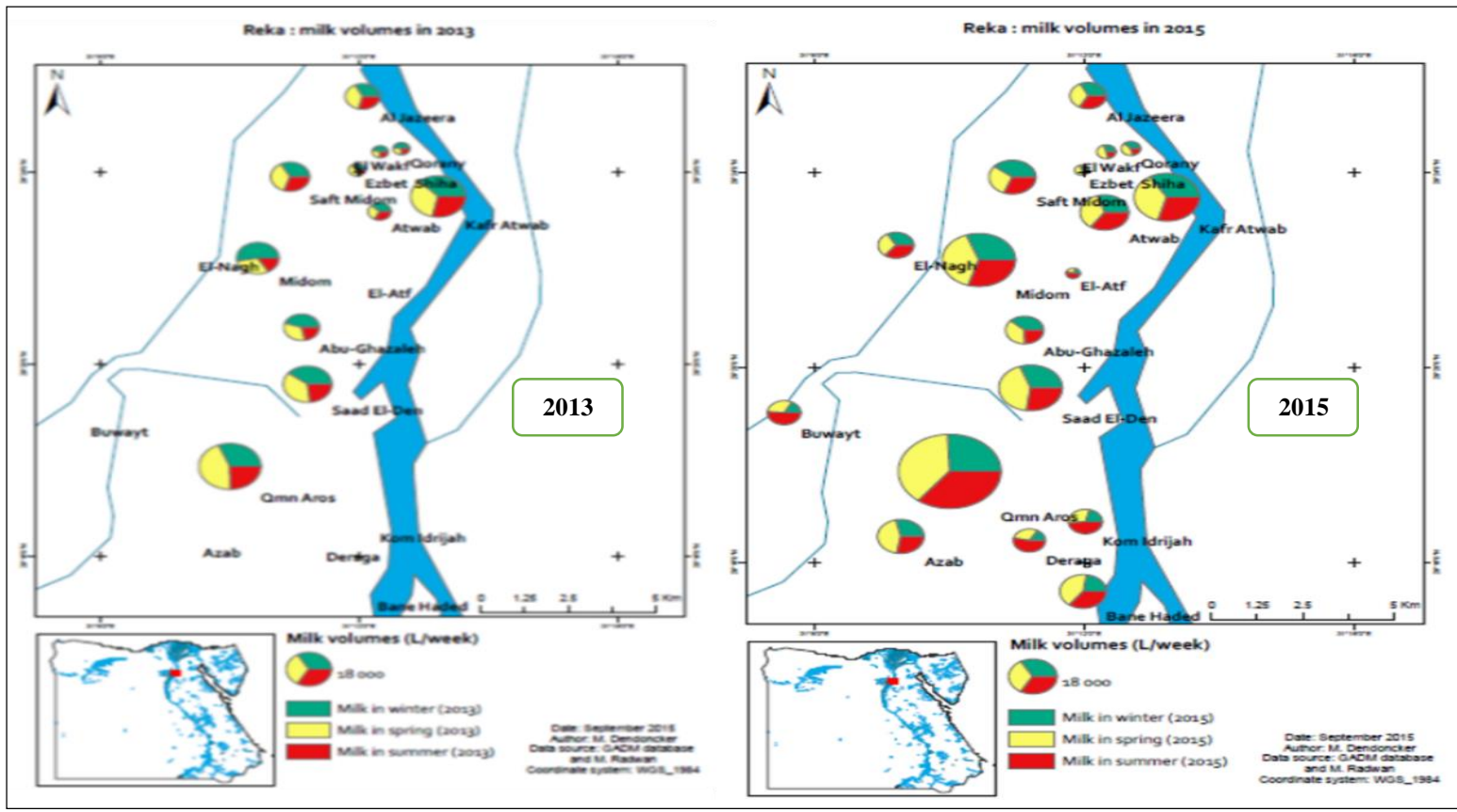
Fig. 21. The location of villages of milk collection points (MCPs) dealing with milk collection center (MCC) and the quantity of milk collected through three seasons in year 2013 and 2015.

The trend of price changes of local skimmed milk and imported international powder milk are shown in Figure 22.
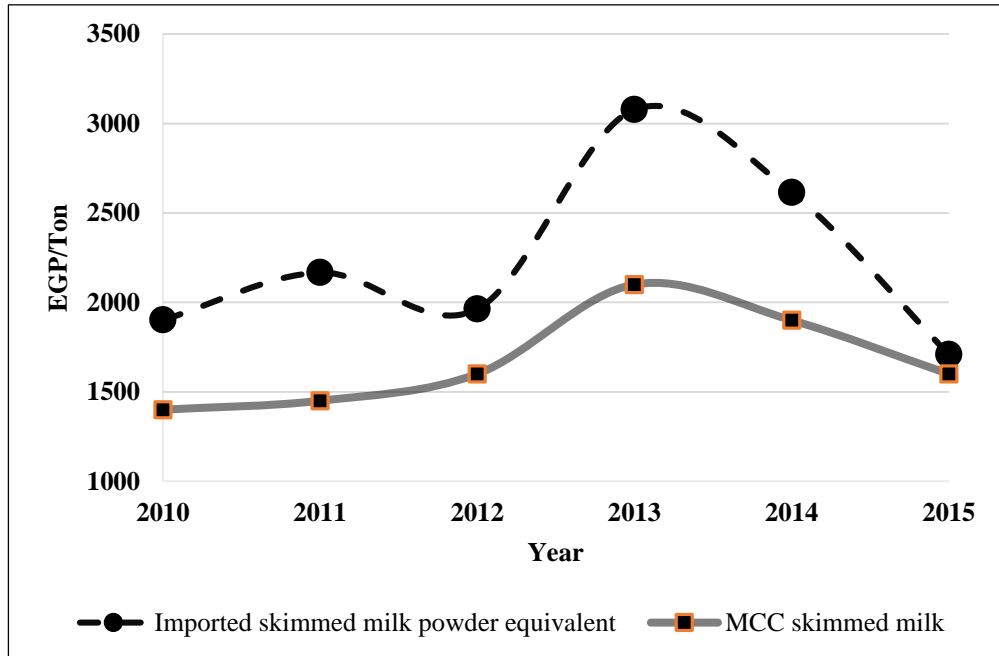
Fig. 22. The changes of the international price of skimmed powder milk (equivalent to liquid) and skimmed milk price for outlets linked with milk collection center (MCC) from year 2010 to 2015.

3. SWOT analysis

The main strengths of this MCC was the development of the skimmed milk chain and its capacity to increase and diversify the actors at the sourcing (farmers and villages) and at the top (small, medium and large outlays). Social network has playing an important role in this chain. Also, this enterprise has created one new job for each 45-55 liters. This means that this enterprise employs around 400 persons (MCC owners, labors, transporters and MCP owners).

The main weakness: milk profitability at farm level, due to the high cost of feedstuffs (concentrate feed mixture, corn and wheat bran) and the increasing cost of renting lands with limiting access. Also, poor genetic merit of animals, bad veterinary service and shortage of extension service were also observed during this study. Furthermore, the seasonality of milk production, as in many places over the world, remains a major constraint for the market. The percentage of sold milk over the production was higher in spring (95.3 %) comparing to summer (89.0 %) and winter (78.9 %) (Radwan *et al.,* 2016).

Another challenge is the total bacterial counts (TBC). Buffalo milk at farmer level recorded the lowest TBC through the three seasons compared to skimmed milk. Also, winter season recorded the lowest TBC compared to spring and summer seasons (Figure 23). Moreover, absence of written contracts among actors along chain could cause unbalanced revenues or unfair pricing system, where no contracts among the chain of farmers and MCC, MCPs and MCC and outlets (in most cases they respect this kind of oral contracts). Also, the big manufactures had the upper hand on this chain. Also, there is no fair pricing system along the chain.
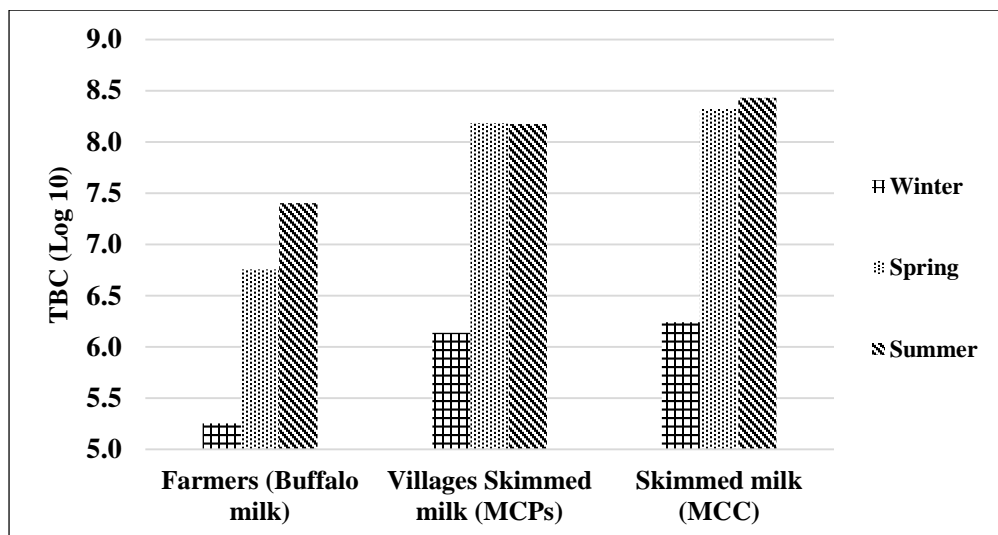
Fig. 23. Total bacterial count (TBC, log10) at farmer (buffalo milk), villages milk collection points (MCPs) (skimmed milk), and milk collection center (MCC) (skimmed milk tanks) through winter, spring and summer seasons.

SWOT analysis summarized the strengths, weaknesses, opportunities and threats of skimmed milk chain as following:

Strengths	Weakness
• Milk is the main source of income for farmers in studied area.	• Increased the price of feedstuffs and concentrate feed mixture.
• Very dynamic chain in terms of quantity of milk, milk price and no. of suppliers and outlets	• Lack of public veterinary services.
• High demand of skimmed milk	• No livestock extension servicers.
• Most links among actors in this chain based on social network.	• Limited cultivated lands.
• Skimmed milk offered with cheaper price	• High cost of land rent. Low price of skimmed powder milk affecting the revenues along the chain.
• Created too many jobs (46-55 liters created one job)	• Increased TBC of skimmed milk especially in warm seasons.
• MCC can link buffalo smallholders with big plants.	• No contracts along the chain among actors.
• Regular quality check by MCC.	• No fair pricing system.

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• Provided regular income for all actors. • Increased the demand of traditional cheese. • Most cheese production in cold season	
Opportunities	**Threats**
• Establish cooperatives that help farmers and provide them with reasonable price inputs and services (Ortmann, and King, 2007). • There is a room for quality control (Figure 23). • Ability of different actors along the chain to update chain standards (Chain Flexibility to set new standards). • Many services can be introduced through the strong social network.	• Unexpected feedstuffs prices fluctuation • Uncertainty of urbanization level at rural areas led to decrease cultivated land limited access of land • Increase cost of rented land • Allow the importation of dairy products without protection for national products • Increasing costs of services introduced to farmers in term of veterinary and extension services. • Continuing decline in the international price of skimmed milk powder. • Increase the level of quality standards of consumers for milk and milk products.

DISCUSSION

Skimmed milk value chain

There is a question why farmers prefer to sell skimmed milk than to sell whole milk or to process milk. Figure 16 showed clearly the economic interest compared to selling of cheese and butter that required more women efforts in processing with high risk for processing and marketing cheese. Indeed there is no regular demand in the local market for the milk products with an unexplained technological failing in traditional milk processing especially in summer. Moreover, the skimmed milk grown faster than buffalo or cattle milk for many reasons: 1) high return % of skimmed milk compared to cattle and buffalo milk as shown in Figure 20, which mean that skimmed milk gain more profits for traders; 2) DPUs considered skimmed milk cheaper than cattle and buffalo milk (Figure 19); and 3) Karish cheese with low fat and Feta cheese with added vegetable oils were cheaper for the local and city markets, where most consumers are more interested in low prices than high quality.

Moreover, the analysis of maps in Figure 16 and 20 indicated that villages south of greater Cairo became an important source of skimmed milk to feed the DPUs concentrated in greater Cairo with the highest demand of dairy products in Egypt. There are two reasons to explain this dynamic: 1) the villages in south Giza (or north Beni Suef) are far from the main fresh milk markets; so, farmers prefer skim milk to produce butter and cheese with more shelf life compared to fresh milk and 2)

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some rural farmers have always a custom that prevent selling milk as fresh.

However, the price of skimmed milk is also affected by the demand, especially from big manufactories which received more than 50 % of MCC milk. This demand varies with the international skimmed milk powder price that influences the national price of skimmed milk (Figure 21). The quantity of skimmed milk sold by MCC increased when the international price increased. Therefore, skimmed milk price sold by MCC in 2015 compared to in 2013 was decreased which might be due to lower international price (Figure 18). However, the demand of cheese is also linked with the population growth. Consequently, the price depends on three main factors: the price of Karish cheese (as an internal factor), the price of international powder milk (as an external factor) and the processing units demand which is directly related to the availability of milk in the market and its alternatives, mainly powder skimmed milk.

The price of skimmed milk could affect the price of Karish cheese in village market due to the demand of skimmed milk. So, the external factors like skimmed milk alternatives price for cheese processing units affect indirectly the revenues of farmers and other related activities through its effect on the skimmed milk purchasing price of CPUs. Farmers are searching for the best price and the lower risk. So the price offered by the MCC is a major factor affecting milk marketing. The owner of the MCC adjusts the price of skimmed milk according to the price of Karish cheese in the local market.

Milk quality and safety

Total bacterial count (TBC) is an indicator for milk handling (Deepika *et al.*, 2015). The TBC increases in the hot season compared to cold season. These results agreed with the findings of Hashmi and Saleem, (2015) (Figure 23). Whole milk contains lower TBC compared to skimmed milk collected from MCPs for each village due mainly to the absence of cooling system, the time of skimming which takes up to three hours (which lead to high multiplication of microorganisms in skimmed milk) and the time of milk collection from all MCPs of each village. Most processors consider cold season as the best period for producing high quality cheese which match with the bacterial count in winter as shown in Figure 23. Establish a proper method to identify microbial contents in food chain is necessary in Egypt (Montet *et al.,* 2015).

Finally, it is observed that MCC, MCPs, and DPUs depend mainly on relatives in running the enterprises. Also, dealing with neighbors and local community build trust to guarantee the daily milk supply and milk quality. In this chain, the MCC tried to check regularly the quality and it discusses with MCPs for improving the quality of collected milk. All farmers could produce at least two types of dairy products (cheese and butter) through accumulated knowledge from one generation to another. Also, DPUs produce many types of cheeses. The technical skills used to process the cheese was obtained from the work in large processing units or transmitted from family members.

Recommendations related to SWOT analysis

Many recommendations could be proposed for enhancing the skimmed milk chain. First, at the farm level, many improvements can be done regarding the supply of good quality feedstuffs and CFM with reasonable price, the access to highly producing buffaloes with high genetic merits and helping farmers through training programs to use milk replacer for calves and applying artificial feeding to save milk. Moreover, there are an increasing demand of training for farmers and MCP owners to produce clean milk and setting pricing system based on quality and a demand of loans for milk collection points to support cooling systems. Furthermore, Ministry of Agriculture, cooperatives and private sectors linked with Research Institutes and Universities and chain stakeholders could provide new skills, green technologies and knowledge about milk handling and processing. Moreover, this link can provide up to date information about the weakness and opportunities, this will help in developing more applicable research plans.

In other region or countries, MCC can play a crucial role to connect the smallholder's producers to processors and provide a lot of job opportunities (Demirbas *et al*., 2009). Moreover, MCC owner can build social relationships as a tool to extension, and a way to secure the enterprise. So, the Reka MCC as a private unit highlights a new model that can be used as a tool to improve the dairy sector, in particular in the whole traditional dairy sector. The social network in this chain needs to be deeply studied to understand the social mechanisms and how useful of these social networks at national level and in other countries that had similar production system and dairy sector.

Part IV: Veal supply chain at village level in Egypt

INTRODUCTION

In several developing countries, buffaloes (*Bubalus bubalis*) are considered as an important source of milk, meat, draft power and leather production (Sarwar *et al.,* 2009). The world buffalo meat production was about 3.7 million tons in year 2013. India comes at the top of world buffalo meat producers (36 %), Egypt ranked the fifth (390 thousand tons represent about 27.3 % of the world buffalo production, FAOSTAT, 2015). El-Saadany (1998) reported that beef and veal meat production represent about 58 % of total meat production in Egypt. Where the annual consumption of beef and veal was about 10.8 kg/capital represent about 46 % of meat demand (OECD-FAO, 2014). Un-estimated huge number of veal animals are slaughtered outside the slaughterhouse, which means no inspection (anti and post mortem), no statistics about the real number of veal slaughtered and no control about slaughtering young females. The relationship between buffalo veal and milk chains where veal calves are sharing rural families in their milk that affect significantly the availability of milk to families' consumptions or to sell as a good daily source of income, especially in the first two months of lactation, where veal calves consume most of buffalo milk.   Value chain has five main stakeholders: inputs, production activities, processing, distribution, and consumption (Khoi and Dung, 2014).

Many studies confirmed that the buffalo meat is rich in iron, high in protein content, low in fat content and low in cholesterol level; this

may led to increase the demand of buffalo meat because it is healthier than cattle meat (Cannarsi *et al.,* 2008; Kandeepan *et al.,* 2009; Abdolghafour and Saghir, 2014 and Giuffrida-Mendoza *et al.,* 2015).

The problem statement focused on the shortage of data available about veal supply chain and meat quality analysis. The aims of this part were to identify the stakeholder along the veal chain, highlights the main characteristics of the whole chain and characterize different meat quality traits related to the consumer preferences of buffalo meat.

REVIEW OF LITERATURE

Ngapo and Gariépy (2006) defined veal 'bob veal' as the calf less than 4 weeks of age, male or female and it's live weight up to 70 kg. Furthermore, Specht *et al.* (1994) define 'vealers' as calves from 4–12 weeks of age with live body weight ranged from 57 to 140 kg. Buffaloes play a vital role in the whole social development in many countries in Asia through contributions for milk, meat, hides and draft power of agricultural sector as reported by Nanda and Nakao (2003) who mentioned that buffalo meat is very popular in most developing countries although it comes from culled animals or surplus males.

Singh *et al.* (2013) reported that buffalo meat value chain in India consists of a network of stakeholders, the roles and responsibilities of each actor along the chain. The value chain is included livestock producers, traders, butchers, wholesale meat dealers and retailers. The dairy farmers were the main predominantly of buffalo meat producers in India. Moreover, most farmers sell their animals to traders while traders don't own slaughter facilities but rather use the services of butchers at public slaughterhouses. The buffalo meat is then collected by wholesale meat suppliers or in some instances directly by retailers.

Regarding to rearing calves on different milk sources, Infascelli *et al.* (2004) found that feeding buffalo calves on cow milk or milk replacer recorded a lower cost compared with feeding on buffalo milk by 73.6 and 71 %, respectively.

Buffalo meat

The buffalo meat types that could be found in the market are veal, fattening calves and culled buffalo (most of them are females). Kandeepan *et al.* (2009) reported that buffalo meat is called by many terms in different countries according to the age of slaughter. Buffalo veal is the meat from male buffalo calves. Buffalo broilers are the buffalo calves reared exclusively on milk for meat purpose. In India, most of buffalo slaughtered after finishing their productive period that lead to reduce the tenderness and decline most of meat quality traits as reported by Naveena *et al.* (2011). Concerning the use of culled buffaloes, in India, meat that produced from culled water buffaloes > 10 years of age is regularly consumed (Neath *et al.,* 2007). Culled cows were an important source of meat and income for farmers, but needed good regime to get correct weight and body condition (Lee *et al.,* 2008).

Giordano *et al.* (2010) reported that water buffalo meat has a low energy yield, a high level of protein and low level of lipids that means healthier for human consumption than beef.

Meat quality

Meat quality is a common term used to define properties and perception of meat. The meat quality is affected by many variables such as breed or genetic, age, gender, feeding, type of suckling milk and management (Guerrero *et al.,* 2013). Giordano *et al.* (2010) demonstrated that buffalo meat can confer significant benefits in terms of cardiovascular risk profile, including lower carotid atherosclerotic burden and susceptibility to oxidative stress.

Calabrò *et al.* (2014) found that the chemical composition of fattening Italian buffalo males contain around 75.5 % moisture, 2.1 % fat and 21.3 % protein. Infascelli *et al.* (2004) found that the veal (age 6 months) was low in dry mater, contain low fat and show more attractive color than young bull (age 16 months). Buffalo calves meat had high protein and fat % and lower moisture compared with buffalo broilers (24.1 vs. 22.46; 1.8 vs. 0.35 and 74 vs. 76.9%, respectively).

Kandeepan *et al.* (2009) in comparison between buffalo fattening males (18 months) and culled females (10 years), found that moisture was higher in fattening males (74.99 %) than culled females (72.63 %), the fat content was higher in culled females (3.98 %) than fattening males meat (2.67 %). Giuffrida-Mendoza *et al.* (2015) found that fat content and cholesterol level in buffalo meat were increased by increasing age from 19 to 24 months (1.5 vs. 1.8 gm/100 gm fresh meat and 53.1 vs. 62.7 mg/100 gm fresh meat, respectively).

Meat color including; Lightness (L*), Redness (a*) and Yellowness (b*) have been measured objectively by Minolta colorimeter (Liu *et al.*, 2003 and Prieto *et al.*, 2008). Meat color (L*, a* and b*) were higher in good meat quality (42.8, 24.7 and 12.6, respectively) than in low quality one (34.7, 19.4 and 9.1, respectively) reported by Kim *et al.* (2008). Age also affect meat color. Revilla and Vivar - Quintana (2006) found that young bulls had slightly higher values of L*, a* and b* (47.7, 16.5 and 16.2, respectively) than heifers (39.5, 12.6 and 9.9, respectively). Buffalo meat color appears dark because it had more

pigment and less fat content. Rodas-González *et al.* (2015) reported that buffaloes had lean meat and less fat compared to cattle.

Collagen content in meat is affected by sex (Seideman *et al.,* 1982), type of feeding (Faueitano *et al.,* 2008), type of muscle (Jurie *et al.,* 2007), genotype (Chambaz *et al.,* 2003 and Serra *et al.,* 2008) and age (Berthiaume *et al.*, 2006). Meat tenderness is an important trait in beef meat for its impact on consumer satisfaction (Schenkel *et al.,* 2006). Consumers consider tenderness is the most important trait of meat quality (Miller *et al.,* 1995), and determine to some extent the meat grade (Kim *et al.,* 2008).

Naveena *et al.* (2011) mentioned that collagen in connective tissue becomes more complex and stronger with advancing age. So, a problem of using aged buffalo's meat is its toughness (Raj *et al.,* 2004). Moreover, Kandeepan *et al.* (2009) indicated that collagen content was higher in culled female compared to fattening males (1.85 vs. 0.82 %, respectively), consequently, shear force values were higher in culled female's meat compared to fattening males 93.8 N (9.6 kgf) and 60.6 N (6.2 kgf), respectively. Veal meat had low shear force value 3.9-4.8 kgf/cm^3 (González *et al.,* 2014). Age affected tenderness, since meat of aged cows had less tenderness than younger ones (Webb *et al.,* 1964).

The history of veal project in Egypt

El-Saadany (1998) reported that, in 1964 the policy makers in Egypt started to think to increase contribution of buffalo in meat production by established "The National Project for Fattening Buffalo Calves" this project provide support farmers to fattening the calves until

150-300 kg and after farmers sold the calves to organization that finishing in station until 450-500 kg. The project was pause in 1991 as a result to adopting free market policies in the agricultural sector and decreased the supported of feed concentrate gradually from 1986. After that the project worked again. Hamza (2015), mentioned that in early of 2012 the Ministry of agriculture was approved by the Social Fund for Development (SFD) and the Principal Bank for Development and Agricultural Credit (PBDAC) with 450 million EGP (58 million $) in funds. This project aimed to improve livestock rearing in Egypt's governorates in an effort to increase the rate of self-sufficiency in meat production by providing micro-credit loans to small farmers at a low interest rate of 4-7 percent. In addition, in December 2013, the Ministry of Agriculture instituted a proscription of the slaughter of live cattle that are less than 250 kilograms in an effort to increase red meat production. According to the Ministry, the decision, which took effect on February 2014, aims to protect 300,000 to 500,000 calves. The decision will also prevent the slaughter of young female calves which at this age and weight are more capable of reproduction.

MATERIALS AND METHODS

Survey analysis was conducted using semi-open questionnaire to identify the main characteristics of veal chain through meeting 82 farmers at 5 villages (ElEmam Malik, Wardan, ElAtf, ElSaf and Reka villages) 4 traders and 4 butchers connected to ElEmam Malik, ElAtf and Reka villages based on French filière approach (Raikes *et al.,* 2000). The quantity of milk that consumed by a calf at 40 and 90 days were (285 and 448 kg/ head, respectively) this quantity is within the range that Ahmed and El-Shazly (1978) mentioned that the calf consumed about 230-700 kg milk through suckling period. Due to the high costs of raising and the economic reasons that reported by farmers, three scenarios of buffalo calves suckling based on real data were suggested. The proposed scenarios were feeding calves with whole buffalo milk, feeding calves with whole cow milk and feeding calves with milk replacer. Cost per each scenario, based on the quantity of milk consumed multiplied by the price for each type of milk used, was calculated.

Technical coefficient used for the calculation of feeding cost

1. Amount of buffalo milk consumed through 40 day =285 kg.
2. Amount of buffalo milk consumed through 90 day =448 kg.
3. The price of one kg of buffalo milk= 5 EGP.
4. The price of one kg of cow milk= 3 EGP.
5. The price of one kg of milk replacer (equivalent liquid milk) =2.6 EGP.

To understand the intervention between dairy and veal chain the preference of consumers to veal meat, samples were collected from Egyptian meat markets (meat shops), from *Longissimus dorsi* muscle, 11 veal samples (meat plus bone); 8 boneless samples of fattening calves and 8 boneless of culled female samples were collected.

Meat analysis

Meat samples were analyzed at Cairo University Research Park (CURP)/ Faculty of Agriculture, Cairo University, for the following traits:

1. Chemical analysis

Moisture, protein, fat and collagen at *Longissimus dorsi* muscle were determined using Food Scan Pro- meat analyzer (Foss Analytical A/S, Model 78810, Denmark). According to the manufacturer instructions, about 50 - 100 gm of fresh lean meat was minced after removing fats and connective tissues. Ground meat was put in meat analyzer cup, which inserted into the apparatus for scanning sample with infra-red to determine the above mentioned components.

2. Cholesterol determination

Cholesterol was quantified spectrophoto-metrical using Stanbio Cholesterol LiquiColor® Kit, (Proc. No. 1010) produced by Stanbio Laboratory Inc., Boerne, Texas, USA. Total cholesterol determination was performed the method by Allain *et al.* (1974).

<u>Samples preparation:</u>

  <u>Saponification</u>: About 2 gm of each meat sample were saponified according to the modified version of the method described by Stewart *et al.* (1992), with 4 ml of 50% potassium hydroxide and 6 ml of 95% absolute ethanol then heated for complete solubilization at 40 ° C, and heated again for 10 min. at 60 ° C. After this, 5 ml of water were added and the samples were cooled. The non-saponifiable fraction was extracted three times using 10 ml of hexane. Aliquots of hexane extracts (3 ml) were dried under a nitrogen flow.

3. **Physical properties**

   Physical traits included color, water-holding capacity (WHC) percentage, cooking loss percentage and shear force values (Indicator for tenderness):

  a. Meat color was measured by Chroma meter (Konica Minolta, model CR 410, Japan) calibrated with a white plate and light trap supplied by the manufacturer. Color was expressed using the CIE *L*, *a*, and *b* color system (CIE, 1976). A total of three spectral readings were taken for each sample on different locations of the LD muscle. Lightness (*L**) (dark to light), the redness (*a**) values (reddish to greenish). The yellowness (*b**) values (yellowish to bluish) were estimated.

  b. The WHC percentage was measured by weighing about (0.3 gm., W1) of meat in filter paper (Whatman No .1) and subjected to pressure of 1000 gm for 10 minutes (Sami *et al.,* 2012) then it was

weighed again (W2). The WHC was estimated as the percentage according to the following formula:

$$WHC \% = [W_2/W_1]*100.$$

c. Cooking loss % was calculated as a weight loss from steaks cooked individually in polythene bags to an internal temperature of 75 °C as measured by temperature probe, in a water bath at 90 ± 0.5 °C and cooled at the room temperature for 30 min. Cooking loss was calculated as outlined by Franco *et al.* (2009) and Sami *et al.* (2012) according to the following formula:

Cooking loss % =

[(initial fresh meat weight- final cooked meat weight)/ initial fresh meat weight]*100.

d. The cooked samples were used to determine the shear force (kgf/cm^3). Samples were kept at 4-5°C for about 12 hours before estimating shear force using Instron Universal Testing Machine (Model 2519-105, USA). Six cores from each sample were taken where cores were removed parallel to the longitudinal orientation of muscle fibers. The shearing machine was adjusted at crosshead speed of 200 mm/min according to the procedure outlined by Shackelford *et al.* (2004).

4. Statistical analysis

Meat quality data were analyzed using the General Linear Model of SAS (2016) as a one way analysis of variance. Duncan's multiple range test was applied to determine the significant differences among means (p<0.05). Data was analysed using the following model:-

$Y_{ij} = \mu + T_i + e_{ij}$

where

Y_{ij} = the measured trait

μ = the overall mean

T_i = effect of buffalo meat type (i= 1, 2, 3; where 1= veal meat, 2= fattening male and 3= culled female).

e_{ij} = Random error

RESULTS

Veal chain actors

1. Farmers

Through interview with farmers, 65 % of the sample tended to sell veal for different reasons which classified into: economic and technical reasons as shown in Table 14. Economic reasons represent about 61 % of total reasons, 14 % of farmers sold veal for technical reasons and 25% for technical and economic reasons (Figure 24).
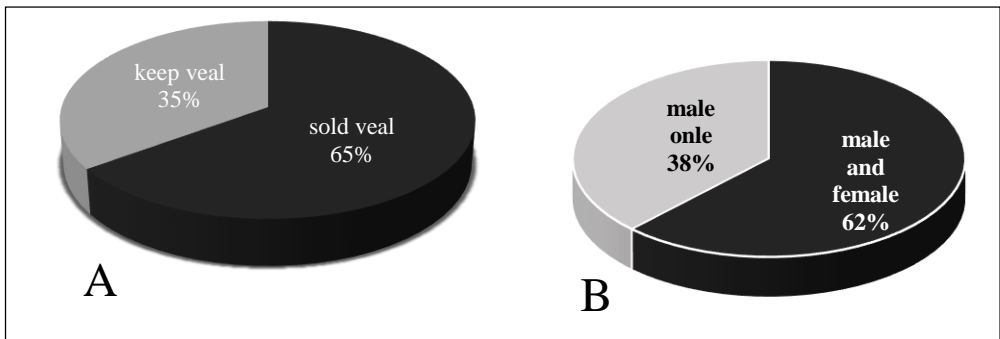
Fig. 24. A: proportion of farmers who sold their veal calves *vs*. who keep them; B: proportion of farmers who sold male and female calves *vs*. who sold male calves only.

According to survey analysis, 65 % of farmers sold veal and 35 % keeping them for fattening (Figure 24; A). 62% of Farmers who sold their calves tend to sell male and female calves, the rest (38 %) were selling male calves only (Figure 24; B). Figure 25, shows the expected cost of suckling calves in each scenario depends on the market price at the year of study, 2013/2014. Milk replacer achieved the lowest cost compared to using cattle milk or buffalo milk, assuming the stability of vet costs and mortality rate for all scenarios.
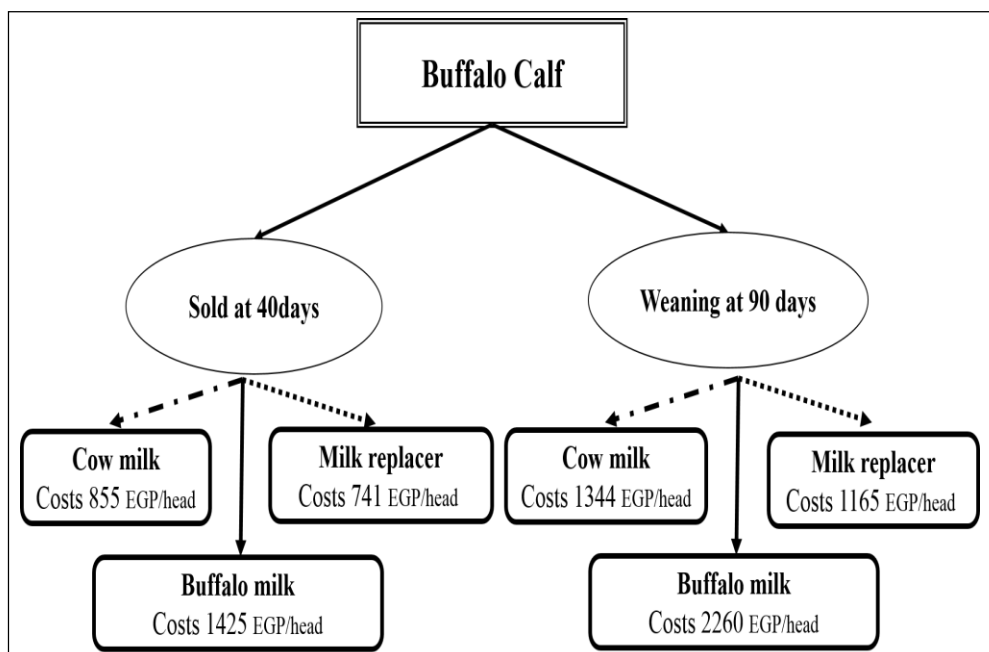
Fig. 25. Cost of feeding veal calves on buffalo milk, cow milk and milk replacer as different scenarios that Egyptian farmers used.

Table 14. Technical and economic reasons responsible for selling veal.

Economic	Technical
• Family needs	• Fattening calves needs long time till marketing weight.
• To save milk for selling & family consumption.	• Risk of missing calves (death: diseases, weaning shock, low growth rate after weaning …etc.).
• High price at veal stage compared to weaned calf price.	• Low milk productivity of buffalo
• To cover feedstuffs and chemical fertilizers costs.	• Land limitation to cover animal's feed requirements.
	• No enough space in the pen.

The average veal selling age was 40.6 days and the average selling price was 1934 EGP/head (Table 15).

Table 15. Mean (±SE) of veal calves age at selling (day) and price of veal (EGP/head) at farm level.

Item	No.	Mean	SE	C.V %
Selling age (day)	54	40.6	1.6	29.0
Price of veal (EGP/head)	54	1934	72.9	27.7

SE: Standard Error, C.V: Coefficient of Variability.

2. Traders

Regarding to data collected during October 2014 to February 2015 in three areas (ElAtf, Reka and ElEmam Malik villages), the large numbers of veal calves in the market were recorded from October to April with lower price ranged from 1200-3500 EGP/head depends on body condition and suckling period compared with the other seasons.

During the period from May to August, lower numbers of veal were available in the market with higher price ranged from 2500 to 5000 EGP/head.

Farmers and livestock market are the main source of trader's supply. Sometimes, traders hire some collectors to arrange and deal with farmers. Also, traders use slaughterhouse as a market to select the best calves (healthy with good body conformation) to supply fattening farms. Regarding to survey analysis, the main criteria that used to estimate veal price was the estimated carcass weight, according to the trader's experience. One of trader's methodologies that identified through traders

interview was the unique grading and pricing system of veal, where traders can expect carcass weight depending on body conformation and multiply the estimated carcass weight by the price of 1 kg.

3. Breeders

Breeders in this chain were mostly the farmers who fattening calves or rearing females till reaching the milk production stage or selling pregnant heifers. This kind of breeders may be bought veal from livestock markets or traders. Farmers indicated that rearing the pre-weaning calves need a lot of experience due to calves' sensitivity to many health problems at this age, where the collected calves received different levels of caring and feeding at the original farm.

4. Butchers and meat shops owners

Butchers or meat shop owners have two ways to get veal carcasses. The first way is to purchase veal from farmers or traders or livestock markets and slaughter them inside /or outside slaughterhouses. The second way is to purchase veal from slaughterhouses or meat traders. The veal carcasses were sold to consumer and /or restaurants. Grading veal carcasses were done according to Egypt meat markets to: grade A: including hind quarters and fore ribs and grade B including fore-quarters. The price of meat cuts based on the traders unique grading system, was higher in the grade A by 21% than grade B. Restaurants prefer to get cuts of grade A which was acceptable by consumers and the demand was higher in summer compared to winter season.

Figure 26 showed the different stakeholders along the veal chain including producers (farmers), mediators, retailers and consumers.

Buffalo meat categories in Egyptian market

A complementary meat analysis approach was applied to justify the reasons of the high demand on veal meat in the Egyptian markets. Regarding to survey analysis, the buffalo meat categories common in Egyptian meat markets were veal meat, fattened buffalo calves and culled females. Regarding to this survey the veal (Figure 27a) is a baby calf's slaughtered at around 40 days and sold to consumer as a carcass (meat + bone). Figure 27b showed that, fattening calves ranged in age from 1 to 3 years slaughtered at 400-500 kg and sold as boneless meat. Figure 27c, showed culled females that slaughtered after finishing the productive life or culled for any reason ranged from 1 and up to 20 years of lactations with a wide weight variation (Kandeepan *et al.,* 2013) and sold as boneless meat.

Meat quality of different buffalo ages

1. Chemical composition and cholesterol level

As shown in Table 16, no significant difference was detected in moisture percentage between veal meat (74.8 %) and fattening calves (73.9 %) but the differences were significant regarding the culled females (71.7 %). Culled females recorded significant percentage of intra muscular fat (4.2 %) compared to fattening calves (2.2 %) and veal (1.8 %). The percentage of collagen appears to be higher in veal meat (1.6 %) than fattening calves (1.5 %) and culled females (1.3%).
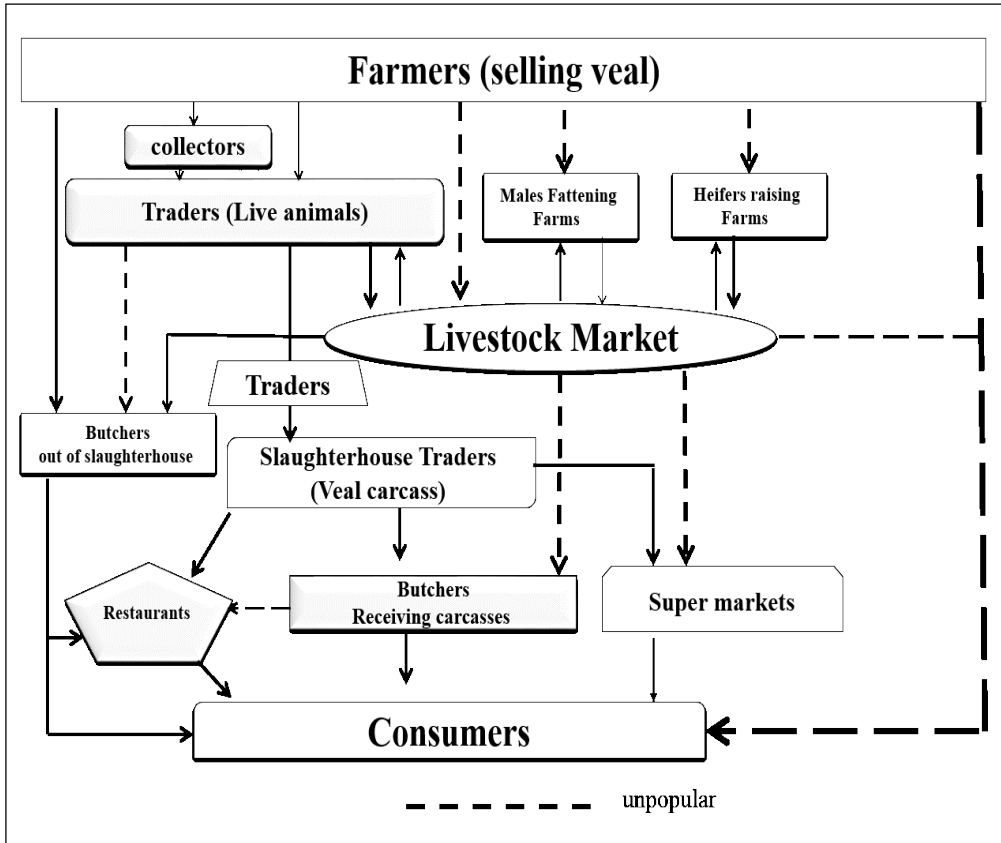
Fig. 26. Map of the different stakeholders along the veal chain.
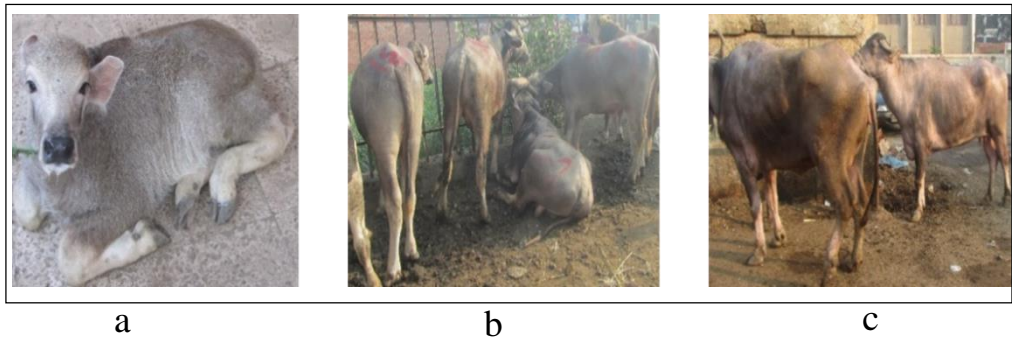
Fig. 27. Egyptian buffalo categories; Veal (a), fattening calves (b) and culled females (c).

Culled females had higher significant cholesterol level compared with fattening calves and veal (61.1, 56.4 and 51.1mg/100g meat). There were no significant differences among all buffalo meat categories in protein %.

Table 16. Mean (± SE) chemical analysis of different buffalo meat categories.

Item	Veal	Fattening male	Culled female
Moisture%	74.8 [a] (0.4)	73.9 [a] (0.4)	71.7 [b] (0.5)
Protein%	21.4 (0.1)	21.5 (0.4)	21.8 (0.2)
Fat%	1.8 [b] (0.1)	2.2 [b] (0.3)	4.2 [a] (0.3)
Collagen%	1.6 [a] (0.03)	1.5 [ab] (0.1)	1.3 [b] (0.04)
Cholesterol (mg/100g meat)	51.1 [c] (0.5)	56.4 [b] (0.5)	61.1 [a] (0.4)

[a,b,c] **Means having different superscripts in the same row differ at (P < 0.05).**

2. Physical traits

Most of meat physical traits were affected by buffalo categories as shown in Table 17.

Results indicated that culled females and fattening calves were darker in color (less L*) than veal meat (32.8, 36.1 and 46.9; respectively). Fattening calves and veal were more reddish (a*) than culled females meat (19.4, 18.6 and 14.0; respectively). No significant differences were identified among buffalo categories in yellowness.

WHC was higher in culled females (74.3 %) than veal (68 %) and fattening calves meat (66.2 %). Veal meat have lower cooking loss compared to fattening calves and culled females meat (34.4, 37.4 and 38.9 %; respectively). Veal meat scoring higher tenderness (4.4 kg/cm^3, lower shear force values) than fattening calves (6.7 kg/cm^3) and culled female (8.0 kg/cm^3).

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Table 17. Mean (± SE) of physical traits of different buffalo categories.

Item	Veal	Fattening calves	Culled females
Color			
L*	46.9 [a] (1.2)	36.1 [b] (1.4)	32.8 [b] (1.2)
a*	18.6 [a] (0.2)	19.4 [a] (0.5)	14.0 [b] (1.0)
b*	7.5 (0.7)	5.6 (0.7)	5.7 (0.4)
WHC %	68.0 [b] (1.0)	66.2 [b] (1.8)	74.3 [a] (1.1)
Cooking loss %	34.4 [b] (0.9)	37.4 [a] (1.3)	38.9 [a] (0.5)
Shear force (kgf/cm^3)	4.4 [b] (0.5)	6.7 [a] (0.7)	8.0 [a] (0.6)

[a,b,c] **Means having different superscripts in the same row differ at (P < 0.05).**

Strengths and weakness of buffalo veal chain

Buffalo veal chain has many strength points concerning the farmers such as: a) provides farmers with money to cover their needs, b) offers a lot of jobs along the chain and c) there a demand of veal meat along the year were observed.

The weakness points almost concerning the markets or at national level such as a) slaughtering veal led to decrease the contribution of buffaloes in Egyptian meat market, b) difficult of controlling veal slaughtering where the butchers can slaughter veal outside the slaughterhouse without any control or inspection and c) there was no training programs for producers to learn about raising buffalo calves and how to maximize the profits of raising and fattening calves.

In Figure 28 shows the suggested model on village to maximized the contribution of buffalo meat at national level.
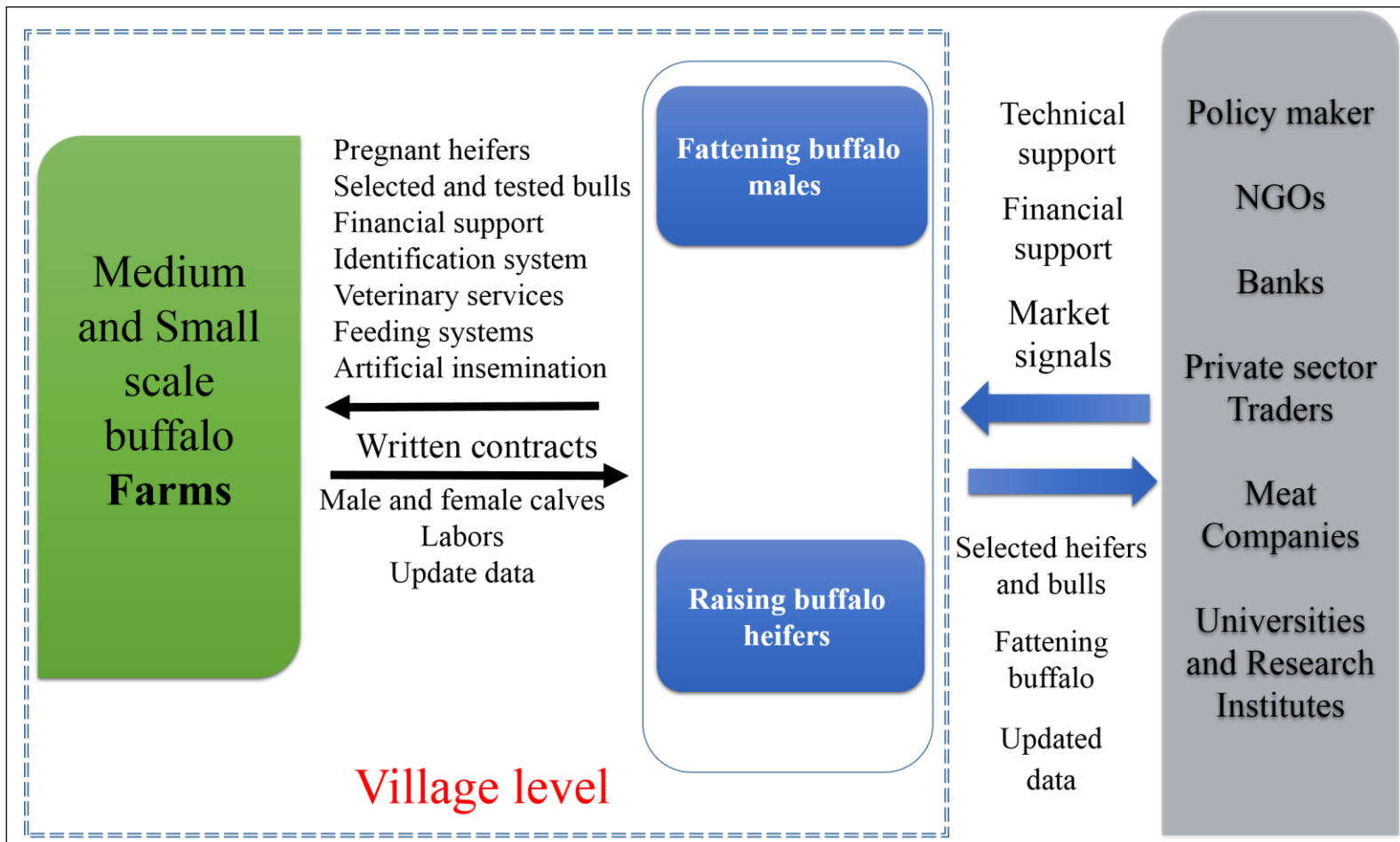
Fig. 28. Suggested model for maximizing buffalo contribution at village level.

DISCUSSION

In Egypt, small scale farmers who rear buffaloes mainly raised buffaloes for milk production to provide daily cash money or to cover the family milk consumption. This type of production system represents the majority of farmers in Egypt which characterized by limited land access, where milk is the main source of cash income and limited income to purchase concentrate feed. So, the results of this part indicated that most of farmers (Table 14) tend to sell calves as early as possible to save milk and to provide money for covering family needs. The majority of farmers sold veal calves due to economic reasons (Figure 24). As shown in Figure 25, if farmers used milk replacer for suckling calves, the cost will be reduced by 48 % relative to buffalo milk and by 13 % compared to cow milk. In this scenario, the same mortality rate and vet cost were used for all scenarios. Also, farmers could need some training to apply artificial milk feeding for calves in an efficient way.

The veal price was affected by season and demand where it decreased in winter compared to summer season by 20-40%. Increasing the available veal in winter where most of buffaloes calved in winter season. In summer, beside the seasonal decrease in the number of veal calves, a higher demand at grilled meat restaurants in big cities was reported by some traders due to low fat content in veal meat compared to lamb's meat, which preferred by grilled meat consumers in hot summer days.

Nutritive value (Chemical composition) of meat is affected by age (Mojto *et al.,* 2009 and Bureš and Bartoň, 2012). Differences of

moisture, fat, collagen percentages of three buffalo categories were significant (Table 16), which matched with the finding of Kandeepan *et al.* (2009). Moisture % and collagen % were decreased by age advancing, and fat % was increased, while the protein % didn't change significantly by advancing age, this result is in agreement with Infascelli *et al.* (2004) and Abdolghafour and Saghir (2014).

Red meat is an important source of cholesterol diet (Ma, 2004). Cholesterol level in buffalo meat was increased by the advance in age, this result was agreed with Giuffrida-Mendoza *et al.* (2015) where the highest level was found in culled females meat followed by fattening calves meat and the lowest level was recorded in veal meat. The recommended level of cholesterol for human healthy body is less than 200 mg/ day (USDHHS, 2005), if person was consumed 200g of buffalo meat his body will get 102-123 mg of cholesterol. So, the buffalo meat especially veal meat, was usually recommended for patients (who have cardiovascular diseases) and old persons. Meat color is an important indicator for meat acceptability, it is a first visual investigation of consumers (Węglarz, 2010). Buffalo meat color is darker than cattle at similar age. Also, meat color became darker by advancing age due to increasing pigment concentration (Kandeepan *et al.,* 2009). So, veal meat had bright color than fattening calves (Infascelli *et al.,* 2004) and culled females.

Water-holding capacity (WHC) is considered one of the main quality characteristics of raw meat, because it affects consumer acceptance and the final product weight (den Hertog-Meischke *et al.,*

1997). Water holding capacity was not differed significantly between veal and fattening calves, however veal meat had a higher WHC than fattening calves and this result was matched with the findings of Infascelli *et al.* (2004). Cooking loss was increased by advancing age, where the veal meat recorded a lower cooking loss percentage than fattening calves and culled females. This may be due to high fat content in culled female's meat and low one in veal meat. Shear force values reflect the meat tenderness, these values increased linearly with advancing age (Rao *et al.,* 2009). Veal meat (younger one) recorded the lowest shear force values (more tender) than fattening calves and culled female's meat. These results answer the question why there is a demand of veal in Egypt compared to other buffalo meat. Generally, buffalo meat is less tender compared to beef meat (Khan and Iqbal, 2009).

Referring to the meetings and interviews with farmers, traders and other stakeholders in the veal chain; results showed that veal chain may be enhanced in Egypt through: 1) set training programs for farmers to use cattle milk or milk replacer for raising veal; 2) Establishment of commercial fattening farms at village level in cooperation with NGO's and/or private sector to control the long distance trading; 3) collecting calves after suckling the colostrum and milk for one or two weeks to save milk for farmers and to provide meat at national scale; 4) make a link among the commercial farms with financial and technical institutions; 5) communicate and link modern farms with small farmers to improve the quality of calves produced and 6) establishment a grading system for calves to be selected for raising and slaughtering the rest through passing to slaughterhouse to meet consumer's needs (elders and patients). This

new kind of fattening farms will save buffalo milk for home consumption and selling purposes, if calves will be fattened for long time and heavy weights it provide a lot of jobs and increasing the contribution of buffalo meat at national scale. Figure 28 showed the suggested model at village level. Policy makers should be participated through facilitating and supporting the whole system through coordination and organizing the relationship among different actors by setting and following up regulations. Universities and research institutes should play an important rule to introduce technical support and to set breeding plans. Collecting data could be used to select the best animals and to propose updated technical support or to propose new agricultural policies. Traders could play a coordination role especially at the beginning of the suggested model and should involve them in a new proposed system. The stations will provide identification system, selected pregnant heifers, good feeding system, selected buffalo bulls, good veterinary services and advices and instructions to small and medium farmers. Fattening stations will select the good calves for fattening and data related to growth and feed efficiency should be used in breeding programs.

CONCLUSION

Under crop-livestock production system in Egypt, the majority of farmers consider dairy animals as the main source of daily regular income and offer a source of family food. Buffalo milk chain can be classified into long and short chain, and each one has advantages and disadvantages. The present thesis consists of four parts, the first three ones dealt with buffalo milk chain while the fourth one is concerned with veal production.

Estimating each of MUN, SCC and milk composition could be used as routine analysis diagnostic tool for sampling small dairy farms in different regions to identify the most priority services and extension needs at village and small scale farm levels (Part one).

Concerning the second part which deals with the diversity of farming system, single agricultural policy will not fit all farmers' categories. Governmental and non-governmental projects are needed to supply farmers with high quality forage seeds, high producing animals and veterinary services with reasonable costs. However, services should be adapted according to the region and the season. High demand of skimmed milk was observed by dairy processing units. Farmers are considered a weak point in the traditional dairy chain, due to their high sensitivity to internal and external factors than mediators. However, the price of skimmed milk is a major factor that affected the farmer's revenues and this price could depend on the price of powder skimmed milk in the international market and the cheese manufactories' strategies.

The MCC could play a vital role in rural communities in terms of local development by allowing a good valorization of milk and in setting new quality standards. Governmental and non-governmental activities could propose new policies to protect the traditional actors along the chain. Specific dairy quality control programs should be developed along the chain. So, dairy sector instruction and rolls should be reviewed to make a balance along the chain and to set a fair pricing system and guarantee food safety for all consumers in local village and city markets.

The fourth part was conducted on veal supply chain in Egypt which involved with many beneficiaries along the chain that affecting the contribution of buffalo meat production at national level. It is important for policy maker to take into account when establishing new polices or new regulations toward reducing the negative effects on producers, mediators and consumer's needs. A contract veal raising model needs to be tested at village level as (a suggested model) for improving whole production system taken into account all actors, components and relationships in the whole village veal production system.

SUMMARY

The present study was carried out in three villages. ElEmam Malik village is located 120 km far from the north of greater Cairo, El-Beheira governorate represents the newly reclaimed land and the other two villages were ElAtf and Reka villages that located, respectively, at 50 and 80 km far from south of greater Cairo, Giza governorate, represent the old system in the Nile Valley. The thesis was divided into four parts; the first part is the characterization of buffalo milk value supply chains. The main objective of this part was characterize buffalo milk chains in three different villages. Milk pathways were followed for each chain in different villages. The starting point was traders, milk collection centers (MCC) and the key persons in the three studied areas. Field visits and interview with semi-open questionnaires where it used to collect the data from farmers and mediators. Milk samples were collected from farmers in winter, spring and summer in the three studied villages at the year 2013-2014. Milk composition, milk urea nitrogen (MUN) and somatic cell count (SCC) were determined. The results indicated that each village had its own chain that proper for each case. Also, there are two chains the first was called long chain which included farmers, mediators in terms of milk collection point, traders, milk collection centers , milk shops and consumers. The second chain called short chain which consists of farmers and consumers or have only one trader in between. Short chain achieved high profit for farmers and reasonable price for consumers compared to long chain. Long chain provided a lot of jobs along the chain. MUN level reflects the level of

nutrition where the best nutrition ratio was found in ElEmam Malik followed by Reka and ElAtf villages. The SCS was not affected by village site, SCS values were ranged from 5.1 to 5.5 which indicated that most animals were infected (subclinical mastitis). Also, normal buffalo milk contains less than 50% in rural areas, where no good management programs were applied and no mastitis control programs are followed. In General, MUN, SCC and milk composition could be used as a routine analysis for sampling small dairy farms in different regions to identify the most priority services and extension needs that should be introduced in different villages and rural regions.

The second part is focused on the characterization of the diversity of dairy farming systems and milk marketing strategies. The aim of this part was to suggest a methodology to characterize the diversity of dairy farming systems in Nile valley lands (NVLs) and newly reclaimed lands (NRLs) in Egypt to understand the traditional dairy sector. Data were collected from 65 farmers in three villages through three consecutive seasons. Interviews and field visits were done at the farm level. Based on multi-factorial and cluster analyses, six farmer groups were identified according to land and livestock assets, milk production and milk marketing. Milk marketing was influenced by season, farmers' traditions, and market access. Structure highlights the dominance of small-scale crop-livestock system, farm family depends on milk as a source of protein and fat for family food and as a main source of income especially in old lands, while in NRLs, there was a higher crop-livestock integration and complementary to cover family and farm expenses, so paid services strategy could fit dairy sector in new lands. Milk

production constitutes a major activity in very small land farms, the sustainability of this sector facing the lack of technical support and lack of pricing system for milk and feedstuffs, where more governmental and non-governmental projects are needed to supply farmers with high quality forage seeds, high producing animals, and veterinary services. So, considering the diversity of farming systems, one agricultural policy will not fit all farmers' categories.

The third part is the traditional skimmed milk chain. The aim of this part was to apply SWOT analysis on traditional milk chain, particularly buffalo skimmed milk chain around greater Cairo which one of the main dairy markets in Egypt. Consequently, SWOT analysis including food safety aspects and value chain analysis were combined to raise the major advantages and malfunctioning of traditional sector. This part was based on regular field visits, interviews, and milk sampling analysis. The main stakeholders of the chain were farmers, points of milk collection, milk collection center, and dairy processing units. the SWOT analysis show that milk chain had a major role of social network to explain the flexibility and adaptation of this sector to the major constraints in link with international competitiveness and national constraints, mainly on land access. Other weaknesses concerned higher price of feedstuffs, and lack of public services, in terms of quality and herd management at farm level. However, the social network opens interesting opportunities to develop efficient and flexible services. These elements could help decision makers and developers to select sustainable development activities in link with global agenda of the agricultural sector and increasing demand for dairy products in Egypt.

The fourth part is veal supply chain at village level in Egypt. The aims of this part were characterize the veal supply chain using survey analysis for different actors along veal chain and to estimate meat quality parameters of buffalo meat categories in Egyptian market to interpret the high demand for veal meat. About 27 meat samples from *Longissimus dorsi* muscle were collected from local markets: 11 samples of veal (meat plus bone); 8 boneless meat samples of fattening calves and 8 boneless meat samples of culled females. Meat chemical composition, cholesterol and physical traits were determined. Survey analysis indicated that 65% of Egyptian farmers sold veal as early as possible. 61% of those farmers sold their animals for economic reasons, 14 % for technical reasons and 25 % for both reasons. Veal price was affected by season, the veal price was lower in winter compared to summer season. Meat chemical composition, cholesterol content and physical traits were influenced by advancing age. Fat content and cholesterol levels were lower in veal meat compared to fattening calves or culled females; the same trend was observed for shear force values and cooking loss percentages. Concerning meat color culled females were darker than fattening calves and consequently veal meat. This result explain why the veal meat is regularly consumed by elders, sick peoples and employees (less physical work) due to it is high tenderness, attractive color, lower fat and cholesterol content. Modification of veal supply chain at village level through establishing fattening calves and heifers raising stations supported by policy makers, banks, NGOs, private sectors, universities and research institutes could improve the contribution of buffalo meat at national scale.

REFERENCES

Abdel Aziz, A. and Sadek, R.R. (1999). Policy issues in the dairy sub-sector. 46 p., workshop on production, processing and marketing policy issues in the dairy sub-sector, held on 28, November 1999 at the Pyramisa Hotel, Giza, Egypt.

Abdolghafour, B. and Saghir, A. (2014). Buffalo: A potential animal for quality meat production-A review. Livestock Research International, 2:19-29.

Abou El-Amaiem, W.E. (2014). Milk value chain constraints in Dakahlia Governorate, Egypt. Epidemiol, 4:2165-1165. doi: 10.4172/2161-1165.1000152.

Abou-Donia, S.A. (2008). Origin, history and manufacturing process of Egyptian dairy products: An overview. Alex. J. Food Sci. Technol., 5(1):51-62.

ACDI/VOCA Egypt. (2007). The livestock value chain in upper Egypt: Challenges and opportunities toward a more competitive agricultural sector. A National Conference 3-5 September, 2007. 67 p. http://acdivoca.org/sites/default/files/attach/legacy/site/Lookup/ACDI VOCA_Livestock.

Ahmed, I .A. and El-Shazly, K. (1978). Early weaning of buffaloes in Egypt. 14 p. "Ruminant nutrition": selected articles from the World Animal Review. Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy.

Ahmed, M.A.M.; Ehui S. and Assefa, Y. (2004). Dairy development in Ethiopia. EPTD discussion paper No. 123. International Food Policy Research Institute. 72 p.

Ahmed, W.M. and Hassan, S.E. (2007). Applied studies on coccidiosis in growing buffalo-calves with special reference to oxidant/antioxidant status. World J. Zool., 2:40-48.

Alary, V.; Messad, S.; Taché, C. and Tillard, E. (2002). Approche de la diversité des systèmes d'élevage laitiers à La Réunion. Revue d'élevage et de Médecine Vétérinaire des Pays Tropicaux, 55(4):285-297.

Al-Atiyat, R.M. (2014). Role of small-scale dairy sector in food security and poverty alleviation. Journal of Food, Agriculture and Environment, 12 (2):427-433.

Ali, M.Z.; Sultana, S.; Rahman, M.T. and Islam, M.S. (2013). Economics of fertility management of small holding dairy farms in Bangladesh. Iranian Journal of Applied Animal Science, 3:509-512.

Allain, C.C.; Poon, L.S.; Chan, C.S.G.; Richmond, W. and Fu, P.C. (1974). Enzymatic determination of total serum cholesterol. Clin. Chem., 20: 470-475.

Arefaine, H. and Kashwa, M. (2015). A review on strategies for sustainable buffalo milk production in Egypt. Journal of Biology, Agriculture and Healthcare, 5:63-67.

Awad, E.I.; Ibrahim, M.A. and El-Shaer, M.I. (2014). Influence of probiotic on microbiological quality of kariesh cheese. Life Sci. J., 11(1):394-397. http://www.lifesciencesite.com.

Bacarin, E.; Medeiros, C.B. and Madeira, E. (2004). A collaborative model for agricultural supply chains. In On the Move to Meaningful Internet Systems 2004: CoopIS, DOA, and ODBASE (319-336 pp). Springer Berlin Heidelberg.

Bandara, B.H.W.M.U.S. (2001). The current status of smallholder dairy systems in Sri Lanka. Smallholder dairy production and marketing: Opportunities and constraints. Proceedings of a South–South workshop held at National Dairy Development Board (NDDB) Anand, India. 13-16 pp.

Banerjee, A. (2007). Lessons learned studies: India. Report of the animal production and health commission for Asia and the Pacific. Food and Agriculture Organization of the United Nations (FAO), New Delhi, India. http://csa-be.org/IMG/pdf_LLS_India_revised_20Dec07.pdf.

Bansal, B.K.; Hamann, J.; Lind, O.; Singh, S.T. and Dhaliwal, P.S. (2007). Somatic cell count and biochemical components of milk related to udder health in buffaloes. Ital. J. Anim. Sci., 6(2):1035-1038.

Bebe, B.O.; Udo, H.M.J.; Rowlands, G.J. and Thorpe W. (2003). Smallholder dairy systems in the Kenya highlands: breed preferences and breeding practices. Livestock Production Science 82:117–127.

Belli, P.; Cantafora, A.F.A.; Stella, S.; Barbieri, S. and Crimella, C. (2013). Microbiological survey of milk and dairy products from a small scale dairy processing unit in Maroua (Cameroon). Food Control, 32:366-370.

Bernet, A.T.; Julca, J.; Sáenz, J. and Prain, G. (2000). Peri-urban milk production in Peru: Assessing farmers' decision-making within a changing market. Livestock Research for Rural Development, 12(4). http://www.lrrd.org/lrrd12/4/cont124.htm.

Bernroider, E. (2002). Factors in SWOT analysis applied to micro, small-to-medium, and large software enterprises: An Austrian study. European Management Journal, 20(5):562-573.

Berthiaume, R.; Mandell, I.; Faucitano L. and Lafrenière, C. (2006). Comparison of alternative beef production systems based on forage finishing or grain-forage diets with or without growth promotants: 1. Feedlot performance, carcass quality, and production costs. J. Anim. Sci., 84:2168-2177.

Beyene, B. (2015). Review on value chain analysis of dairy products in Ethiopia College of Agriculture and Veterinary Medicine. Journal of Economics and Sustainable Development, 6: 26-36. http://www.iiste.org

Black, A.C. (2009). Dictionary of Food Science and Nutrition. A&C Black. London. 289 p.

Borghese, A. (2010). Development and perspective of buffalo and buffalo market in Europe and Near East. In Proc. 9th World Buffalo Congress, Buenos Aires, 25-28 pp.

Bureš, D. and Bartoň, L. (2012). Growth performance, carcass traits and meat quality of bulls and heifers slaughtered at different ages. Czech J. Anim. Sci., 57(1):34-43.

Byerlee, D. and Collinson, M.P. (1980). Planning technologies appropriate to farmers: Concepts and procedures. 71 p. Mexico, DF (Mexico). CIMMYT.

Bytyqi, H.; Zaugg, U.; Sherifi, K.; Hamidi, A.; Gjonbalaj, M.; Muji, S. and Mehmeti, H. (2010). Influence of management and physiological factors on somatic cell count in raw milk in Kosova. Veterinarski Archiv, 80(2):173-183.

Calabrò, S.; Cutrignelli, M.I.; Gonzalez, O.J.; Chiofalo, B.; Grossi, M.; Tudisco, R.; Panetta, C. and Infascelli, F. (2014). Meat quality of buffalo young bulls fed Faba bean as protein source. Meat Science, 96:591–596.

Canadian Dairy Information Centre, CDIC. (2015). Global consumption per capita of dairy products (total cheese consumption). http://www.dairyinfo.gc.ca/index_e.php?s1=dffcil&s2=cons&s3=con sglo&s4=tc-ft.

Cannarsi, M.; Baiano, A.; Sinigaglia, M.; Ferrara, L.; Baculo, R. and Del Nobile, M.A. (2008). Use of nisin, lysozyme and EDTA for inhibiting microbial growth chilled buffalo meat. International Journal of Food Science and Technology, 43:573-578.

Cerón-Muñoz, M.; Tonhati, H.; Duarte, J.; Oliveira, J.; Muñoz-Berrocal, M. and Jurado-Gámez, H. (2002). Factors Affecting Somatic Cell Counts and Their Relations with Milk and Milk Constituent Yield in Buffaloes. J. Dairy Sci., 85:2885–2889.

Chambaz, A.; Scheeder, M.R.L.; Kreuzer, M. and Dufey, P.A. (2003). Meat quality of Angus, Simmental, Charolais and Limousin steers compared at the same intramuscular fat content. Meat Science, 63:491-500.

Chatikoboa, P.; Chogab, T.; Ncubec, C. and Mutambarad, J. (2013). Participatory diagnosis and prioritization of constraints to cattle production in some smallholder farming areas of Zimbabwe. Preventive Veterinary Medicine, 109:327– 333.

Chinogaramombe, G.; Muchenje, V.; Mapiye, C.; Ndlovu, T.; Chimonyo, M. and Musemwa, L. (2008). Challenges for improving smallholder dairy production in the semi arid areas of Zimbabwe. Crops, 7: 0-3.

CIE (Commission International de l'E´ clairage) (1976). Official recommendations on uniform color spaces. Color difference equations and metric color terms, Suppl. No. 2. CIE Publication No. 15 Colorimetry. Paris.

CISE (2012). Egyptian Buffalo Herdbook. Cattle Information System/Egypt, fourth edition, 247 p.

Claeys, W.L.; Verraes, C.; Cardoen, S.; De Block, J.; Huyghebaert, A.; Raes, K.; Dewettinck, K. and Herman, L. (2014). Consumption of raw or heated milk from different species: An evaluation of the nutritional and potential health benefits. Food Control, 42:188-201.

Cortesi, M. L. and Murru, N. (2007). Safety and quality along the buffalo milk and cheese chain. Ital. J. Anim. Sci., 6(2):207-216.

Curzi, D.; Raimondi, V. and Olper, A. (2015). Quality upgrading, competition and trade policy: evidence from the agri-food sector. European Review of Agricultural Economics, 42(2):239-267.

Daburon, A.; Tourrand, J.F.; Alary, V.; Ali, A. and Elsorougy, M. (2014). Typologie exploratoire des systèmes d'élevage laitier familiaux de la mégalopole du Grand Caire en Egypte, contraintes et opportunités. Revue d'élevage et de médecine vétérinaire des pays tropicaux, 67(4): 173-182.

Deepika, S.D.; Geetha, S.; Laxmi, S.K.; Sri Lakshmi, B. and Sulakshana, M. (2015). Studies on buffalo milk samples collected from different sources in Visakhapatnam. World Journal of Pharmacy and Pharmaceutical Sciences, 4(10):728-740.

Dekkers, J.C.M.; Erp, T.V. and Ynte Schukken H. (1996). Economic benefits of reducing somatic cell count under the milk quality program of Ontario. J. Dairy Sci., 79:396-401.

Demirbas, N.; Tosun, D.; Cukur, F. and GÖLGE, E. (2009). Practices in milk collection centers for quality milk production: A case from the Aegean Region of Turkey. New Medit, 8(3):21-27.

den Hertog-Meischke, M.J.A.; van Laack R.J.L.M. and Smulders F.J.M. (1997). The water holding capacity of fresh meat.Veterinary Quarterly, 19(4):175-181, DOI:10.1080/01652176.1997.9694767.

Desta, T.T. (2012). Introduction of domestic buffalo (*Bubalus bubalis*) into Ethiopia would be feasible. Renewable Agriculture and Food Systems, 27:305-313.

Devendra, C. (2001). Small ruminants: Imperatives for productivity enhancement improved livelihoods and rural growth. A review. Asian-Aust. J. Anim. Sci., 14(10):1483-1495.

Devendra, C.; Thomas, D.; Jabbar, M.A. and Kudo, H. (1997). Improvement of livestock production in crop-animal systems in rainfed agro-ecological zones of South-East Asia. ILRI (aka ILCA and ILRAD). Nairobi, kenya. 116 p.

Dhakal, I.P. (2006). Normal somatic cell count and subclinical mastitis in Murrah buffaloes. J. Vet. Med. B., 53:81-86.

Doyle, M.M.; Garcia, S.; Bahati, E.; Karamuzi, D.; Cullor, J.S. and Nandi, S. (2015). Microbiological analysis of raw milk in Rwanda. African Journal of Food Science and Technology, 6(5):141-143.

Duncan, A. J.; Teufel, N.; Mekonnen, K.; Singh, V. K.; Bitew, A. and Gebremedhin, B. (2013). Dairy intensification in developing countries: effects of market quality on farm-level feeding and breeding practices. Animal, 7 (12): 2054-2062.

El Saadany S.A. (1998). The Egyptian experience in developing the red meat industry. In: Belhadj T. (ed.), Boutonnet J.P. (ed.), Di Giulio A. (ed.). *Filière des viandes rouges dans les pays méditerranéens*. Zaragoza : CIHEAM, 73-80 p. (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 35). Séminaire International sur la Filière des Viandes Rouges dans les Pays Méditerranéens, 20-23 April 1997, Tunis (Tunisia). http://om.ciheam.org/om/pdf/a35/98606218.pdf

El-Ramady, H.R.; El-Marsafawy, S.M. and Lewis, L.N. (2013). Sustainable agriculture and climate changes in Egypt. Sustainable agriculture reviews, Sustainable Agriculture Reviews 12. DOI 10.1007/978-94-

007-5961-9_2, © Springer Science Business Media Dordrecht 2013. http://www.springer.com/978-94-007-5960-2.

Eltawil, E.A.; Moukhtar, S.A.; Galal, E.S. and Khishin, E.S. (1976). Factors affecting the production and composition of Egyptian buffalo milk. Tropical Animal Health and Production, 8(2):115-121.

ESRI (2014). Environmental Systems Research Institute, Arc Map 10.2.2 Redlands, California.

Fagiolo, A. and Lai, O. (2007). Mastitis in buffalo. Ital. J. Anim. Sci., 6(2): 200-206.

Fahim, N.H. (2009). Performance of Lactating Buffaloes under the Flying Herds System in Egypt. Ph.D. Thesis, Faculty of Agriculture, Cairo University, Egypt, 101 p.

FAO, WFP. "IFAD" (2012). The state of food insecurity in the world. Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition." Food and Agriculture Organization of the United Nations, Rome, Italy (2015).

FAOSTAT (2015). Food and Agriculture Organization of the United Nations. http://faostat3.fao.org/browse/Q/QA/E.

Faucitano, L.; Chouinard, P.Y.; Fortin, J.; Mandell, I.B.; Lafrenière, C.; Girard, C.L. and Berthiaume, R. (2008). Comparison of alternative beef production systems based on forage finishing or grain-forage diets with or without growth promotants: 2. Meat quality, fatty acid composition, and overall palatability. J. Anim. Sci., 86:1678-1689.

Faye, B. and Lhoste, P. (1999). Le conseil en élevage en milieu tropical. In : Actes 6es Rencontres autour des recherches sur les ruminants, Paris, France, 63-67 pp.

Forsbäck, L.; Lindmark-Månsson, H.; Andrén, A.; Åkerstedt, M.; Andrée, L.; and Svennersten-Sjaunja, K. (2010). Day-to-day variation in milk yield and milk composition at the udder-quarter level. Journal of Dairy Science, 93(8):3569-3577.

Franco, D.; Bispo, E.; González, L.; Vázquez, J.A. and Moreno, T. (2009). Effect of finishing and ageing time on quality attributes of loin from the meat of Holstein–Fresian cull cows. Meat Science, 83:484-491.

Gammack, J.G.; Hobbs, V. and Pigott, D. (2006). Informatics Concepts Techniques. Cengage Learning Australia, 549 p. http://books.google.com/books?id=Chwg077PIlsC&pg=PA29d=group+of+interacting,+interrelated,+or+interdependent+elements+production&sig=Q6un3njG6Qft490iPzpvcc-eToM.

GDTHL (2015). Global Dairy Trade Holdings Limited. https://www.globaldairytrade.info.

Ghosh, N. (2005). Management Control Systems. Prentice-Hall of India Private Limited, M-97, Connaught Circus, new Delhi-110001, 248 p. http://books.google.com/books?id=mLk11itaLrIC&pg=PA4&d=group+of+interacting,+interrelated,+or+interdependent+elements+production+2005&sig=GyaejfLTlKaDFsGV5q8_q_6_c_Q.

Giordano, G.; Guarini, P.; Ferrari, P.; Biondi-Zoccai, G.; Schiavone, B.; and Giordano, A. (2010). Beneficial impact on cardiovascular risk profile of water buffalo meat consumption. European Journal of Clinical Nutrition, 64(9):1000-1006.

Giuffrida-Mendoza, M.; Moreno, L.A.; de Huerta-Leidenz, N.; Uzcátegui-Bracho, S.; Valero-Leal, K.; Romero, S. and Rodas-González, A. (2015). Cholesterol and fatty acid composition of longissimus thoracis from water buffalo (*Bubalus bubalis*) and Brahman-influenced cattle raised under savannah conditions. Meat Science, 106:44-49.

Godden, S.M.; Lissemore, K.D.; Kelton, D.F.; Leslie, K.E.; Walton, J.S. and Lumsden, J.H. (2001). Factors associated with milk urea concentrations in Ontario dairy cows. Journal of Dairy Science, 84(1):107-114.

González, L.; Moreno, T.; Bispo, E.; Dugan, M.E.R. and Franco, D. (2014). Effect of supplementing different oils: Linseed, sunflower and soybean, on animal performance, carcass characteristics, meat quality and fatty acid profile of veal from "Rubia Gallega" calves. Meat Science, 96:829-836.

Grunert, K.G. (2005). Food quality and safety: consumer perception and demand. European Review of Agricultural Economics, 32(3), 369-391.

Guerrero, A.; Velandia Valero, M.; Campo, M.M. and Sañudo, C. (2013). Some factors that affect ruminant meat quality: from the farm to the fork. A review. Acta Scientiarum. Animal Sciences, 35(4):335-347.

Gupta, P.R.D.I.Y. (2007). Dairy India yearbook. A-25 Priyadarshini Vihar, Delhi-110092, India. 836 p. https://books.google.com. eg/books? id= GR6cXwAACAAJ.

Hahlani, C.D. and Garwi, J. (2014). Operational challenges to smallholder dairy farming: The case of Mayfield dairy settlement scheme in chipinge district of Zimbabwe. IOSR Journal of Humanities and Social Science (IOSR-JHSS), 19:87-94. www.iosrjournals.org.

Hamza, M. (2015). Livestock and Products Annual. USDA'S Global Agriculture Information Network (GAIN), 13 p. http://apeda.gov.in/

agriexchange/MarketReport/Reports/Livestock%20and%20Products %20Annual_Cairo_Egypt_8-31-2015.pdf.

Han, B-Z.; Meng, Y.; Li, M.; Yang, Y-X.; Ren, F-Z.; Zeng, Q-K. and Nout, M.J.R. (2007). A survey on the microbiological and chemical composition of buffalo milk in China. Food Control, 18:742-746.

Hashmi, S. and Saleem, Q. (2015). An investigation on microbiological and chemical quality of buffalo milk supplies. Int. J. Curr. Microbiol. App. Sci., 4(1):78-83.

Hay, G.J. and Castilla, G. (2006). Object-based image analysis: strengths, weaknesses, opportunities and threats (SWOT). In Proc. 1st Int. Conf. OBIA (4-5 pp).

Hemme, T. and Otte, J. (2010). Status of and prospects for smallholder milk production – A global perspective. FAO, Rome, 185 p.

Herrero, M.; Thornton, P.K.; Notenbaert, A.M.; Wood, S.; Msangi, S.; Freeman, H.A.; Bossio, D.; Dixon, J.; Peters, M.; van de Steeg, J.; Lynam, J.; Rao, P.P.; Macmillan, S.; Gerard, B.; McDermott, J.; Sere, C. and Rosegrant, M. (2010). Smart investments in sustainable food production: revisiting mixed crop-livestock systems. Science 327:822-825. http:// dx.doi.org/10.1126/science.1183725.

Hof, G.; Vervoorn, M.D.; Leaners, P.J. and Tamminga, S. (1997). Milk urea nitrogen as a tool to monitor the protein nutrition of dairy cows. J. Dairy Sci., 80:3333-3340.

Hofi, M. (2011). Contamination in dairy chains and approaches to quality control in Egypt. Internet Journal of Food Safety, 13:264-269. https://www.globaldairytrade.info/en/product-results/download-histor -ical-data/?cb=1453659514896.

Ibrahim, M.A.R. and Abdelrazek, I.M. (2012). Water buffalo for our next generation in Egypt and in the world. Scientific Papers.. Animal Science, Series D. Vol LV:183-192. http://animalsciencejournal. usam v.ro/pdf/vol55/a34.pdf.

Infascelli, F; Gigli, S. and Campanile, G. (2004). Buffalo meat production: performance infra vitam and quality of meat. Veterinary Research Communications, 28:143-148.

Johnson, R.G. and Young, A.J. (2003). The association between milk urea nitrogen and DHI production variables in western commercial dairy herds. Journal of Dairy Science, 86(9):3008-3015.

Jurie, C.; Picard, B.; Hocquette, J.F.; Dransfield, E.; Micol, D. and Listrat, A. (2007). Muscle and meat quality characteristics of Holstein and Salers cull cows. Meat Science, 77:459-466.

Kaine, G.; Vigliaturo, J.; Bewsell, D. and Botha, N. (2004). Farming systems research and consumer behavior theory. Farming and Rural Systems Resaerch and Extension, 117-126.

Kandeepan, G.; Anjaneyulu, A.S.R.; Kondaiah, N.; Mendiratta, S.K. and Lakshmanan, V. (2009). Effect of age and gender on the processing characteristics of buffalo meat. Meat Science, 83:10-14.

Kandeepan, G.; Mendiratta, S.K.; Shukla, V. and Vishnuraj, M.R. (2013). Processing characteristics of buffalo meat-A review. Journal of Meat Science and Technology, 1(1):01-11.

Kaplinsky, R. and Morris, M. (2001). A Handbook for Value Chain Research (Vol. 113). Ottawa: IDRC. 119 p. http://www.prism.uct.ac.za/ Papers /VchNov01.pdf.

Khan, B.B. and Iqbal, A. (2009). The water buffalo: An underutilized source of milk and meat: A Review. Pakistan J. Zoo. Supp. Ser., 9:517-521.

Khoi, N.V. and Van Dung, T. (2014). The dairy industry in Vietnam: A value chain approach. International Journal of Managing Value and Supply Chains, 5(3):1-17.

Kim, N.K.; Cho, S.; Lee, S.H.; Park, H.R.; Lee, C.S.; Cho, Y.M.; Choy, Y. H.; Yoon, D.; Im, S.K. and Park, E.W. (2008). Proteins in *longissimus* muscle of Korean native cattle and their relationship to meat quality. Meat Science, 80:1068-1073.

Kremen, C.; Iles, A. and Bacon, C. (2012). Diversified farming systems: an agro-ecological, systems-based alternative to modern industrial agriculture. Ecology and Society 17(4): 44-63. http://dx.doi.org /10.5 751/ES-05103-170444.

Kuma, A.; Tolossa, D. and Abdisa, M. (2015). Assessment of raw milk microbial quality at different critical points of oromia to milk retail centers in Addis Ababa. Food Science and Quality Management, 38:1-9. http://iiste.org/Journals/index.php/FSQM/article/view/21355.

Kumar, A. and Staal, S.J. (2010). Is traditional milk marketing and processing viable and efficient? An empirical evidence from Assam, India. Quarterly Journal of International Agriculture, 49:213-225.

Kumar, A.; Staal, S.J. and Singh, D.K. (2011). Smallholder dairy farmers' access to modern milk marketing chains in India. Agricultural Economics Research Review, 24(2):243-253.

LACTIMED (2014). Developing the typical dairy products of Alexandria and Beheira: Diagnosis and local strategy. 54 p. www.lactimed.eu.

Lambertz, C.; Sanker, C. and Gauly, M. (2014). Climatic effects on milk production traits and somatic cell score in lactating Holstein-Friesian cows in different housing systems. J Dairy Sci., 97(1):319-329.

Lee, M.R.F.; Evans, P.R.; Nute, G.R.; Richardson, R.I. and Scollan, N.D. (2008). A comparison between red clover silage and grass silage feeding on fatty acid composition, meat stability and sensory quality of the *M. Longissimus* muscle of dairy cull cows. Meat Science, 81:738-744.

Liu, Y.; Lyon, B.G.; Windham, W.R.; Realini, C.E.; Pringle, T.D.D. and Duckett, S. (2003). Prediction of color, texture, and sensory characteristics of beef steaks by visible and near infrared reflectance spectroscopy. A feasibility study. Meat Science, 65:1107-1115.

Livestock Census (2006). Agricultural Census Organization, Statistic Division, Govt. of Pakistan, Gulberg, Lahore.

Losito, F.; Arienzo, A.; Bottini, G.; Priolisi, F.R.; Mari, A. and Antonini, G. (2014). Microbiological safety and quality of Mozzarella cheese assessed by the microbiological survey method. J. Dairy Sci., 97:46-55.

Lujerdean, A.; Bunea, A. and Mireşan, V. (2007). Seasonal related changes in the major nutrients of bovine milk (total protein, lactose, casein, total fat and dry matter). Scientific Papers University of Agricultural Science and Veterinary Medicine Iasi, 52:372-374.

Ma, H. (2004). Cholesterol and human health. Nature and Science, 2(4):17-21.http://www.sciencepub.net/nature/0204-supplement/04-ahongbao .pdf.

Mahapatra, I.C. (1994). Farming systems research-A key to sustainable agriculture. Fertiliser News, 39:13-23.

Manly (1994). Multivariate Statistical Methods, A Primer (2nd Ed.) New York: Chapman and Hall.

Markelova, H.; Meinzen-Dick, R.; Hellin, J. and Dohrn, S. (2009). Collective action for smallholder market access. Food Policy, 34:1-7.

Martin, B.; Coulon, J.B.; Chamba, J.F. and Bugaud, C. (1997). Effect of milk urea content on characteristics of matured Reblochon cheeses. Le Lait, 77(4):505-514.

Ménard, O.; Ahmad, S.; Rousseau, F.; Briard-Bion, V.; Gaucheron, F. and Lopez, C. (2010). Buffalo *vs.* cow milk fat globules: Size

distribution, zeta-potential, compositions in total fatty acids and in polar lipids from the milk fat globule membrane. Food Chemistry, 120: 544-551.

Mhone, T.A.; Matope, G. and Saidi, P.T. (2011). *Aerobic bacterial, coliform, Escherichia coli and Staphylococcus aureus* counts of raw and processed milk from selected smallholder dairy farms of Zimbabwe. International Journal of Food Microbiology, 151:223-228.

Mikkelsen P. (2014). World Cheese Market Report 2000-2020. PM Food and Dairy Consulting. 700 p.

Miller, M.F.; Huffman, K.L.; Gilbert, S.Y.; Hammon, L.L. and Ramsey, C.B. (1995). Retail consumer acceptance of beef tenderized with calcium chloride. J. Anim. Sci., 73:2308-2314.

Mohamed, A.A.E.; Wahba, A.K.A.; Faisal, R.A.S.R. and Yousreya, H.M. (2013). Some bacteriological and biochemical studies on subclinical mastitis in buffaloes. New York Science Journal, 6(7):71-79.

Mojto, J.; Zaujec, K. and Gondeková, M. (2009). Effect of age at slaughter on quality of carcass and meat in cows. Slovak J. Anim. Sci., 42, (1): 34-37.

Montet, D.; Al Shobaky, A.; Barreto Crespo, M.T.; Payrastre, L.; Mansour, H.; Othman, Y.; Morshdy, A.; El Zayat, Ibrahim, M.H.; El-Arabi, T.; Magid El-Shibiny, A.A.; Nagy, K.; Fadaly, H.; Sorour, M.A.; Hassanien, Y.A.; Hassan, A.R.; Abdel-Mawgood, A.L.; Ahmed, A.; Abdelghany, S.; Radwan, M.; Ismaiel, M.; Magdy, M.; Negm, M.; Mossa, A.T.; Heika, T.; Abd EL-Hamid, A.M.; El Shahaby, O.; Abdu, A.; Mowafy, A.; Sabaa, G. and Mohamed, S. (2015). Future topics of common interest for EU and Egypt in food quality, safety and traceability. Quality Assurance and Safety of Crops & Foods, 7(3):401-408.

Morton, J.F. (2007). The impact of climate change on smallholder and subsistence agriculture. PNAS., 104:19680–19685. www.pnas.org _cgi doi_10.1073_pnas.0701855104.

Mourad, K.A. (1997). Buffaloes in Egypt. Buffalo Bulletin, 16:81-85. http://ibic.lib.ku.ac.th/e-Bulletin/IBBU199700018.pdf.

Mrode R.A. and Swanson G.J.T. (1996). Genetic and statistical properties of somatic cell count and its suitability as an indirect means of reducing the incidence of mastitis in dairy cattle. Anim. Breed. Abstr., 64:847-857.

Munthali, J.T.K.; Musa, F.A. and Chiwayula C.L.K. (1992). Smallholder dairy development in Malawi. Proceedings of the Workshop held

Future of livestock industries in East and Southern Africa, Zimbabwe 20-23 pp.

Nanda, A.S. and Nakao, T. (2003). Role of buffalo in the socioeconomic development of rural Asia: Current status and future prospectus. Animal Science Journal, 74(6):443-455.

Naveena, B.M.; Kiran, M.; Reddy, K.S.; Ramakrishna, C.; Vaithiyanathan, S. and Devatkal, S.K. (2011). Effect of ammonium hydroxide on ultrastructure and tenderness of buffalo meat. Meat Science, 88:727-732.

Neath, K.E.; Del Barrio, A.N.; Lapitan, R.M.; Herrera, J.R.V.; Cruz, L.C.; Fujihara, T.; Muroya, S.; Chikuni, K.; Hirabayashi, M. and Kanai, Y. (2007). Difference in tenderness and pH decline between water buffalo meat and beef during postmortem aging. Meat Science, 75(3):499-505.

Němcová, E.; Štípková, M.; Zavadilová, L.; Bouška, J. and Vacek, M. (2007). The relationship between somatic cell count, milk production and six linearly scored type traits in Holstein cows. Czech Journal of Animal Science, 52(12):437-446.

Ng, L.; Jost, C.; Robyn, M.; Dhakal, I.P.; Bett, B.; Dhakal, P. and Khadka, R. (2010). Impact of livestock hygiene education programs on mastitis in smallholder water buffalo *(Bubalus bubalis)* in Chitwan, Nepal. Preventive Veterinary Medicine, 96(3):179-185.

Ngapo, T.M. and Gariépy, C. (2006). Factors affecting the meat quality of veal. Journal of the Science of Food and Agriculture, 86(10):1412-1431.

Ngongoni, N.T.; Mapiye, C.; Mwale, M. and Mupeta, B. (2006). Factors affecting milk production in the smallholder dairy sector in Zimbabwe. Livestock Research for Rural Development, 18 (05). http://www. cipav.org.co/lrrd/lrrd18/5/ngon18072.htm.

OECD-FAO (2014). Agricultural Outlook 2014-2023. 328 p. [http://www.oecd-ilibrary.org/agriculture-and-food/oecd-fao-agricultu -ral -outlook-2014_agr_outlook-2014-en].

Ortmann, G.F. and King, R.P. (2007). Agricultural cooperatives II: Can they facilitate access of small-scale farmers in South Africa to input and product markets?. Agrekon, 46(2):219-244.

Osman, O.; Ozturk, I.; Bayram, O.; Kesmen, Z. and Yilmaz, M.T. (2010). Characterization of cheese spoiling yeasts and their inhibition by some spices. Egyptian J. Dairy Sci., 75(2):637-640.

Oxford (2012). The Milky Way: Considerable scope for increasing milk production. The Report: Egypt. http://www.oxfordbusinessgroup.com.

Park, Y.W. and Haenlein, G.E.W. (2006). Handbook of Milk of Non-Bovine Mammals. Blackwell Publishing, 409 p.

Patil, M.P.; Nagvekar, A.S.; Ingole, S.D.; Bharucha, S.V. and Palve, V.T. (2015). Somatic cell count and alkaline phosphatase activity in milk for evaluation of mastitis in buffalo. Veterinary World, 8(3):363-366.

Perera, B.M.A.O. (2008). Reproduction in domestic buffalo. Reproduction in Domestic Animals, 43:200-206.

Perera, B.M.A.O. and Jayasuriya, M.C.N. (2008). The dairy industry in Sri Lanka: current status and future directions for a greater role in national development. Journal of National Science Foundation Sri Lanka, 36: 115-126.

Perrot, C. and Landais, E. (1993). Comment modéliser la diversité des exloitations agricoles. Cah. Rech. Dév., 33:24-40.

Phiri, B.J.; Benschop, J. and French, N.P. (2010). Systematic review of causes and factors associated with morbidity and mortality on smallholder dairy farms in Eastern and Southern Africa. Preventive Veterinary Medicine, 94:1-8.

Prieto, N.; Andrés, S.; Giráldez, F. J.; Mantecòn, A. R. and Lavìn, P. (2008). Ability of near infrared reflectance spectroscopy (NIRS) to estimate physical parameters of adult steers (oxen) and young cattle meat samples. Meat Science, 79:692-699.

RAC/CP. (2002). Prevention of pollution in the dairy industry regional activity centre for cleaner production. Mediterranean Action Plan Web page: http://www.cema-sa.org.

Raikes, P.; Friis Jensen, M. and Ponte, S. (2000). Global commodity chain analysis and the French filière approach: comparison and critique. Economy and Society, 29(3):390-417.

Raj, K.R.; Rao, R.J.; Rao, D.N. and Mahendrakar, N.S. (2000). Influence of direct and delayed chilling of excised female buffalo muscles on their textural quality. Meat Science, 56(1):95-99.

Rangnekar, D. and Thorpe, W. (2001). Smallholder dairy production and marketing-opportunities and constraints. Proceedings of a South–South workshop held at NDDB, Anand, India, 13-16 March 2001. NDDB (National Dairy Development Board), Anand, India, and ILRI (International Livestock Research Institute), Nairobi, Kenya. 538 p.

Rao, A.V.; Thulasi, G. and Ruban, W.S. (2009). Effect of age and sex on meat quality characteristics of south Indian non-descript buffalo. Buffalo Bulletin, 28 (3):138-147.

Rathod, P.; Nikam, T.R.; Landge, S. and Hatey, A. (2011). SWOT analysis of dairy cooperatives: A case study of western Maharashtra. International Journal of Research in Commerce and Management, 2:35-41.

Redda, T. (2001). Small-scale milk marketing and processing in Ethiopia. In smallholder dairy production and marketing—Opportunities and constraints. Proceedings of a South–South workshop held at NDDB, Anand, India, 13-16 pp.

Revilla, I. and Vivar-Quintana, A.M. (2006). Effect of breed and ageing time on meat quality and sensory attributes of veal calves of the ''Ternera de Aliste'' Quality Label. Meat Science, 73:189-195.

Rodas-González, A.; Huerta-Leidenz, N.; Vidal, A.; Colina, O.; Lopez, J. and Rodriguez, R. (2015). Comparison of water buffalo (*Bubalus bubalis*) with crossbred and purebred Brahman cattle for growth performance on savannah and slaughter traits at four ages in Venezuela. Animal Production Science, 55(8):967-977.

Rome, D. (2006). The future of dairy products in the Mediterranean market: Specialties or commodities. EAAP publication No. 119:11-19 pp. Santarem, Portugal, 25-27 September 2005.

Roy, B.; Brahma, B.; Ghosh, S.; Pankaj, P.K. and Mandal, G. (2011). Evaluation of milk urea concentration as useful indicator for dairy herd management: A review. Asian J. Anim. Vet. Adv., 6(1):1-19.

Roy, B.; Mehla, R.K. and Sirohi, S.K. (2003). Influence of milk yield, parity, stage of lactation and body weight on urea and protein concentration in milk of Murrah buffaloes. Asian Australasian Journal of Animal Sciences, 16(9):1285-1290.

Sabahelkhier, M.K.; Faten, M.M. and Omer, F.I. (2012). Comparative determination of biochemical constituents between animals (goat, sheep, cow and camel) milk with human milk. Research Journal of Recent Sciences, 1(5):69-71.

Salami, A.; Kamara, A.B. and Brixiova, Z. (2010). Smallholder agriculture in East Africa: Trends, constraints and opportunities. Working Papers Series N° 105 African Development Bank, Tunis,Tunisia. 52 p.

Sami, A.S.; El-Asheeri, A.K. and Radwan, M.A. (2012). Carcass merits, chemical composition and physical properties of beef under

unconventional fattening regimen. Journal of Animal and Veterinary Advances, 11(20):3732-3737.

Sarwar, M.; Khan, M.A.; Nisa, M.; Bhatti, S.A. and Shahzad, M.A. (2009). Nutritional management for buffalo production. Asian-Aust. J. Anim. Sci., 22(7):1060-1068.

SAS. (2016). SAS Institute Inc.2016. SAS® University Edition. Cary, NC, USA.

Sayin, C.; Nisa-Mencent, M. and Karaman, S. (2011). The roles of milk collection centers in milk distribution channels in Turkey: A case study of Antalya. African Journal of Agricultural Research, 6(1):174-180.

Schenkel, F.S.; Miller, S.P.; Jiang, Z.; Mandell, I.B.; Ye, X.; Li, H. and Wilton, J.W. (2006). Association of a single nucleotide polymorphism in the calpastatin gene with carcass and meat quality traits of beef cattle. J. Anim. Sci., 84:291-299.

Seideman, S.C.; Cross, H.R.; Oltjen, R.R. and Schanbacher, B.D. (1982). Utilization of the intact male for red meat production: A Review. J. Anim. Sci., 55:826-840.

Seifu, E. and Doluschitz, R. (2014). Analysis of the dairy value chain: Challenges and opportunities for dairy development in Dire Dawa, Eastern Ethiopia. International Journal of Agricultural Policy and Research, 2 (6):224-233**.**

Serra, X.; Guerrero, L.; Guárdia, M.D.; Gil, M.; Sañudo, C.; Panea, B.; Campo, M.M.; Olleta, J.L.; García-Cáchan, M.D.; Piedrafita, J. and Oliver, M.A. (2008). Eating quality of young bulls from three Spanish beef breed-production systems and its relationships with chemical and instrumental meat quality. Meat Science, 79:98-104.

Shackelford, S.D.; Wheeler, T.L. and Koohmaraie, M. (2004). Evaluation of sampling, cookery, and shear force protocols for objective evaluation of lamb *longissimus* tenderness. J. Anim. Sci., 82:802-807.

Sharif, A.; Ahmad, T.; Bilal, M.Q.; Yousaf, A. and Muhammad, G. (2007). Effect of severity of sub-clinical mastitis on somatic cell count and lactose contents of buffalo milk. Pakistan Veterinary Journal, 27(3): 142-144.

Sharma, N.; Singh, N.K. and Bhadwal, M.S. (2011). Relationship of somatic cell count and mastitis: An overview. Asian Aust. J. Anim. Sci., 24(3): 429-438.

Singh, B.; Gauhan, S.K.; Chauhan, M.S. and Singla, S.K. (2015). Textbook of Animal Biotechnology. New Delhi, India: The Energy and Resources Institute (TERI). 678 p.

Singh, G.S.; Hazra, A.K.; Ruchira, Sen, R.; Koli, S. and Bhardwaj, A. (2013). Overview of the Indian Buffalo meat value chain. Agriculture Division Federation of Indian Chamber of Commerce and Industry Federation House, Tansen Marg New Delhi 110 001. India. 80 p. www.ficci.com.

Sørensen, J.T.; Peart, R.M. and Curry, R.B. (1997). Modeling and Simulation in Applied Livestock Production Science. Agricultural systems modeling and simulation, 475 p.

Specht, S.M.; Faustman, C.; Bendel, R.B, Malkus, L.A.; Kinsman, D.M. and Sison, C. (1994). Carcass composition of ''bob'' and ''special-fed'' veal and its prediction. J. Anim. Sci., 72:2635-2641.

Sraïri, M.T.; Benhouda, H.; Kuper, M. and Le Gal, P.Y. (2009). Effect of cattle management practices on raw milk quality on farms operating in a two-stage dairy chain. Trop. Anim. Health Prod., 41:259-272.

Stewart, G.; Gosselin, C. and Pandian, S. (1992). Selected ion monitoring of tert-butyldimethylsilyl cholesterol ethers for determination of total cholesterol content in foods. Food Chem., 44:377-380.

Suzuki, K.; Kanameda, M.; Ogawa, T.; Nguyen, T.T.D.; Dang, T.T.S.; Luu, Q.H. and Pfeiffer, D.U. (2006). Productivity and socio-economic profile of dairy cattle farmers amongst rural smallholder communities in northern Vietnam. Livestock Science, 101:242-250.

Syed, A.M.; Digraskar, S.U. and Awaz, K.B. (2009). Evaluation of buffalo milk with reference to somatic cell count and antitrypsin. Veterinary World, 2:267-268. www.veterinaryworld.org.

Tassew, A. and Seifu, E. (2009). Smallholder dairy production system and emergence of dairy cooperatives in Bahir Dar Zuria and Mecha Woredas, Northwestern Ethiopia. World Journal of Dairy and Food Sciences, 4(2):185-192.

Tegegne, A.; Gebremedhin, B.; Hoekstra, D.; Belay, B. and Mekasha, Y. (2013). Smallholder dairy production and marketing systems in Ethiopia: IPMS experiences and opportunities for market-oriented development. Working Paper No. 31. 78 p. www.ipms-ethiopia.org.

Thioulouse, J.; Chessel, D.; Dolédec, S. and Olivier, J.M. (1997). ADE-4: A multivariate analysis and graphical display software. Statistics and Computing, 7(1):75-83.

Todaro, A.; Adly, F.A. and Omar O.A.H. (2013). History, Processing and Quality Enhancement of Traditional Egyptian Kariesh Cheese: A Review Food Science and Technology, 1(1):1-6.

Tripaldi, C.; Palocci, G.; Miarelli, M.; Catta, M.; Orlandini, S.; Amatiste, S.; Di Bernardini, R. and Catillo, G. (2010). Effects of mastitis on buffalo milk quality. Asian-Aust. J. Anim. Sci., 23(10):1319-1324.

Urassa, J. K. and Raphael, E. (2004). The contribution of small scale dairy farming to community welfare: A case study of Morogoro municipality. Tanzania. 10 p. http://www.fiuc.org/esap/MOROG/ MO -ROG5/General/dairyfarming.pdf.

US Department of Health and Human Services, USDHHS. (2005). Your guide to lowering your cholesterol with TLC. NIH Publication, (06-5235). 85 p.

Webb, N.B.; Kahlenberg, O.J. and Naumann, H.D. (1964). Factors influencing beef tenderness. J. Anim. Sci., 23:1027-1031.

Webber, C.M. and Labaste, P. (2010). Building competitiveness in Africa's agriculture: A guide to value chain concepts and applications. World Bank Publications, Washington DC 20433, 204 p. https://open knowledge.worldbank.org.

Węglarz, A. (2010). Meat quality defined based on pH and color depending on cattle category and slaughter season. Czech J. Anim. Sci., 55 (12): 548-556.

Yoon, J.T.; Lee, L.J.; Kim, C.K.; Chung, Y.C. and Kim, C.H. (2004). Effects of milk production, season, parity and lactation period on variations of milk urea nitrogen concentration and milk components of Holstein dairy cows. Asian Australasian Journal of Animal Sciences, 17(4):479-484.

Zwald, N.R.; Weigel, K.A.; Fikse, W.F. and Rekaya, R. (2001). Characterization of dairy production systems in countries that participate in the international bull evaluation service. Journal of dairy science, 84(11):2530-2534.

APPENDICES

APPENDIX I

Questionnaire at the farm level

T1_Identification

1. **Code number:** ____   **5. Location: N**

2. **Location:**   **6. E**

3. **Farmer's Name:**   **7. Way point:**

4. **Date of visit:**   **8. Mobile phone:**

T2_Structure

9. How many persons in your family? (Persons who depend economically on you): /_____/

10. How many persons work ?   Male : / _____/   11. Female : /_____/

12. Number of occasional labor /_____/   13. cost (LE/day): /_____/

14. Number of permanent labor /_____/   15. cost (LE/month):/_____/

Crop production

16. How many Kerat of land do you own? /_____/ Kerat.

17. How many Kerat of land do you rent? /_____/ Kerat.

18. How many Kerat of land do you cultivate? /_____/ Kerat.

19. How many kerat of forage crop in winter? /_____/ Kerat

20. How many kerat of forage crop in summer? /_____/ Kerat

21. How many kerat of cereal crops? /_____/ Kerat

22. How many kerat of vegetable crops? /_____/ Kerat

Animal production

T3_Herd composition for large ruminants (day of visit)

Type	Buffalo	Holstein	Crossbred	Baladi
Dairy animal				
Bulls				
Heifers				
Male calves (< 3 months)				
Fattening calves (> 3 months)				

Other animals: number of

- 23. Goats :
- 24. Sheep :
- 25. Donkeys :

Code number: _____   **Date of visit** :

Part 2: Variables to access

1. <u>T4_ Milk</u> (The day of the visit):

	Buffalo	**Cow**
Number of milked female		
Milk (kg/day)		
Main milk selling destination		
Sale to collector or collection point (kg/day)		
Price (EGP / liter)		
Cream return (Yes / No)		
The use of raw milk via the family farm		
Self-consumption of raw milk (kg/day)		
Direct raw milk sale (kg/day)		
Transformation for cheese (kg/day)		
Transformation for cream (kg/day)		
Transformation for *raïben* (kg/day)		
Do you sell raw milk (Yes / No)?		
If "yes", how many this day (kg / week)?		
Price (EGP / kg)		
Do you sell butter (Yes / No)?		
If "yes", how many (kg / week) this week		
Price (EGP / kg)		
Do you sell cheese (Yes / No)?		
If "yes", how many (kg / week) this week		
Price (EGP / kg)		

The main selling point for cheese and butter?

2. **T5_Veal**

26. Do you sell veal (Yes / No)?

If "Yes "

- 27. average price this season (EGP / head)
- 28. average age this season (months / head)
- 29. Where (trader, market)?
- 30. Age of weaning (in days)
- 31. source of milk ( ) Buffalo ( ) Cow (   ) milk powder
- 32. How much milk did you feed for veal first 10 day (total kg / head)?
- 33. How much milk did you feed for veal after first 10 day (total kg / head)?
- 34. Average concentrate feeds (kg)
- 35.Composition : wheat bran / mixed / other

3. **T6_Feedstuff**
- 36. Do you feeding Animal on concentrate (yes or no)?
- 37. If no give why?
- 38. Average concentrate feeding (kg/ day)
- 39. Composition of Concentrate
- 40. type of forage /____/ a. clover   b. green corn   c. sweet corn d. other
- 41. Explain the other …………………….
- 42. Average forage feeding kg/day
- 43. Average Silage feeding kg/day
- 44. type of Roughage /____/ a. Wheat straw b. Rice straw   c. other

- 45. Average Roughage feeding kg/day

- 46. the price of silage (ton)

- 47. the price of concentrate (ton)

- 48. the price of Roughage (ton)

4. **T7_Question?**
49. What is the reason for contact with trader or milk center other than another one?

50. Why you don't sell milk?

51. Why do you sell veal?

Code number: _____   **Date of visit** :

APPENDIX II

Questionnaire at the collection point level

Code number: _____   **Date of visit**:

Location:

Head's unit Name: Location: N

                                     E

                                     Way Point:

Part 1: Description (only for the first visit)

1. Story of the head of the Collection Point (Establishment date, experience before, key dates of change in the unit)
2. Organization around the Collection Point (Capacity, equipment, products, suppliers …) To draw a diagram with all stakeholders, types – volumes and prices of each milk products
3. Future for the Collection Point? (What do you like to change in the future? If you have a lot of money, what will you do / milk activity?)

Part 2: Milk flows at the Collection Point

Today:

- Number of collected farmers :
- Maximum distance between the farmer and collection point (km) :
- All raw Milk Collection (kg/day):
        Buffalo: Cow:
- Skimmed Milk Collection (kg/day) :
        Buffalo: Cow:

- Milk price to the farmer (EGP/kg) :

APPENDIX III

Questionnaire at the collection center level

Code number: _____   **Date of visit**:

Head's collection center Name: Location: N

                                                                            E

                                                                Way point:

Part 1: Description (only for the first visit)

1. Story of the head of the Collection Centre (Establishment date, experience before, key dates of change in the unit)
2. Organization around the Collection Centre (Capacity, equipment, products, suppliers, retailers, …) To draw a diagram with all stakeholders, types – volumes and prices of each milk products
3. Future for the Collection Centre? (What do you like to change in the future? If you have a lot of money, what will you do / milk activity?)

Part 2: Milk flows at the Collection Centre level

IF RECORDING BOOKS: monthly collected and selling milk per stakeholder (collection points or farmers / cheese collection units or airy

Today: IF NO RECORDING BOOKS: 3 visits if necessary (to confirm)

- Milk Collection (kg) :   Buffalo :
         Cow :
- Sale (kg/day and price) :   -   Buffalo raw all milk :

APPENDIX VI

Questionnaire for veal selling decision at the farm level

1. **Code number:** ____   **5. N**

2. **Location:**   **6. E**

3. **Farmer's Name:**   **7. Way point:**

4. **Date of visit:**   **8. Mobile phone:**

9. **Level of Education:**
   Labor:

10. Number of occasional labor /_____/ 11. cost (LE/day): /_____/

12. Number of permanent labor /_____/   14. cost (LE/month):/_____/

Veal

13. The sex of calf

14. Date of birth   15. Period of suckling

16. Suckling method

17. Amount of milk until weaning or selling

18. Weight at selling or weaning

19. Selling price

20. Why did you selling veal? Ranking the season

 (Money need – shortage in milk - sex. -)

21. Why did not selling the veal?

APPENDIX IV

Questionnaire for veal at the trader and butcher level

1. Code number: ____   5. N

2. Location: 6. E

3. Trader Name: 7. Way point:

4. Date of visit: 8. Mobile phone:

9. Level of Education:

10. History of the enterprise

       10.1 Data of starting

       10.2 where

11. Type of live animals

………………../………………………./………………………../…………

………../……………………

12. Name of markets visited by traders/ week and day of this market the

distance for each on

…………………………../…………………………../………………

………/………………………....

13. The highest veal price………………EGP, and the lowest veal price

………………………. EGP

14. Purchasing systems depend on :

Weight ( ) Body conformation ( ),   age ( ) Other (

)……………………………………………………

15.   Keeping   period   before   selling   or

slaughtering……………………………………………….

16. The price of cuts

17. The time to selling all carcasses

18. The type of customers

19. The reason of work with Veal

20. Do you think the rearing veal better or slaughter?

21. How is slaughter?

If rear veal (farmers or traders have a veal enterprise)

22. No. of veal / cycle…………………..

23. For fattening ( ) or for breeding ( ) or Both ( )

24. Selling weight (   ) or age (   )

25. Period of cycle

26. Cost of head

27. Selling price

28. Type and quantity of feeding Restaurant

الملخـــــص العـــــربي

توصيف سلسلتى إنتاج اللبن والبتلو من الجاموس تحت نظام الإنتاج النباتى-الحيوانى فى مصر

الهدف العام من الدراسة هو توصيف سلسلتى اللبن والبتلو من الجاموس وتحديد أهم العناصر الفاعلة فى كل سلسلة والعوامل المؤثرة على كل سلسلة.

تقع هذه الدراسة في أربعة فصول.

الفصل الأول: يختص بتوصيف سلاسل إنتاج اللبن الجاموسى في ثلاث قرى مصرية. وتمثلت الأهداف الرئيسية لهذه الدراسة في تحديد العناصر الأساسية على طول سلسلة إنتاج اللبن، وكذلك إجراء تحليل اللبن لدراسة ما إذا كان لموقع القرية تأثير على التركيب الكيميائى للبن وكذلك مستوى اليوريا و الخلايا الجسدية فيه.

والقرى التي تم اختيارها هي الإمام مالك وتقع على بعد ١٢٠ كم شمال القاهرة بمحافظة البحيرة (كمثال للأراضي حديثة الاستصلاح)، اما القريتين الأخريين العطف و الرقة على بعد ٥٠ و ٨٠ كم، على التوالي جنوب الجيزة (كمثال للنظام القديم في وادي النيل). وقد تم تتبع مسارات اللبن فى كل سلسلة من سلاسل إنتاج اللبن لكل قرية. وكانت نقطة البداية من التجار ومراكز تجميع اللبن الأطراف الفاعلة فى قطاع الألبان في المناطق الثلاث. كانت الزيارات الميدانية والمقابلات الشخصية هما الوسائل الأساسية المستخدمة لجمع البيانات من الفلاحين و الوسطاء.

تم جمع عينات اللبن في فصول الشتاء والربيع والصيف من القرى الثلاث خلال الفترة من ٢٠١٣ الى ٢٠١٤. وتم تقدير التركيب الكيميائى ومستوى اليوريا فى اللبن (MUN) وعدد الخلايا الجسدية (SCC). وأشارت النتائج إلى أن كل قرية لها سلسلة خاصة بها تتناسب وظروفها الخاصة. وقد وجد أن هناك سلسلتين، الأولى: طويلة وتشمل الفلاحين والوسطاء من حيث نقطة تجميع اللبن والتجار ومراكز تجميع اللبن والمحلات التجارية والمستهلكين. في حين أن السلسلة القصيرة تتكون من المنتجين والمستهلكين وقد تحتوى على وسيط واحد فقط. ومن

فوائد السلسلة القصيرة أنها تحقق ربح مرتفع للفلاحين وسعر معقول للمستهلكين مقارنة بالسلسلة الطويلة. بينما توفر السلسلة الطويلة الكثير من فرص العمل على طول السلسلة.

أشارت النتائج أن مستوى MUN يعكس مدى ملاءمة نظام التغذية المتبع حيث تحققت أفضل النسب كمؤشرات للتغذية الجيدة في قرية الإمام مالك تلاها قرية الرقة ثم قرية العطف.

لم يظهر تقديردرجة الخلايا الجسدية إختلافاً بين القرى محل الدراسة وكانت القيم تتراوح بين ٥,١ ـ ٥,٥ درجة والتى تشير إلى أن معظم الحيوانات كانت مصابة (بإلتهاب الضرع ـ غير المرئى). حيث، وجد أن أقل من ٥٠% من الجاموس خالي من الإصابة بالتهاب الضرع، حيث تعانى معظم القرى من غياب تطبيق برامج الرعاية الجيدة و برامج السيطرة على مرض التهاب الضرع على مدار العام. ومن هنا كانت الحاجة لإجراء هذه التحليلات بصفة دورية و أخذ عينات بصفة مستمرة من مختلف القرى حتى يمكن توفير الدعم الفني للخدمات ذات الأولوية طبقاً لإحتياجات كل قرية.

الفصل الثانى: يختص بتوصيف تنوع النظم الزراعية واستراتيجيات تسويق الألبان في القرى الثلاثة بهدف اقتراح منهج بحثى لدراسة وتوصيف تنوع النظم الزراعية لانتاج الألبان في أراضي وادي النيل و الأراضي حديثة الاستصلاح لفهم قطاع إنتاج الألبان تحت النظام التقليدي فى القرى المحيطة بالقاهرة الكبرى. وقد تم جمع البيانات من عدد ٦٥ مزارع في القرى الثلاث خلال ثلاثة مواسم متتالية. وقد أجريت الزيارات الحقلية والمقابلات الشخصية على مستوى المزرعة. وبناء على تحليل العوامل المتعددة والتحليل الفئوى تم تحديد ست مجموعات من الفلاحين وفقاً لأصول الأراضي والثروة الحيوانية وإنتاج اللبن وطبيعة تسويق اللبن. وقد تأثر تسويق اللبن بالموسم وتقاليد الفلاحين، وطريقة تسويق اللبن فى كل منطقة، ومن خلال تسليط الضوء على صغار الفلاحين الذين يهيمنون على نظام الإنتاج النباتى الحيوانى التقليدي وخاصة فى الأراضى القديمة، حيث أن الأسرة الريفية تعتمد على اللبن كمصدر للبروتين الحيواني والدهن في الطعام وكمصدر رئيسي للدخل وخاصة في الأراضي القديمة، بينما في الاراضى حديثة الاستصلاح كان هناك قدر كبير من التكامل بين الإنتاج النباتى والإنتاج الحيوانى يهدف لتغطية نفقات الأسرة والمزارع، لذلك فإن استراتيجية الخدمات مدفوعة الأجر يمكن أن تساهم فى إصلاح قطاع الألبان في الأراضى حديثة الإستصلاح. ويشكل إنتاج اللبن

النشاط الرئيسى لأصحاب الحيازات الصغيرة جداً، كما أن تحقيق الإستدامة فى هذا القطاع يواجه عدم توفر الدعم الفني وغياب وجود نظام مناسب لتسعير الألبان والأعلاف، وبالتالى يحتاج هذا القطاع للمزيد من المشاريع الحكومية وغير الحكومية لدعم الفلاحين من خلال توفير بذور الأعلاف المحسنة عالية الإنتاج، وتوفير حيوانات محسنة وراثياً ذات إنتاج عالي وتقديم الخدمات البيطرية. ونظراً لتنوع النظم الزراعية، فإن سياسة زراعية واحدة لن تناسب كل فئات الفلاحين. كما يجب مراعاة أن تتناسب الخدمات الحكومية وغير الحكومية المقدمة طبقاً للمنطقة والموسم.

الفصل الثالث: وفيه تم تحليل نقاط القوة والضعف والفرص والمخاطر (SWOT) لسلسلة إنتاج اللبن الفرز التقليدية تحت النظام التقليدى بهدف تطبيق تحليل SWOT على سلسلة إنتاج الألبان تحت هذا النظام، وخاصة سلسلة إنتاج اللبن الجاموسى (الفرز) حول القاهرة الكبرى التي تعتبر واحدة من الأسواق الرئيسية في إستيعاب منتجات الألبان فى مصر. ونتيجة لذلك تم عمل تحليل SWOT بما في ذلك تناول بعض المقايس الخاصة بسلامة الأغذية وتحليل سلسلة الإنتاج لتحديد أهم المزايا والمشاكل التى تواجه هذا القطاع. تم جمع البيانات و أخذ عينات اللبن من خلال الزيارات الحقلية المنتظمة، والمقابلات الشخصية. حيث شملت العناصر الرئيسة في السلسلة وهم: الفلاحين، ونقاط تجميع اللبن، مركز تجميع اللبن، وحدات تصنيع الألبان. وقد سمح تحليل SWOT بتسليط الضوء على الدور الرئيسي لشبكة من العلاقات الإجتماعية وتوضيح المرونة والتكيف التى يتمتع بهما هذا القطاع مع المعوقات الرئيسية والتى ترتبط مع التنافسية الدولية، و ندرة الحصول على الأراضي الصالحة للزراعة والتى تعتبرمن المعوقات المحلية. ومن نقاط الضعف الأخرى إرتفاع أسعار مكونات الأعلاف في الأسواق، وعدم توفر الخدمات العامة من حيث تحسين الجودة و رعاية القطعان على مستوى المزرعة، ومع ذلك فإن شبكة العلاقات الإجتماعية يمكن الاستفادة منها في تطوير وتقديم خدمات فعالة ومرنة هذه العناصر يمكن أن تساعد صناع القرار والتنمويين فى تحديد أولويات أنشطة التنمية المستدامة وربطها ببرامج الزراعة العالمية وزيادة الطلب على منتجات الألبان في مصر.

الفصل الرابع: كان الهدف من هذا الفصل وصف سلسلة البتلو بإستخدام تحليل الاستبيان لمختلف العناصر الرئيسية على طول السلسلة وتقدير جودة اللحوم لفئات اللحوم الجاموسى

المختلفة في السوق المصري لتفسير زيادة الطلب على لحوم البتلو. تم شراء ٢٧ عينة من لحوم عضلة الظهر(بيت الكلاوي) من الأسواق المحلية على النحو التالى ١١ عينة من لحم البتلو، ٨ عينات من لحوم الكندوز و ٨ عينات لحوم من الإناث المستبعدة. وتم تحديد التركيب الكيماوي والكوليسترول والصفات الطبيعية للحوم. أشارت النتائج إلى أن ٦٥% من الفلاحين المصريين يقومون ببيع العجول البتلو في عمر صغير(٤٠ يوم)، ٦١٪ من هؤلاء الفلاحين يبيعون حيواناتهم لأسباب إقتصادية، و ١٤٪ لأسباب فنية و ٢٥٪ لكلا السببين معاً.

وقد لوحظ أن أسعار العجول البتلو تتأثر بالموسم، حيث سجلت أقل سعر في فصل الشتاء مقارنة مع فصل الصيف. ووجد أن التقدم في عمر الحيوان له تأثيرات على كلٍ من التركيب الكيميائي للحوم ومستوى الكوليسترول والخصائص الطبيعية للحوم. حيث إنخفضت نسبة الدهن بين الألياف ومستوى الكوليسترول في لحوم "البتلو" مقارنة مع لحوم "الكندوز" ولحوم "الأناث المستبعدة". وقد لوحظ أن القوة اللازمة للقطع (كمؤشر للطراوة) والنسبة المئوية للفقد بالطبخ قد أخذت نفس الاتجاه.أيضا. كان لون لحوم الإناث المستبعدة أكثر قتامة عن لحوم الذكور المسمنة ولحوم البتلو. هذه النتائج قد تفسر سبب تزايد الإقبال على إستهلاك لحم البتلو من قبل كبار السن والمرضى والموظفين (بذل مجهود بدني أقل) والراجع إلى إرتفاع درجة الطراوه، اللون الفاتح، وانخفاض محتواها من الدهن والكوليسترول.

ويوصى الدراسة بزيادة مساهمة الجاموس من اللحوم الحمراء على المستوى القومى عن طريق تعديل سلسلة البتلوعلى مستوى القرية من خلال إنشاء محطات لتسمين العجول وأخرى لتربية العجلات بدعم من قبل صانعي السياسات الزراعية والبنوك والمنظمات غير الحكومية والقطاع الخاص إضافه إلى المشاركة الفنية من الجامعات والمعاهد البحثية.

اسم الطالب: محمد على عبدالله رضوان			**الدرجة:** دكتوراه الفلسفة

عنوان الرسالة: توصيف سلسلتي إنتاج اللبن والبتلو من الجاموس تحت نظام الإنتاج النباتي-الحيواني فى مصر

المشرفون: دكتور: آمال كمال العشيري

دكتور: السيد صلاح الدين جلال

دكتور: كرستيان كورنيه

دكتور: شريف عبدالغنى طلبة

قسم: الإنتاج الحيواني   **فرع:** تربية الحيوان   **تاريخ منح الدرجة:** ٩ / ٦ /٢٠١٦

المستخلص العربي

اشتملت هذه الرسالة على أربعة أجزاء لتوصيف سلسلتي إنتاج اللبن الجاموسي و البتلو. كان هدف الجزء الأول إبراز و تحديد أوجه الاختلاف فى سلاسل الإنتاج وكذلك تحديد الأطراف الفاعلة فى سلسلة إنتاج اللبن في ثلاث قرى تقع حول القاهرة الكبرى لفهم كيفية عمل هذه السلاسل الإنتاجية. تم إجراء تحليل لعينات اللبن لدراسة تأثير المكان على التركيب الكيميائي للبن و مستوى اليوريا فى اللبن وكذلك عدد الخلايا الجسدية. تم تجميع البيانات عن طريق الزيارات الحقلية والمقابلات الشخصية. كما تم جمع عينات اللبن من الفلاحين خلال الفترة من ٢٠١٣إلى٢٠١٤. أظهرت النتائج أن هناك سلسلة لإنتاج اللبن قصيرة و أخرى طويلة. السلسلة القصيرة تحقق أعلى عائد للفلاح وكذلك سعر مناسب للبن المباع للمستهلك وذلك عند مقارنتها بالسلسلة الطويلة. إلا أن السلسلة الطويلة توفر العديد من فرص العمل. وقد لوحظ أن تقدير مستوى اليوريا وعدد الخلايا الجسدية فى اللبن و التركيب الكيميائى للبن يمكن استخدامه كوسائل تشخيصية فى مختلف القرى لتحديد أولويات الخدمات الإرشادية المطلوبة على مستوى كل قرية.

كان الهدف من الجزء الثاني وضع مقترح منهجى لتوصيف الاختلافات فى نظم إنتاج الألبان فى مصر حتى يتسنى فهم قطاع الألبان التقليدي . تم تجميع البيانات من ٦٥ فلاح من ثلاث قرى خلال ثلاثة مواسم متتالية، وإعتماداً على تحليل العوامل المتعدد و التحليل الإحصائي الفئوي تم تحديد ٦ مجاميع. حيث يشكل إنتاج اللبن النشاط الرئيسي لصغار الفلاحين. وقد وجد أن إستدامة هذا القطاع تواجه العديد من المعوقات منها ضعف الدعم الفنى وعدم وجود نظم لتسعير الألبان والمواد العلفية. وبناء عليه يحتاج القطاع إلى مشاريع حكومية وغير حكومية تساهم في دعم الفلاحين ببذورذباتات علفية محسنة، حيوانات عالية الانتاج أوتوفير الخدمات البيطرية. وبناء على تباين النظم المزرعية فإن سياسة زراعية واحدة تعتبر غير ملائمة لكل الفلاحين مع الأخذ فى الاعتبار المنطقة والموسم.

كان الهدف من الجزء الثالث هو تطبيق تحليل نقاط القوة والضعف والفرص والمخاطر لسلسلة إنتاج اللبن التقليدية و بالأخص سلسلة إنتاج اللبن الفرز حول القاهرة الكبرى والتى تعتبر من أكبر أسواق منتجات الألبان فى مصر. أوضحت هذه الدراسة أن الفلاحين و نقاط تجميع اللبن و مركز تجميع اللبن و وحدات تصنيع الألبان تشكل العناصر الأساسية للسلسلة. وقد أمكن بواسطة تحليل نقاط القوة والضعف والفرص والمخاطر تسليط الضوء على الدور الرئيسى لشبكة العلاقات الإجتماعية وبيان قدرة هذا القطاع من مرونة وتكيف مع المعوقات الرئيسية والتى ترتبط بالتنافسية الدولية، و تعتبرندرة الحصول على الأراضي الصالحة للزراعة من المعوقات المحلية الرئيسية. هذه العناصر يمكن أن تساعد صناع القرار والتمويين في تحديد أولويات الأنشطة لتحقيق التنمية المستدامة وربطها ببرامج الزراعة العالمية.

كان الهدف من الجزء الرابع توصيف سلسلة إمداد البتلو بإستخدام تحليل الاستبيان لمختلف العناصر على طول السلسلة وكذلك فهم أسباب تفضيل بعض المستهلكين للحوم البتلو من خلال مقارنتها مع لحوم فئات الجاموس الأخرى فى السوق المصري، حيث أشتملت على تحليل جودة اللحم لكل من لحم البتلو و لحم الكندوز الجاموسي و إناث الجاموس المستبعدة. أشارت النتائج إلى أن ٦٥% من الفلاحين يقومون ببيع العجول البتلو في عمر صغير. ووجد أن ٦١٪ من هؤلاء الفلاحين يبيعون حيواناتهم لأسباب إقتصادية، و ١٤٪ لأسباب فنية و ٢٥٪ للسببين مجتمعين. كما أوضحت التحاليل المعملية أن كلاً من محتوى اللحم من الدهون و مستوى الكوليسترول فيه كانت أقل فى لحوم البتلو مقارنة بلحوم الجاموس الكندوز و لحوم إإناث الجاموس المستبعدة، وفيما يتعلق بتقدير درجة طراوة اللحوم (القوة اللازمة لقطع ألياف اللحم) وكذا الفقد بالطبخ فقد سلكا نفس الاتجاه. وربما تفسر هذه النتائج سبب تزايد الإقبال على إستهلاك لحم البتلو من قبل كبار السن والمرضى والموظفين (ممن يؤدون مجهود بدني أقل) والراجع إلى إرتفاع درجة الطراوه، اللون الفاتح، محتواها القليل من الدهن والكوليسترول.

الكلمات الدالة: الجاموس، سلسلة الإنتاج النباتي الحيواني، نقاط القوة والضعف والفرص والمخاطر، اللبن الفرز، البتلو.

توصيف سلسلتى إنتاج اللبن والبتلو من الجاموس تحت نظام الإنتاج النباتى-الحيوانى فى مصر

رسالة مقدمة من

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بكالوريوس في العلوم الزراعية (الإنتاج الحيواني)، كلية الزراعة، جامعة القاهرة، مصر، ٢٠٠٤
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للحصول على درجة

دكتوراه الفلسفة

في

**العلوم الزراعية
(الإنتاج الحيواني)**

**قســــم الإنتاج الحيواني
كليــــة الزراعــــة
جامعــة القـاهرة
مصــــــر**

٢٠١٦

توصيف سلسلتى إنتاج اللبن والبتلو من الجاموس تحت نظام الإنتاج النباتى-الحيوانى فى مصر

رسالة دكتوراه الفلسفة
في العلوم الزراعية
(الإنتاج الحيواني)

مقدمة من

محمد على عبدالله رضوان

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ماجستير في العلوم الزراعية (الإنتاج الحيواني)، كلية الزراعة، جامعة القاهرة، مصر، ٢٠٠٩

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التاريخ: ٢٠١٦/٠٦/٠٩

<u>استمارة معلومات الرسائل التى تمت مناقشتها</u>

<u>الكلية / المعهد</u> :   القسم   القسم

١ ـ <u>الدرجة العلمية</u> :   ماجستير ☐   دكتوراه ∎

٢ ـ <u>بيانات الرسالة</u> :

عنوان الرسالة باللغة العربية :
توصيف سلسلتى إنتاج اللبن والبتلو من الجاموس تحت نظام الإنتاج النباتى-الحيوانى فى مصر

عنوان الرسالة باللغة الأجنبية :

Characterization of Milk and Veal Production Chains of Buffalo Under Crop-Livestock Production System in Egypt

التخصص الدقيق : علوم إنتاج حيوانى "رعاية الحيوان"
تاريخ المناقشة : ٢٠١٦/٠٦/٠٩

٣ ـ بيانات الطالب :

الاسم : محمد على عبدالله رضوان   الجنسية : مصرية   النوع : ذكر

العنوان :١٨ شارع الحبشة العزبة الشرقية الحوامدية الجيزة   تليفون ٣٨١١٨٢٦٩

جهة العمل : قسم الإنتاج الحيوانى– كلية الزراعة–جامعة القاهرة   رقم الفاكس :

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٤ ـ المشرفون على الرسالة :

<u>ا لاسم</u>	<u>الـقـسـم</u>	<u>الـكـلـيـة</u>	<u>الـجـامـع</u>
اد/ آمال كمال العشيرى	قسم الانتاج الحيوانى ـ كلية الزراعة ـ جامعة القاهرة		
اد/ السيد صلاح الدين جلال	قسم الانتاج الحيوانى ـ كلية الزراعة ـ جامعة عين شمس		
د/ كرستيان كورنيه	بمعهد سيراد ـ مونبلييه- فرنسا		
د/ شريف عبد الغنى طلبة	قسم الانتاج الحيوانى ـ كلية الزراعة ـ جامعة القاهرة		

٥ ـ مستخلص الرسالة (Abstract)

٥ ـ ١ باللغة العربية : بشرط ألا يزيد عن ٧ أسطر

اشتملت هذه الرسالة على ٤ أجزاء لتوصيف سلسلتى إنتاج اللبن الجاموسي و البتلو. كان هدف الجزء الأول إبراز و تحديد أوجه الاختلاف فى سلاسل الإنتاج وكذلك تحديد الأطراف الفاعلة فى سلسلة إنتاج اللبن في ثلاث قرى تقع في محافظتي الجيزة والبحيرة لفهم كيفية عمل هذه السلاسل الإنتاجية. أظهرت النتائج أن هناك سلسلة قصيرة لإنتاج اللبن و أخرى طويلة. أما الجزء الثاني فقد كان الهدف منه وضع مقترح منهجى لتوصيف الاختلافات فى نظم إنتاج الألبان فى مصر حتى يتسنى فهم قطاع الألبان التقليدي. كان الهدف من الجزء الثالث هو تطبيق تحليل نقاط القوة والضعف والفرص والمخاطر لسلسلة إنتاج اللبن التقليدية و بالأخص سلسلة إنتاج اللبن الفرز حول القاهرة الكبرى. أوضحت هذه الدراسة أن المزارع الصغيره و نقاط تجميع اللبن و مركز تجميع اللبن و وحدات تصنيع الألبان تشكل العناصر الأساسية للسلسلة. أما هدف الجزء الرابع فهو توصيف سلسلة إمداد البتلو بإستخدام تحليل الاستبيان لمختلف العناصر على طول السلسلة وكذلك فهم أسباب تفضيل بعض المستهلكين للحوم البتلو من خلال مقارنتها مع لحوم فئات الجاموس الأخرى فى السوق المصرى، أشارت النتائج إلى أن ٦٥% من الفلاحين يقومون ببيع العجول البتلو في عمر صغير. وربما تفسر هذه النتائج سبب تزايد الإقبال على إستهلاك لحم البتلو من قبل كبار السن والمرضى والموظفين.

الكلمات الدالة: الجاموس، سلسلة الإنتاج النباتي الحيواني، نقاط القوة والضعف والفرص والمخاطر، اللبن الفرز، البتلو.

٥ ــ ٢ باللغة الأجنبية : بشرط ألا يزيد عن ٧ أسطر

This thesis includes four parts to characterize Buffalo milk and veal chains at different chain levels, the objectives of the first part were to identify the diversity of different chains and more deeply to determine main actors along the milk value chains in three different villages to understand how these chains work. Results indicated that there were a short chain and a long chain. The aim of the 2nd part was to suggest a methodology to characterize the diversity of dairy farming systems in Egypt to understand the traditional dairy sector. So, considering the diversity of farming systems, one agricultural policy will not fit all farmers' categories taking into account the region and the season. The objective of the 3rd part was to apply SWOT analysis on traditional milk chain, particularly buffalo skimmed milk chain. SWOT analysis highlights the major role of social network to explain the flexibility and adaptation of this sector to the major constraints in link with international competitiveness and national constraints. The aim of 4th part was to characterize the veal supply chain. Survey analysis results indicated that 65 % of Egyptian farmers sold veal as early as possible. Meat quality analysis results explained why the veal meat is regularly consumed by elders, sick people and employees.

Key words: Buffalo, chain, crop/livestock production system, SWOT, skimmed milk, veal

٦ ـ أهم النتائج التطبيقية التى تم التوصل إليها :

(لا تزيد عن سطرين لكل منها)

٦ ـ ١- تطبيق المنهج البحثى المناسب لدراسة إنتاج الألبان والبتلو فى مصر.

٦ ـ ٢- تحديد نقاط القوة و الضعف و الفرص و التهديدات التى تواجه قطاع الألبان التقليدى فى مصر

٦-٣- وضع نموذج مقترح لتطوير قرية لتحسين الإستفادة من الموارد الحيوانية المحلية المتاحة (البتلو)

٧ – ما هى الجهات التى يمكن أن تستفيد من هذا البحث :

(اذكر هذه الجهات مع شرح أهمية البحث لهذه الجهة بما لا يزيد عن أربعة سطور لكل جهة

٧ – وزارة الزراعة : تساعد هذه الرسالة صانعي السياسات الزراعية لفهم سلسلة إنتاج اللبن التقليدية وأهم المعوقات وكيفية النهوض بهذا القطاع. كذلك فهم سلسلة الإمداد بالبتلو وكيفية رفع مساهمة الجاموس فى إنتاج اللحوم على المستوى المحلى بإستخدام النموذج المقترح للقرية المصرية للاستفادة من البتلو، بالاضافة إلى ذلك سوف تساعد صناع القرار والتنمويين في تحديد أولويات الأنشطة لتحقيق التنمية المستدامة وربطها بالبرامج الزراعية على المستوى المحلى و الدولى.

٧ – شركات تصنيع الألبان: يمكن الإستفادة بمعرفة المشاكل التى تواجه الفلاحين وبالتالى تؤدي إلى تقليل جودة الألبان وبالتالى العمل على المساعدة في حل المشاكل للوصول لمنتج ذو مواصفات عالية الجودة.

٧ – مراكز تجميع الألبان: حتى تتمكن من معرفة كيفية تحسين جودة الألبان التى يتم تجميعها من صغار المزارعين.

٨ – هل توجد علاقة قائمة بإحدى هذا الجهات :   نعم ▇   لا ☐

فى حالة نعم اذكر هذه الجهات :

٨ – ١ وزارة الزراعة

٨ – ٢ شركات تصنيع الألبان

٨ – ٣ مراكز تجميع الالبان

ما هى طبيعة العلاقة :

مشروع بحثى ☐

تعاون أكاديمى ☐

مشروع ممول من جهة ثالثة ▇ (اذكر ما هى : Institut de recherche pour le développement (IRD)

https://www.ird.fr/les-partenariats/renforcement-des-capacites/des-programmes-specifiques/jeunes-equipes-associeees-a-l-ird-jeai/liste-des-jeai/mediterranee/jeai-dairy-egypte-2012-2015

أخرى ☐ (تذكر)

٩ ـ **هل توافق على التعاون مع جهات مستفيدة من خلال الجامعة :**

لا ☐ (لماذا   )

نعم ■

(أ) لتطبيق البحث : ■

(ب)   لاستكمال البحث : ■

(ج)   أخرى ☐ (تذكر   )

١٠ ـ **هل تم نشر بحوث مستخرجة من الرسالة فى مجلات أو مؤتمرات علمية**

(تذكر مع جهة النشر و المكان و التاريخ)

Radwan, M.A.; Abdelghany, S.; Corniaux, C.; El-Asheeri, A.K. and Alary, V. (2016). Characterization of the diversity of dairy farming systems and milk marketing strategies around greater Cairo (Egypt). Int. J. of Adv. Res., 4(3):686-698.

١١ ـ **هل سبق التقدم لتسجيل براءات اختراع** (تذكر مع الجهة و المكان و التاريخ)

لا

١٢ ـ **هل توافق على إعطاء البيانات المذكورة فى هذه الاستمارة لجهات أخرى**

نعم ■   لا ☐

توقيع الطالب :   توقيع المشرفين :

                                                        –

                                                        –

                                                        –

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وكيل الكلية (المعهد) للدراسات العليا و البحوث :   التاريخ