

CAMELS AS A MIRACLE KEY FOR ANIMAL PRODUCTION SUSTAINABILITY IN EGYPT

G. Ashour¹ and Samah M. Abdel-Rahman²

1-Animal Production Department, Faculty of Agriculture, Cairo University, 2- Animal Production Research Institute, Agricultural Research Center

SUMMARY

Egypt is an agricultural country, and livestock production is an integral part that accounting 37.5% to the total value of agricultural production. Since 1989, the FAO suggested that the minimum requirements of animal protein per capita is 29.3 g protein/ cap/ day. Unfortunately, in Egypt the daily per capita share of animal protein is 19.2 g. The Ministry of Agricultural and Land Reclamation, the Ministry of Health and the Ministry of Environment have joined forces with the FAO Africa Sustainable Livestock 2050 (ASL2050), to set scenarios for the future of livestock sector. Because, by 2050, it is expected that the demand of animal protein will rise to reach to 109%. This requires farmers to expand and enhance their production capabilities. Additionally in the few decades, the scientists pointed to a very important problem, which is climate change. That represents the environmental, economic and social challenges due to its negative impacts on both agriculture and livestock sectors. Therefore, to face all these challenges, attention paid to a very important animal that consider the key for protecting the socio-economic status and maintain animal production sustainability, which is camel. Camels contribute hugely to human survival in less agro-ecological parts of African, Asian and Arabian deserts, and they are very important in the arid world as sustainable livestock species. Camels possess inimitable features which enable them to survive in extreme desert conditions. This was confirmed through fewer genetic studies, which cleared that, camels have several genes that enable them to adapt to desert conditions. They can withstand with long hunger and thirst, and they can get their energy requirements from the fat stored in their hump. Moreover, camel milk have medical features, but fewer studies were concerning about the therapeutic uses of camel products. Actually, camels must have a huge interest in the field of genetics, because genetic diversity help us in creating the suitable breeding programs for camels.

Keywords: *Camels, Animal production, Sustainability, food security*

INTRODUCTION

The Egyptian Ministry of Agricultural and Land Reclamation (MALR) started to use new plans to develop the agriculture sector since 1980s. Consequently, a decision to develop new strategies for sustainable agriculture towards 2030 and 2050 were established in cooperation with Food and Agriculture Organization (FAO) of United Nations, to face the global and local challenges of agriculture in Egypt.

The term "Sustainability" refers to the importance of studying interactions between natural and social systems and how this interaction can affect sustainability?. In order to meet the recent and future population needs and to overcome poverty (El-Ramady *et al.*, 2013). The three pillars of sustainability are regarded as the reconciliation of environmental, social equity and economic demands. In the last decades, Egyptian populations increased and currently reached to 101 million and it is expected to be 151 million in 2050. These population elevations will result in increasing livestock products demands, which expected to be 109%, 290% and 162% for beef, milk and egg production, respectively (FAO, 2020). Another serious problem started to be existed from several decades, which is climate change (CC). The CC mainly caused by human

activities and gas emission from ruminant's digestive system. Resulted in increasing earth temperature, sea and salinity levels. According to the report of WBG (2020). Maximum mean annual temperature change in Egypt is expected to be 1.8°C to 5.2°C by 2080. While, minimum of temperature change will be 1.5°C - 4.6°C (Figure, 1) over the same period. It is expected that, the temperature anomaly during 2080 - 2099 will be + 3.4 - 6.2 (Table, 1). In addition, the report pointed out to the increase in heat waves duration (may be lasted to 9 days) and the cold season is expected to be shorter. Actually, domestic animals (buffalo, cattle, goat and sheep) can deal with CC to a certain limits. After that, they lose their ability to adapt to these changes (Al Jassim and Sejan, 2015).

So, to increase and sustain food security for the expected growing population, attention must be directed to God miracle on earth, which is, camel (ship of the desert). Camels have morphological and physiological features that enable them to stand with harsh environmental conditions. Nonetheless, this animal is one of the most neglected species compared with other domestic animals. Piro *et al.* (2020) stated that there is absence of clear genetic differences between camel species that impedes of their genetic improvement. Moreover, there are differences and less accuracy in camels stock at global level.

Table 1. Expected temperature anomaly in Egypt from 2020 to 2099

Temperature Anomaly (C°)	Years			
	2020-2039	2040-2059	2060-2079	2080-2099
	+0.6 – 1.7	+1.5 – 3.0	+2.4 – 4.5	+3.4 – 6.2
	(1.6)	(2.1)	(3.3)	(4.4)

Source: WBG (2020)

For example, Faraz *et al.* (2019) mentioned that, camels number in worldwide is 26 million head. While according to FAO (2019) statistics, there are 35 million head all over the world. These differences could be attributed to, some reports of camel number is not updated and most of authors are depending on FAO statistics. Unfortunately, there is a gap between the FAO data and the national reports of camel numbers because, it is not well addressed. Additionally, within the country, the statistical data

vary according to their institutions or source (Faye, 2020). Therefore, camels with their miracle and unique features deserve more attention and put them in our consideration to face the upcoming challenges.

The objective of this review is focusing on the importance of camels and their role in food security with reference to the most important recommendations to maximize their role in animal production sustainability.

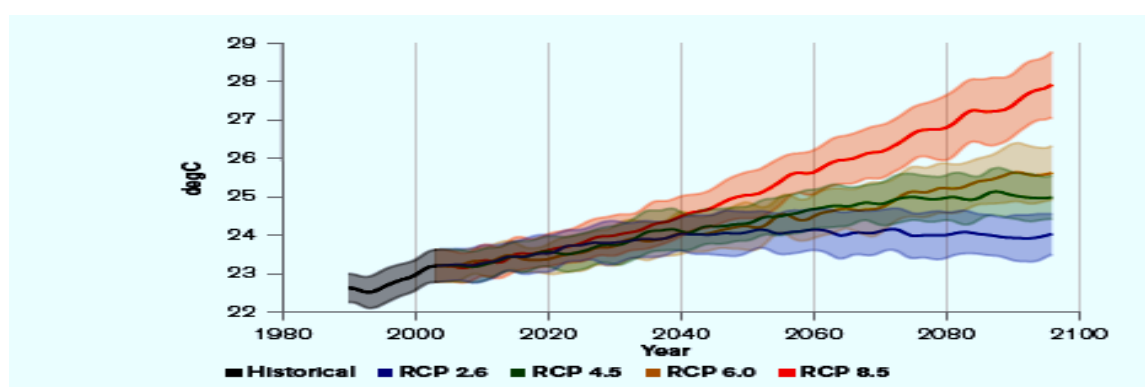


Figure 1. Historical and projected average temperature for Egypt from 1980 to 2099.

Camels in Egypt and their role in food security:

Food security is the main issue in the global agenda, because it is linked to the goal of sustainability development. In 2018, the FAO and World Health Organization (WHO) gave the priority of food security to provide the needs of expected growing population and to increase the awareness of dealing with the expected consequences of CC (Orazov *et al.*, 2020). With all these expectations, we need to focus on camels, they have the ability to utilize low feed quality and use water in economic way during dehydration period, and fluctuating their

body temperature to reduce sweating rate (Faraz, 2020).

Camel stock in Egypt:

Since 2010 until 2017, the growth rate in camel numbers is regular (Figure, 2), they increased from 110,571 to 155,713 head, respectively. Then at 2018, a noticeable decrease (85,293) was recorded, then after, their numbers retain to recover in 2019 to be 119,885 head according to the statistics of FAO (2021).

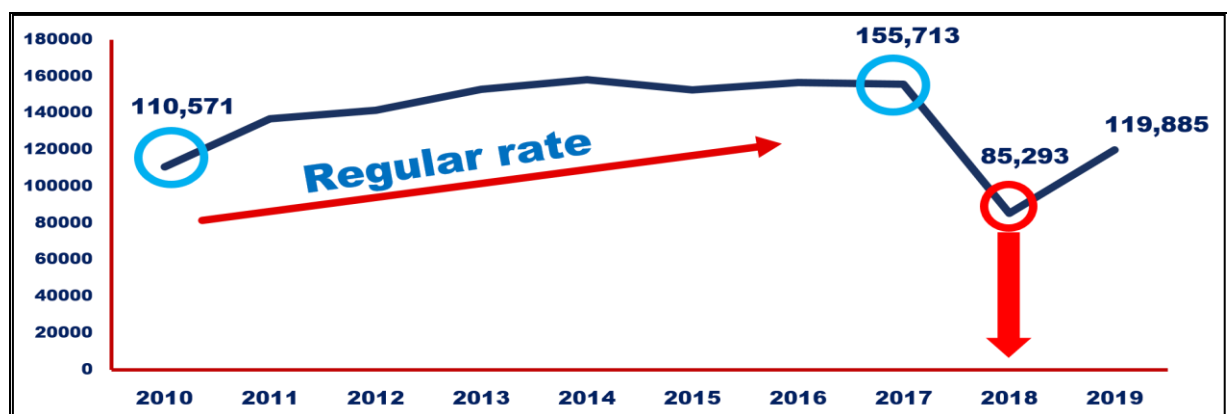


Figure 2. Changes in camel stock in Egypt from 2010 to 2019 according to FAO (2021).

Additionally, FAO (2021) recorded that camel share percent to total livestock is considered very low, not exceeded that 1.33 % (recorded in 2017). So, Egypt is classified as low proportion country of camel. At global level, camels total livestock unit (TLU) among different livestock is ranged between 2.8 – 4.4 %. The parameter of TLU is simply defined as live weight of 250 kg during the period of 1961 – 2018 in the countries with high camel population. In addition, Egypt have annual negative growth rate (-24), while Oman have the highest growth rate of camel (+45.29) according to data of FAO (2020).

In Egypt, there are five camel breeds (Falahi or Baladi, Maghrabi, Somali, Sudani and Mowalled, that hybrid between Maghrabi and Falahi). These

breeds are distributed in Nile Delta, desert regions (such as Matrouh) and oasis (Sallam 2020).

In Matrouh, Mansour and Faye (2016) applied a questionnaire included 51 questions to 200 camel owners in three different regions Matrouh (n=30 farms), Sedy prane (n=100), Al negela (n=70). As shown in Table (2), the majority of camels in Matrouh governorate is adult female more than male. Most of camel owners (90%) are rearing other types of domestic animals used as another source of income, and 10% of the owners breed camel only. The goal of camel breeding was for extensive (91.5%), dairy (1.5%) and for fattening (7%).

Table (2) Camel male and female numbers in Matrouh governorate

Herd composition	Age	Gender	Number
Camels	Young	F	311
		M	171
	Sub adult	F	846
		M	124
	Adult	F	3351
		M	115

F = female, M = male (Adopted from Mansour and Faye, 2016)

Previously, Abdel-Aal *et al.* (2012) mentioned that, Maghrabi breed is the main one in New valley and the only one in Matrouh governorate. Meanwhile, Sudani is the only breed in Aswan and the main one in Sharkia. They also found that camels are suffering from low productive performance and delay in puberty in Matrouh than that in Sharkia and Aswan governorates. They attributed that, to feeding on green fodder in such governorates, which positively affect productive and reproductive performance than camels reared in Matrouh. Actually, there is a lack in studying camel distribution in Egypt, Faye (2020) stated that there is missing data in world information about camel distribution and should be wider than that reported by FAO.

The potential of camel production

Camels are multipurpose, they can be used for transporting (such as Falahi), racing (Sudani and Somali) and for meat production (Maghrabi).

Camel meat:

In Egypt, the per capita share of animal protein is lower (19.2 g protein/day) than the recommendations of FAO in 1989 (El-Badawi, 2021). According to the data of Egyptian Agricultural and Land Reclamation. There was a reduction in red meat production (858,000 tones) in 2020 than that produced in 2017 (880,000 ton). This reduction could be attributed to several factors such as;

- Weak of genetic makeup to enhance local breeds productivity
- Climate change and its impact of lands, green fodder availability in summer season

- Poor services in newly reclaimed areas and lack of water needed for irrigation

In the light of foregoing, attention must be paid to the importance of increasing camel meat spread in the Egyptian markets, because of its incredible productive and medical features. The most importantly, the spread of camel meat may contribute to elevate red meat production and facing the demand of animal protein in the future (El-Badawi, 2021).

Actually, Egypt is considered the most imported camel meat, and the slaughtering rate (Figure, 3) reached to 121% which indicating that, Egypt is more importing for live camels than that exporting them (Faye *et al.*, 2014). Egypt is ranking the fourth in camel meat production all over the world, it is producing 45,000 ton (Figure, 4) of camel meat (El-Badawi, 2018). Based on Egyptian studies, El-Badawi (2021) stated that, fattening camels has a great economic advantage, because the daily dry matter intake (DMI) is 1.44% of their body weight, while cattle calves consumed 2.5% of DMI of their body weight. Moreover, El-Badawi *et al.* (1999), Yacout and El-Badawi (2001), and El-Badawi and Yaqout (2004) found that, camel average of daily gain was ranged between 810-840 g/day, in calves aged between 2-3 years old, and fed rations containing 12-14% crude protein. The best age for slaughtering camels is 1-3 years and should not be exceeded than 4-5 years old. Because, when they get older, their meat become harder with dark brown color and little seat taste. From the economic point of view, camels produce large amount of meat with less fat percentage and cholesterol level (61 mg) and bone. For example, when camels with 350-700 kg BW can produce 43-62.7% net meat of their BW

with 0-4.3% fat and 15.9 – 38.1% bones (El-Badawi, 2021).

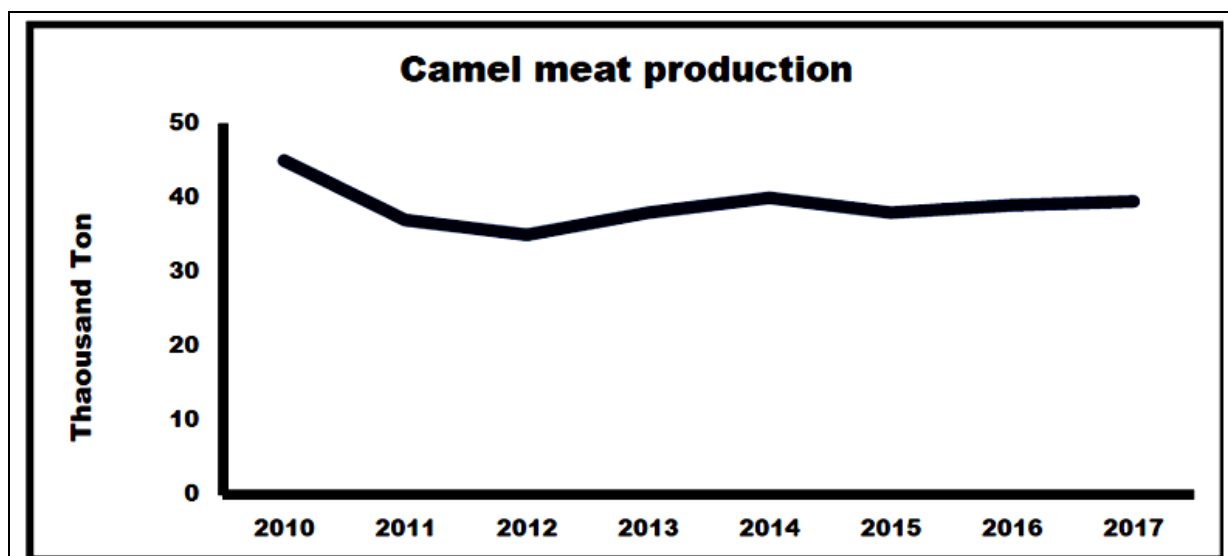


Figure 3. Camel slaughtering rate in Egypt during 1961-2009, Faye (2013).

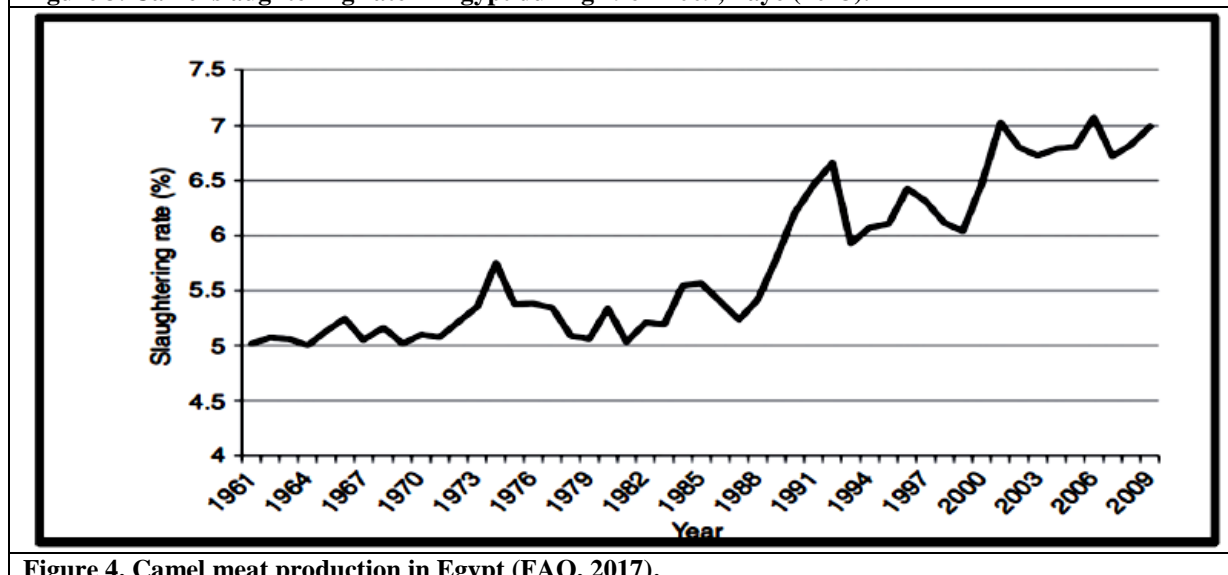


Figure 4. Camel meat production in Egypt (FAO, 2017).

There are several facts about camel meat, such as having a variety of vitamins and minerals (B complex, Ca, Fe,.....etc.) with higher percent of amino acids and lower content of muscular fat. In addition, camel meat contains unsaturated fatty acids that have the ability to protect human against cancer. Having higher level of glycogen that can convert to glucose, which supply the nerve cells with required energy (El-Badawi, 2018 and 2021).

Camel milk:

There are few data concerning the amount of camel milk production either on the global level or in Egypt. Faye (2013) mentioned that, milk production was globally increased form 629.148 ton in 1961 to 2,785,382 ton in 2008. In Egypt, Sallam (2020) stated that, camel milk yield is under estimation. In general, they produce 3.5-20 kg milk / day, depending on feed quality and seasonal variations (Mostafa *et al.*, 2017).

Camel milk have salty taste, with opaque white color because of finely homogenization of fat throughout milk. Also, it is rich in vitamin C (Vit C) that gave camel milk the powerful of antioxidant property. In addition, Vit C caused reduction in pH thus can be preserved for longer period (Yadav *et al.*, 2015). As well as, their milk containing immunoglobulins that give human body protection against bacterial and viral infections (Mal *et al.*, 2006). El-Agamy (2000) cleared that, immunoglobulins are found in camel milk throughout lactation period. When human consumed camel milk, small immunoglobulins can pass to human blood to boost and rehabilitating immunity against diseases. Besides that, camel milk have much lactoferrin than other ruminants. Its role is preventing bacterial growth and supporting the primary immune system to invade pathogens (Yadav *et al.*, 2015). In 1998, Kiselev discovered peptidoglycan recognition protein

in camel milk. This protein controlling metastasis and stimulating response of host immune system (Kustikova, 1996). According to Singh *et al.* (2006), camel milk is richer than cow milk in insulin, calcium, potassium, niacin, and whey acidic protein. With lower content of fat (Table, 3). In 2017 Abbas *et al.*, compared milk composition in lactating animals in Egypt (buffalo, cattle, camel, goat, and sheep).

They confirmed that, camel should receive special care to produce more milk on large scale and this could be achieved though establishing dairy farms specific for camel with providing health care and management. Thus could save million dollars and will elevate milk share per capita.

Table 3. Differences between camel and cow's milk

Parameters	Camel milk	Cow milk
Water (%)	90	87
Total solids (%)	10.00	13.00
Fat (%)	2.00	4.00
Insulin (μu/ml)	40.50	16.30
Iron (Mg/100g)	0.05	0.27
Calcium (Mg/100g)	132	120
Potassium (Mg/100g)	152	140
Zinc (Mg/100g)	0.50	0.40
Vitamin C (Mg/ml)	35	10
Niacin (Mg/ml)	4.60	0.60
Pantothenic acid (Mg/ml)	0.90	3.80
β-lacto-globulin (Mg/ml)	0	3500
Whey acidic protein (Mg/ml)	157	0
Peptydoglycon recognition protein (Mg/ml)	107	0
β- lacto albumin (Mg/ml)	3500	1200
Kappa casein (%)	5.00	14.00
Casein micelles (μm)	320	160
Whey protein (%)	1.00	0.80
Omega-6 (%)	3.50	5.20
Omega-7 (%)	11.60	2.30

Source: Singh *et al.*, (2006)

Do camels receive their welfare?

Several studies in the last decades confirmed the incredible features of camel products, suggested to improve and expand marketing for their products and give the animal more attention and care. But, unfortunately the required welfare for camels was not set up. There is a scarcity in the information between camel physiology and behavioral aspects for example, impact of housing conditions on camel welfare and its relation with human (Padalino and Menchetti, 2021). To assess camel welfare, there are specific indicators should be considered, some of them are based on animal (health records, body condition score). Others based on management such as; the allowed space for individual animal, feeding system and environmental conditions (Welfare Quality, 2009 and AWIN, 2020). Unfortunately, camel welfare specific indicators have not been well developed yet. The World Organization for Animal Health, documented camel as transporter animal with no chapter for camel production. Padalino and Menchetti (2021) stated that, camel did not receive

any interest in the second largest European project "The Animal Welfare Indicators Project". Actually, the study of Padalino and Menchetti (2021) was almost the first one to ensure the importance of camel welfare. They used three levels to set these indicators, the first one; caretaker level, through asking the breeder (face to face) questions mainly based on management system. Such as, how many time the breeders feed their camel? did they notice any abnormalities on camel (e.g. diseases) and how they deal with these abnormalities?. The second level, herd level, this including where the animal is kept and is it clean or partially dirty?, if the place of feeding and watering camel clean or not?. Is the housing system including shades or not?, if yes, what are the dimensions of these shades?. The third level is animal level, which concerning about body condition scoring, and whether the level of nutrition is good or not. From their study, the authors confirmed the importance of applying this protocol by scientist and stakeholders, to set the standard welfare indicators for camels.

Socio-economic importance of camels:

The contribution of camels to human welfare is obscured in spite of their versatility of their ability to survive and produce in harsh conditions. Camels have great socio-economic importance, because they are the cheaper source for people transportation and goods. Besides that, camels can be used in drawing water from wells, crushing sugarcanes, ploughing, grinding wheat and other grains (Ahmed *et al.*, 2010). In the Arabian community, camel breeding has three systems, the first one; is nomadic Bedouin system, which have large camel numbers reaching to 100 heads and camels are considered the main source for food and cash income. The second system is, semi-Bedouin who temporary transported with their families during rainy season then returned to their home. In this system, camel owners have usually small camel numbers, because they do not depend-on camels for their income, they are using camels only for travelling. In the third one (settled Bedouin system), farmers own olive oil factories and have very small number of camels (1-5) and they are rearing camels for milk production and transportation. There is another system which is pastoral farm that already exist in Egypt on large scale, in order to prepare the imported camels from Sudan to be ready for slaughtering or for sale. But, feeding in this system occupy 70% of total production cost, so further studies are urgently needed to decline feeding costs. In the areas of north-west coast, Saini, Sharkia, Behaira and Fayoum camels are rearing in semi-intensive system that depending on grass land and residues of cultivated crops in feeding camels (El-Seretty, 2014).

Mansour and Faye (2016) studied camel socio-economic importance in Matrouh governorate, Egypt. Through carrying out a questionnaire for camel herders and they found that, 33% of them were illiterate, 57.5% was educated in Kottab, 3% have primary education and 2% and 4.5% got secondary and high education, respectively. Majority of camel owners (85.5%) have good experience in camel breeding reaching to 20-30 years. In addition, they recorded that, most of those herdsmen (68%) were working as farmers, 7% as business man, 1.5% as housewife, 5% as employee and 1% was retired. Additionally, the main purpose for rearing camels was extensive breeding while 1.5% and 7% of camels were used for milk production and fattening, respectively.

In Pakistan, Faraz *et al.* (2021) carried a questionnaire for camel herdsmen to evaluate their management practice, socio-economic status and identified the most constrains that facing camels pastolists living in desert regions. They illustrated

that, educational level of 48% of pastoralists were illiterate. While, most of them reached to primary level, and about 42% of those herdsmen have their own land and others are landless. Besides that, they recorded that, 70% of herdsmen owned 2-3 adult camels and 2-3 calves.

The longevity of she-camel lasted for 15 years, they allowed young calves to suckle from one side (from two teats only), and the other side is for the herder consumption. The results also cleared that, 20% of young camel calves obtained their all milk needs, while the rest get their need restrictedly until reaching to weaning age (10-12 months). As well as, she-camel can lactate for 6-18 month producing 5-9 kg milk/day (in average). The camel males are sold at age 8 years old. Generally, camels in Pakistan are reared in semi-shaded open yard and the herdsmen give them water for 2-3 times/ day. They let camels go for grazing (8-10 h/day) and consuming crop residual. The herders also breed goat and sheep (due to their early maturity) besides camels. Moreover, they pointed out that, some people in Pakistan are considering camel milk is taboo. This point emphasized the urgent actions to increase awareness of camel milk importance and conducting scientific research to enhance camel milk taste, which is not preferred by many without compromising its components.

Therefore, camel herders should be directed to the right way in camel breeding and how they can provide the suitable management and health care. Because camel breeding under good management and feeding system can reproduce and produce more milk and meat in efficient way. Thus, their contribution in socio-economic importance will expand.

Do camels receive adequate attention in the field of scientific research?

After ignoring camels for long time, the interest in camels has gradually increased at global level. In order to seek niches and working on basic requirements that are necessary for developing camel industry. Pastarana *et al.* (2020) carried out electronic search to clarify scientific advance in camel production. They typing the words of camel, camelid, camelus on the site of www.science-direct.com to obtain data about the published research articles during the period 1880-2019. They found that, there were 24,611 published papers, most of them (13,932) were published during the period 2000-2019. While, 10,679 published from 1880 to 1999 with an average 177 articles/year (we summarized most of their results on Figures, 5 and 6 adopted from their articles).

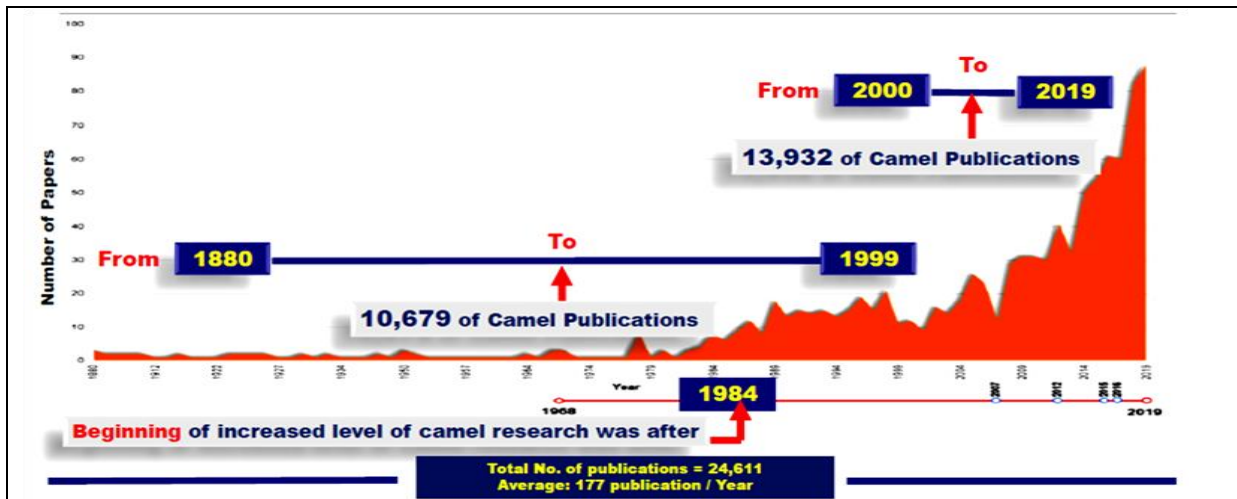


Figure 5. Number of camel publications during the period 1880-2019 (According to Pastarana *et al.*, 2020).

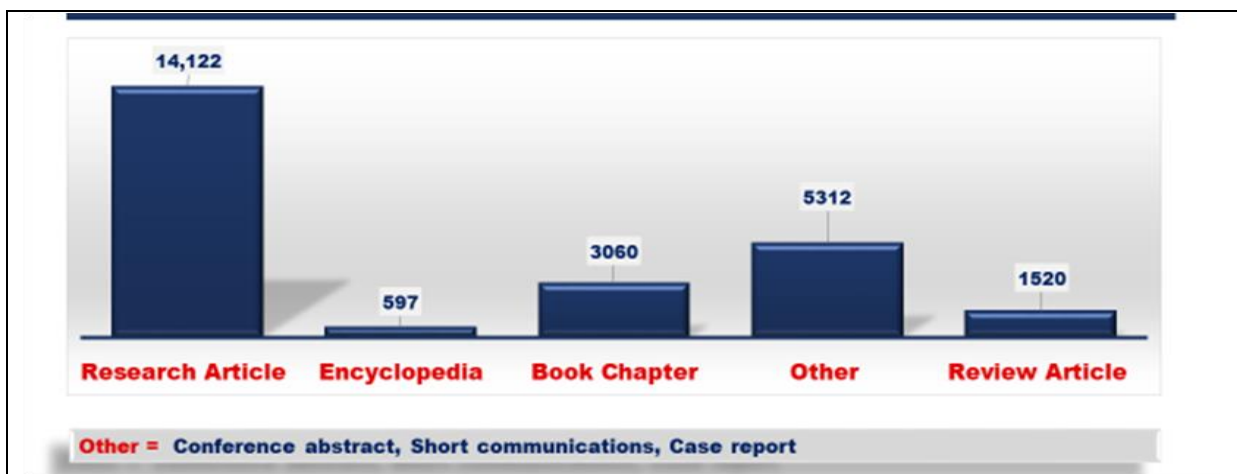


Figure 6. Variations in camel publications during the period 1880-2019 (According to Pastarana *et al.*, 2020).

Concerning camel papers per country, Egypt was classified with country published 51-101 in the field of camel research articles (Map, 1). Ranking the third

country all over the world after Saudi Arabia and United Arab of Emirates.



Map 1. Egypt ranking in camel publications (According to Pastarana *et al.*, 2020).

Can camels be the best solution for animal production sustainability?

One of the most important sustainable challenges is to maintain economic development without increasing using of resources and negative impacts on environment. This could be achieved through, using technologies that break the link between growth of economic and environmental damage.

As mentioned previously, camels are 35 million head in all world. In spite of their number is considered marginal in comparison with other domestic animals (buffalo and cattle, Figure, 7), they have faster growth rate compared with cattle and similar with those of buffalo.

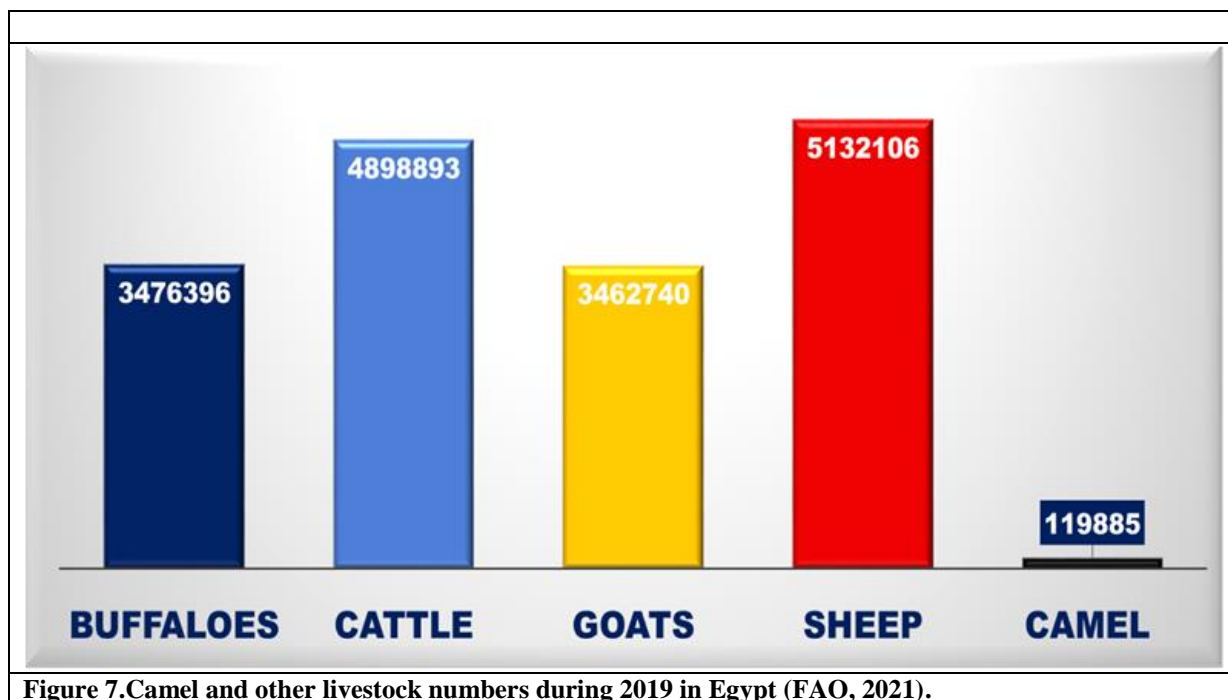


Figure 7. Camel and other livestock numbers during 2019 in Egypt (FAO, 2021).

Camels are considered as the most important animals in Bedouin system and significantly contribute to desert productivity. Indeed, camel could be the best solution to maintain sustainable development. Because, CC caused extension of Sahara (desertification) and increased aridity of the environment. In such conditions, camels are animals less affected by climate change.

The way that CC effects on camels is through increasing the geographical distribution for this species. Moreover, the changes in world economy and its globalization leads to work on increasing camel products sharing more than its recent marginal contribution (Faye, 2016). Especially that, in some countries, there are specific factories for camel milk products were established, which leads to the appearance of new products made of camel milk such as yogurt and cheese (Faye et al., 2014). In 2006, The International Society of Camelid Research and Development (ISOCARD) was held in Arab United Emirates. The aim of this annual conference is to focus on increasing research on camel science and gave more acclaim on the field of “Camelology”, and there were few research articles were already presented in this field in the Fourth International Conference of ISOCARD held at Almaty Kazakhstan (Faye, 2016).

As it well known, camels in the pastoral areas can feed on halophytes, trees and variety of plants that ruminants cannot feed on, and they grazing for 8h/day. The digestive system helps camel to feed on such plants through slow transit, nitrogen recycling and ruminal microflora. In fact, camel farming in recent years turned into intensive system to develop camel production. In this system, camels feed twice daily; this enables the scientists to study the impact of feeding system (free or limited) on digestive system microflora and metabolism. Could feeding system affect milk composition?. Moreover, a comparison between two systems (free and limited feeding in intensive system) should be held. Additionally, in intensive system camel farming it is necessary to calculate water consumption. Because, in Saudi Arabia camel water consumption was multiplied 3.2 which caused pressure on water resources (Faye, 2016).

The aspects to maintain sustainability of camel economy, are the integration and balance between the services that provided by camel farming and the negative impact of camel farming on environment. Furthermore, to sustain business practice, the prices and taxes of camel products should be added to the aspects that linked to camel farming success (Faye, 2013).

RECOMMENDATIONS

- There is an urgent need to conduct an official count of the camel population, because enough evidence to suggest that the camel place would be strongly growing
- Camels are considered as a sustainable food security animal, if accomplished to highest possible extent, will increase the effectiveness of camel value chain and breeders quality of life will be noticeable enhanced. However, the success could be multiplied if governorate may advise community education, veterinary cover, marketing facilities and interest, free small loans for pastoralists.
- Stakeholders and authorities must re-evaluate the urgent needs of indigenous communities, their education, husbandry skills to promote economic/financial support in low-income remote areas.
- There is an urgent need for extensive educational and training programs for pastoralists with the intent of improving their management practices and to refine their traditional knowledge.
- Multi-site factorial experimentation, including nutritional and climatic studies and manipulation are required in order to elucidate the mechanisms, which govern seasonality.
- Reducing age at first parturition, some shortening of birth intervals and slightly increased age at culling could easily lead to another young per breeding female career.
- It is urgent to work on improving meat quality. Working to set accurate record system for camels (population, growth rate, milk production, meat production). This will help in establishing genetic improvement to enhance camel productivity.
- Further studies on calf mortality are urgently needed, because it is a major problem that slows down herd growth in camel production systems. The reason behind is the lack of veterinary care and mostly the pastoralists rely on ethno-veterinary practices and traditional treatment methods while it is well proved that the access to veterinary services considerably reduced camel calf mortality.
- Studies should be applied on camel welfare, to illustrate their own welfare indicators.

CONCLUSION

Camels are a good source of milk and meat, especially in arid and severe aridity regions where negative of environmental and weather changes are adversely affected the performance of other farm animals. Therefore, they can play a miracle role in

food security, especially if they receive attention and updating studies that help in maximizing the productivity of camels and thus increasing their role in the animal production sustainability.

From the social point of view, the binomial "Science-Society" should take more serious steps, because the social awareness is depending on science to increase camel role in socio-economic development.

REFERENCES

- Abbas, H.M., O.A. Ali, J.M. Kassem and W.M. Zaky, 2017. Evaluation of different types of Egyptian milk from biochemical aspects. *Inter. J. Dairy Sci.*, 12: 130-136.
- Abdel-Aal, E., A. Aboul-Naga, M. Osman, B. Rischkowsky, M. Madboly and A. Haile, 2012. Production and reproduction performance of camel herds under different production systems in Egypt. *Proceedings of the ICAR Satellite Meeting on Camelid Reproduction 2012 - Vancouver, Canada* 163-166.
- Ahmad, S., M. Yaqoob, N. Hashmi, Ahmad, S. M. A. Zaman and M. Tariq, 2010. Economic importance of camel: Unique alternative under crisis. *Pak. Vet. J.*, 30: 1-8.
- Al Jassim, R., and V. Sejian, 2015. Review paper: Climate change and camel production: impact and contribution. *J. Camelid Sci.*, 8: 1–17.
- AWIN, 2020. European Animal Welfare Indicators Project, Animal Welfare Science Hub. (2020). Available online at: <http://www.animalwelfarehub.com/about-us>.
- El-Agamy, E.I., 2000. Specific immunoglobulins to human rota virus in camel colostrum and milk. In: *Proceeding of 2nd International Camelid Conference, Agro-economics of Camelid Farming*. Almaty, September, p.98.
- El-Badawi, A., 2018. The present situation of animal protein in Egypt and the role of camels in providing cheap and healthy meat for people in poor greenery lands. *Inter J. Avian Wildlife Biol.*, 3: 319–322.
- El-Badawi, A., 2021. "Camels can Provide a Solution of Red Meat Shortage in Egypt", In: *New Visions in Biological Science*, Chapter, 10, Vol. 2, Pp 100-107. doi: 10.9734/bpi/nvbs/v2.
- El-Badawi, A.Y., and M.H.M. Yacout, 2004. Growth performance and body composition of dromedary camels raised on rations have varying levels of energy: protein ratio. In *Proceeding of the 55th Annual Meeting of the EAAP*, Bled, Slovenia. 2004.
- El-Badawi, A.Y., M. I. Mohamed and I. M. Awadalla, 1999. Effect of feeding regime on body composition and utilization efficiencies of MEM and NEg for Ossimi lambs during finishing-growth period. *Egypt. J. Nutri. Feeds*, 2:17.
- El-Ramady, H. R., M. S. El-Marsafawy and N. L. Lowell, 2013. Sustainable Agriculture and Climate Changes in Egypt, In, *Sustainable*

- Agriculture Reviews, Eric Lichtfouse, Springer Dordrecht Heidelberg New York London, Pp: 1-63.
- El-Seretty, S. M. A., 2014. Possibilities for developing of camels in the most severe arid areas in the Arab world by using modern biotechnology. *American-Eurasian J. Agric. Environ. Sci.*, 14 (12): 1322-1338.
- FAO, 2017. Country brief Egypt. <https://www.fao.org/publications>.
- FAO, 2019. Food and Agriculture Organization of the United Nations, Rome, Italy. The report can be downloaded from: <http://faostat.fao.org/site/339/default.aspx>.
- FAO, 2020. The long-term future of livestock and fishery in Egypt Production targets in the face of uncertainty. <https://www.fao.org/publications>.
- FAO, 2021. Food and Agriculture Organization of the United Nations. The report can be downloaded from: <http://www.fao.org/faostat/en/#data/QA/visualiz>.
- Faraz, A., 2020. Food security and socio-economic uplift of camel herders in Southern Punjab, Pakistan. *Land Sci.*, 2: 1-4. <https://doi.org/10.30560/ls.v2n2p8>.
- Faraz, A., Y. Muhammad, C. I. Pastrana, A. T. Nasir and S. N. Muhammad, 2021. Socio-economic constraints on camel production in Pakistan's extensive pastoral farming. *Pastoralism: Res. Policy Prac.*, 11: 1-9.
- Faraz, A., A. Abdul Waheed, R. H. Mirza and Ishaq, H. M. 2019. Role of camel in food security: A perspective aspect, *J. Fisheries Livest. Prod.*, 7:1-2.
- Faye, B., 2013. Camel farming sustainability: The challenges of the camel farming system in the XXIth century. *J. Sustainable Dev.*, 6: 74-82.
- Faye, B., 2016. The camel, new challenges for a sustainable development. *Trop. Anim. Health Prod.*, 48:689-692.
- Faye, B., 2020. How many large camelids in the world? A synthetic analysis of the world came demographic changes. *Res. Policy Pract.*, 10: 1-20. <https://doi.org/10.1186/s13570-020-00176-z>
- Faye, B., H. Madani and A.H. El-Rouili, 2014. Camel milk value chain in Northern Saudi Arabia. *Emir J. Food Agric.*, 26: 359-365.
- Kiselev, S.L., 1998. Molecular cloning and characterization of the mouse tag-7 gene encoding a novel cytokine. *J. Biol. Chem.*, 273:18633-18639. doi: 10.1074/jbc.273.29.18633.
- Kustikova, O.S., 1996. Cloning of the tag-7 gene expressed in metastatic mouse tumours. *Russ. J. Gene.*, 32: 540-546.
- Mal, G., S. D. Suchitra, V.K. Jain and M.S. Sahani, 2006. Therapeutic value of camel milk as a nutritional supplement for multiple drug resistant (MDR) tuberculosis patients. *Israel J. Vet. Med.*, 61: 88-94.
- Mansour, S., and B. Faye, 2016. Socioeconomic study for camel farming system in Egypt. *Inter. J. Econom. Commerce Manag.*, 6: 377-389.
- Mostafa, T.H., O.M. El-Malky, A.M. Abd El-Salaam and A. M. Nabih, 2017. Some studies on milk production and its composition in Maghrebi She-camel under farming and traditional pastoral systems in Egypt. *Inter. J. Hort. Agric.*, 2: 1-9.
- Orazov, A., N. Liudmila, B. Kazybay, M. Muradova and A. Zhumayeva, 2020. Role of camel husbandry in food security of the Republic of Kazakhstan. *Agric.J.*, 11: 1-16. doi.org/10.3390/agriculture11070614.
- Padalino, B., and L. Menchetti, 2021. The first protocol for assessing welfare of camels. *Frontiers Vet. Sci.*, 7: 1-16.
- Pastrana, C. I., J.N. Francisco, E.C. González, B.C. Cecilio and V. Juan, 2020. Effect of Research Impact on Emerging Camel Husbandry, Welfare and Social-Related Awareness. *Anim.* 1-20. doi:10.3390/ani10050780.
- Piro, M., F. E. Mabsoute, N., El Khattaby, H. Laghouaouta and I. Boujenane, 2020. Genetic variability of dromedary camel populations based on microsatellite markers. *Anim.*, 14: 2452-2462.
- Sallam, A.M., 2020. Future opportunities for genetic improvement of the Egyptian camels. *Egypt. J. Anim. Prod.*, 57:39-45.
- Singh, R., S. K. Ghorui and M.S. Sahani, 2006. Camel milk: Properties and processing potential. *The Indian camel. NRCC, Bikaner*. Pp. 59-73.
- WBG, 2020. World Bank Group; Climate Risk Country Profile, Egypt. 1818 H Street NW, Washington, DC 20433, Pp 1-28. www.worldbank.org.
- Welfare Quality, 2009. Welfare Quality R Assessment Protocol for Cattle. Lelystad: Welfare Quality R Consortium (2009).
- Yacout, M. H. M., and A. Y. El-Badawi, 2001. Effect of dietary protein level on fattening performance of camel calves. *Egypt. J. Nutri. Feeds*, 4:545.
- Yadav, A. K., R. Kumar, P. Lakshmi and J. Singh, 2015. Composition and medicinal properties of camel milk: A Review. *Asian J. Dairy Food Res.*, 34: 83-91.

الإبل المفتاح المعجزة لاستدامة الإنتاج الحيواني في مصر

جمال عاشور^١، سماح محمد عبد الرحمن^٢

١- قسم الإنتاج الحيواني، كلية الزراعة، جامعة القاهرة، ٢- معهد بحوث الإنتاج الحيواني، مركز البحوث الزراعية

مصر بلد زراعي، والإنتاج الحيواني يمثل ٣٧.٥٪ من القيمة الإجمالية للإنتاج الزراعي. منذ عام ١٩٨٩، اقترحت منظمة الأغذية والزراعة أن الحد الأدنى لمتطلبات البروتين الحيواني لكل فرد هو ٢٩.٣ جم بروتين / فرد / يوم، ولسوء الحظ، في مصر نصيب الفرد اليومي من البروتين الحيواني هو ١٩.٢ جرام. تعاونت وزارة الزراعة واستصلاح الأراضي ووزارة الصحة ووزارة البيئة مع منظمة الفاو للثروة الحيوانية المستدامة في إفريقيا ٢٠٥٠ (ASL2050)، لوضع سيناريوهات لمستقبل قطاع الثروة الحيوانية. لأنه بحلول عام ٢٠٥٠، من المتوقع أن يرتفع الطلب على البروتين الحيواني ليصل إلى ١٠٩٪ وهذا يتطلب من المزارعين توسيع وتعزيز قدراتهم الإنتاجية. بالإضافة إلى ذلك، في العقود القليلة الماضية، أشار العلماء إلى مشكلة مهمة للغاية، وهي تغير المناخ. وهذه تمثل تحديات بيئية واقتصادية واجتماعية لما لها من آثار سلبية على كل من قطاعي الزراعة والثروة الحيوانية. لذلك، ولمواجهة كل هذه التحديات، يجب الانتباه إلى حيوان مهم للغاية يعتبر مفتاح حماية الوضع الاجتماعي والاقتصادي والحفاظ على استدامة الإنتاج الحيواني، وهو الإبل.

تساهم الإبل بشكل كبير في بقاء الإنسان في الأماكن الأقل إستزراعاً في الصحاري الأفريقية والآسيوية، وهي مهمة جداً في العالم القاحل كأصناف حيوانية مستدامة. تمتلك الإبل سمات فريدة والتي تمكنها من البقاء في ظروف الصحراء القاسية. وقد تأكد ذلك من خلال عدد قليل من الدراسات الجينية التي أوضحت أن للإبل عدة جينات تمكنها من التكيف مع ظروف الصحراء. حيث يمكنهم تحمل الجوع والعطش لفترة طويلة، ويمكنهم الحصول على احتياجاتهم من الطاقة من الدهون المخزنة في سنامهم. علاوة على ذلك، فإن حليب الإبل له خصائص طبية، ولكن القليل من الدراسات أجريت عن الاستخدامات العلاجية لمنتجات الإبل. في الواقع، يجب أن نهتم بالإبل بشكل كبير خاصة في مجال الوراثة، لأن التنوع الوراثي يساعدنا في إنشاء برامج التربية المناسبة للإبل.