



The Economic Importance of Camel Production in the Red Sea State

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Abstract

This study was aimed for the assessment of the current camel production and determining it is economic feasibility in the Red Sea State, Sudan during the year 2022. For this study eighty (80) respondents from camel owners and herders were selected randomly from three Localities. Questionnaire survey was administered to the respondents to obtain data on demography including gender and education level; camel management systems, prevalence diseases and some production practices. The results indicated that the majority of the surveyed respondents were males 75% versus 25% for females and they were less educated 28.75% of them were illiterate. Based on the respondents responses it is clear that camel milk and meat production were economically feasible while hides and hair were less. Moreover, camel could be a reliable and sustainable option for food security during droughts. The obtained results revealed that the majority of camels are managed under extensive system (62.5%). Moreover, Rashidi camel is the highest milk producing breed followed by Bishari then hib-kwalit while to the least is white Anafi. The results also showed that the most prevalence camel diseases are: incidence of mange, followed by respiratory infections, then camel box and low incidence of mastitis. Milk yield reported in the questionnaire was ranged between 1-14 liters per day per she- camel with a mean of 7.5 liters per day. It was therefore concluded that under extensive management system camel production is economically feasible in the Red Sea State.

Key words: camel, management, hide and skin.

1. Introduction

Sudan is one of the highest countries in the world owing camel population and only second to Somalia. Sudan camel population is estimated as 4.960 million heads according to (AOAD, 2022). The majority of Sudanese camels are found in the Western regions mainly in Kordufan and Darfour, besides the Eastern regions particularly in the Butana plains and the Red Sea hills (El Amin, 1979; Eisa and Mustafa, 2011). Camels are of significant socio-economic importance in many arid and semi-arid parts of the world and their milk constituting an important component of human diets in these regions Farah (1986). Most of camel breeders are illiterates and they keep no production records (Musa et al., 2006; Ishag and Ahmed 2011). Moreover, there is no official data so it is difficult to estimate camel milk production under this situation (Al Haj and Al Kanhal, 2010). Camels are raised for milk production in most regions of the world, however, in other nations camels are used as form of amusement, tourist attraction and as means of transport in the remote areas and along the beaches (Gebremichael et al., 2019). Camels are very important to the pastoralist communities, particularly in the arid and semi-arid lands, where they provide transportation, meat and milk for households, as well as other by products including hides and hair in addition to earning money from the sale of live animals (Aujla, et al., 2013; Elhadi et al., 2015). Camels have excellent advantages in ability to adapt and remain productive under harsh climatic conditions, so they are economically viable in arid lands (Nori et al. 2006). Science the issue of food security has come to the world's attention due to increased human population growth, camel can plays an important role not only in the food security but also to the national economy of various countries in the world (Faraz et al., 2013). Therefore, this study aims to evaluate the current status of camel production and to determine it is economic feasibility.



2. Materials and Methods

2.1 Research Design

The research was conducted using a descriptive survey design for gathering information by sampling some of the camel owners and herders in the study areas. The survey was conducted using questionnaires and personal interview. The survey was performed in sampled camel owners and herders in three localities in the Red Sea State. The population of this study was 80 members from camel owners and herders. The population target of the study particularly consisted of 30 members from port Sudan, 30 members from Sinkat and 20 members from Sawakin. The questionnaire composed of two sections. The first section captured general information about the respondents while the second section was related to information on camel production factors.

2.2 Study area

This study was conducted in Red Sea State of Sudan in three localities particularly (Port Sudan, Sawakin and Sinkat) during the year 2023. The Red Sea State is located in the north eastern part of Sudan between latitude 17° to 22° north and longitude 33° to 38° in the east. The climate of the Red Sea area is typically a semi desert climate with high temperatures and greatly varying, but generally low precipitations, less than a 100 mm per year. Over 90% of the annual rainfall occurs between October and January, mostly in November. The vegetation cover in the state is poor, most of which is found around the streams and Khors at the mountains and in the southern part of the state. The study area was characterized by the presence of various types of trees and shrubs which are browsed by the camels such as the Arak (*Salvadora persica*), Heglig (*Balanitesa egyptiaca*), Sidr (*Ziziphus spinachristi*), Tundob (*Capparis decidua*), Talih (*Acacia seyal*), Senamakka (*Senna alexandrina*), Lisan al-tayr (*Ailanthus altiissima*), Darisa and (*Tibulus maropterus*). The principal types of livestock found in the state are cattle, sheep, goats and camels which represent 6.06% of the ruminants in the Red Sea State (Anon, 2010).

2.3 Statistical analysis and results presentation

The data collected via questionnaire was first coded; arranged, edited and statistical analysis was performed using SPSS Statistics software (version 20.0). Mean and standard deviations were calculated for continuous variables while, frequencies and percentages were calculated for qualitative variables. The obtained data was subjected to descriptive analysis. Cronbach's alpha (α) was used to evaluate the internal consistency of the questionnaires according to (Cronbach and Meehl, 1955). When alpha (α) was 0.7 or higher, indicating a satisfactory level and higher reliability (Boateng et al., 2018). Pearson's correlation coefficient was used to calculate the reliability. Moreover, Pearson's correlation coefficient was also used to determine the relationship between the questionnaire variables and factors. Furthermore, the relationship direction between a given dependent and independent variables was indicated by the positive or negative sign of the coefficient (r).

3. Result and Discussion

3.1 Socioeconomic Characteristics of Respondents

The study involved 80 respondents and their demographic data including gender and education level were assessed. The personal information obtained from the respondents was presented in the (table 1 and figure1) indicates that the majority of the survey respondents were males 75% versus 25% for females. This result is consistent with the finding of Wako et al. (2022) who reported dominant male respondents 89.6% against females and indicating that men were the heads of households and held the bulk of decision-making positions in Borana Zone, Southern Ethiopia. This may be due to the fact that in the study area the majority of camels are owned and herded by males due to society cultures so they have more knowledge on camel production and management.

Table (1) and figure (1) also shows the education level of the respondents; 28.75% were illiterate, Primary level consisted of 25%, intermediate 30 % while a few members reached secondary level that is 11% and only 4 members (5%) of the respondents completed a university education. This low education level can be attributed to the fact that the inability to access the services, inadequate income from the activity isn't enough to educate children to higher levels. Moreover, it may also be because they spend most of their time away with the camels looking for pasture and water. Furthermore, some of the camel pastoralists are not really ready to accept the concept of school. In this result



illiteracy among the respondents is noticeable (28%) which is supported by earlier study conducted in Butana area (Darosa et.al, 2011) and that of Mansour and Faye (2016) (33%) in Matrouh governorate, Egypt.

3.2 The economic feasibility of camel rearing in Red Sea State

The data related to the economic feasibility of camel rearing is presented in table (2). The data analysis indicated that the demand for camel meat was high as 97.5% of the respondents said that camel is economically feasible for meat production. Consequently, the demand for camel milk is also high which was revealed by 88.75% of the respondents that camel milk production is economically feasible. Moreover, the majority of the respondents 73.75% admitted that camel is a reliable and sustainable option for food security during droughts.

In contrast table (2) shows that camel hair and hides and skins were less economically feasible as noted by the respondents 41.24% and 22.5% respectively. Table (2) also shows that camel rearing in Red Sea State is economically feasible as revealed by the majority of the respondents in term of food security, providing milk and meat and their byproducts.

Figure (2) shows the ranking of the economic feasibility of the variable of the study area based on the respondents view. Most of them rank meat production first followed by milk production, then the reliability and sustainability of camel for food security during droughts. On other hand hides and skin and hairs production were least important. The majority of the respondents revealed that camel production in the study area is economically feasible. This study is in line with the result of Abdulahi et al. (2020) which indicated that 77.8% of Somali pastoralists responded that camels are used as a reserve stock and the reason for camel production was for income source, social and cultural functions, and milking purpose. Camel rearing is economically feasible in the study area which arise from the responses of the respondents specially meat and milk production which are directly related the sustainability of food security. These results are also in line with Elhadi et al. (2015) who reported that the role of camel in pastoralist's livelihoods at household and community levels. Moreover, camel milk production is largely contributes to local communities and also could be expanded in to the world economy (Fay et al., 2011).

The economic feasibility of camel meat production ranked top to milk production by the respondents in this results, which is agreed with the statement of Khan et al. (2016) who stated that meat from camel is suitable for human consumption and may take over meat supply from other domestic animals in some cultures. The percentage of camels as a suitable option for food security among the respondents are enormously high 73.75% in this study, a closely similar to this percentage (72.1%) of camel producers was obtained by (Raga et al., 2017) and they reported this high percent indicate the camel production have a positive impact on the food security in Sudan. Similarly (Faraz 2020; Faraz et al. 2023) reported that in Southern Punjab, Pakistan camel has an important role in food security providing milk, meat and other valuable by-products like wool, dung and urine.

Moreover, closely comparable to these findings (Yosef et al., 2014) reported that camel sector constitutes significantly to human livelihood and food security of poor people who are live in pastoralist area.

3.3 Correlations between the economic feasibility of camel production variables

It is clear that from table (3) the relations between all camel production economic feasibility variables studied were significantly ($p < 0.01$), positively and strong to moderate (0.94 - 0.50). Camel is a sustainable option for food security is very strongly correlated with the economic feasibility of camel milk and meat production while it is strongly correlated with the economic feasibility of camel hides and skins production and moderately correlated with camel hair production. Moreover, the economic feasibility of camel milk and meat production is very strong. Consequently, the economic feasibility of camel hides and skins and hair production is very strongly related. The most highly related parameters is camel is a sustainable option for food security and the economic feasibility of camel milk production.

3.4 production systems

Based on the data obtained; in the Red Sea State there are three major camel production systems, which are extensive (nomadic), semi - intensive (transhumant, sedentary) and intensive management systems. Table (4) and figure (4) revealed that camel production management is basically traditional as reported by the respondents. The majority 62.5% of them practice extensive system (nomadism) and 31.25% practice semi - intensive (transhumant,



sedentary) while only 6.25% practice intensive management system. The results of this study are closely similar to Ghude, et al. (2022) who noted that in north-west, Nigeria majority (97.90%) of the respondents engaged the practice of extensive/free range system of management while only 2.10% practice semi-intensive with none of them practicing intensive system. The obtained results are in line to that of Faraz et al.(2021b) which classified camel management into the following systems; traditional nomadic management system, transhumant, sedentary, semi-intensive and intensive system. Moreover, in Sudan similar results were previously reported by (Musa et al 2006; El Zubeir and Nour 2006; Ishag and Ahmed, 2011; Abdalatif 2011). In contrast to this study Abdulahi, et al. (2020) described the mainly three types of camel production systems in Korahay zone of Somali regional state, 71.5% were transhumant and pastoralists, 19.6% were sedentary with resettlement and use mixed farming system, and only 8.9% use pastoral nomadic system in which livestock and owner move from place to place without permanent home, but pure nomadism seems to be disappearing.

3.5 Dairy camel breeds

Table (5) shows milk producing camel breeds. Read Rashidi is the highest milk producing as admitted by the majority of the respondents 60% followed by Bishari 21.25% then hib-kwalit 15% while to the least white Anafi 3.75%. The majority of the respondents noted that Red Rashidi camel is the highest milk producing camel in the study area followed by Bishari and Bishari subtypes. This finding is supported by early reports that the Rashaidi camel is found in eastern Sudan and characterized as dairy camel (Amasaib et al., 2017) and also to that of Wardeh (2004) which classified the Rashaidi camels as dairy camels. The Annafi and the Bishari (The Red Sea Hills "Beja") Type and it's Subtypes are classified as Riding Camel (Wathig et al., 2007). Bishari is also reputed to be a good milk animal.

3.6 Camel milk production

Table (6) shows the respondent estimation of daily camel milk yield in the study area which was ranged from 1 - 14 liters. The obtained results revealed that the 75% of the respondent highlighted that daily camel milk yield ranged from 5 - 10 liters. Some camels produce about 1- 4.5 liters of milk per day as represented by 17.75% of the respondents. Moreover, a few camels produce more than 10 liters as responded by 7.25%. The milk produced per camel per day in this work ranges from 1 - 14 liters. Moreover, 75% of the respondents highlighted the range from 5-10 liters. Observed milk production yields in the current study have supported the findings previously reported by (El Amin, 1979; Agab and Abbas, 1993) which estimated the average daily milk yield of Sudanese she camel was ranged between 5 - 10 kg. In contrast the results of the present study are much higher to the findings of Bakheit (1999) who reported that the she-camel in western Sudan reared under nomadic management produced 2.36 liters of milk per day, and with Eisa (2006) who estimated the daily camel milk in Butana area ranged between 2.2 liters and 3.5 liters. The values of camel milk production reported his finding were fairly coincides with the values reported by previous workers such as (Hussien, 1989; Kebebew and Baars, 1998) who found milk production values ranging from 4.5 to 7.5 liters/day in Eastern African camels.

3.7 The most prevalent camel diseases in the Red Sea State

Table (7) shows the respondent estimation of camel most prevalent diseases. According to the respondents view, the incidence of mange was the highest and the percentage of it was reported by 60% of the respondents, followed by respiratory infections 21.25%, then camel box 15% and low incidence of mastitis as 3.73%. In the past camels were considered as resistant to some diseases but in fact Abbas and Omar (2005) noticed that camels are susceptible to many common diseases that affecting other animal species. The main diseases affecting camel production in the study area were identified by the respondents in order of their reverence as mange infestation is most significant disease followed by respiratory infections. These results are earlier supported by Agab and Abbas (1999) who reported that mange is the most prevalent clinical condition encountered in camels in eastern Sudan. Similarly Abbas and Omer (2005) also concluded that diseases of the respiratory tract, particularly pneumonia, are among the most important and commonly encountered diseases of the camel in the Sudan. Similarly, Shommein and Osman (1987) concluded that trypanosomiasis and helminthoses besides Sarcoptic mange and tick infestation also occur were the most important camel diseases reported in the Sudan. In this results camel pox and mustitis are least



important. In agreement with these observations (Pasha et al., 2013) observed that Pox, Mange and Surra are the more common diseases of camels in Punjab.

Conclusions and Recommendations

In conclusions, the results of the current study may contributes to knowledge about camel rearing in the Red Sea State which is a key ward for improvement and development of strategies for the improvement of the standard of living of the pastoralist in the Red Sea State. More researches should be conducted for future prospects, to know about feeding systems and milk yield under different systems of management and factors that influence camel milk production.

Conflict of interest

The authors declare that they have no conflict of interest that could inappropriately influence, or be perceived to influence, the submitted work.

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Table 1: Gender and education level of the respondents

Demographic factor	Variable	Respondents (n)	Percentage (%)
Gender	Male	60	75%
	Female	20	25%
Education Level	University degree	4	5%
	High Secondary school	9	11.25%
	Intermediate school	24	30%
	Primary school	20	25%
	No school at all (illiterate)	23	28.75%

Table 2: The economic feasibility of camel rearing in the Red Sea State

Variables	count	Frequency (%)
Camel is economically feasible for meat production	78	97.5
Camel milk production is economically feasible	71	88.75
Camel is reliable and sustainable option for food security during drought.	59	73.75
Camel hides and skins production is economically feasible	33	41.24
Camel hair production is economically feasible	18	22.5

Table 3 : Matrix Pearson correlations between camel production economic feasibility variables n= 80

	Camel is a sustainable option for food security	Camel meat production is economically feasible	Camel milk production is economically feasible	Camel hides and skins production is economically feasible	Camel hair production is economically feasible
Camel is a sustainable option for food security	1	.861**	.941**	.773**	.571**
Camel meat production is economically feasible	.861**	1	.820**	.694**	.500**
Camel milk production is economically feasible	.941**	.820**	1	.839**	.609**
Camel hides and skins production is economically feasible	.773**	.694**	.839**	1	.839**
Camel hair production is economically feasible	.571**	.500**	.609**	.839**	1

****.** Correlation is significant at the 0.01 level (2-tailed).



Table 4: Camel production systems in the Red Sea State

production systems	frequency	Percent (%)
Extensive	50	62.5
Semi-intensive	25	31.25
Intensive	5	6.25
Total	80	100

Table 5: The most milk yielding camel breed in the Red Sea State

Camel breed/ type	Frequency (n)	Percent (%)
Read Rashidi (Ahamara)	48	60
Bishari (White)	17	21.25
Hib - kwalit (Bishari Subtype)	12	15
White Anafi	3	3.75

Table 6: Average milk production per camel per day in the Red Sea State

Average daily milk yield	Respondents (n)	percentage%
Less than 1 liter	0	0
1 - 4.5 liter	14	17.75
5 - 10 liter	60	75
More than 10 liters	6	7.25

Table 7: The most prevalent camel diseases in the Red Sea State (n = 80)

Disease	Frequency (n)	Percent (%)
Mange	48	60
Respiratory infections	17	21.25
Camel box	12	15
Mastitis	3	3.75

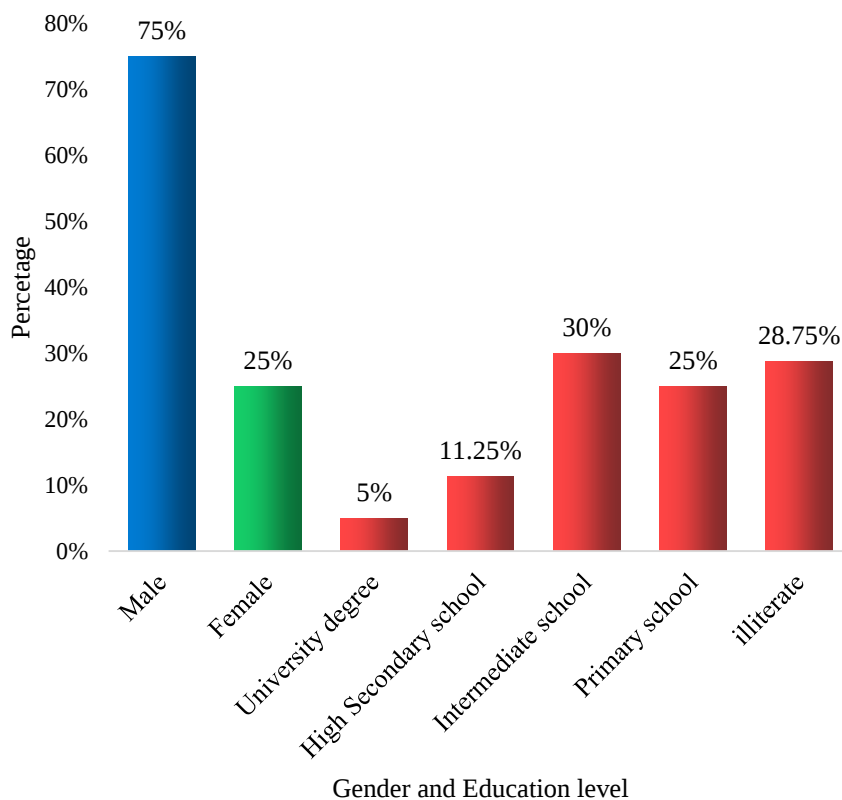


Figure 1 : Gender and education level of the respondents

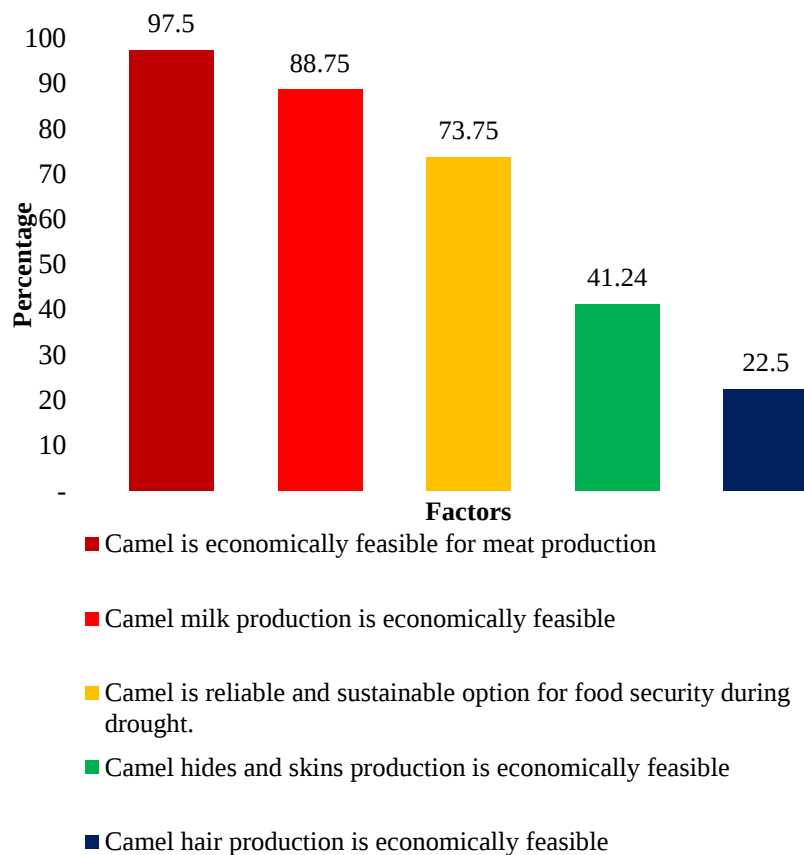


Figure 2: The ranking of the economic feasibility variables of camel rearing in the study area

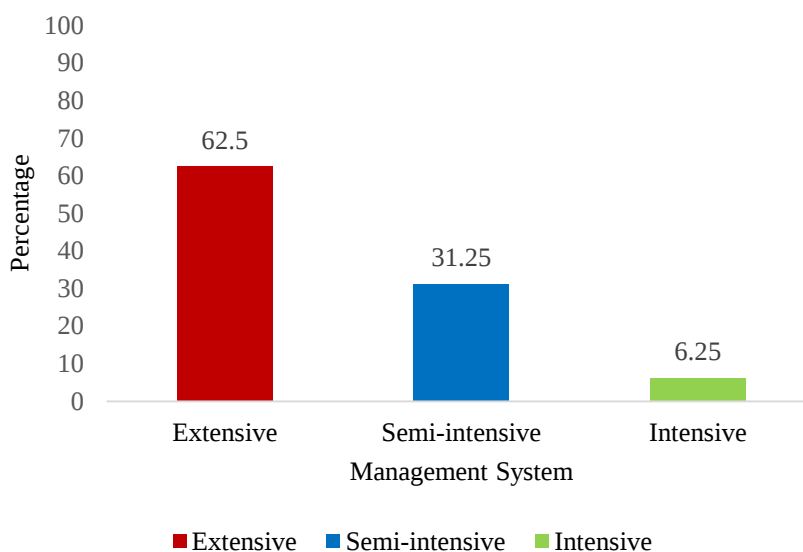


Figure 3: Camel production and management systems in the Red Sea State

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