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Camels Production in Sudan: Impact on the Food Security and Circumstances

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Abstract In Sudan given climate is nearly extremes and food insecurity in most regions of the country, the food availability is a crucial component of household food security status. Camel production play an important role in the livelihood of people in dry and semi dry zones, however camel pastoralist challenged by serious production constraints e.g. the lack of marketing facilities, improper infrastructure, impact of liberalization policy on prices and civil war. The general objective of this study was to assess the role of camel production on food security in the Butana State in weastern Sudan. Precisely the objectives aim to identify the main factors that may be responsible for food insecurity among camel pastoralist. The study is heavily depending on primary data collected during the season 2013/2014. Statistical tools of data analysis are implemented focusing on descriptive, food security status and logistic binary regression methods. The study results are showed that most of the surveyed camel pastoralists are illiterate and landless. The study reveals that lowe percentages of sampled households in the study area are faced to food security. According to the results, the camels production are significantly improves food security. There are positive correlation between education level, food availability and food access. Moreover, food utilization is significant affected by family size and number of males in the households. In addition, it is substantial affected by milk production and camel selling in the region. The major constraints of the camel production were the camel diseases such as trypanosomiasis and mastitis. The food insecurity reducing by the age of the household-headed.

Keywords Camels, Food Security, Logistic Binary Regression, Sudan

1. Introduction

Sudan has nearly three million camels, the second-largest national herd in the world, after Somalia's (1). Tribal groups in Sudan breed distinctive types of camels (Mason and Maule, 1960), the well-known among these are the Anafi and Bishareen. Camels are the backbone of the Rashaida pastoralists' economy and are also central part of their culture. Cash is received at town markets for male camels sold for slaughter at the age of six to seven years. They are collected at regular intervals from the large herds and driven to the meat markets in Egypt. The live camel trade is gradually increasing in number with most going on hoof to Egypt and Libya. The greater part of Sudan's trade with Egypt used to be in camel trade, which has been for years conducted by a number of Sudanese traders. The camel has played a conspicuous and extremely significant role in the development of Sudanese communities whose natural environment has allowed of it chance for adaptation (Mohamed and Ahmed, 1991).

The camel farming is mainly traditional based on the mobility of the herd. The camel belt in Sudan includes the states of North and South-Darfur, North and South-Kordofan, Khartoum, Gezira, Kassala, Red Sea, River-Nile, Northern Sudan, White Nile, Blue Nile and Sennar State (Faye et al., 2011). The Butana plains, where this study was conducted, occupy the area lying between the River Nile in the West and the Atbara River in the east. In Butana area of Sudan camels are commonly raised under nomadic conditions in a geographical zone which lies approximately between latitude 14-16 N and longitude 33-36 E (Al-Amin, 1979). The total area is about 120 000 km^2. The Butan plains are inhabited by transhumant camel owning Sudanese tribes such as the Shukriya, Lahawiyin, Kawahla and Rashaida.

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2. Problem Related Factors and Justifications

Camels play an important role in the livelihood of people in dry and semi dry zones, yet camel producers faced by serious production constraints. These constraints include lack of feeds, disease prevalence, water shortage (Ishag and Ahmed, 2011), lack of marketing facilities, improper infrastructure, impact of liberalization policy on prices and civil war.

Actually, the livestock living conditions were so poor particularly at the beginning of the rainy season due to limited availability of pasture. Pastoralists predominantly for livestock production traditionally have been classified as a separate farming system, even though they are integrated with other farming systems, particularly with traditional rain-fed farming. In Sudan, camel traders pay taxes and transit fees in more than 21 places in route to the terminal markets or final destinations. As well, most previous research conducted on camels was oriented towards diseases and infections, reproductive physiology and characterization.

3. Objectives of the Study

The general objective of this study was to assess the role of camel production on food security in the Butana State. The specific objectives of this study are to:

1. Determine the socio-economics factors of the camel producers in the region.
2. Estimate the food security status in the regions.
3. Identify the camel circumstances and constraints of the camel pastoralists in Butan areas.
4. Identify the main factors that may be responsible for food insecurity among camel pastoralists.

4. Study Approach and Methods

Surveys regarding household status are vital for the analysis of welfare allocation and household characteristics. At the same time, aggregate household-level analysis can provide only limited understanding of the intra-household distribution of resources, especially of income and consumption. This study attempts to select the regions, where the camels is concentrated, central and western regions, since these regions are most vulnerable and wealthy in camels. The study is heavily relied on the primarily data collected from the pastoralist from Butan areas, where the Butan area is located in the border between central and western Sudan. The Tambul city was selected as study area. Data employed in this study is collect by using structural questionnaire from the camels producers carried out during the reference period 2013-2014. This survey is based on the sampling method which allows for the generalization of the results to the whole population of households within a margin of an error. The number of households are participating in the survey was 104 participants. In this study household-headed is taken into account. In those households exclusive or main source of maintenance is income from family farms in livestock. The survey questionnaire covered issues on various aspects of household food security. The filed survey was designed to collected data on demographic and socio-economic attributes of the households and on consumption of various food items on weekly basis. Further the information on various aspects of household food security were collected. In-depth interview and focused group discussions were held with the subjects such as camel's information (e.g. compositions, prices, production and consumption pattern as well as marketing and camels diseases and infrastructures aspects). Further information on income, total expenditure and calorie consumption were collected. Additionally supported secondary data was collected.

Statistical methods of data analysis are implemented focusing on descriptive, food security status and binary regression methods.

Food security status of the camels was measured by calculating their per capita calorie intakes using 7 days recall method for food consumption information. A household with per capita calorie intake equivalent to or above 2, 300 Kcal/capita/day was considered as food secure household determined by WHO, 2003. Mathematically, the food security status of a household can be written as:

$$FS_{ich} = \sum AC_{ich} - 2{,}300 \leq 0$$

FS_{ich} is the food security status of the ith camel households (1 for food secure and 0 for food insecure),

AC_{ich} is the adjusted calorie intakes of ith camel household, and 2,300 is the threshold level for household defined by WHO, 2003.

As argued by various researchers (Omotesho, et.al, 2006; Arene and Anyaeji, 2010; and Bashir et.al, 2012) the binary logistic regression was used to determine the effects of some socioeconomic characteristics of the livestock producers on their food security status. Pursuing these researchers the binary logistic regression was used to test the role of camels along with other socio-economic factors on household food security in this study. The dependent variable 'food security' is a binary variable in the form of '0' (for food insecure) and '1' (for. food secure).

A linear function is assumed and can be written as:

$$FS_{ich} = \sum_{i\ldots1}^{n} a_i \; x_i + \varepsilon_i$$

Where a_i , represent the coefficients of the model, x_i represents the vector of socio-economic factors and ε_i is the error term. As the dependent variable is a discrete variable, the equation 2 can be re-written in terms of the probability of a household becoming food secure. Whereas x_i is the vector of socio-economic factors. The cumulative

logistic probability model of this study is specified according to the model illustrated by Gujarati, 1995 as follows:

$$L_i = \ln[F_i / (1 - F_i)] = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + a_5x_5 + a_6x_6 + a_7x_7 + \varepsilon_i$$

Where:

L_i = logit means log of the odds ratio

F_i = the probability that an individual is being food secure and ($1\text{-}F_i$) = the probability that a household will not be food secure households. a_0 = constant term.

X_1 = Number of family size (number).

X_2 = Age of households (in year).

X_3 = Distance to markets (killo meter).

X_4 = Total livestock holding (in Livestock Unit).

X_5 = Amount of food aid obtained by the households (Sudanese pound).

X_6 = Gender of the households (male = 1; female = 0).

X_7 = Education level of the households (Literate = 1; illiterate = 0).

ε_i = error term.

5. Results and Discussions

Socio- economics characters of the camel producers in the region

The average age of household heads' was about 50 years (ranges between 20 and 82 years). The average of the family size was 8 members per household with a range of 3 to 15 members in a family. Illiteracy among camel producers is high (71%) this results confirmed by studies conducted earlier in the same area (Dorsa et.al, 2011 and Majid and Sakr 1998).

Food security status is determined by the combination of aggregate food availability, household food access and utilization. Availability and access to food are affected by population growth, demographic trends, economic development, government policies, income levels, health, nutrition, gender, environmental degradation, natural disasters, refugees, migration, disease, and concentrated resource ownership (Stringer, 2000).

Table 1. Matrix Correlation of Socioeconomics Characters and Food Security Factors in Butana State

Item	MP	CS	EL	WS	FS	NM	NF	FV	FA	FU
1. Milk Production										
Pearson Correlation	1	-0.007	-.008	.230**	0-.103*	0.65*	0.231	0.087	0-.095	0.591**
Sig. (2-tailed)	-	-.003	.924	.000	.075	0.00	0152	.135	.102	0.00
2. Camel Selling										
Pearson Correlation	-..007	1	0.323**	0.308**	.264**	0.781**	0.153	0-.024	0.082	0.298*
Sig. (2-tailed)	-.003	-	.000	.000	.000	0.00	0.021	.676	.157	0.001
3.Education Level										
Pearson Correlation	-.008	-.323**	1	0.077	-0.086	0.265	-0.076	0.166**	-0..877*	-0.014
Sig. (2-tailed)	.924	.000.	-	.184	.136	0.23	0.237	.004	.185	.823
4. Water Source										
Pearson Correlation	0. 230**	-0.308**	0.077	1	-0.336**	-0.088	-0.088	-0.143*	0.004	-.0144*
Sig. (2-tailed	.000	.000	.184	-	.000	0.066	0.066	.014	.945	.025
5.Family Size										
Pearson Correlation	0.103*	0.264**	-0.086	-.0.336**	1	0.781*	0.200	0.100	0.099	0.134*
Sig. (2-tailed)	.075	.000	.138	.000	-	0.00	.067	.086	.088	.037
6. Number of Males										
Pearson Correlation	.00.65*	0.781**	0.265	-0.088	0.781*	1	-0.135	0.551	0.357*	0.845**
Sig. (2-tailed	0.00	0.00	0.23	0.066	0.00	-	-009	0.102	0.001	0.00
7. Number of Female										
Pearson Correlation	0.231	0.153	-0.076	0.200	0.135	0.135	1	-0.348*	-.0.347**	-0.123
Sig. (2-tailed	0152	0.021	0.237	.067	-009	-009	-	0.000	.000	0.125
8. Food Availability										
Pearson Correlation	0. 087	-0.024	0.166**	-0.143*	0.100	0.551	-0..348*	1	-.0347**	0.335**
Sig. (2-tailed)	.135	.676	.004	.014	.086	0.102	0.000	-	.000	.000
9. Food Access										
Pearson Correlation	0-.095	0.082	-0.877*	0.004	0.099	0.357*	-0.347**	-.0347**	1	-.0327**
Sig. (2-tailed)	.102	.157	.185	.945	.088	0.001	.000	.000	-	.000
10. Food Utilization					.					
Pearson Correlation	0.591**	0.298*	-0.014	-0.144*	0.134*	0.845**	-0.123	0.335**	-0.327**	1
Sig. (2-tailed)	0.00	0.001	.823	.025	.037	0.00	0.125	.000	.000	-

Source: Authors' Calculation, 2013/2014.

** Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed).

The study estimated the relation between food availability, access and utilization with socioeconomics and biophysical characters of the household. As observed in Table 1, there is positive correlation between education level and food availability. The food availability show a negative impact on water sources. Furthermore the food utilization is significantly affected by the family size and number of males in the households.

There are positive correlation between education level, food availability and food access. In addition the food utilization is significantly affected by milk production and camel selling in the region.

Food security status of the camel herders

The universal cut – off point of the food insecure is 2100 kcal per adult equivalent per day (Bogale and Shimelis, 2009). As shown in table 2 about 28% of the camel producers are food insecure (less than 2100 kcal). Further more this figure divided into three stage of the food insecure to categorize the degree of severity of food insecurity as follow: 14.4% are marginally food insurer between 2100 kcal and 1800 kcal while 9.6% are moderately food insurer and only 3.9% are severely food insecure. The percentage of the food secure among the camel producers are enormously high 72.1%. This indicate the camel production have a positive impact on the food security in Sudan.

Table 2. Food Security Status of the Camel Producers

Food security status	Calorie consumption /person/day	Frequency	Percentages
1. Food secure	Above 2100 kcal	75	72.1
2. Food insecure: Marginal food insecure Moderately food insecure Severely food insecure	 2100 – 18700 1800 – 1300 1300 and less	 15 10 4	 14.4 9.6 3.9
Total		104	100

Source: Field survey, 2013/2014.

Camel circumstances, functions and constraints

The most important types of camels are found in the area are pack camels constituting more than 45 % of the camels in the Butan. The Anafi breed seems to be the preeminent breed in the area (30%) followed by the Bishari breed (15%) and crosses between these two types (10%). Majority of the pastoralists indicted that the milking procedure are done by the men (97%) who owner the camels or other eldest males from the family members, a few of them hired the labour for milking process (5%). No women allow to milk the camels and this results is confirmed by Mohamed and Ahmed (1991) and also reported that there are extremely cases with the Beja in the Red Sea Hills the women did not only allow to milk the camels but also any types of the domestics livestock herds. In Sudan the average milk production of camels was 5-10 kg/day (Agab, 1993).

The surveyed producers reported that the camel milk yield in Butana area is more that 9 liters per day during the autumn and the amount decreases during the summer to reach less than 2 liter/day and this is mainly due to shortage of the feed. These results are supported by various researches in Sudan (Bakheit, 1999, Salman, 2002 and Eisa and Mustafa, 2011). Majority of the producers (98%) consumed the fresh milk and a few of them preferred to be fermented and consumed as *gariss* mainly processed under the traditional methods. No cheese or other forms of processing are manufactured.

- Camel diseases are the major constrains of production such as trypanosomiasis and mastitis. More than 89% of the camel producers reported that the most important diseases affected their animal during the surveyed time are trypanosomiasis and helminthoses.

Most of the deaths were caused by helminthes (70%). Furthermore, majority of the camels producers were suffering from tick diseases (80%). Although ticks are incriminated as efficient transmitters of various infectious diseases in animals, their role as disease vectors in camels is minor (Higgins, 1985). Furthermore the results reveal that the tick infestation and tick paralysis as causes the mortality of camels in Butan area. This results are confirmed by various researchers (Osman, 1976; Schwartz and Dioli, 1992; Khanna, et.al 1992 and Agab and Abbas, 1993) earlier. Beside the diseases constraint, the shortage of investments and inadequate supporting infrastructures and poor veterinary services are the major constraints faced the sampled households. In addition to the milk quantity, processing and lack of market cannals of both milk and live animal are others constraints faced the producers.

Determinants of food security of the camel producers

The variables list in Table 3 are defined as follows:

A. Dependent variable:

Food security of the household is a binary variable in the form of ‘0’ for " food insecure" and ‘1’ for" food secure".

B. Explanatory variables:

DISTANCMRT = Distance to markets (in kilo meter).

AGE = Age of households in a year.

GENDER = Gender of the households (male = 1; female = 0).

AMOUNFAID= Amount of food aid obtained by the households (in pound)

LIVEHOD = Total livestock holding (in Livestock Unit)

FAMSIZ = Number of family size (in number).

EDUCALEVEL= Education level of the households (Literate = 1; illiterate = 0)

Table 3. Food Security Determinants among the Camel Producers

Variable	Estimated coefficient (β)a	Standard error	Wad	Odds Ratio Exp (β)	95% of C.I. for odds ration	
					Lower	Upper
1. DISTANCMRT	0.114	0.156	0.135	1.239	0.418	3.669
2. AGE	-0.083	0.189	0.164	.0851	0.624	1.359
3.GENDER	0.066	0.183	0.138	0.852	0.526	1.227
4. AMOUNFAID	- 0.020	0.070	0.049	1.020	0.855	1.217
5. LIVEHOD	- 0. 172	0.279	0.451	1.188	0.687	2.054
6. FAMSIZ	0.544	0.681	1.583	0.452	0.153	2.129
7. EDUCALEVEL	- 1.752	1.142	2.022	4.085	0.534	2.589
CONSTANT	0.123	3.256	0.016	0.214		
Regression statistics: Number of observation = 104 Likelihood ratio test: $X^2_{0.05}$ (7) = 14.150 Adjusted R-squared: 0.145 2- Log likelihood = 82.511						

Source: Survey findings and authors' calculations, 2013/2014.

From the results obtained from table 3 denote that the positive estimate of parameters (β) occurs at variables of distance to markets, gender of the households, number of family size. While the negative estimate of parameters (β) occurs at the variables: age, education level, amount of food aid obtained by the households and the total livestock holding.

Food insecurity reducing by the age of the household-headed, i.e. the risk of food insecurity was on average lower in households with male head and young of the households head. As well, the risk of food insecurity was on average lower in educated households. The large amount of food aid obtained by the household was reduced the food insecurity. In addition, the household of being with extra of the total livestock owing are reduced the food insecurity.

6. Conclusions

Although Sudan is the big owner of the camels population, the camel farming is mainly going on following the traditional manners, based on the mobility of the herd. The socioeconomics characters of the camels producers had considerably affect the food security, mainly the education level and number of the males in the households. Additionally the number of selling camel and water availability are highly affecting the food security of the producers. Food insecurity had largely reduced by the age of the head household, number of male, educated households and the total livestock owing.

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REFERENCES

[1] Agab, H. and Abbas, B. (1993). Epidemiological studies on camel diseases in the eastern Sudan. Camel Research Project, Gedaref, Sudan.

[2] Agab, H., (1993). Epidemiology of camel diseases in Eastern Sudan with emphasis on brucellosis, pp: 184. M.V.Sc. thesis. Faculty of Vet. Medicine. U. of K. Khartoum - Sudan.

[3] Al-Amin, F.M., (1979). The dromedany camel of Sudan. In: camels IFS. Symposium, Sudan, pp: 35-53.

[4] Arene, C.J. and Anyaeji, R.C.(2010). Determinants of Food Security among Households in Nsukka Metropolis of Enugu State, Nigeria. Pakistan Journal of Social Sciences (PJSS). Vol. 30, No. 1. pp. 9-16.

[5] Bakheit, S.A. (1999). Studies on milk production and composition of camels (Camelus dromedarius) under. nomadic system. M.Sc. thesis. Faculty of Animal Production, University of Khartoum, Sudan.

[6] Bashir, M.K., Schilizzi, S. and Pandit, R., (2012). Livestock and rural household food security: The Case of small farmers of the Punjab, Pakistan, Working Paper 1207, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia.

[7] Bogale, A. and Shimelis, A., (2009). Household Level Determinants of Food Insecurity in Rural Areas of Dire Dawa, Eastern Ethiopia. Journal of Ajfand 9(9): 1914: 1926.

[8] Dorsa, A.; Elmalik K.; Salih A. and Abdelhdi, O (2011). Some Aspects of Camel Raising in the Butana Area of the Sudan. Conference on International Research on Food Security, Natural Resource Management and Rural Development. University of Bonn, Germany.

[9] Eisa, A and Mustafa, A.B (2011). Sudan Camel (Camelus dromedarius): A Review Middle-East Journal of Scientific Research 7 (2): 132-135.

[10] Faye, B, Abdelhadi, O M A, Ahmed, A. I. and Bakheit, S. A.

(2011). Camel in Sudan: future prospects. Livestock Research for Rural Development. Volume 23, Article #219. http://www.lrrd.org/lrrd23/10/faye23219.htm.

[11] Gujarati DN (1995). Basic econometrics (3rd ed), McGraw Hill, Inc., New York.

[12] Higgins A (1985). - Common ectoparasites of the camel and their control. Br. vet. J., 141, 197-216. Reprinted in The camel in health and disease. Baillière Tindall, London, 1986, 72-91.

[13] Ishag, I.A., and M.K.A. Ahmed (2011). Characterization of production system of Sudanese camel breeds. Livestock Research for Rural Development. 23:3. www.irrd.org/irrd23/3/ishag23056.htm.

[14] Khanna, N.D., Tandon, S.N. & Sahani, M.S (1992). Calf mortality in Indian camels. In Proc. First Int. Camel Conf., Dubai, p. 89-93. UK, R&W Publications.

[15] Majid, A and Sakr, I. (1998). Scio-economics of camel disease of camel herders in east Sudan.

[16] MAR, Ministry of Animal Resources (2008). Khartoum, Sudan.

[17] Mason, I L and Maule, J. P (1960). he Indigenous Livestock of Eastern and Southern Africa. Technical Communication No. 14 of the Commonwealth Bureau of Animal Breeding and Genetics, Edinburgh.

[18] Mohamed, T, A. and Ahmed, A. G. (1991). Camel pastoralism as a food system in the Sudanan: limitations and Changes. Nomadic People: 29., Khartoum, Sudan.

[19] Omotesho, O. A.; Adewumi, M. O.; Muhammad-Lawal, A. and. Ayinde, O. E. (2006). Determinants of Food Security Among The Rural Farming Households in Kwara State, Nigeria. African Journal of General Agriculture. Vol. 2, No. 1, Nigeria, pp 7-15.

[20] Osman, A.M. (1976). A review on tick-borne diseases in Sudan and their control. Bull. Off. Int. Epiz.

[21] Salman, M (2002). Some husbandry aspects in the Butana area in Eastern Sudan. M.Sc. thesis faculty of Animal Production. University of Khartoum, Sudan.

[22] Schwartz, H.J. & Dioli, M. (1992). The one-humped camel in eastern Africa. A pictorial guide to diseases, health care and management, p. 282. Germany, Josef Margraf.

[23] Stringer, R. (2000). Food Security in Developing Countries. Centre for International Economic Studies. University of Adelaide, Adelaide. Australia.

[24] WHO, (2003). World Health Organization. Khartoum Office, Sudan.