International Journal of Professional Practice (IJPP) Vol.12 Issue No.3,

Influence of Camel breeds on Productivity in Mandera County, Kenya

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Abstract

Mandera County relies mainly on camel production for income and livelihoods. However, the trade in camel and camel products remains largely under exploited. Efforts at exploiting the potential in the camel and its products have been made, albeit to a very low extent, but a lot remains to be done if camel productivity is to be maximized. It was against this background that the current study sought to investigate the influence of camel breeds on productivity in Mandera County. The objective of the research was to find the influence of camel breeds on productivity of meat, milk, hides and other products. Basic Needs Theory anchored the study. Descriptive research design was adopted. Both purposive and random sampling techniques were used to select respondents. Random sampling technique was applied on a population of 43,691 camel dealers in Mandera County, from which a sample of 396 households was obtained. 100 respondents were purposively selected from each Sub County. Government officers that work with camel dealers were interviewed. Reliability and dependability of the data were confirmed before analysis using SPSS Version 26. Cronbach alpha coefficient of 0.778 was realized for reliability of constructs of camel breeds. Descriptive statistics were used to explain the findings, while information from government officers was analyzed qualitatively for triangulation purposes. Hypothesis testing indicated that effects of breeds on camel productivity was statistically significant (β=0.201, p=0.032). Results revealed that effects of camel breeds were positively and significantly correlated to camel productivity at r=0.733. It was concluded that Camel breeds were critical to improvement of productivity. The study recommended that Mandera County invests in acquisition of adequate and good breeds of camel especially bulls and avail them in to the farmers so as to maximize productive cycles of female camels that often lack bulls when on heat losing production.

Key Words: *Camel breeds, productivity, government, camel producers, camel dealers*

IJPP 12(3); 45-57

1.0 Introduction

The livelihoods of inhabitants of Mandera County in Northern Kenya is significantly influenced by the production and trade of camels. Many families in these areas, which are marked by harsh climatic conditions and environments with limited access to water and other resources, depend seriously on camels as a source of milk, meat, and income. Camel breeding typically takes place among nomadic pastoralist groups in Mandera County who depend on their herds for both subsistence and income. The camel is utilized for food, clothing, and transportation. Camel milk is a crucial source of sustenance, especially for children and expectant mothers, as well as in customary rituals and celebrations (Isako & Kimindu, 2019). Guliye (2007) elaborates the role of the camel in traditional lifestyles of pastoralists in Northern Kenya.

The population of camels worldwide is estimated to be 19 million; out of which 15 million are thought to reside in Africa, and 4 million in Asia (Berheet et al., 2017). Due to the fact that camel bodies are designed to survive in harsh environments, they are mostly found in the semi-arid and arid areas of Africa. The one-humped dromedary comprises 94% of the animal's global populace, while the two-humped wild Bactrian breed is at risk of going extinct (Chuluunbat et al., 2014).

In Kenya, only one species and four breeds of humped dromedaries are kept by the Somali, the Rendille/Gabbra, and the Turkana communities. The Pakistani breed imported in the 1990s is mostly found in Laikipia ranches (Mohamed et al., 2019). Crossbreeding between two camel breeds, as well as between distinct species, can produce breeds with altered or combined traits.

Food products derived from livestock account for up to 30% of the agricultural gross domestic product in Africa (GDP). Kenya has the fourth-major camel populace globally after Chad, Somalia, and Sudan with over 4,640,085 camels (Kenya Agricultural and Livestock Organization [KALRO], 2019). According to a nationwide census conducted in 2019, Mandera had the most camels (1,828,665), followed by Wajir County (1,176,532) and Garissa (816,057) (KNBS, 2019).

Over 80% of Kenya is made up of rangelands mostly used as pasture lands by the pastoral communities. Camels consume 30–40 kg of fresh feed each day; with 80% water content, and 8–12 kg of dry matter (DM). According to Mohamed (2019), camel diets are dominated by trees, shrubs, and other vegetation throughout the wet season. The proportion of these feeds decreases during the dry seasons when the leaves have shed off. There are no pedigree records kept by the camel herders that reflect the output of each animal. For several years, farmers maintained small and inadequate number of bulls for breeding which led to inbreeding depression. Due to the long distance to market centers, farmers occasionally lack access to veterinary drugs thereby resulting in the death of livestock (Dokata, 2014).

Statement of the Problem

The potential for camel and camel products is quite low and unexploited. Efforts to exploit the immense potential of this animal and its products have been made albeit to a very low

extent, yet a lot remains to be done if camel production and productivity is to be improved especially in Mandera County. There are local marketplaces that serve as butcheries for camel meat. The off take is thought to be between 15 and 30 camels per day, which is still very low. This trade does not impact on the people who keep camels for livelihoods as the prices for live animals and their products are very low and the genetic potential is wanting. Therefore, there is need to do something to arrest the situation and turn around camel business into profitable venture. This study aimed bring out the importance of camel breeds on the critical issues of camel productivity. The study looked at effects of breeds on productivity and the opportunity to exploit the unlimited potential of camel as the animal of livelihoods and economic value of the Northern Kenya farmers who depend on it for survival and socio-economic development in Mandera County.

Objective

To establish how camel breeds influences productivity of camels in Mandera County

Hypothesis

There is no association between camel breeds and camel productivity in Mandera County.

Literature Review

There are two types of camel breeds in the world: the one humped dromedary, and the two humped Bactrian breed. Only the one-humped dromedary is found in Kenya. The dromedary breed produces more milk than the Bactrian and its hybrids. KARLO (2019) indicates that the ideal lactation period ranges between 14 to 18 months. The global camel production may be significantly impacted by the usage of breeding bulls. Breeding bulls can contribute to long-term survival and adaptation of the camel species by preserving the genetic diversity of camel populations. Breeders can support the herd's genetic variety by selecting for desirable qualities, which can be important in the face of shifting environmental situations and disease outbreaks. By lessening incidences of inbreeding that result in depressed yields and higher susceptibility to hereditary diseases, the use of high value breeding bulls can contribute to improvement of camel production and productivity. However, there have been challenges in using breeding bulls such as their inadequacy or low numbers against higher number of females and possible spread of genetic diseases and defects. To reduce these risks and ensure that the best animals are used for reproduction, breeding operations must be properly managed (Kadim et al., 2018).

"The study found out that camel breed had a statistically significant positive impact on camel productivity"

Good breeding bulls are used to improve traits of local herds, such as growth rate, milk production, and disease resistance, and lead to increased efficiency and profitability for

farmers and breeders. This also helps increase the demand for camels and their products, and improve the overall economic prospects for the industry. In addition, breeding programs should be custom-made to the precise requirements of local communities considering the unique cultural, economic, and ecological conditions of each region (Kadim et al., 2013). Kadim (2013) in a study carried out in North Eastern Kenya noted a scarcity of Somali breeding bulls. Herds of up to 300 camels, from different famers, rely on one Somali bull for breeding. However, KARLO (2020) recommends an average of 50 females for one bull, for efficient breeding and growth of the herd. Further, it is challenging to rely on bull-sharing because all farmers require producing bulls at the same breeding time, yet camels are periodic breeders, unlike other livestock species. According to Mohamed et al. (2017), inbreeding could lead to loss of hybrid performance and degradation of the breed's quality. It could further increase the probability of recessive traits and inbreeding depression, and the offspring's ability to survive and reproduce (Kagunyu & Wanjohi, 2014). Inbreeding has been linked to a decline in fertility, reduced production, increased abnormalities and pre-natal mortalities.

The enhancement of a camel breed among camel keepers is also dependent on the breeding retirement threshold adopted. Hashim et al. (2003) records that the sperm quality of males decreases as they approach old age, and recommends a maximum of 12 years of mating. On the other hand, Riyadh et al. (2012) recommends a maximum of six calvings after which a female camel should also retire. Retiring the bulls while still retaining females was also common among camel keepers in the region, which he termed as dangerous. Using old bulls and females for breeding results in weak off-springs, vulnerable to diseases and with increased cases of mortality (Tekle & Tesfay, 2013).

2.0 Materials and Methods

The population of the study was 43,691 camel-keeping households in Mandera County (KNBS, 2019). Random sampling was used to choose target respondents from among the camel farmers. Sampling was done using Yamane (1967) formula. The sample size for the study was determined, thus;

$$n = \frac{N}{1 + N(e)^2}$$

Where,

n = Selected Sample Size

N = Total Population

e = Error Value (0.05)

Therefore,

$$n = \frac{43{,}691 \text{ households}}{1+43{,}691\ (0.05)^2}$$

$$= 396 \text{ households/respondents.}$$

However, since three sub counties of Mandera County were not accessible due to insecurity and transport related challenges during the time of data collection, the target respondents for each of the remaining three sub counties included in the study was revised up from possible 66 (if shared equally among the six sub counties) to 100 for the three sub counties, hence the sample size was

300 respondents. Six government officers in positions of livestock production and veterinary services, two from each sub county, were selected purposively for interviews. Structured surveys were used to collect data from target respondents who were camel farmers/dealers. The questionnaires contained closed-ended statements mostly on a 5-point Likert scale. For farmers or camel dealers who were illiterate and could not fill in the questionnaires, and whose input into the study was deemed critical, the researcher enlisted research assistants to conduct focused group discussions among common interest groups like camel cooperatives where camel farmers were assisted to respond to the statements on the questionnaire. Government officers were interviewed using an interview schedule. Pilot study was carried out on 30 camel dealers in Garissa County, which had comparable weather conditions and similar socio-economic lifestyles to Mandera County, and results used to improve the questionnaire in terms of validity. Cronbach alpha coefficient was used to assess the reliability of the study instrument upon analysis. Data was collated and tabulated in excel spreadsheets and analyzed through SPSS version 26. While inferential statistics were applied to the quantitative data to make deductions generalizable, descriptive statistics (mean, standard deviation, and percentages) described the characteristics of the sample. For ease of presenting results and reporting, the findings from the five-point Likert Scale were condensed into three categories in which those who strongly agreed (5) and those who agreed (4) were combined to "agreed" and the same for those who disagreed strongly (1) combined with those who disagreed (2) to represent "disagreed". Those who were undecided remained neutral (3).

3.0 Results and Discussion

Response Rate

Out of 300 target respondents, 223 filled and returned the questionnaires, giving a response rate of 74.33% which was above 70% considered excellent (Mugenda and Mugenda, 2003).

Table 1

Cronbach's alpha Reliability Coefficient

Variables	Number of items	Cronbach's alpha
Camel Breed [CB]	9	0.778

Effects of Camel Breed Preferences and Camel Productivity

Findings on whether respondents chose a breed because of its high milk, meat, and hide productivity indicated that only 93(41.5%) of respondents agreed with the statement, 78(35.1%) disagreed and 52(23.4%) neither agreed nor disagreed, with a standard deviation of 0.89, indicating low variability

in responses. On the qualities of the breed of camels kept, the majority of respondents 172(77.3%) agreed that the breed was for resilience and production, with a mean of 4.1 and a standard deviation of 1.02. This breed had been tried and tested and had characteristics of resilience, productivity, and commerce. Wernery (2003) claims that proficient camel milkers can generate 20 to 30 litres per day. According to Bekele et al. (2002) and Farah (2004), the Somali breed camels produce an average of 5 to 8 liters of milk each day. Camels can produce between 12 to 20 liters of milk per day in more intense systems, according to Ramet (2001).

On keeping mixed breeds to enhance productivity, 169(75.8%) of the respondents agreed with the statement, with only 31(13.9%) disagreeing, with a mean of 4.1 and a standard deviation was 1.17. The majority of respondents 176(78.7%) agreed with the statement that camel breeding was primarily through bulls. On whether they had tried other breeds of camels but failed, the majority of respondents 175(78.4%) were in the affirmative with a mean score of 4.1 and a standard deviation of 1.21. Further, results showed that the majority of respondents 150(67.3%) agreed with the statement that farmers in the study area could not access any other breed of camels, with a mean score of 3.9 and a standard deviation of 1.91. Other responses on the effect of breed preferences are as shown in Table 2. The overall mean and standard deviation of 3.7 and 1.1 respectively showed that most of the respondents were around the mean, but gravitating towards agreeing with the statements.

Table 2

Effect of Camel Breed Preferences on Camel Productivity in Mandera

Statements	Disagree	Neutral	Agree	Mean	S.D
I prefer the breed for its high productivity of milk, meat, and hides	78(35.1%)	52(23.4)	93(41.5%)	3.1	0.87
The breed of camels kept in this area is only one due to its tried and tested qualities of resilience, productivity, and trade	30(13.4%)	21(9.3%)	172(77.3%)	4.1	1.02
I keep mixed breeds of camels to compare their productivity	31(13.9%)	23(10.3%)	169(75.8%)	4.1	1.17
Camel breeding is mainly through bulls (camel males) hence the only breed(s) available	25(11.3%)	22(10.0%)	176(78.7%)	4.1	0.81

I have tried other breeds of camels in this area but they have failed	12(5.5%)	36(16.1%)	174(78.4%)	4.1	1.21
Farmers in this area cannot access any other breed of camel	33(14.6%)	40(18.1%)	150(67.3%)	3.9	1.91
Technology for artificial insemination is not available hence farmers use male camels for breeding low-quality breeds.	29(13.2%)	57(25.4%)	137(61.4%)	3.6	1.14
Farmers can access the better genetic potential of breeds through cooperatives and other pooled resources.	37(16.7%)	33(14.7%)	153(68.6%)	3.8	1.14
There is a shortage of male camels which negatively affects productivity due to loss of mating time and genetic vigor.	22(9.9%)	42(18.7%)	159(71.4%)	3.9	0.11
Mean and Standard Deviation				3.7	1.1

N = 223

The study sought to get factors determining camel productivity and the findings are shown in Table 3.

Table 3

Camel Productivity response

	Disagree	Neutral	Agree	Mean	Std dev
I keep camels for their high-quality milk	0(0.0%)	16(7.0%)	207(93.0%)	4.6	0.83
Camels provide enough milk for my family and for sale to generate income	63(28.1%)	37(16.7%)	123(55.2%)	3.5	1.12
The yield of milk/camel/day has been increasing over the years	66(29.7%)	28(12.5%)	129(57.8%)	3.6	0.87
I keep camels for high quality meat which I sell in the local butcheries/abattoirs for income.	52(23.4%)	48(21.4%)	123(55.2%)	3.5	1.38
The meat production per unit (carcass cold dressed weight (Kg)/slaughtered camel) are high and have continued to increase	40(18.0%)	72(32.3%)	111(49.7%)	3.7	1.19

I sell high quality hides from camels when I slaughter them and get income	32(14.3%)	74(33.0%)	118(52.7%)	3.6	1.2
I keep camels for other by-products like manure which I use in crop production or sell.	45(20.2%)	49(21.8%)	129(58.0%)	3.4	1.32
The quality of hides (price/hide/camel) is high and increasing	37(16.7%)	41(18.2%)	145(65.1%)	3.5	0.79
My camels provide other sources of food like milk by-products (cream) and blood.	5(2.3%)	20(9.0%)	198(88.7%)	4.1	0.82
Camel trade generates enough profits to keep my business running and surplus for investments.	32(14.5%)	16(7.2%)	175(78.3%)	3.6	1.17
I am able to educate my children with income from camel production and trade.	35(15.5%)	51(22.8%)	138(61.7%)	3.6	1.25
I could get more in terms of milk and meat from camels if I got productivity enhancing inputs like supplementary feeds.	58(26.1%)	41(18.2%)	126(56.6%)	3.4	1.23
Camel business gives my family income to carry out other financial transactions to improve our lives.	45(20.2%)	30(13.5%)	148(66.3%)	3.6	0.94
Average Mean and Standard Deviation				3.8	1.08

N = 223

According to the findings, 207(93.0%) agreed that they kept camels for their high-quality milk as shown by a mean of 4.6 and a standard deviation of 0.83. Regarding whether camels provided enough milk for their families and for sale to generate income, 63(28.1%) disagreed, 37(16.7%) were neutral, while 123(55.2%) agreed as shown in Table 4.9. On milk production, 129(57.8%) agreed that the yield of milk/camel/day had been increasing over time with 28(12.5%) being undecided, while 66(29.7%) disagreed resulting in a mean of 3.6 and a standard deviation of 0.87. Regarding the quality of meat sold, most of the respondents 123(55.2%) agreed that they kept camels for high quality meat which they sold in the local butcheries/abattoirs for income, with 52(23.4%) disagreeing, while 48(21.4%) were undecided at a mean of 3.6 and a standard deviation of 1.2. Regarding quality and price of hides, 118(52.7%) of the respondents agreed that the price/hide/camel was high and increasing, while 74(33.0%) were undecided, and 32(14.3%) were neutral with a mean of 3.5 and a standard deviation of 0.79. Further, 138(61.7%) agreed they were able to educate their children with income from camel production as shown by a mean of 3.6 and a standard deviation of 1.25. On increased family income, 148(66.3%) agreed that camel business gave their families income to carry out other financial transactions to improve their lives, resulting in a mean of 3.6 and a standard deviation of 0.94. Other indicators of the dependent variable, which was improvement of camel

productivity and trade, are as shown in Table 3.

Underlying Assumptions of the Multiple Linear Regression

Before conducting regression, analysis and evaluating hypotheses, it was essential to run diagnostic tests to ensure that the assumptions of regression model were met (Green, 2007). These tests include normality, multicollinearity and autocorrelation.

Normality Test

Kolmogorov-Smirnov and Shapiro Wilks Tests were performed to determine the data distribution's shape (Shapiro & Wilk, 1968). Kolmogorov-Smirnov should have significant value of more than the standard value of 0.05 (Ghasemi and Zahedias, 2012) for the data to be normally distributed. The rule of thumb is that there is linearity if p< 0.05. However, the reverse is true if the p value> 0.05. The data in Table 4 yielded a Kolmogorov-Smirnov Z statistic of 0.091 (p = 0.001). Since the p value was less than 0.05, the alternative hypothesis was deemed plausible and the null hypothesis was rejected. It was concluded that the research data had a normal distribution and appropriate for linear regression analysis.

Table 4

Kolmogorov-Smirnov Test

	Kolmogorov-Smirnov[a]		
	Statistic	**df**	**Sig.**
Camel productivity	.091	366	.082

a. Lilliefors Significance Correction

Multi-Collinearity Test

Absence of multicollinearity is indicated by Tolerance values and Variance Inflation Factors. Cooper and Schindler (2014) claim that multicollinearity exists when the threshold of tolerance is less than 0.1 or the VIF is greater than 10 for any predictor variables. According to Field (2013), high relationship between the variables is ruled out by tolerance values more than 0.1, while VIF values greater than 10 imply the existence of multi - collinearity. According to the results, the tolerance scores ranged from 0.121 to 0.173. As a result, neither the tolerance values nor the VIFs pointed to presence of multicollinearity; meaning there was absence of multicollinearity in the data, as shown in Table 5.

Table 5

Collinearity Statistics

Variables	Tolerance values	VIF
Camel Breed Preferences [CB]	0.139	2.143

Autocorrelations test

Durbin-Watson Statistic was used to check for the presence of autocorrelation. According to Gujarat (2009), Durbin-Watson statistic ranges in value between 1 and 2, indicating no autocorrelation. The Durbin-Watson statistic for this research was 1.513 (Table 6). The fact that the value was in the range of 1.5 to 2.5 shows that the data did not automatically correlate.

Table 6

Autocorrelation Test

Model	**Durbin Watson**
1	1.513

In order to determine the model's significance, analysis of variance (ANOVA) was performed. The F-ratio (F= 76.312, p=.000) in the ANOVA Table 7 indicates that the model was statistically significant.

Table 7

ANOVA results

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	8234.138	3	2744.713	76.312	.000[b]
	Residual	7876.765	219	35.967		
	Total	16110.903	222			

a. Dependent Variable: Camel productivity and trade

b. Predictors: (Constant), Camel breed, Animal Care, Infrastructure, and Government interventions

Regression model

Camel breed had a positive and significant effect on camel productivity and trade in Mandera County (ß= 0.201, p-value = 0.032) as shown in Table 8.

Table 8

Model Summary

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.808	.394		2.049	.044
	Camel breed	.201	.092	.233	2.183	.032

a. Dependent Variable: Camel productivity

Hypotheses Testing

Camel breeds have no significant effect on camel productivity in Mandera County

From the results shown in Table 8, camel breed had a statistically significant positive impact on camel productivity (β= 0.201, p=0.032). Therefore, at a 5% level of significance, the null hypothesis was rejected.

Correlation Analysis

The Pearson's correlation coefficients are normally in the range of -1 to +1, with +1 denoting a perfect positive connection, -1 denoting a perfect negative correlation, and 0 denoting no correlation at all. The results were shown in Table 9.

Table 9

Correlations

	CB
CP	223 .733** .000 223

KEY: CB = Camel Breed, **CPT** = Camel productivity

Table 9 indicates that camel breed had a significant and positive relationship with camel productivity as attributed by the Pearson's correlation coefficient r= 0.733** and p-value of 0.000.

4.0 Conclusion

The results indicated that the aggregate mean was 3.7 and the standard deviation 1.1 for effects of camel breeds on productivity in Mandera County.

This meant that most of the respondents were in agreement with statements on the Likert scale related to influence of camel breeds on productivity of the animal. After carrying out correlation analysis, the study results indicated that camel breed was positively and highly significantly correlated with Camel productivity at r=0.733**. The study further confirmed that camel breed had a statistically significant positive impact on camel productivity (β= 0.201, p=0.032). The null hypothesis of non-significant relationship was therefore rejected. The study concluded that breeds of camels determined how much milk, meat, hides and other products the farmers got from camel business, other factors constant. It was concluded that a lot need to be done to improve camel breeds if productivity was to be increased to make camel business more rewarding to farmers and even the traders.

5.0 Recommendations

From the findings, the county government of Mandera needed to invest in more productive breeds and avail to farmers adequate bulls for production so as to maximize on the breeding period of female camels, which is normally wasted due to inadequate camel bulls.

Future research

Future research should consider other aspects of camel productivity and delve more into aspects of breeds and breeding to deepen understanding on the influence of breeds on specific aspects of productivity. Further, it would be useful to carry out the same type of research in other counties to compare results.

References

Berhe, T., Seifu, E., Ipsen, R., Kurtu, M. Y., & Hansen, E. B. (2017). Processing challenges and opportunities of camel dairy products. *International journal of food science*, *2017*(1), 1-8 https://doi.org/10.1155/2017/9061757

Chuluunbat, B., Charruau, P., Silbermayr, K., Khorloojav, T., & Burger, P. A. (2014). Genetic diversity and population structure of M ongolian domestic Bactrian camels (Camelusbactrianus). *Animal Genetics*, *45*(4), 550-558. https://doi.org/10.1111/age.12158

Cooper, D. R., & Schindler, P.S. (2014). *Business Research Methods* (12th Ed.). McGraw Hill.

Dokata, M. D. (2014). *Factors influencing camel milk production in central division of Isiolo District: A case of three camel milk women self-help groups in Isiolo County, Kenya* [Doctoral dissertation, University of Nairobi]. Kenya. http://hdl.handle.net/11295/74148

Guliye, A. Y., Noor, I. M., Bebe, B. O., & Kosgey, I. S. (2007). Role of Camels (Camelus

Dromedarius) in the Traditional Lifestyle of Somali Pastoralists in Northern Kenya. *Outlook on Agriculture, 36*(1), 29–34. https://doi.org/10.5367/000000007780223669

Hashim I. B., Khalil A. H., Habib H. (2023). Quality and acceptability of a set-type yogurt made from camel milk. *Journal of Dairy Science,* 92(3), 857–862. https://doi: 10.3168/jds.2008-1408.

Isako, T., & Kimindu, V. (2019). Camel milk value chain in Kenya: a review. *Journal of Marketing and Consumer Research*, *9*(6), 51-57. https://core.ac.uk/reader/234658100

Kadim, I. T., Al-Amri, I. S., Al Kindi, A. Y., & Mbaga, M. (2018). Camel meat production and quality: a review. *Journal of Camel Practice and Research*, *25*(1), 9-23. https://squ.elsevierpure.com/en/publications/camel-meat-production-and-quality-a-review

Kadim, I. T., Mahgoub, O., Faye, B., & Farouk, M. M. (Eds.). (2013). *Camel meat and meat products*. CABI. https://www.cabidigitallibrary.org/doi/abs/10.1079/9781780641010.0000

Kagunyu, A. W., & Wanjohi, J. (2014). Camel rearing replacing cattle production among the Borana community in Isiolo County of Northern Kenya, as climate variability bites. *Pastoralism*, *4*(1), 1-5. https://pastoralismjournal.springeropen.com/articles/10.1186/s13570-014-0013-6

Mohammed, Y. K, Ali, S., & Mengistu, U. (2017). Camel (camelus dromedaries) meat product potential and associated constraints in Eastern Ethiopia. *Eastern Africa of Veterinary and Animal Science, 1*(2), 77-86. https://eajvas.haramayajournals.org/index.php/eajvas/article/view/428

Mugenda, O. M., & Mugenda, A. G. (2013). *Research Methods: Qualitative and Quantitative Approaches*. Acts Press.

Shapiro, S. S., & Wilk, M. B. (1968). Approximations for the null distribution of the W statistic, *Technometrics*, *10*(1), 861–866. https://www.tandfonline.com/doi/pdf/10.1080/00401706.1968.10490638

Tekle, T., & Tesfay, Y. (2013). Production potential of camels (Camelus Dromedarius) under pastoral and agro-pastoral systems in North Afar, Ethiopia. *Livestock Research for Rural Development*, *25*(12), 13. http://lrrd.cipav.org.co/lrrd25/12/tekl25215.html

Wernery, U. (2003). Novel observations on camel milk. In *Proceedings of the 9th Kenya Camel Forum, Giriftu*. http://erepository.uonbi.ac.ke/bitstream/handle/11295/74148/Dokata_Factors%20influencing%20Camel%20milk%20production%20in%20Central%20Division%20of%20Isiolo%20District.pdf?sequence=2

Yamane, T. (1967). *Statistics, an Introductory Analysis* (2nd Ed.). Harper and Row.