Original Research Article

STUDY ON PREVALENCE OF ONE HUMPED CAMEL MANGE AND ITS ASSOCIATED RISK FACTORS IN SELECTED KEBELES OF KEBRIBEYAH DISTRICT OF FAFAN ZONE, SOMALI REGIONAL STATE, ETHIOPIA.

ABSTRACT

Camel mange is an extremely pruritic and contagious disease of camel caused by a small parasite *Sarcoptes scabiei var cameli*, It mostly affects the head, neck, flanks, inner side of the thighs and inguinal region of the animal. It is transmitted by direct or indirect contact, is one of the most important parasitic diseases affecting camels. Camel mange is economically important disease that hinders productivity and health of camel. Therefore, a cross sectional study was conducted between March to September 2021 to determine prevalence of camel mange mites and associated risk factors. A total of 384 animals were randomly selected and subjected to skin scrapings to recover mange from suspected lesions which was later on examined under microscope, out of the complete camels examined 116 (30.2%) camels were found positive for mange mite infestation. Only *Sarcoptes scabiei var cameli* was identified as the only mite species in all skin scraping samples collected from the suspected mange mite lesions. PA, sex and age showed no significant variation on mange infestation (P>0.05), while only body condition and herd size were shown statistically significant difference in prevalence of mange mites (P<0.05). This study indicates that camel populations in Kebribeyah district had large amount of mange mites which could hamper health and production status of the camels. Therefore, more emphasis should be given to improve the management system, further studies and control measures should be conducted to shrink the effect of mange mite infestation on camel husbandry.

Keywords: *Camel, Kebribeyah, Mange Mite, prevalence, Sarcoptes, Skin Scraping.*

Comment [p1]: Omit

Comment [p2]: ???

Comment [p3]: Spacing P > 0.05

Comment [p4]: spacing

Comment [p5]: Rephrase and correct the grammar

1. INTRODUCTION

Due to increasing number of human population and climatic change, the per capita production of food in sub-Sahara Africa is decreasing and there is a need of developing previously marginalized resources in the semi-arid and arid range lands through appropriate livestock production systems (1). Camel is an important livestock species in the pastoral economy (2) and is commonly distributed in subtropical dry areas in Africa and Asia (3) .The camel population is estimated to be 80% in the arid lowland of Eastern Africa of African camel and above 66% of that of its world camel population (1). The importance of camel become clearly evident for the region and the camel herders and camel do also play a significant socio-cultural role in the lives of pastoralists (4).

Ethiopia is one of the largest camel populated countries in the world. The camel population of Ethiopia is estimated to be 2.3 million of which two third is found in Eastern lowlands, from this population about 36.2% is found in Somali region (5). Ethiopia ranks third in Africa next to Somalia and Sudan (6). In Ethiopia, camel is found in eastern, south eastern and north eastern arid and semi-arid areas of the country mainly Somali region, Afar region and Borana zone which are believed to be account for about one third of the total surface area of the country (7). Even though the country has a large number of camels, little is known about its productive and reproductive performance (8).

The one humped camel (*Camelus dromedaries*) plays an important role in the subsistence economy of the pastoral society of eastern Ethiopia, the Somali state by providing milk, meat it is also as sole source dowry and the like (9). The ability of the camel to survive in harsh areas of the world, its endurance in prolonged drought, and above all its high potential to convert the scanty resources of the desert into milk and meat makes them more important to the pastoralists (10) .The camels have been bred owing to the extraordinary power to withstand thirst and hunger for long duration in the most inhospitable ecological conditions of the world (11).

Pathogenic diseases, poor nutrition and traditional management systems as well as lack of veterinary services have hampered their full utilization, despite the importance of dromedary in the semi-arid and arid areas where the environment is harsh and hostile (9). Parasitic diseases either lower the production and working efficiency or even may result in death of animals or

sometimes potentially endanger the public health (12). Among these, several endo and Ecto-parasite have been identified as the major problems affecting the health, productivity and performance of camels (9).

Camel mange is the second disease which is often considered to be the most parasitic disease affecting the production and productivity of the animal next to Trypanosomosis, and having its public health importance (13). Camel mange is an extremely pruritic and contagious disease of camel caused by a small parasite *Sarcoptes scabiei var cameli* (14). It mostly affects the head, neck, flanks, inner side of the thighs and inguinal region of the animal (15). Sarcoptes are a burrowing mite that penetrates deep into skin and lead to pruritus, development of papules, hairless areas and scab formation (16). "*Sarcoptes scabiei var cameli*" infestation causes serious disturbance and irritation leading to poor health status of animal and decreased production and efficiency (17).

The transmission of camel mange is determined by the interaction of the factors associated the host and external environment. It is very important in the rainy season, where it spreads fast through direct or indirect contact of animals (18). This disease has only one causative agent, a mite of the family Sarcoptidea, *Sarcoptes scabies vari cameli* (19). This mite is particularly confined to genus Camelus, humans are also infected. The life cycle lasts for 5 weeks. The parasite survives off the host for a maximum of 2 weeks. Fertilized females dig into epidermis causing inflammation and pruritis. When larvae, nymphs or adults are transferred from infected camel to healthy one, or when from objects which had come in contact with an infected camel, such as harnesses, tents and tree trucks or contact with soil transmission occurs (20).

Contempt very few studies had been reported the prevalence of camel mange in Ethiopia: For instance, prevalence of 10.68% 25%, 31.5% were reported from Dire Dawa, Borana and Fafan respectively (16,21,22). Despite these studies, there is no current information regarding the prevalence of camel mange and its associated risk factors in the study areas. Therefore, the objectives of this study was

- To determine the overall prevalence of camel mange and its associated risk factors in selected kebeles of Kebri-Beyah district.

Comment [p6]: Would you please show the scientific justification or rationale to conduct this study?

Explain in brief why this study was conducted?

Comment [p7]: ??

Comment [p8]: Omit the bullet and make it a sentence, in the same line.

2. MATERIALS AND METHOD

2.1 Study Area

The study was conducted from March, 2021 to September, 2021 in Kebri-Beyah district of Fafan zone, Eastern Ethiopia. Fafan zone is one of the eleven administrative zones of the SRS. The Kebri-Beyah is located 674.1 km southeast of Addis Ababa and 50 km southwest of Jigjiga. This town has a latitude and longitude of 9.0985^{0}N 43.1796^{0}E with an elevation of 1686 meters above sea level. The zone is situated in the northwest of SRS and borders on the south by Degehabur zone, on the southwest by Fiq zone, on the west and northwest by the Gursum, on the east by Harshin, and on the southeast by Awbare zone (23).

2.2 Study Population

The study population was consisted of indigenous breeds of one humped camel (camelus dromedaries) reared under pastoral management system in Jingada, Guyo, and Gillo kebeles of Kebri-Beyah district Somali region. Extensive system is dominant husbandry practice in the area in which animals are allowed to graze freely but sometimes the owners may give special intensive management for those camels intended for fattening purpose and housed in poorly constructed barns at night.

2.3 Sampling Methods and Sample Size Determination

The sample size was calculated according to the formula given by (24). Indicated below by considering 31.1% of prevalence (25). And 95% confidence level with a 5% desired absolute precision. The calculated sample size was 331.5 and to increase the precision of the study, a total of 384 camels were sampled and were examined for the presence of mange mites.

Formula:-. N= 1.962 * Pexp (1 - Pexp) / d2; where, N = required sample;

Pexp= expected prevalence; d = desired absolute precision. Accordingly, the sample size required for this study was 384. During sampling individual animals were selected using simple random sampling method and records were done regarding with age, sex, body condition, herd size and peasant associations of each selected animal.

Comment [p10]: Please omit this and take it to the study method. Here only describe the study area.

Comment [p11]: Please show the total population of one humped camels in the study area.

Comment [p12]: Please take this to the introduction part

Comment [p13]: Please correct

Comment [p14]: Omit the word formula, rather show the formula it self

The formula should be written in an appropriate mathematical function

Comment [p15]: n

Comment [p16]: n

Comment [p17]: Spacing
Pexp =

Comment [p18]: Records were taken with their corresponding age, sex, body condition, ……

2.4 Study Design and Methodology

The study was carried out from March 2021 to September 2021. A cross sectional study was conducted to estimate the prevalence rate and associated risk factors for the occurrence of camel mange in the study area.

2.4.1. Collection of Skin Scrapings

Skin scrapings of 384 camels with considering of peasant association, age, sex, and body condition and herd size, was taken from the camel populations in three selected kebeles of Kebri-Beyah district. The age of the sampled animals was determined by dental eruption according to (26) and conventionally were grouped into ≤3, as a young and ≥4 years as an adult camel. The body condition score (BCS) of sampled camels was evaluated by looking the back and flank then categorized as good, medium and poor according to (27). Herd size (HS) was categorized as small, medium and large according to the classification of (28). After selection of animals, each camel was restrained properly and the hairs were shaved using scalpel blade from the edges of the lesions till blood oozes out of the capillary (29).

2.4.2. Laboratory Investigation

Skin scrapings from suspected cases of mange were collected in labeled Petri-dishes and preserved in 10% formalin and taken to the laboratory and 10% potassium hydroxide (KOH) was added to digest or clean the scraped material of skin, hair, and other debris so that mites released from scabs and crusts before examination following procedures indicated by (29). All scraped tissues were carefully placed on microscopic slide for microscopic examination (40x or 100x magnification) and identification of the mange mite species based on the morphological characteristics described by (30).

2.5 Data Management and Analysis

The data collected from the study area was coded and recorded in Microsoft excel spread sheet and then analyzed by using SPSS version 20. Descriptive statistics was used to determine the prevalence of mange and Chi-square test ($\chi 2$) was used to determine any association between the prevalence of camel mange with sex, age, PA, body condition and herd size. In all the cases, confidence interval was held at 95% and $P<0.05$ was set for significance.

Comment [p19]: Study method and design

Comment [p20]: A cross-sectional study was conducted to determine the prevalence and associated risk factors responsible for the occurrence of mange mite infestation in one humped camels of the study area.

Comment [p21]: Please see at this sentence.

Samples of skin scrapping was taken…….

Comment [p22]: Grammar??????

Comment [p23]: Rephrase the entire paragraph.

Grammar issue

Comment [p24]: ?

Comment [p25]: Please see what does chi squared test do in statistics?
What about odds ratio (OR)

3. RESULT

3.1. Overall Prevalence of Camel Mange

The 384 camels examined for the presence of camel mange in the study area, 116 were found to be positive with an overall prevalence of 30.2%. In this study, only *sarcoptes scabiei* var. *cameli* was identified as the only mite species in all skin scraping samples collected from the suspected lesions.

Comment [p26]: Please rearrange ideas Grammar ????

3.2. Prevalence of Camel Mange in Relation to Peasant Associations

In the study area, Jingada, 29.6%, and Guyo, 32% were found with slightly higher prevalence followed by Gillo, 28.6% kebele respectively. But there was no statistically significant difference in the occurrence of camel mange among peasant associations ($p > 0.05$). **(Table 1).**

Comment [p27]: ?????????????

Table 1: Prevalence of Camel Mange in Relation to Peasant Associations

Comment [p29]: Please merge all tables in one

Table 1 to 5 can be one table.
And put the Odds ration and the 95% confidence interval for the variables which are statistically significant.

Variable	Category	No. Examined	No. Positive	Prevalence %	χ2	p-value
PA	**Jingada**	128	38	29.6%	0.652	0.836
	Gillo	122	35	28.6%		
	Guyo	134	43	32%		
	Total	**384**	**116**	**30.2%**		

3.3. Prevalence of Camel Mange in Relation to Sex

The sex group of the animals examined for prevalence of camel mange in kebribeyah district scored results of female 79 (32.1%) and male 37 (26.8%) in respectively. There was no statistically significance difference between the two sex groups (P>0.05). (Table 2).

Table 3: Prevalence of camel mange in relation to sex

Variable	Category	No. Examined	No. Positive	Prevalence %	χ2	p-value
Sex	**Male**	138	37	26.8%	1.359	0.274
	Female	246	79	32.1%		
	Total	**384**	**116**	**30.2%**		

3.4. Prevalence of Camel Mange in Relation to Age

The result revealed a higher rate of infestation in young aged group camels (36.6%), than adult aged group camels (27.6%), but the difference was not statistically significant (p>0.05). (Table 4).

Table 5: Prevalence of Camel Mange in Relation to Age

Variable	Category	No. Examined	No. Positive	Prevalence %	χ2	p-value
Age	**Young**	109	40	36.6%	2.394	0.122
	Adult	275	76	27.6%		
	Total	**384**	**116**	**30.2%**		

3.5. Prevalence of Camel Mange in Relation to Body Condition Score

In the current study, the prevalence of camel mange was higher in camels with poor body condition (37.3%), followed by medium (26.8%) and good body conditioned camels (20.2%) and the variation was statistically significant (P<0.05). (Table 6).

Table 7: Prevalence of Camel Mange in Relation to Body Condition Score

Variable	Category	No. Examined	No. Positive	Prevalence %	χ2	P-value
BCS	**Poor**	166	62	37.3%	12.316	0.004
	Medium	149	40	26.8%		
	Good	69	14	20.2%		
	Total	**384**	**116**	**30.2%**		

3.6. Prevalence of Camel Mange in Relation to Herd Size

The analysis result of this study revealed that small (<20), medium (20-40) and large (>40) herd sizes had the prevalence of 22.3%, 32.4% and 38.2% respectively and the variation was statistically significant in their prevalence (P<0.05). (Table 8).

Table 9: Prevalence of Camel Mange in Relation to Herd Size

Comment [p28]: Please show what HS mean somewhere

Variable	Category	No. Examined	No. Positive	Prevalence %	χ2	P-value
HS	**Small (<20)**	139	31	22.3%	8.468	0.019
	Medium (20-40)	151	49	32.4%		
	Large (>40)	94	36	38.2%		
	Total	**384**	**116**	**30.2%**		

4. DISCUSSION

Comment [p30]: Amend the discussion after properly interpreting and writing the results

Prevalence of camel mange in the current study was 30.2% at kebribeyah district. This is in agreement with the finding reported by different authors in Ethiopia although there is variation in the level of mange in such report work done (32.4%) by (22), in Eastern Ethiopia (27.8%) by (3) in Borana, Southern Ethiopia (25%) by (21) in Borana, Southern Ethiopia (28%) by(31) in Saudi Arabia. However, this prevalence was lower than several studies conducted in different parts of the world such as Egypt (47.6%) by (32) Jorden (83%) by (33). On the contrary, comparatively lower prevalence of camel mange mites has been reported from Azebu district (16.7%) by (14) from Northern Ethiopia (11.28%) by (17) from Punjab Pakistan (10.7%) by(2) from Eastern Ethiopia (3.5%) by (34) from Sokoto Nigeria (3.14%) by (35) from Cholistan-Pakistan. These variations of the infestation could be due to variations in environment, study seasons, level of awareness of the community with regard to methods of transmission & control and animal husbandry and managements.

Sarcoptic mange is one important camel diseases that were detected in the population studied. Sarcoptes scabiei var. cameli was identified as the only mite species in all scrapings collected from suspected skin lesions. The even reports have been experience by numerous authors such as (22, 17). Even though both sarcoptic and chorioptic mange mites have been reported (36).

The prevalence of camel mange mite infestation between the peasant associations, sexes, and age was no significant variation ($P > 0.05$). This result in general agreement with reports of (21) in Borana, southern Ethiopia, (25) from eastern Ethiopia and (28) in Borana, southern Ethiopia. These dealings might be due to similarities in management and the availability of same veterinary services as well as micro climatic condition of the study area.

The prevalence of mange mite infestation among body condition scores and herd size of camels was significant difference ($P<0.05$). This finding was in agreement with the result reported by (25), and another this result was disagreement with the results reported by (28) in Borana, Southern Ethiopia and (14) in Azebu district, Northern Ethiopia; it could be due to a variation in environment, study seasons and management practices.

In this study sex is not statically significance difference (P>0.05). This finding was agreed with the reports, by (37, 16). On the other hand these results were not agreed with (14) who found a significant difference between infested males and females. The increase of prevalence of female animals than that of male animals in the study might be due to hormonal influences the higher level of prolactin and progesterone hormones could make the females more susceptible to any infection. Additionally, pregnancy and lactation stress could also aggravate the susceptibility of the female camels to infections. Furthermore, the breeding behavior of mange infected males could also be attributed to the transfer of the disease to a number of females (38).

The age of camels might be important factors in mange infestation, in which both very young and very old camels are particularly susceptible. In this study the age is not statically significance different (P>0.05). This result was agreement with the report by (14). On the other hand these finding was disagreement with reports by (35). Furthermore, close interaction of the suckers with infested lactating females could also be another factor which makes more liable to the disease, leading to a higher prevalence in this age group.

On the other hand, the finding of this study showed a statistically significant variation (P<0.05) in mange infestation rate in relation to body condition score of camels. This result was disagreed with the report of (2) and (16) On contrary; this result was agreed with the report of (25). The mange mite infestation rate was highest in camels with poor body condition score (37.3%). The higher prevalence in poor body conditioned animals might be due to trypanosomiasis, worm burden and poor nutrition status which can act as predisposing factors of sarcoptic mange infestation as described by (36).

The present study of herd size shown an escalation in the prevalence of *Sarcoptes scabiei var cameli* in herds with larger size which is most probably to the fact that camels from large herd sizes are more prone to be exposed to diseased animals supporting the contagious nature of mite infestation and contacts during herding, housing and interactions at watering points and auction marts favors the establishment and spread of mite infestation (21).

5. CONCLUSION AND RECOMMENDATIONS

The present study conducted in Kebribeyah district of Fafan zone, eastern Ethiopia showed that camels living in this area are frequently infested with mange mites with a likely impact on their health and productivity. The overall prevalence of mite infestation was 30.2 %, *Sarcoptes scabiei var cameli* being the only mange mite found in affected camels in that area. Origin, sex and age were not significantly associated with the prevalence of mange mite infestation, while a positive association existed with body condition score and herd size. It was noted that the infestation of camel mange was positively correlated on animals with poor body condition and large herds among the risk factors assessed during the study. Feed scarcity to the camel population in the area favored close contact of these animals at available communal watering points and enhanced the establishment and transmission of mite infestation. This study showed that camels of harbor high mange mite which could have significant implication on the health and production performance of these animals.

Based on the results of these findings the following recommendations were forwarded:

- Good animal health services have to be established in the area.
- More emphasis should be given to improve the management system.
- Regional programs for controlling Ecto parasites should be expanded.
- Further studies on the seasonal pattern of camel mange should be conducted.
- Urgent professional interruption to the higher prevalence of the disease.
- Awareness rising in the community about mange and its control approaches has to be in place.

Comment [p31]: Omit bullets and write recommendations as a paragraph

6. REFERENCE

1. Gelagay, A. (2009): Investigation of the A etiology of the Emerging Camel Diseases in Pastoralist's areas of Ethiopia to Design Possible Control Measures, National Veterinary Institute, Debre Zeit, Ethiopia.
2. Dinka, A., Eyerusalem, B. andYacob, HT. (2010): A study on major ectoparasites of camel in and around Dire-Dawa, Eastern Ethiopia. Review Medical Veterinary, **161(**11):498–501
3. Abebe, F. (2001): Prevalence and intensity of ectoparasite infestation in Issa camel, eastern Ethiopia; DVM Thesis. Ethiopia. FVM, AAU Debrezeit, Pp: **6**-26.
4. Dirie, M.F. and Abdurahman, O. (2003): Observations on little known diseases of camels (Camelusdromedarius) in the Horn of Africa. Revue scientifiqueet technique-Office international des épizooties, **22**(3), 1043-1049
5. Buckary, A. (2011). Prevalence and Economic Significance of Hydatidosis in Camel (Camelus dromedaries) at Jigjiga Municipal Abattoir, Eastern Ethiopia, DVM Thesis, School of Veterinary Medicine, Hawassa, University, Hawassa, Ethiopia.
6. CSA/ (Central Statistical Authority) (2013): Agricultural sample enumeration statistical abstract. Addis Ababa, Ethiopia: Federal Democratic Republic of Ethiopia.
7. Dawo, F. (2010). Mysterious mortality in camel, (Camelusdromedarius) in Borena,Ethiopia, Evidence of its association with reproduction and age groups, Faculty Veterinary Medicine, Addis Ababa, Debrezeit, Ethiopia. 3: 621- 628
8. Samuel. (2008): Gross and Microscopic Pulmonary Lesions of Camel from Eastern Ethiopia, Tropical Animal Health and Production. 40: (25)-28
9. Bekele, T. (2002): Epidemiological studies on gastrointestinal helminthes of dromedary (Camelus dromedarius) in semi-arid lands of eastern Ethiopia. Veterinary parasitology, **105**(2), 139-152
10. Wosene, A. (1991): Traditional husbandry practices and major health problems of camels in the Ogaden, Ethiopia Nomadic People, 29:21-30.
11. Al-Dahash, S and Sassi, M. (2009): A preliminary study on management, breeding and reproductive performance of camel in Libya. *Journal Veterinary Science*, **23**: 276-281

Comment [p32]:

Comment [p33]:

Comment [p34]:

Comment [p35]:

12. Abdelrahman, O., and Hunter, A., (2001): Parasites of One humped Camel (Camelus dromedarius) in Sudan, *Central* Research Laboratory, Alamarat. Animal Resource Research Corporation, Khartoum, Sudan. **1**, 3-55.
13. Anwar, A. and Khan, M. (1998): Parasitic fauna of camel in Pakistan: Proceedings of the Third Annual Meeting for Animal Production under Arid Conditions. **2**:69-76.
14. Awol, N., Kiros, S., Tsegaye, Y., Ali, M. and Hadush, B. (2014). Study on mange mite of camel in Raya- Azebo district, northern Ethiopia. In Veterinary research forum*: an international quarterly journal*, **5**(1): 61-64
15. Elias, M., Hailu, Y., Jilo, K. (2020). Prevalence, risk factors and species diversity of Ixodid tics that parasitize dromedary camel in Yabello district of Borana Zone, Southern Ethiopia. *Journal of Parasitology and Vector Biology*, **12** (2), 52-59.
16. Megersa, B., Damena, A., Bekele, J., Adane, B. and Sheferaw, D. (2012): Ticks and mange mites infesting camels of Boran pastoral areas and the associated risk factors, southern Ethiopia *Journal of Veterinary Medicine and Animal Health*, **4**: 71-77.
17. Zahid, M., Maqbool, A., Anjum, S., Ashraf, K., Khan, M. and Ahmad, N. (2015): Prevalence of Sarcoptic Mange in Camels in Punjab, Pakistan. *Journal of Animal & Plant Science*, **25**(5), 1259-1263
18. Omer, M.M., Ahmed, A.M and Abusalab, S.M.A. (2007): A Retrospective Study on Camel Parasitic disease Diagnosed at Kassala Veterinaty Research Laboratory, Eastern Sudan, Kassala, Sudan, Veterinary Research. **1**(3):70
19. Wernery, U., and Kaader, O.R. (2002): Infectious Disease in Camelids: 2th edition Black Well Science Berlin, 313-324.
20. Bekele, M. (2010): An Epidemiological Study of Major Camel Diseases in the Borana lowland, Southern Ethiopia. *DCG Report* No. **58**
21. Yohannis Teshome, Kula Jilo, Nura Kararsa, Zelalem Zegeye, Zemanay Guyo, Tura Duba. Prevalence of Camel Mange Mite and Associated Risk Factors in Gomole District, Borana Zone, Southern Ethiopia. Animal and Veterinary Sciences Vol. **9**, No. 4, 2021, pp. 88-92
22. Teka, F., Mulisa, M., Keder, M., Yonas, G. and Tewodros, A. (2017): Major Ectoparasites infesting camelus dromedarius in three districts of Somali regional state, eastern Ethiopia. *World Applied Sciences Journal* **35** (1), 96-103

23. KDLRDO, (2018): Kebribeyah district livestock resources development office annual report.
24. Thrusfield, M. (2018). *Veterinary epidemiology*. John Wiley & Sons.
25. Teka Feyera, Petros Admasu, Ziad Abdilahi and Bahar Mummed, (2015): Epidemiological and therapeutic studies of camel mange in Fafan zone, Eastern Ethiopia. Parasites & vectors,**8**(1), p.612.
26. Bello A., Sonfada M.L., Umar A.A., Umaru M.A., Shehu S.A., Hena S.A., Onu J.E., Fatima O.O. (2013): Age estimation of camel in Nigeria using rostral dentition. *Scientific Journal of Animal Science*.**2**:9-14.
27. Faye B., Benoumi M., Cleradin A., Tabaruni A., Chilliard Y. 2001. Body condition score in dromedary camel: A tool for management of reproduction. Emirgence. *Journal of Agricultural Science*.**13**:1-6
28. Bekele, M., Abreham, D., Jemere, B., Bedne, A. and Desie, SH. (2012): Ticks and Mange mites infesting camels on Boran pastoral areas and the associated risk factors, southern Ethiopia. *Journal of Veterinary Medicine and Animal Health* **4**(5), 71-77.
29. Soulsby, E. (1982): Helmenths, Arthropods and Protozoa of Domesticated Animals,
30. Urquhart, GM., Armour, A., Duncan, JL. And Jennings, FW. (1996): Veterinary parasitology. (2nd ed.). London: Blackwell Science.
31. Ahmed A., Walaa M., Aml M. Abdel-Raouf., (2021): Epidemiological investigations in Sarcoptic mange in camels with special reference in treatment *J Parasit Dis* **45**(3):689–694.
32. Marwa A. Ahmed, Ehab Kotb Elmahallawy, Ahmed Gareh, Abdelbaset Eweda Abdelbaset, Fatma A. El-Gohary, Nagwa M. Elhawary, Ahmed K. Dyab, Elzahara Elbaz, and Mostafa F. N. Abushahba, (2020): Epidemiological and Histopathological Investigation of Sarcoptic Mange in Camels in Egypt *journal/animals* 2020, **10**, 1485.
33. Lawal, MD., Ameh IG, Ahmed, A. (2007): Some ectoparasite of Camelus dromedaries in Sokoto. Nigeria, *Journal of Entomol*, **4**(2), 143-148.
34. Odeh F. Al-Rawashdeh, Falah K. Al-Ani, Labib A. Sharrif, Khaled M. Al-Qudah,Yasin Al-Hami and Nicholas Frank. (2000): A Survey of Camel (Camelus dromedarius) Diseases in Jordan. *Journal of Zoo and Wildlife Medicine*, Vol. **31**, No. 3 (Sep., 2000), pp. 335-338

35. Ashraf, S., Chaudhry, SH., Chaudhry, M., Iqbal, Z., Ali, M., Jamil, T., Sial, N., Shahzad, MI., Basheer,F., Akhter, S., Rehman, SH., Yasin, A. (2014): Prevalence of Common Disea ses in Camels of Cholistan Desert Pakistan. *Journal of Infection and Molecular Biology*, **2**: 49-52
36. Parsani, H.R., Veer., Sengh., and Momin, R.R. (2008): Common Parasitic Disease of Camel Department of Parasitology, College of Veterinary Science and Animal Health, S.D. Agricultural University, Sardar krushinagar, India, 385-506
37. Kotb S, Abdel-Rady A (2013) Epidemiological studies of equine mange with special reference to different therapeutic protocols for effective treatment of Chorioptic mange. Ass Univ Bull Environ Res 16(2)
38. Lioyd, S. (1983): Effect of pregnancy and lactation upon infection. Vet. Immunol. Immunopathol. **4**(1-2):153-176