

Prevalence of Calf Scour and Associated Risk Factors in Model Dairy Farms of Holeta Town and Adea Berga District, Central Ethiopia

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Abstract

A cross-sectional study was conducted in Holeta town and Adea Berga district on model dairy farms from November 2020 to April 2021 with the aims of determining the prevalence of calf scour and its associated risk factors and identification of helminth parasites (*Ostertagia* and *Cooperia*) and *E. coli*. Descriptive statistics were used to determine the prevalence and Pearson's *Chi-square* (χ^2) test was applied to assess the association between the prevalence of calf scour and different risk factors. The overall prevalence of calf scour was found to be 57 (48.7%). Of the total positive samples 29.8%, 35.1%, 22.8, and 12.3% were found to be positive for *E. coli*, *Ostertagia*, *Cooperia* and mixed (*Ostertagia* and *Cooperia*), respectively. The results of *Chi-square* (χ^2) analysis revealed that among the different risk factors associated with the occurrence of calf scour only colostrum feeding ($P=0.001$; $\chi^2=10.191$), breed ($P=0.001$; $\chi^2=10.191$), body condition ($P=0.00$; $\chi^2=21.680$) and hygiene ($P=0.037$; $\chi^2=6.594$) had significant difference in the prevalence of calf scour. Of the total 117 examined calves 17 (14.5%) were positive for *E. coli*. Among the different risk factors associated with the occurrence of colibacillosis age ($P=0.000$; $\chi^2=23.576$), colostrum feeding ($P=0.002$; $\chi^2=9.199$), breed ($P=0.002$; $\chi^2=9.199$), and hygiene ($P=0.000$; $\chi^2=16.453$) had significant difference in the prevalence of colibacillosis. Of the total 117 examined calves 40 (34.2%) were positive for helminth parasites. Of the helminth positive samples 50%, 32.5%, and 17.5% were positive for *Ostertagia*, *Cooperia*, and mixed (*Ostertagia* and *Cooperia*), respectively. Among the different risk factors associated with the occurrence of helminthiasis age ($P=0.012$; $\chi^2=6.307$), and body condition ($P=0.00$; $\chi^2=22.756$) had significant difference in the prevalence of helminthiasis. In general, the current study revealed that there is alarmingly high prevalence of calf scour in the study areas. Hence, improved calf management practices should be implemented so as to minimize the occurrence of calf scour in the study areas.

Keywords: *Cooperia* • *E. coli* • Holeta • *Ostertagia* • Prevalence • Adea Berga

Introduction

Ethiopia is endowed with abundant livestock resources of varied and diversified genetic roles with specific adaption to its wide range of agro ecologies [1]. This great livestock potential is not properly exploited due to many prevailing socio-economic values and attitudes, traditional management methods, limited genetic potential and rampant disease. Gastrointestinal parasite infections are a problem for both small and large scale farms; however, their impact is greater in Sub-Saharan Africa. The prevalence of gastrointestinal parasites and the severity of infection vary considerably depending on the genera of helminth and protozoan parasites involved, animal species, local environmental conditions such as humidity, temperature, rainfall, vegetation and management practices [2-4].

The most important disease problems in the young calf are pneumonia and diarrhea. Enteric disease is a major health problem in calves, and diarrhea is associated with reduced weight gain and increased mortality rates in cattle production [5,6]. Furthermore, diarrhea in young calves has been found to increase the risk of other diseases later in life [7].

Calves are at greatest risk of developing diarrhea during the first month of life, and the risk then decreases with age [8,9]. The etiology of calf diarrhea is multifactorial and may include infective, environmental, nutritional, and management factors such as calves being born from a heifer [10], being born during the summer [11,12] suckling [11,13], low serum IgG concentrations [14], and large herd size [15].

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The pathogens associated with calf diarrhea are Rotavirus, Coronavirus, *Salmonella*, *E. coli* species, protozoan parasites, *Eimeria* and *Cryptosporidium* species [16,17]. The pathogenic effect of gastro-intestinal parasites may be sub clinical or clinical. Young animals are most susceptible. The effect of these parasites is strongly dependent on the number of parasites and the nutritional status of the animals they are infecting. The major clinical signs are weight loss, reduced feed intake, diarrhea, and mortality reduced carcass quality and reduced wool production/quality [18]. Young animals do not have a great deal of immunity to parasites during their first year at pasture. The second year, they have partial immunity and, although they may appear healthy, they eliminate many eggs. Adult animals are much less susceptible to most parasites, unless they are in poor living conditions [19].

The etiologic diagnosis is not determined for a large percentage of cases of neonatal diarrheas. Although calf scour is an important cause of calf morbidity and mortality in Ethiopia in general and in the study area in particular, little research work has been worked previously and very little attention has been given to the disease and losses.

Therefore, the objectives of this research were to estimate the prevalence of calf scour and various associated risk factors in Holeta town and Adea Berga district model dairy farms, and to identify helminth parasites (*Ostertagia* and *Cooperia*) and *E. coli*.

Materials and Methods

Study area

The study was conducted in Holeta town and Adea Berga district which are located in Oromia regional state. Holeta is located 45 km West of Addis Ababa at altitude 2400 meter above sea level. In these areas the rainfall pattern is bimodal, with short rainy period from February to April and a long rainy season from mid-June to September. The annual temperature ranges between 18°C to 24°C and the rainfall of the area ranges from 1000 to 1100 mm. Adea berga is located in central highland of Ethiopia at 9°16'N latitude and 38° 23, longitude, 70 km West of Addis Ababa and 35 km North west of Holeta on the main road of mugger. It lies at altitude of 2500 meter above sea level. It characterized by cool subtropical climate with mean annual temperature and rain fall of 18°C and 1225 mm respectively.

Study population

The study population consisted of calves with less than one year of age belonging to Holeta town and Adea Berga district model dairy farms (large and small scale dairy holders). Examined calves were categorized into two age groups: Less than or equal to one month (≤ 1 month) and greater than one month (1 month-12 months) which was determined by asking the owner of the animal orally and by observing calf age records.

Study design and sampling methodology

Cross-sectional study was conducted in Holeta town and Adea Berga district model dairy farms from November 2020 to April 2021 and a purposive sampling method was used to collect samples from calves. Moreover, the sexes, feeding types of colostrum, body conditions, hygienic condition of the house and breed types of calves were registered [20].

Questionnaire survey

A pretested questionnaire was administered to dairy farm owners to assess the general calf husbandry practices. Generally the questionnaire includes all practices in the farm that included about calf health care, hygiene, health problem, colostrums feeding type and duration as well as types of diarrhea that affect the growth of calves.

Sample size determination

The sample size was determined using the formula recommended by Thrusfield [21]. Since there was no previous investigation conducted on the same title in the study area, and expected prevalence of calf scour was 50%. Thus, by giving attention to this consideration the sample size was calculated based on the 95% confidence limit and 5% sampling error according to the following formula.

$$n = z^2 P_{exp} (1 - P_{exp}) / d^2$$

$$n = 1.96^2 P_{exp} (1 - P_{exp}) / d^2$$

Where,

n=Sample size,

z=Statistic for a level of confidence,

d=Required absolute precision,

P_{exp} =Expected prevalence.

Therefore using the above mentioned formula and the given figures, the sample size was calculated to be 384. However, the actual sample size collected during the study period was 117 since there were no enough amounts of calves in the study area.

Sample collection and examination

Fecal samples were collected from calves for identification of pathogenic helminthes parasites and *E. coli*. At the time of sampling, the name of the farm (owner), date of sampling, the age, sex, breed, address and management system was recorded for each calf on a data recording format. Fresh fecal samples were collected from rectum from each calf using sterile disposable plastic gloves. The samples were placed in labeled clean plastic containers (universal bottles) and were transported to the parasitology laboratory of Holeta agricultural research center and Sebeta microbiology laboratory on the same day of collection and were preserved at refrigerator until processing within 48 h of arrival.

Parasitological techniques

Floatation technique: Three grams of feces was placed in a beaker then 50 ml of flotation fluid (sodium chloride) was poured to the beaker containing 3 g of feces and then the flotation fluid was mixed with feces thoroughly with stick rod. The resulting fecal suspension was poured through a tea strainer into another beaker. The fecal suspension was poured into a test tube from the second container, then placed in a test tube rack, leaving a convex meniscus at the top of the tube and a cover slip was carefully placed on top of test tube. The tube was left to stand for 20 minutes and finally the cover slip was lifted off from the tube vertically together with the drop of fluid adhering to it and immediately placed on microscope slide and examined the presence of nematode eggs under the microscope [22].

Fecal cultures for *Ostertagia* and *Cooperia*: Fecal samples from calf whenever positive for strongyles types of eggs were cultured for harvesting third stage larvae (L3) and identification of the most important genera (*Ostertagia* and *Cooperia*) of non-distinguishable nematode eggs in cattle (calves) according to Hansen and Perry [19]. Pooled fecal samples were broken up using stirring device, kept moist and crumbly; the mixtures transferred to petri-dishes and placed at 27°C for 7 to 10 days. The samples were kept humid, mixed occasionally and aerated every 1 to 2 days. During this period the larvae hatched from the eggs and developed into L3. Finally larvae were recovered using the Baermann technique. From each culture, the third-stage larvae (L3) of *Ostertagia* and *Cooperia* were morphologically differentiated and identified according to keys provided by Hansen and Perry [19].

Bacteriological isolation and identification of *E. coli*: Isolation of *E. coli* was attempted according to Quinn et al. [23] with slight modification. All samples were cultured on blood agar and incubated aerobically at 37°C for 24 to 48 hrs. After morphological examination, type of hemolytic, and Gram staining characteristics pure colonies were further sub-cultured and incubated on nutrient agar and MacConkey Agar (MCA), which is a dual purpose (selective and differential) medium, by four flame technique at 37°C for 24 h. Pink colored colonies were considered as presumptive of *E. coli*. Gram's staining was performed to determine the size, shape

and arrangement of bacteria. The organisms revealed gram negative, pink colored with rod shaped appearance and arranged in single or in pair were suspected as *E. coli*. A single isolated colony was picked from MCA and streaked on Eosin Methylene Blue Agar (EMB) medium and incubated at 37°C for 24 h. The characteristic green metallic sheen growth of colonies is a presumptive identification for *E. coli*. Colony morphology and colors on MCA and EMB agar plates together with the gram stain procedure were used as initial identification of *E. coli* colonies. Such colonies were taken from EMB into nutrient broth and agar for further biochemical examination [23].

Biochemical tests were performed to confirm *E. coli*: Slide catalase test, Oxidase test, Indole test, Methyl Red (MR) and Vogues Proskauer (VP) tests, Citrate utilization test and Triple Sugar Iron test and Carbohydrate fermentation tests were performed [23].

Data management and analysis

The collected data were entered into Microsoft excel sheet and analyzed through Statistical Package for Social Sciences (SPSS) Version 20. Accordingly, descriptive statistics such as percentages and frequency distribution were used to determine the prevalence and Pearson's *Chi-square* (χ^2) test was applied to assess the association between the prevalence of calf scour and different risk factors. A value of $p \leq 0.05$ was considered significant.

Results

Overall prevalence of calf scour

Out of the total 117 examined calves 57 (48.7%) were positive for calf scour. Of the total positive samples 29.8%, 35.1%, 22.8, and 12.3% were found to be positive for *E. coli*, *Ostertagia*, *Cooperia* and mixed (*Ostertagia* and *Cooperia*), respectively. The *Chi-square* (χ^2) analysis results revealed that among the different risk factors associated with the occurrence of calf scour only colostrum feeding ($P=0.001$; $\chi^2=10.191$), breed ($P=0.001$; $\chi^2=10.191$), body condition ($P=0.00$; $\chi^2=21.680$) and hygiene ($P=0.037$; $\chi^2=6.594$) had significant difference in the prevalence of calf scour as shown below in Table 1.

Risk factors	No. of examined	No. of positive (%)	χ^2	P-value
Age				
≤ One month	11	7 (63.6)	1.082	0.298
One month-12 months	106	50 (47.2)		
Sex				
Female	93	45 (52.7)	2.86	0.091
Male	24	8 (33.3)		
Colostrum feeding				
Bucket	80	47 (58.8)	10.191	0.001

Natural	37	10 (27.0)		
Breed				
Cross	80	47 (58.8)	10.191	0.001
Jersey	37	10 (27.0)		
Body condition				
Good	22	2 (9.1)	21.68	0
Moderate	67	34 (50.7)		
Poor	28	21 (75.0)		
Hygiene				
Good	12	7 (58.3)	6.594	0.037
Moderate	75	30 (40.0)		
Poor	30	20 (66.7)		
Overall	117	57 (48.7)		

Table 1. Overall prevalence of calf scours with different associated risk factors.

Prevalence of colibacillosis

Of the total 117 examined calves 17 (14.5%) were positive for *E. coli*. The *Chi-square* (χ^2) analysis results revealed that among the different risk factors associated with the occurrence of colibacillosis age (P=0.000; $\chi^2=23.576$), colostrum feeding (P=0.002; $\chi^2=9.199$), breed

(P=0.002; $\chi^2=9.199$), and hygiene (P=0.000; $\chi^2=16.453$) had significant difference in the prevalence of colibacillosis as shown below in Table 2.

Risk factors	No. of examined	No. of positive (%)	χ^2	p-value
Age				
≤ One month	11	7 (63.6)	23.576	0
One month-12 months	106	10 (9.4)		
Sex				
Female	93	14 (15.1)	0.1	0.752
Male	24	3 (12.5)		
Colostrum feeding				
Bucket	80	17 (21.2)	9.199	0.002
Natural	37	0 (0.0)		
Breed				
Cross	80	17 (21.2)	9.199	0.002
Jersey	37	0 (0.0)		
Body condition				
Good	22	2 (9.1)	1.469	0.48
Moderate	67	12 (17.9)		
Poor	28	3 (10.7)		
Hygiene				
Good	12	0 (0.0)	16.453	0
Moderate	75	6 (8.0)		

Poor	30	11 (36.7)
Overall	117	17 (14.5)

Table 2. Prevalence of *E. coli* with different associated risk factors.

Prevalence of helminthiasis

Of the total 117 examined calves 40 (34.2%) were positive for helminth parasites. Of the helminth positive samples 50%, 32.5%, and 17.5% were positive for *Ostertagia*, *Cooperia*, and mixed (*Ostertagia* and *Cooperia*), respectively. The *Chi square* (χ^2) analysis

results revealed that among the different risk factors associated with the occurrence of helminthiasis age ($P=0.012$; $\chi^2=6.307$), and body condition ($P=0.00$; $\chi^2=22.756$) had significant difference in the prevalence of helminthiasis as shown below in Table 3.

Risk factors	No. of examined	No. of positive (%)	χ^2	p-value
Age				
≤ One month	11	0 (0.0)	6.307	0.012
One month-12 months	106	40 (37.7)		
Sex				
Female	93	35 (37.6)	2.393	0.122
Male	24	5 (20.8)		
Colostrum feeding				
Bucket	80	30 (37.5)	1.233	0.267
Natural	37	10 (27.0)		
Breed				
Cross	80	30 (37.5)	1.233	0.267
Jersey	37	10 (27.0)		
Body condition				
Good	22	0 (0.0)	22.756	0
Moderate	67	22 (32.8)		
Poor	28	18 (64.3)		
Hygiene				
Good	12	7 (58.3)	3.503	0.174
Moderate	75	24 (32.0)		
Poor	30	9 (30.0)		
Overall	117	40 (34.2)		

Table 3. Prevalence of helminths infection with different associated risk factors.

Discussion

The overall prevalence of calf scour in the study was 48.7%. Of the total positive samples 29.8%, 35.1%, 22.8, and 12.3% were found to be positive for *E. coli*, *Ostertagia*, *Cooperia* and mixed (*Ostertagia* and *Cooperia*), respectively. Among the different risk factors associated with the occurrence of calf scour only colostrum feeding, breed, body condition and hygiene had significant difference in the prevalence of calf scour.

The prevalence of *E. coli* in the present study was 14.5%. The current finding is lower than reports Dereje (43.1%) [24], Masud et al. (44%) [25], Paul et al. (76%) [26], Haggag and Khaliel (82%) [27], El-Shehedi et al. (35.83%) [28], Osman et al. (63.6%) [29], and Hassan (50%) [30]. However, this finding is higher than the findings of Viring et al. [31] (11.5%) and Azzam et al. (5.4%) [32]. This high and low occurrence of *E. coli* may be due to the difference in study area, age of calves, farm size, and sample size, managements, and hygiene measurements.

The prevalence of helminth parasites was 34.2%. Of the helminth positive samples 50%, 32.5%, and 17.5% were positive for *Ostertagia*, *Cooperia*, and mixed (*Ostertagia* and *Cooperia*), respectively. The present finding for ostertagiosis was higher than previous finding by Refiullah et al. (6.7%) [33], Elele (5.2%) [34] and Addisu and Berihu (1.8%) [35]. However, it was less than reports of Slocombe (60.2%) [36] and Enyiew et al. (52.6%) [37]. The difference the occurrence of ostertagiosis may due to seasonal variation among the different study periods, housing system, age of calves, hygienic conditions of the farms, appropriate timing for colostrum feeding and other managerial practices in the different study areas.

Conclusion

The current study revealed that there is alarmingly high prevalence of calf scour in the study areas with high level of prevalence of helminth parasitic infections. However, the occurrence of colibacillosis is lower than the helminth infections. Among the different associated risk factors, colostrum feeding type, breed, body condition, and hygiene, have significance differences in the occurrence of calf scour. Moreover, the age of the calves has also a significant association with the occurrence of colibacillosis. Therefore, improved calf management practices should be implemented so as to minimize the occurrence of calf scour, and appropriate amount of colostrum and feeding time should be practiced uniformly in the different farms so as to boost the immune systems. Further advanced investigations should be conducted in order to render more detail information related to the mentioned etiological agents of calf scour in the study area, so as to put appropriate control and prevention measures in place.

References

- Central Statistical Agency (CSA). Federal Democratic Republic of Ethiopia: Central Statistical Agency Agricultural sample survey, Volume II, report on Livestock and Livestock characteristics, Bulletin No.578. Addis Ababa, (2015): 12-15
- Debela, Etana. "Epidemiology of Gastrointestinal helminthiasis of Rift valley goats under traditional husbandry system in Adami Tulu District, Ethiopia." *SINET Ethiop J Sci* 25 (2002): 35-44.
- Sandhu BS, and LD Singla. "Coccidiosis in bovines: an increasing problem." *Compendium of Winter School on Novel Approaches for Diagnosis and Control of Parasitic Diseases of Domestic and Wild Animals held from* (2005): 07-27.
- Wadhwa, Ashutosh RK, Tanwar LD, Singla S. Eda, Naveen Kumar, and Yogesh Kumar, et al. "Prevalence of gastrointestinal helminthes in Cattle and buffaloes in Bikaner, Rajasthan, India." *Vet World* 4 (2011): 417.
- Wittum, TE, MD Salman, KG Odde, RG Mortimer, and ME King, et al. "Causes and costs of calf mortality in Colorado beef herds participating in the National Animal Health Monitoring System." *J Am Vet Med Assoc* 203 (1993): 232-236.
- Virtala, AM, GD Mechor, YT Grohn, and HN Erb. "Morbidity from nonrespiratory diseases and mortality in dairy heifers during the first three months of life." *J Am Vet Med Assoc* 208 (1996): 2043-2046.
- van Donkersgoed, Joyce, Carl S Ribble, Leona G Boyer, and HG Townsend. "Epidemiological study of enzootic pneumonia in dairy calves in Saskatchewan." *Can J Vet Res* 57 (1993): 247.
- Bendali, Fatah, Herve Bichet, Francois Schelcher, and Moez Sanaa. "Pattern of diarrhoea in newborn beef calves in south-west France." *Vet Res* 30 (1999): 61-74.
- Garcia A, JA Ruiz-Santa-Quiteria, JA Orden, D Cid, R Sanz, and M Gomez-Bautista. "Rotavirus and concurrent infections with other enteropathogens in neonatal diarrheic dairy calves in Spain." *Comp Immunol Microbiol Infect Dis* 23 (2000): 175-183.
- Clement JC, ME King, MD Salman, TE Wittum, HH Casper, and KG Odde, et al. "Use of epidemiologic principles to identify risk factors associated with the development of diarrhea in calves in five beef herds." *J Am Vet Med Assoc* 207 (1995): 1334-1338.
- Svensson, Catarina, Karin Lundborg, Ulf Emanuelson, and Sven-Ove Olsson. "Morbidity in Swedish dairy calves from birth to 90 days of age and individual calf-level risk factors for infectious diseases." *Prev Vet Med* 58 (2003): 179-197.
- Svensson C, J Hultgren, and PA Oltenacu. "Morbidity in 3-7-month-old dairy calves in south-western Sweden, and risk factors for diarrhoea and respiratory disease." *Prev Vet Med* 74 (2006): 162-179.
- Trotz-Williams LA, KE Leslie, and AS Peregrine. "Passive immunity in Ontario dairy calves and investigation of its association with calf management practices." *J Dairy Sci* 91 (2008): 3840-3849.
- Blom, Jens Yde. "The relationship between serum immunoglobulin values and incidence of respiratory disease and enteritis in calves." *Nord Vet Med* 34 (1982): 276-284.
- Frank, Nancy A, and John B Kaneene. "Management risk factors associated with calf diarrhea in Michigan dairy herds." *J Dairy Sci* 76 (1993): 1313-1323.
- Bhat SA, PD Juyal, and LD Singla. "Prevalence of cryptosporidiosis in neonatal buffalo calves in Ludhiana district of Punjab, India." *Asian J Anim Vet Adv* 7 (2012): 512-520.
- Brar APS, NK Sood, P Kaur, LD Singla, BS Sandhu, and K Gupta, et al. "Periurban outbreaks of bovine calf scours in Northern India caused by Cryptosporidium in association with other enteropathogens." *Epidemiol Infect* 145 (2017): 2717-2726.
- Radostits OM, Clive C Gay, Douglas C Blood, and Kenneth W Hinchcliff. "A textbook of the diseases of cattle, sheep, pigs, goats and horses." *Vet Med* 9 (2000): 603-700.
- Hansen J and B Perry. *The Epidemiology, Diagnosis and Control of Helminthes Parasites of Ruminants. A handbook*, ILRAD, Nairobi, Kenya, 1994.
- Cole B. *Beef Production Guide*. Macarthur Press, Parramatta, 1978.
- Thrusfield M. *Veterinary Epidemiology. 3rd lactating cows and associated risk factors in and Ed.*, Blackwell Science Ltd., Oxford, UK, Pp. 233-261, 2005.
- Hendrix CM. "Diagnostic Veterinary Parasitology 2nd Edition." (1998): 266-267.
- Quinn PJ, Bryan K Markey, ME Carter, WJC Donnelly, and FC Leonard. *Veterinary microbiology and microbial disease*. Blackwell science, 2002.
- Dereje W. *Isolation and identification of Enterobacteria species from diarrheic calves in and around Addis Ababa, Ethiopia*, 2012.
- Masud MA, M Fakhruzzaman, MM Rahman, MM Shah, and KHMNH Nazir. "Isolation of *Escherichia coli* from apparently healthy and diarrheic calves in Dinajpur area in Bangladesh and

26. Paul K, M Khan, and S Mahmud. "Isolation and characterization of *E. coli* from buffalo calves in some selected areas of Bangladesh." *Bangl J Vet Med* 8 (2010): 23-26.
27. Haggag YN, and SA Khaliel. "Public health importance of certain bacteria isolated from calves and small ruminants." In 2nd Veterinary Congress, Faculty of Veterinary Medicine, Minufiya University, Egypt 2 (2002): 173-184.
28. El-Shehedi M, A Mostafa, M Eraqi, and RA Aisha. "Characterization of *Escherichia coli* from diarrheic calves with special reference to plasmid profile." *Am J Sci* 9 (2013): 54-59.
29. Osman KM, AM Mustafa, M Elhariri, and GS Abdelhamed. "The distribution of *Escherichia coli* serovars, virulence genes, gene association and combinations and virulence genes encoding serotypes in pathogenic *E. coli* recovered from diarrhoeic calves, sheep and goat." *Transbound Emerg Dis* 60 (2013): 69-78.
30. Hassan AM. "Some studies on bacteriological causes of enteritis in calves." *J Vet Adv* 4 (2014): 503-507.
31. Viring S, SO Olsson, S Alenius, U Emanuelsson, SO Jacobsson, and B Larsson. "Studies of enteric pathogens and γ -globulin levels of neonatal calves in Sweden." *Acta Vet Scand* 34 (1993): 271-279.
32. Azzam RA, WH Hassan, MA Ibrahim, and MS Khaled. "Prevalence of verocytotoxigenic *E. coli* O157: H7 in cattle and man in Beni-Sueif Government." *Alex J Vet* 24 (2006): 111-122.
33. Rafiullah A, T Ali, S Abdul, R Sayyed, A Shabbir, and S Muhammad, et al. Veterinary Research Institute, Khyber Pakhtunkhwa, Peshawar. *Pakistan J Agric Bio Sci* 6 (2011): 9-18.
34. Elele K, O Owhoeli and L Gboeloh. Department of Animal and Environmental Biology, University of Port Harcourt, P. M.B 5323 Choba, Rivers State, Nigeria International Research Medicine. *Science* 1 (2013): 010-017.
35. Addisu B, and H Berihu. In West Arsi zone, Ormia Regional State, 2014.
36. Slocombe JOD. "Abomasal nematodes in cattle in Ontario." *Can J Comp Med* 38 (1974): 18.
37. Alemnew, Enyiew, Faris Delil, and Habtamu Addis. "Prevalence of bovine coccidiosis and ostertagiosis in and around Kombolcha district of south Wollo, Ethiopia." *Academ Arena* 9 (2017): 16-25.

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