

DOI: <https://doi.org/10.32792/jeps.v14i2.436>

Prevalence of *Cysticercus tenuicollis* in Slaughtered Goats in Thi-Qar province, Iraq

Wesam Jasim Hansh

General Directorate of Education in Thi-Qar Province / Iraq.

wjhansh81@gmail.com, WesamHansh@utq.edu.iq

Received 3/2/2024 Accepted 21/2/2024, Published 1/6/2024



This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

Abstract

The present study was conducted in slaughterhouse of Al-Nassiriyah city at Thi-Qar province / Iraq to investigate the prevalence of *Cysticercus tenuicollis* (*Taenia hydatigena* cysts) in goats during the period from July 2022 to June 2023. A total 540 (286 male and 254 female) of goats were examined based on visual inspection method of meat. The current study showed that the prevalence of *C. tenuicollis* in the examined goats is 132(24.44%) and intensity of infection is 1.62. In this study, April recorded the highest infection rate (48.57%) with a significant difference ($p < 0.05$), followed by February (34.37%), while the lowest infection rate was in August (7.89%). Statistical analysis demonstrated there is no significant difference between the infection rate in the males (22.38%) and females (26.77%) goats, also, the intensity of the infection was relatively similar, 1.66 and 1.59 in the males and females respectively. The highest infection rate was recorded in older goats (29.24%) without significant variation ($p > 0.05$) when compared with young goats (17.57%). The most common site of *C. tenuicollis* was in omentum (84.85%) with a significant difference followed by liver (9.09%), while a low infection rate was recorded in other organs.

Keywords : *Cysticercus tenuicollis*, Goats, Thi-Qar province.

1. Introduction

Parasitic infections are important causes of morbidity and mortality in animals and humans (Pal *et al.*, 2014). *Taenia hydatigena* is a widespread parasite that affects a large number of herbivores with its larval cystic phase, *Cysticercus tenuicollis* (Murrell *et al.*, 2005). *Cysticercus tenuicollis* is cystic stage (a metacestode) of *T. hydatigena*, and the life cycle includes carnivores (dogs and wild canids) as the final hosts of *T. hydatigena* while domestic and wild ruminants are mostly (sheep, goats, cattle, horses, deer and pigs) act as intermediate hosts (Oryan *et al.*, 2012 ; Omar *et al.*, 2016). *Cysticercus tenuicollis* grows as sacs containing fluid that cause damage to affected organs (Radostits *et al.*, 2007). The adult worm of *T. hydatigena* shed eggs in the feces of final hosts, thus facilitating intake by ruminants during grazing. The eggs hatch after being eaten in the small intestine of ruminants and then move to other organs. This may cause weight loss, appetite loss, and decrease in milk and meat production (Oryan *et al.*, 2012). The size of *C. tenuicollis* cysts ranges from one cm up to (6–7) cm, with a long neck scolex. These cysts are adhered to various organs, including: the mesenteries, omentum, and sometimes on the superficial layer of the liver (OIE, 2008).

Prior studies proposed that official examination of sheep at slaughterhouses represents one of the precise methods of diagnosis of infection with *C. tenuicollis* cysts (Saulawa *et al.*, 2011). The diagnosis of cysticercosis is relied on the morphological and molecular identification of *T. hydatigena* cysts, such as, number of hooks in scolex, hook size and blade length. Presently, molecular techniques are mostly used to differentiate between different species of parasites. (Boufana *et al.*, 2015 ; Rostami *et al.*, 2015 ; Zhang *et al.*, 2018). To date, no study is available about the *C. tenuicollis* in goats in Thi-Qar province, therefore, the current study aimed to detect the prevalence of *C. tenuicollis* in goats in slaughterhouse of Al-Nassiriyah city / Thi-Qar province.

2. Materials and Methods

2.1. A Study area

The current study was performed in AL-Nassiriyah municipal slaughterhouse in Thi-Qar province/ Iraq to determine the prevalence of *C. tenuicollis* in goats during the period from July 2022 to June 2023. A slaughterhouse was visited weekly (once a week).

2.2. Data Collection

During the present study, 540 of goats including 286 males and 254 females from different ages were examined. During post-mortem examination, *C. tenuicollis* cysts were inspected in the visceral organs by

applying the routine visual inspection method of meat (Gracey *et al.*, 1999). *C. tenuicollis* cysts were first diagnosed according to their characteristics: transparent cysts containing the pellucid fluid and a long neck with small white spots (a long necked single scolex) in the fluid (Soulsby, 1982 ; Kaufmann, 1996). The sex, age, and affected organs of the examined and infected goats were recorded on a form for this purpose. The goats age was estimated based on teeth examination with assistance of the veterinarian.

2. 3. Estimation of parasitological indicators

Two parasitological indicators were estimated according to Margolis *et al.* (1982)

Prevalence (%) = number of infected goats / number of examined goats. x 100

Intensity of infection = number of *C. tenuicollis* cysts / number of infected animals.

2. 4. Statistical analysis

The recorded data on the effect of monthly distribution, sex, age and affected organs on the prevalence of *C. tenuicollis* in goats were analyzed using Chi-square tests in SPSS software. P-value (≤ 0.05).

3. Results

3.1. Prevalence of *C. tenuicollis* in goats

The current study exhibited that all *C. tenuicollis* cysts of *T. hydatigena* isolated from affected organs were transparent cysts filled with fluid, surrounded by a very thin wall and necked scolex. Post-mortem examination of the visceral organs of (540) goats showed that the overall prevalence of *C. tenuicollis* cysts was 132(24.44%) and total intensity of infection is 1.62 in goats. Figure (1), Table (1).

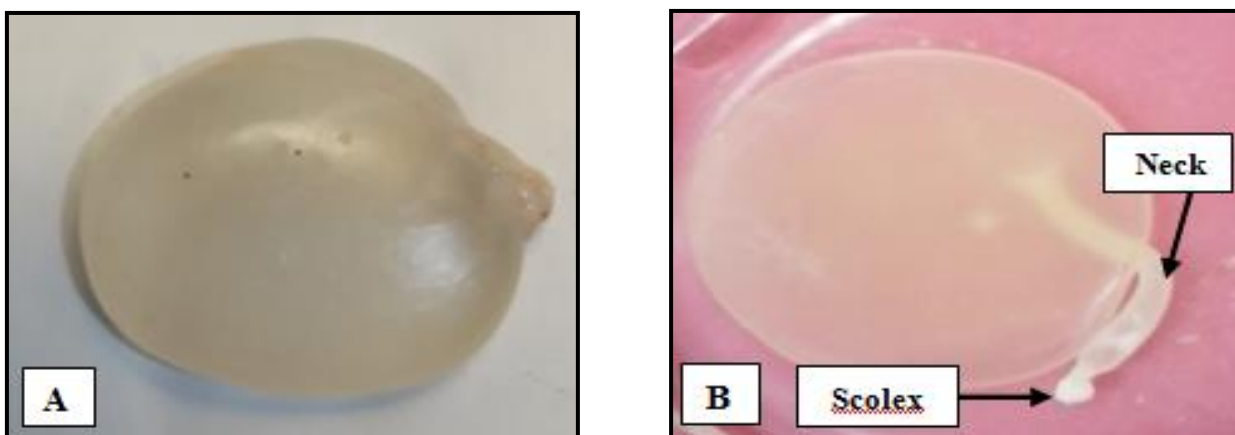


Figure 1: *C. tenuicollis* cyst (A), Larval stage within cyst showed scolex and neck (B).

Table 1: Overall prevalence of *C. tenuicollis* and intensity of infection in goats.

Animal	No. examined	No. infected	% of infection	No. of <i>C. tenuicollis</i> cysts	Intensity of infection
Goats	540	132	24.44	214	1.62

The prevalence of *C.tenuicollis* in goats was distributed throughout the year, with the highest rate of infection recorded in April (48.57%) with a significant difference ($p < 0.05$) when compared with other months followed by February (34.37%), while the lowest rate of infection was in August (7.89%). The highest infection intensity was 2.15 in October and the lowest was in August and March 1. Statistical analysis exhibited there is no significant variation in infection intensity during months of the year. Table (2).

Table 2: Monthly distribution of *C.tenuicollis* infection in goats.

Months of year	No. of examined	No. of infected	% of infection	No. of <i>C. tenuicollis</i> cysts	Intensity of infection
July	48	6	12.5	10	1.66
August	38	3	7.89	3	1
September	49	14	28.57	28	2
October	60	13	21.66	28	2.15
November	42	10	23.81	15	1.5
December	37	4	10.81	4	1
January	25	8	32	13	1.6
February	64	22	34.37	28	1.27
March	41	8	19.51	8	1
April	35	17	48.57	30	1.76

May	45	9	20	14	1.55
June	56	18	32.14	33	1.83
P. value	-	-	0.0001	-	0.99

The present results exhibited that the infection rate in females goats was (26.77%) higher than in males (22.38%), while the intensity of the infection was relatively similar in male and female goats 1.66 and 1.59 respectively. Statistical analysis showed there is no significant difference in the infection rate and intensity between male and female goats ($p>0.05$). Table (3).

Table 3: Infection rate of *C.tenuicollis* in slaughtered goats according to the sex.

Sex	No. examined goats	No. infected goats	% of infection	No. of <i>C. tenuicollis</i> cysts	Intensity of infection
Male	286	64	22.38	106	1.66
Female	254	68	26.77	108	1.59
P. value	-	-	0.47	-	0.98

In this study, the prevalence of *C.tenuicollis* in older goats (>1 year) was 93(29.24%) higher than young goats (< 1 year) 39(17.57%), Statistically, no significant difference between old and young goats, also, no significant difference in the intensity of infection according to age of goats ($p>0.05$). Table (4).

Table 4: Infection rate with *C.tenuicollis* in slaughtered goats according to the age.

Age	No. of examined goat	No. of infected goat	% of infection	No. of <i>C. tenuicollis</i> cysts	Intensity of infection
< 1 year	222	39	17.57	58	1.49
>1 year	318	93	29.24	156	1.68
P. value	-	-	0.10		0.60

The present study revealed that omentum was the most influenced organ 112(84.85%) with *C. tenuicollis* in goats with a significant variation ($p < 0.05$) when compared with other infected organs, liver 12(9.09%), omentum and liver 3(2.27%) and lung 1(0.76%). The highest infection intensity was 6 in organs (Omentum, Liver and Gallbladder) with no significant difference, while the least intensity of infection was 1 in the lung and mesentery. Table (5), Figure (2).

Table 5: Infection rate of *C.tenuicollis* in infected organs.

infected Organs (132)	No. of infected organs	% of infection	No. <i>C.tenuicollis</i> cysts	Intensity of infection
Omentum	112	84.85	179	1.60
Liver	12	9.09	15	1.25
Lung	1	0.76	1	1

Omentum and Liver	3	2.27	9	3
Omentum and Gallbladder	1	0.76	2	2
Omentum, Liver and Gallbladder	1	0.76	6	6
Mesentery	2	1.51	2	1
P. value	-	0.0001	-	0.20

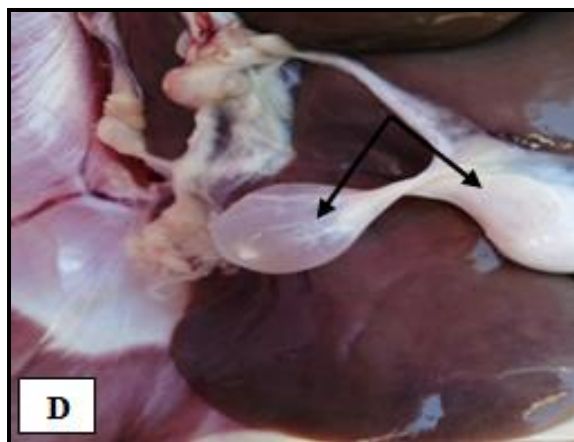
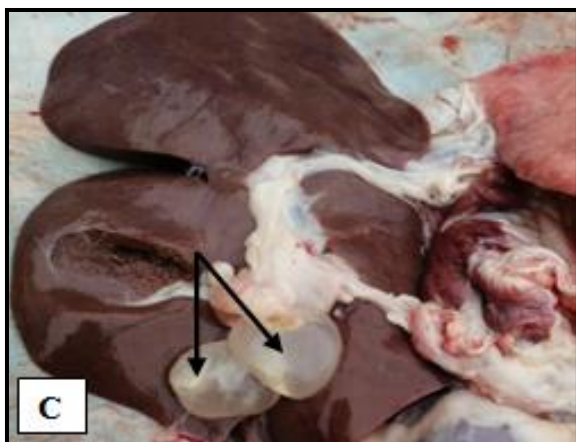
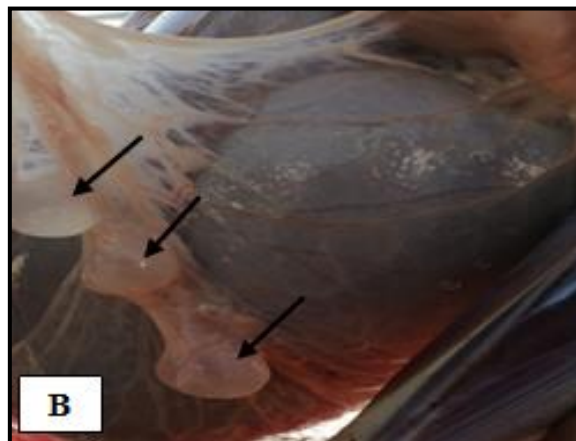


Figure 2: *C. tenuicollis* cysts isolated from Omentum (A), Omentum affected by *C. tenuicollis* (B), Liver infected by *C. tenuicollis* (C) and *C. tenuicollis* attached to gallbladder (D) of goats.

4. Discussion

Slaughterhouses play an important role as a source of information for the prevalence of diseases in developing countries (Wondimu *et al.*, 2011). The current work revealed that the prevalence of *C.tenuicollis* in goats in AL-Nassiriyah municipal slaughterhouse in Thi-Qar province was (24.44%). The results of this study was higher than that registered by Hama *et al.* (2018) in Sulaimani province (2.59%), Al-Bakri (2012) in Mosul province (10%) and Al-Hamzawi and Al-Mayali (2020) in Al-Diwaniyah Province (2.85%) in goats of Iraq. On the contrary, the current study was much less than the other studies recorded by Haddawee *et al.*(2018) in Kerbala province (35.41%) and Al-Sudani and Al-Amery (2022) in Baghdad province (35%). Also, the current study was higher than that reported in some neighboring countries: by Wakid and Alsulami (2022) in Saudi Arabia (4.75%) and Radfar *et al.* (2005) in Iran (18.04%) in goat, whereas, Oryan *et al.*(2012) in Iran recorded incidence in goats (55.05%) higher than the present study.

The present study reported that the overall intensity of infection was 1.62 and this was less than what Khaled *et al.* (2020) mentioned who showed that the overall intensity in goats was 2.85. The reason of decreasing in the intensity of infection may be due to the increase in the number of infected goats compared with number of *C.tenuicollis* cysts isolated from goats.

The widespread of stray dogs on pastures land can be a source of spread of contaminated parasite eggs of environment, also dogs feeding on infected viscera of ruminants especially in places of indiscriminate slaughter, may be one of the risk factors, moreover, the differences in the infection rate in this study from other studies may be associated with geographical area and environmental factors which are critical to the life cycle of the helminthes, in addition to the study period and sample size. Scala *et al.* (2006) mentioned some of the factors, including the existence of large grazing land, stray and shepherd dogs, illegal slaughter and incorrect disposal of infected offal promote the spread of other metacestode infections, like *C.tenuicollis*, coenurosis and hydatidosis.

According to the monthly distribution of *C.tenuicollis* infections, it was noted that the highest infection rate was in April (48.57%) and February (34.37%) which is distinguished by relative humidity, while the lowest infection rate was in August (7.89%). The present study is consistent with the study of Mohammed (2019) in Sulaimani abattoir who exhibited that the highest percentage of infection was in April (26.1%), and the lowest was seen in August (19%), while, this study differed from Haddawee *et al.*(2018) in Kerbala province which showed that the highest incidence in goats was (45.57%) in August, also, El-Azazy and

Fayek (1990) in Egypt reported that the highest proportion of sheep and goats infection were (6.4%) in August. The high prevalence of disease may be due to geographical and environmental factors including: temperature, relative humidity, rainfall level, season, soil properties and climate which are critical to the life cycle of the parasites. Attindehou and Salifou (2012) exhibited that the frequency of *C.tenuicollis* was high in moist seasons than dry seasons.

In this study, the infection rate in females goats was (26.96%) higher than males (23.98%), but there were no significant differences between females and males, also, intensity of infection in males and females was almost similar. The reason may be due to both female and male goats being together in the pasture, which leads to similar exposure to *T. hydatigena* eggs. Senlik (2008) indicated that both male and female sheep were grazing on the same pastures and thus exposed to *T. hydatigena* eggs. The current results are relatively consistent with Essa and Al-Azizz (2011) in Basrah abattoir, which showed that the infection rate in males and females (21.56%) and (25.64%) respectively, while it differs from the results of Al-Sudani and Al-Amery (2022) in Baghdad province, who recorded infection rate (35%) in males only. The infection rate in this study was higher than that recorded by Wakid and Alsulami (2022) in Saudi Arabia and Mokhtaria *et al.*(2018) in Algeria. The intensity of the infection in this study differs from Khaled *et al.* (2020) which showed that the intensity of the infection in male goats is higher than in females.

The present results indicated that the infection rate of *C.tenuicollis* in older goat (above one year) was higher with no significant difference than young goat (less than one year), as well, the intensity of infection in older goats is slightly higher 1.68 than in young goats 1.49. The present results were confirmed by Abu-Elwafa *et al.* (2009) and Morais *et al.* (2017) which exhibited higher incidence in older goat than young animals, also, the present results were lower than the study of Oryan *et al.* (2012) in Iran, which exhibited that the frequency of *C.tenuicollis* in $3 \geq$ largest goat (67.41%) and ≥ 2 young goats (30.91%). The present study suggest that the high infection rate in aged goat may be because of high ingestion of *T. hydatigena* eggs in addition to close contact to the definitive hosts, whereas, young goats are usually raised indoors away from the source of infection.

The most common site of cysts is the omentum (84.85%) with a significant difference followed by liver (9.09%), also, other infections found together within various organs in same animal. previous studies demonstrated that these organs are the most affected, with different rates: the omentum (82.14%), liver (18.24%), lung (0.66%) gallbladder (0.0%) in goats (Radfar *et al.*, 2005), omentum (69%), liver (11%), lung (0.0%) (Omar *et al.*, 2016), but the present study recorded infection rate in omentum and liver together (2.27%) less than the study of Mokhtaria *et al.*(2018) who showed that the high infection rate in omentum

and liver (17.4%). The reason behind the large number of *C.tenuicollis* cysts in the omentum is that it encloses a large superficial part in the peritoneal cavity. The intensity of the infection did not show a significant difference between the affected organs, this may be due to the differences in the number of infections compared to the number of cysts in each organ.

5. Conclusion

The current study indicated that the *C.tenuicollis* is very predominant in goats in Thi-Qar province. Goats are a typical intermediate host and this is demonstrated by the high prevalence of the disease. The current study recommends preventing stray dogs from consuming viscera infected with *C. tenuicollis*, especially in places of random slaughter.

Acknowledgment

The researcher would like to express his thank to members of slaughterhouse of Al-Nassiriyah municipality for their assistance during this study.

References

- Abu-Elwafa, S. A.; Al-Araby, M. A. and Abbas, I. E. A. (2009). Metacestodes among sheep slaughtered at Mansoura abattoir, Dakahlia province, Egypt. *Mansoura Veterinary Medical J.*, 11(1): 2133.
- Al-Bakri, H. S. (2012). Prevalence of Tenuicollosis Among Livestock Slaughtered at Ninevah Governorate-Iraq. *J. Advanc. Biomed. Pathobiol. Res.* 2: 30-39.
- Al-Hamzawi, E. G. and Al-Mayali, H. M. H. (2020). Morphological characterizations of *Cysticercus tenuicollis* of *Taenia hydatigena* isolated from sheep and goats slaughtered in Al-Diwaniyah Province Abattoirs, Iraq. *EurAsian Journal of BioSciences*, 14(1): 2261-2266.
- Al-Sudani, G. D. Y. and Al-Amery, A. M. (2022). Study the prevalence of *Cysticercus tenuicollis* in sheep and goats in Baghdad city. *International Journal of Health Sciences*, 6(S3): 6123-6132.
- Attindehou, S., & Salifou, S. (2012). Epidemiology of cestodes infections in sheep and goats in Benin. *Veterinary Research*, 5(3), 59-62.
- Boufana, B.; Scala, A.; Lahmar, S.; Pointing, S.; Craig, P. S.; Dessi, G.; Zidda, A.; Pipia, A. P and Varcasia, A. (2015). A preliminary investigation into the genetic variation and population structure of *Taenia hydatigena* from Sardinia, Italy. *Vet. Parasitol.*, 214: 67-74.

- EL-Azazy O.M. and Fayek, S. A. (1990). Seasonal pattern of *Fasciola gigantica* and *Cysticercus tenuicollis* infections in sheep and goats in Egypt. *Bulletin of Animal health and Production in Africa*. 38(4): 369-373.
- Essa, I. M. and Al-Azizz, S. A. (2011). Studies on *Cysticercus tenuicollis* collected from slaughtered sheep and goats in Basrah abattoir, Iraq. *Egypt. J. Exp. Bio. (Zool.)*, 7(2): 343-347.
- Gracey, J. F.; Collins, D. S. and Huey, R. J. (1999). *Meat hygiene* 10th ed. Bailliere, Tindall, London, UK, 10-12, 223-260 pp.
- Haddawee, R. H.; Sulbi, I. M. and Abass, Z. F. (2018). Prevalence of *Cysticercus tenuicollis* in slaughtered sheep and goats by season, sex, age, at Karbala abattoir, Iraq. *Sci. J. Med. Res.*, 2 (5): 52-56.
- Hama, A. A.; Zorab, R. H.; Ali, F. M. Salih, A.M. and Hassan, A. A. (2018). Prevalence and Molecular Characterization of *Cysticercus tenuicollis* Isolated from Some Intermediate Host in Kurdistan-Iraq. *Kurdis. J. Appli. Res.*, Special Issue: 2nd International Conference on the Health & Medical Sciences, 177 – 182.
- Khaled, K.; Teber, G.; Bouaicha, F.; Amairia, S.; Rekik, M. and Gharbi, M. (2020). Infestation of small ruminants by the metacestode stage of *Taenia hydatigena* in slaughterhouse, North East Tunisia. *Vet. Med. Sci.*, 6(2): 204-208.
- Kaufmann, J. (1996). *Parasitic infections of domestic animals: a diagnostic manual*. Birkhauser, Verlag, Basel, Schweiz. 423 pp.
- Margolis, L.; Esch, G. W.; Holmes, J. C.; Kuris, A. M. and Schad, G. A. (1982). The use of ecological terms in Parasitology. *J. Parasitol.*, 68:131 – 133.
- Mohammed, A. A. (2019). Prevalence and Molecular Study of *Cysticercus tenuicollis* among Sheep in Sulaimani Slaughterhouse. Ph.D. Thesis, Coll. Vet. Medi., Univ. Sulaimani: 117 pp.
- Mokhtaria, K.; Fadela, S.; Ammar, S. S. M.; Belcaceem, B. T.; Ammar, A. A.; Ameer, A. S. and Abdelkader, B. (2018). *Cysticercus tenuicollis* in small ruminants of Algeria: abattoir survey, biochemical and morphological characterizations. *Bulgarian Journal of Agricultural Science*, 24(4): 698–703.
- Morais, D. F. D.; Vilela, V. L. R.; Feitosa, T. F.; Santos, V. M. D.; Gouveia, V. R.; Athayde, A. C. R. and Azevêdo, S. S. D. (2017). Prevalence and risk factors for *Cysticercus tenuicollis* in goats and sheep in Paraíba, northeastern Brazil. *Revista Brasileira de Parasitologia Veterinária*, 26: 235-238.
- Murrell, K. D.; Dorny, P.; Flisser, A.; Geerts, S.; Kyvsgaard, N.C.; McManus, D. P. and Nash, T. E. (2005). WHO/FAO/OIE Guidelines for the surveillance, prevention and control of taeniosis / cysticercosis. 156 pp. Paris, OIE/WHO/FAO.
- OIE (2008). OIE Terrestrial Manual 2008, Chap. 2.1.4. In: *Echinococcosis/Hydatidosis*, Paris, pp 175–189.

- Omar, M. A.E.; Elmajdoub, L. O.; Al-aboody, M. S.; Elsify, A. M.; Elkhtam, A. O. and Hussien, A. A. (2016). Molecular characterization of *Cysticercus tenuicollis* of slaughtered livestock in Upper Egypt governorates. *Asian. Pac. J. Trop. Biomed.*, 6: 706–708.
- Oryan, A.; Goorgipour, S.; Moazeni, M. and Shirian, S. (2012). Abattoir prevalence, organ distribution, public health and economic importance of major metacestodes in sheep, goats and cattle in Fars, southern Iran. *Trop. Biomed.*, 29(3): 349-359.
- Pal, M.; Abdurahman, M. and Zewdu, M. (2014). Grwoing significance of fascioliasis as an emerging zoonosis. *Ethiopian International Journal of Multidisciplinary Research*. 1: 10-13.
- Radfar, M. H., S. Tajalli, S. and Jalalzadeh, M. (2005). Prevalence and morphological characterization of *Cysticercus tenuicollis* (*Taenia hydatigena* cysticerici) from sheep and goats in Iran. *Vet. Arhiv.*, 75: 469-476.
- Radostits, O. M.; Gay, C. C. and Hinchcliff, K. W. (2007). *Veterinary Medicine* (10 Page 27 of 34 (SJVS, Vol. 9 no 2) th edition). McGraw-Hill publishers. Pp 1582-1583.
- Rostami, S. R.; Salavati, R. N.; Beech, Z.; Babaei, M.; Sharbatkhori, M. R.; Baneshi, E.; Hajjalilo, H.; Shad, M. and Harandi, F. (2015). Molecular and morphological characterization of the tapeworm *Taenia hydatigena* (Pallas 1766) in sheep from Iran. *J. Helminthol.*, 89: 150-157.
- Saulawa, M. A.; Magaji, A. A.; Faleke, O. O.; Mohammed, A. A.; Kudi, A. C.; Musawa, A. L.; Sada, A.; Ugboma, A. N.; Akawu, B.; Sidi, S.; Lawal, N. and Ambursa, A. U. (2011). Prevalence of *Cysticercus tenuicollis* cysts in sheep slaughtered at Sokoto abattoir, Sokoto state, Nigeria. *Sokoto J. Vet. Sci.*, 9(2): 24-27.
- Scala, A.; Garippa, G.; Varcasia, A.; Tranquillo, V. and Genchi, C. (2006). Cystic echinococcosis in slaughtered sheep in Sardinia (Italy). *Vet. Parasitol.*, 135:33–38.
- Senlik, B. (2008). Influence of host breed, sex and age on the prevalence and intensity of *Cysticercus tenuicollis* in sheep. *Journal of Animal and Veterinary Advances*, 7(5): 548-551.
- Soulsby, E. J. L. (1982). *Helminths, arthropods and protozoa of domesticated animals* (7 Edition). Bailliere Tindall, London.
- Wakid, M. H. and Alsulami, M. N. (2022). Genotyping of *Taenia hydatigena* isolated from sheep and goats in KSA based on Cox1 gene. *Saudi Journal of Biological Sciences* 29: 1270–1275.
- Wondimu, A.; Abera, D. and Hailu, Y. (2011). A study on the prevalence, distribution and economic importance of *Cysticercus tenuicollis* in visceral organs of small ruminants slaughtered at an abattoir in Ethiopia. *J. Vet. Medi. Anim. Heal.*, 3(5): 67-74.

Zhang, Y.; Zhao, W.; Yang, D.; Tian, Y.; Zhang, W. and Liu, A. (2018). Genetic characterization of three mitochondrial gene sequences of goat/sheep-derived *Coenurus cerebralis* and *Cysticercus tenuicollis* isolates in Inner Mongolia, China. *Parasite*, 25: 1-6.