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Review Article

Bibliometric Analysis of Worldwide Research Studies on Goat Ticks: A Seven Decade Outlook

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Abstract: This study illustrates the results trends of academic literatures in line with goat ticks globally. An aggregate of 1204 documents was Web of Science (WOS) data archive for evaluation utilizing bibliometric analysis. From the study, the result presented comprised, relevant subject matters in the field of study, global citations, affiliated organizations, source of documents as well as vital keywords and keywords plus associated with the research niche area on the subject matter, among others. Articles involving ticks in small ruminants (goats) increased in research numbers with yearly rise of 8.53 %. Country like China leads the chat with peak number of research numbers (n = 141), with highest number of article citations (n = 2955). The single-authored documents gave, n = 49, while the co-authors per documents gave, n = 6.21, but the mean citations per article gave, n = 19.04, accordingly. The nation of South Africa, Ethiopia, Kenya as well as Tunisia were also listed as the African nations in the best performing regions with high research outputs on goat and ticks. Nations with multiple country publications (MCPs) had China, Pakistan, USA and Germany lead the order, respectively. The findings indicated China (n = 2955), USA (n = 2052), Germany (n = 1637), Turkey (n = 1301) and South Africa (n = 1121) ranked highest with regards to the total citations on goat ticks research, globally. The increase (annual rise of 8.53%) in outputs on studies done with goat ticks over the study period of the bibliometric evaluation shows the economic role of ticks in goat husbandry.

Keywords: Caprine, Ticks, Bibliometric Analysis, Farming, Tick-Borne Diseases

Introduction

Goats play a significant part in the farming sector (Jariko *et al.*, 2020; Idamokoro, 2023). Goats are used for accomplishing the needs in terms of nutrition and nutrients of humans for both the global as well as local market (Khaskheli, 2020; Idamokoro, 2023). Despite their known global and local usefulness, there are several external parasites such as mites, lice as well as ticks associated to goats that causes constraint in goat husbandry. For instance, ticks causes significant negative concerns extending from stunted growth, loss of weight, skin damage, reduce production, paralysis, reduced goat product quality resulting from damaged hides and skin (Ofukwu and Akwuobu, 2010; Muhammad *et al.*, 2021; Onyiche and MacLeod, 2023).

Report has it that the critical economic forfeiture resulting from Ixodidae ticks in livestock (with goat inclusive) was estimated as $7.0 billion (Rajput *et al.*, 2006). Ticks transmits pathogens such as haemato-protozoan, virus and bacteria between livestock to humans and livestock to livestock when sucking blood from their host (Rajput *et al.*, 2006). Ticks further causes anaemia as well as reduction in production leading to negative financial and economic impact locally and globally particularly in developing nations (Onyiche and MacLeod, 2023). The mechanism leading to anaemia caused by ticks to their host happens during sucking of blood 7 – 14 days, and this act is influenced based on species type and the host the ticks are attached to (El Hakim *et al.*, 2007). Ticks are able to suck an amount of between 0.5 – 2.0 ml of blood from its host within a short time (24 hours) which could cause morbidity and in some cases mortality of its host (Ram *et al.*, 2004).

Livestock body temperature of hosts that suits the survival and growth of ticks falls within a humidity of 85% and temperature of 26-37°C (Jariko *et al.*, 2020), which is suitable ticks growth and survival (Aktas *et al.*, 2004) which later makes them feed (parasitic) on their host who becomes the victims of pathogenic infection. Ticks has without doubt becomes a severe threat globally with developing nations being the worse hit. This has led

to the increase in investigation on goat ticks (Iqbal *et al.*, 2014).

Consequently, a well-known spread of virulent tick-related viral zoonosis called Crimean-Congo hemorrhagic fever (CCHF) is presently making wave in livestock farming in recent times (Nasirian, 2022). This disease is a severe tick-transmitted human infection as a result of an acute as well as possibly lethal infections that has the main spread of any other transmitted pathogens caused by tick virus (Nasirian, 2022). The transmissions of CCHFV happens via tick-vertebrate-tick (i.e. natural enzootic) transmission cycles as well as through trans-ovarial means, within tick species (Nasiria, 2022). A range of animals (both wild and domestic) offers asymptomatic hosts for CCHF virus in one endemic CCHF cycle of infection, dire to nurturing ticks which support the "spread-cycle" to a novel group of tick species. The spread of CCHF virus into different regions may happen via a number of ways, such as by the introduction of CCHFV infected livestock, ticks or humans into the areas (Nasirian, 2019; Nasirian, 2020; Serretiello *et al.*, 2020).

Regardless of numerous research in the literatures, till date it appears that, articles projecting findings in this subject matter (goat and ticks) is scare hence, this manuscript becomes of immense importance to the body of knowledge. Bibliometric is a unique as well as exceptional instrument for representing and characterizing research outputs, and the result of a bibliometric research combines mathematical illustration and statistical computations to relate scholarly discourse in order to chat a pathway in research in a particular niche area (Zou *et al.*, 2019; Idamokoro, 2023). This approach therefore simplifies directions for scientists, and policymakers to bring up stratagems, proposals and policies that will boost vital projects together with impactful and innovative research discoveries within that field (Olisah and Adams, 2020). Bibliometric study is a vital niche of research that assist scholars to weigh the magnitude of impact in a specific scientific sphere (Zhang *et al.*, 2019). In line with the afore-mentioned explanations, this study adopted a bibliometric technique to discuss the trends as well as research publications with respect to goat ticks with the use of article data derived from Web of Science (WoS) together with Scopus datasets (from 1952–2023). This study aimed is to pin-pointed global scholarly coverage on ticks in goat, which include for instance, keywords, authors, countries spread, academic outputs, the global developments in citations, as well as new and emerging topics on ticks in goat.

Materials and Methods

Collection of Data and Assessments

Collection of articles (data) for this study is a bibliographic dataset often adopted for research work for collating a broad spectrum of literatures and search queries for this kind of investigation (Zhu and Liu, 2020; Pranckute, 2021; Zhang *et al.*, 2023). This data archive was from WOS. Web of Science is a dataset that is known for documenting reliable and top-ranked scholarly publications (Repiso *et al.*, 2018). The topic search for this investigation was utilized to collate documents (articles) from WOS for the purpose of a broad collection of data for the field in this discipline. The gathered data obtained from the archive were then filtered before validation for descriptive evaluation. The procedure for data retrieval is in concordance with earlier work (Fesseha *et al.*, 2020). Data that were collected were transferred into R Studio for further analysis. The bibliometrix R-package was used (R-project web interface in Biblioshiny) to explain the outputs which include citation evaluation, individual authors' impact, nations impact, leading keywords, and scholarly collaboration by leading nations as well as authors in the research discipline. A figure description of data gathering, exclusion and analysis is given (Figure 1).

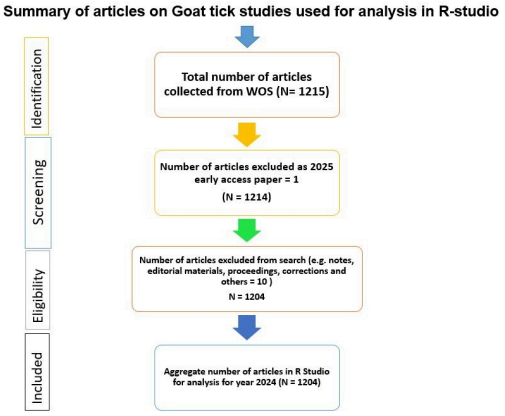

Fig. 1: Diagram showing data inclusion and exclusion of documents for selection

Data Analysis

The evaluation of data gotten from WoS as well as Scopus archive were initially transferred into a bibliometrix software after which they were assessed for descriptive analysis. The descriptive analysis for this work include trend in worldwide publication per year, number of outputs per annum as well as citation by different nations, source of documents and their scientific impact, global networks, as well as distribution of essential subject matter as was listed from the function of (RStudio v. 127.0.0.1: 5645) (Aria and Cuccurullo, 2017). Every other results were presented according partner of bibliometric and authors' impact in a given field was analysed accordingly (Lotka, 1926).

Results and Discussion

Trends on Studies in Ticks and Goat Research

The trends on ticks and goat studies from 1990 - 2024 were presented. 1204 documents indexed in WoS

data bank as presented (Table 1) in 305 data bases and from 4931 researchers. Single-authored papers were published by 43 scholars, the co-authors per articles were authored by 6.21% scientists, respectively. The research articles had an aggregate of 25980 references. The mean citations per paper was 19.04. The author's keywords (DE) as well as the keyword plus (ID) was 2181 and 1975, respectively.

Table 1: Findings of published articles on goat tick indexed in WOS data bases from 1990 -2024

Description	Results
Main Information About Data	
Timespan	1990:2024
Sources (Journals, Books, etc)	305
Documents	1204
Annual Growth Rate %	8.53
Document Average Age	9.35
Average Citations Per Doc	19.04
References	25980
Document Contents	
Keywords Plus (ID)	1975
Author's Keywords (DE)	2181
Authors	
Authors	4931
Authors of Single-Authored Docs	43
Authors Collaboration	
Single-Authored Docs	49
Co-Authors Per Doc	6.21
International Co-Authorships %	36.63
Document Types	
Article	1064
Article; Book Chapter	4
Article; Data Paper	1
Article; Early Access	5
Article; Proceedings Paper	47
Article; Publication With Expression Of Concern	1
Proceedings Paper	9
Review	73

Annual Article Growth and Citations on Goat and Ticks Studies

Study done with bibliometric is a research tool that is used to project how scholarly investigation grow numerically for a given discipline. An annual reduction in research work for a particular year is indicative of a depreciating interest among scholars (Okaiyeto and Oguntibeju, 2021). Regarding the yearly increase in the publications on goat and ticks studies, it showed a dwindling trends in publications between the year 1990 and 2015 with a slow rise in number of publications, however, a significant rise was noticed from 2016 to 2022 (Figure 2). The peak number of literatures (goat and ticks) on this study was in 2022, with 105 papers (Figure 2). Likewise, research works in this area of niche showed a yearly rise of 8.35%. This outcome was lesser in comparison to the ones reported by other researchers (Idamokoro and Hosu, 2022; Smith *et al.*, 2021). Conversely, the steady rise in investigation on goat ticks as from 2016 is a testament that studies carried out in this field of discipline is gaining global recognition. This observation could have stemmed from the latest increase in the studies on goat tick across the global (Beyer and Carlyon, 2015; Perveen *et al.*, 2021; Perveen and Khan, 2022). The prospective significant influence of infection caused by ticks on humans, other livestock as well as their impacts on the environment is also felt nationally and globally (Li *et al.*, 2015).

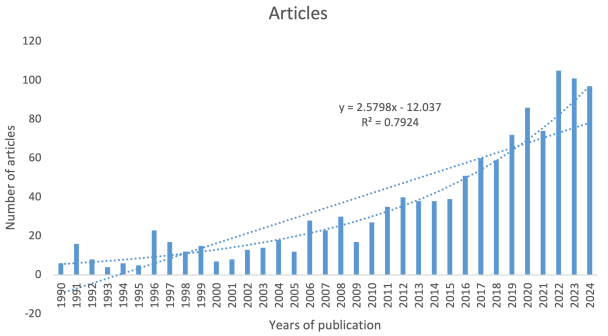

Fig. 2: Annual scientific article publications (from 1990 to 2024) on goat tick research studies indexed in WOS with an annual growth rate of 8.53%

Relevant Scholars Involved in Research in the Niche Area

We observed that 4931 scientists carried out studies in research on 1204 studies within the year in consideration. In addition, the co-publishers per document was 6.21 and the global co-authorship was 36.63%, which show how strong in partnership of various global researchers. Table 2 show the contributing scientists in goat and ticks studies, having h-index of 9 to 22 with citations of 245 to 1414. This observation was well expected, because there are increase numbers of scholars that in this field in comparison to other fields who published lesser number of citations of researchers in other various fields (Tywabi-Ngeva *et al.*, 2022). Regarding the h-index result, it is generally employed to assess the score scholar's research work and how relevant they are in a specific scientific field (Huang *et al.*, 2019). H-index is further utilized to assess the performance and prolificacy of scientists within an organization or nation (Hirsch, 2005). The ranking of scientists around the global are scored and rated using h-index ratings, which also aligns with the number of scholarly publications in line with the number of citations by other scholars in the niche area, and this h-index ratings is estimated with the use of logic that h articles were cited h times by other scientists and scholars (Hirsch, 2005). However, the reason behind using h-index to compare the impact of an author among other authors should fall within the same niche of study. Utilization of h-index to rate a paper's impact is an

important to showcase accurate reproduction of the performance of the document/paper to the global body of scientific information (Guilak and Jacobs, 2007).

Table 2: Top 20 rated researchers on goat and tick studies indexed in WOS from 1990 - 2024

S/N	Element	h_index	g_index	m_index	TC	NP	PY_start
1	Yin H	22	37	0.786	1414	41	1997
2	Aktas M	16	28	0.8	825	30	2005
3	Li Y	15	26	0.833	726	33	2007
4	Liu Z	15	26	0.789	708	29	2006
5	Luo J	14	21	0.737	630	21	2006
6	Guan G	13	21	0.722	596	21	2007
7	Horak IG	12	19	0.343	403	19	1990
8	Jongejan F	12	14	0.353	563	14	1991
9	Li J	12	18	0.667	341	18	2007
10	Liu J	12	20	0.667	459	20	2007
11	Yang J	12	17	0.923	365	17	2012
12	Mahan SM	11	13	0.324	366	13	1991
13	Ozubek S	11	16	0.917	267	18	2013
14	Ali A	10	17	0.909	305	22	2014
15	Altay K	10	12	0.5	472	12	2005
16	Dumanli N	10	11	0.5	543	11	2005
17	Papa A	10	12	0.556	245	12	2007
18	Xuan X	10	17	0.714	322	17	2011
19	Belkahia H	9	9	0.9	289	9	2015
20	Ben Said M	9	16	0.9	328	16	2015

PY_start: Publication year start; TC: Total citation; NP: Number of publication

The peformance of institutions/organizations, relevance of researchers, as well as different countries with regards to their input to the scientific body on the subject of consideration were analysed. Conversely, the significance of a research paper in most cases is built on how many times the paper/document is being cited by others. Nonetheless, making use of academic paper citations is often seen as not a perfect yardstick of the global performance of that manuscript (Su *et al.*, 2018). Scholars in the past have argued that counting the number of citations alone does not give a perfect performance of an author on the global stage reasoning being that each authors of manuscript gets ratings for each paper or publications, which does not take into consideration the volume and number of writing partners in that paper (Altarturi *et al.*, 2023). Another recommended approach to score a researcher with his/her writing partners is by employing a calculation (in fractions) such that the ranking of a manuscript is shared (i.e. divided) by all authors involved in writing the article (Altarturi *et al.*, 2023). This score that is calculated provides the separate authors and writing partners of a certain article a score of one (1) divided by the number of authors who wrote the paper. This approach has been supported by research agencies as well as journals including the journal called Nature (Nature, 2018).

The performance of the top ranked journal publishers was listed in Table 2, from which authors like Yin H, Aktas, M and Li, Y contributed 41, 30 and 33 articles from the total of 1204 indexed in WoS databank, accordingly. In addition, our result observed that these three (3) researchers had h-indexes of 22, 16 and 15, respectively. The author by the name Jongejan F (with h-index = 12) seated in the 8th place in ranking, had more citations (n = 563) in comparison to the seventh ranked scientist with a citation of 403 despite the fact that the author recorded a lesser articles. This observation is an indicator that using article citation numbers does not only impact the amount of articles written by an individual and the h-index ranking, but by the period (year) the article is published online (Okaiyeto and Oguntibeju, 2021).

Table 3: The 20 relevant institutions on goat tick research with over 25 publications per institution

S/N	Affiliation	Articles	Countries
1	University of Pretoria	76	South Africa
2	Lanzhou Veterinary Research Institute	75	China
3	University of Veterinary & Animal Sciences	74	Pakistan
4	Abdul Wali Khan University Mardan	61	Pakistan
5	Fırat Üniversitesi	58	Turkey
6	Friedrich-Loeffler-Institut	53	Germany
7	Tehran University of Medical Sciences	52	Iran
8	Aristotle University of Thessaloniki	49	Greece
9	Pasteur Institute of Iran	47	Iran
10	Obihiro University of Agriculture and Veterinary Medicine	43	Japan
11	University of Florida	38	USA
12	University of Agriculture Faisalabad	36	Pakistan
13	Kyungpook National University	35	South Korea
14	University of Malaya	34	Malaysia
15	Urmia University	34	Iran
16	King Saud University	33	Saudi Arabia
17	Centers for Disease Control and Prevention	31	USA
18	University of Tehran	29	Iran
19	University of Edinburgh	28	Scotland
20	University of Manouba	27	Tunisia

Top Rated Global Affiliations on Goat and Ticks Studies

The highest with regards to numbers (n = 76) of papers on goat and ticks done globally was by the universityU of Pretoria in South Africa, followed by a university from China (Lanzhou Veterinary Research Institute) in the second position (n = 75), accordingly (Table 3). 20 percent (i.e. 4 out of the 20) top ranked organization were from Iran. This observation is not in line with earlier bibliometric findings that reported organizations from the USA with more outputs in different fields of study (Idamokoro and Hosu, 2022; Idamokoro and Niba, 2024).

Most Relevant Article Source on Goat and Ticks Research

According to Leydesdorff and Rafols (2009), different article source show their field of specialty in different research together with the amount of a particular discipline in a particular journal is a vital means of measurement in bibliometric analysis for propagating relevant scientific result. The top most rated journal outlets for the present subject matter was were evaluated (Figure 3). From Figure 3, the first four (4) top journal outlets were; Ticks and Tick-borne diseases (n = 63); Tropical Animal Health and Production (n = 43); Parasitology Research (n = 41); and Veterinary Parasitology (n = 40).

Top Relevant Cited Papers in Goat Ticks Studies

The metrics of citation for rating a manuscript points to how many in numbers the manuscript was cited in indexed datasets. In addition, the citation of a manuscript is dependent on the intellectual contribution of the citing article and not as a result of how popular the article is. For instance, a manuscript cited by a high impact factor (score) manuscript attracts more recognition in a given field, while the citation numbers of a publication draws its international impact, not putting into consideration the impact of the other article that cites or acknowledges it.

The most significant and relevant cited articles evaluated via the total citations per year (TC/Year) and the total citations (TCs) in goat and ticks study from 1990 – 2024 as indexed in WOS is presented in Table 4. Authors including, De La Fuente, J (2007), Stuen, S (2007), Li H (2015), Schnittger, L (2004) and Liu, S (2014) had the top cited articles. These top ranked manuscripts were written in Veterinary Microbiology (TC: 217; TC/Year: 12.06), Veterinary research communications (TC: 204; TC/Year: 11.33), Lancet Infectious Diseases (TC: 196; TC/Year: 19. 60), Parasitology Research (TC: 154; TC/Year: 7.33) and Reviews in Medical Virology (TC: 151; TC/Year: 13.73), accordingly. The study by Stuen (2007), explained how the causal agent (*Anaplasma phagocytophilum*) causes an extensive of infection (tick-borne) in goats and other livestock in some regions of Europe. Meanwhile, other associated factors including climatic and environmental conditions, farm animal management, infections from other sources were further pointed to play a role in the indirectly promotion of tick-borne livestock infection.

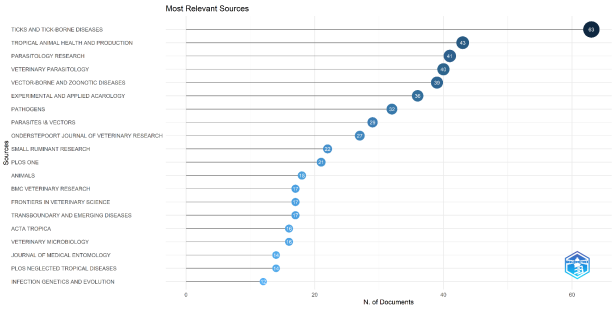

Fig. 3: The 20 most relevant journals in the field of goat tick indexed in WOS from 1990 to 2024

Table 4: Top 20 most cited articles on goat tick research indexed in WOS from 1990 – 2024

S/N	First Author, Year & Journal	DOI	TC	TC/Year	Normalized TC
1	De La Fuente J, 2007, Veterinary Microbiology	10.1016/j.vetmic.2006.09.011	217	12.06	3.89
2	Stuen S, 2007, Veterinary Research Communications	10.1007/s11259-007-0071-y	204	11.33	3.66
3	Li H, 2015, The Lancet Infectious Diseases	10.1016/S1473-3099(15)70051-4	196	19.60	7.74
4	Schnittger L, 2004, Parasitology Research	10.1007/s00436-003-0980-9	154	7.33	5.31
5	Liu S, 2014, Reviews in Medical Virology	10.1002/rmv.1776	151	13.73	4.80
6	Liu Z, 2012, Applied and Environmental Microbiology	10.1128/AEM.06848-11	150	11.54	4.39
7	Holzmann H, 2009, Emerging Infectious Diseases	10.3201/eid1510.090743	150	9.38	3.89
8	Rehman A, 2017, Parasites & Vectors	10.1186/s13071-017-2138-0	134	16.75	5.71
9	Schnittger L, 2003, Parasitology Research	10.1007/s00436-003-0979-2	129	5.86	4.98
10	Khan AS, 1997, American Journal of Tropical Medicine and Hygiene	10.4269/ajtmh.1997.57.519	113	4.04	2.87
11	Carelli G, 2007, Veterinary Microbiology	10.1016/j.vetmic.2007.03.022	112	6.22	2.01
12	Woldehiwet Z, 2006, Annals of the New York Academy of Sciences	10.1196/annals.1374.084	112	5.89	3.36
13	Zeller HG, 1997, American Journal of Tropical Medicine and Hygiene	10.4269/ajtmh.1997.56.265	111	3.96	2.82
14	Renneker S, 2013, Transboundary and Emerging Diseases	10.1111/tbed.12149	109	9.08	3.66
15	Nabeth P, 2004, Emerging Infectious Diseases	10.3201/eid1012.040535	107	5.10	3.69
16	Kazar J, 2005, Annals of the New York Academy of Sciences	10.1196/annals.1355.018	106	5.30	2.60
17	Aydin L, 2007, Parasitology Research	NA	104	5.78	1.86
18	Hilpertshauser H, 2006, Applied and Environmental Microbiology	10.1128/AEM.00823-06	104	5.47	3.12
19	Nicholson WL, 1997, Journal of Clinical Microbiology	10.1128/JCM.35.6.1510-1516.1997	103	3.68	2.61
20	Madani TA, 2005, Journal of Infection	10.1016/j.jinf.2004.11.012	102	5.10	2.50

It is vital to understand that because of the extensive spread organisms (pathogenic tick disease) which are accountable for illnesses/death in animals globally, several research are now tilting on genetic investigations to determine the exact tick that causes livestock diseases. For instance, the study of De La Fuente *et al.* (2007), it

was stated that the pathogenic organisms called *Anaplasma ovis* led to ruminant infections in some parts of America. Likewise, the total citation per year (TC/Year) and the total citation (TC) ranged from 217 to 102 and from 19.60 to 3.67 (Table 4). The international impact of a publication in the global space is mostly influenced by the number of citations (Tahim *et al.*, 2016). This international impact of an article also progresses with years (Faggion *et al.*, 2017). Meanwhile, the rise in the number of citations of an article may cause negative criticism due to self-citations from authors who do self-citations (Cheek *et al.*, 2006). For articles that are published newly within a particular research niche, it have been observed that, they accumulate more citations with increase in years (Feijoo *et al.*, 2014).

Table 5: The top 20 publications by nations on goat tick research indexed in WOS from 1990 – 2024

S/N	Country	Articles	SCP	MCP	Freq	MCP_Ratio
1	China	141	109	32	0.117	0.227
2	Pakistan	85	33	52	0.071	0.612
3	South Africa	72	54	18	0.06	0.25
4	Iran	70	62	8	0.058	0.114
5	USA	69	48	21	0.057	0.304
6	Germany	58	28	30	0.048	0.517
7	Turkey	54	49	5	0.045	0.093
8	France	38	23	15	0.032	0.395
9	India	38	32	6	0.032	0.158
10	Greece	30	20	10	0.025	0.333
11	United Kingdom	29	12	17	0.024	0.586
12	Ethiopia	28	22	6	0.023	0.214
13	Japan	27	5	22	0.022	0.815
14	Brazil	25	15	10	0.021	0.4
15	Italy	25	12	13	0.021	0.52
16	Korea	21	16	5	0.017	0.238
17	Kenya	19	8	11	0.016	0.579
18	Spain	19	7	12	0.016	0.632
19	Tunisia	17	9	8	0.014	0.471
20	Netherlands	15	10	5	0.012	0.333

SCP: Single Country Publications; MCP: Multiple Country Publications

Most Impactful Nations on Goat and Ticks Studies

The impactful nations having more number of documents on goat and ticks studies by corresponding authors is also listed in this study (Table 5). In this result, eight (8) countries are European nations, six (6) countries are from the continent of Asia, four (4) nations are from Africa, one (1) is from North America while the other one (1) is from South America. This observation indicates that European nations were more deliberate with this kind of research. The research contributions from China shows that the nation is impactful in this research niche.

There were position switch in the ratings among the top relevant countries who were placed as top nations in researches done on goat ticks via articles that were evaluated using the total citation (TC) per country (i.e. between Tables 5 and 6). This result is in agreement with other bibliometric reports (Orimoloye and Ololade, 2021). The reason for the ranking shift when employing the aggregate citation index to decide author's contributions may define its unreliability as a dependable way for determining the author's productivity. The frequency of paper citation of a given nation does not invariably depicts the publications of that researcher (Fricke *et al.*, 2013). The reason for this is because of the few article numbers utilized for analysis in this type of study, the more important a few frequently cited papers (Fricke *et al.*, 2013).

Table 6: The top 20 most cited nations as relates to the average article citations (AAC) in researches on goat ticks indexed in WOS from 1990 to 2024

S/N	Country	TC	Average Article Citations
1	China	2955	21.00
2	USA	2052	29.70
3	Germany	1637	28.20
4	Turkey	1301	24.10
5	South Africa	1121	15.60
6	Iran	1108	15.80
7	Pakistan	993	11.70
8	France	986	25.90
9	Greece	601	20.00
10	Japan	593	22.00
11	United Kingdom	526	18.10
12	Italy	513	20.50
13	Slovakia	454	37.80
14	Netherlands	452	30.10
15	India	415	10.90
16	Tunisia	352	20.70
17	Norway	348	49.70
18	Ethiopia	320	11.40
19	Brazil	296	11.80
20	Slovenia	285	35.60

Organizations, Authors, and Nations Collaborations on Goat Ticks Studies

Collaborations is a vital tool used to advance the importance of research investigations and intensifies publications, as it expands networking among scholars in the same niche area globally. Collaboration further allows multi-disciplinary knowledge exchange sharing and helps to enhance scholarly fellowship at various levels among scholars in the same field (Wu *et al.*, 2019). In addition, networking pulls interest and support from financial organizations, policy makers and government agencies for research strengthening in different multi-disciplinary fields. Collaborations also improves the quality of investigations of a research (Bukvuva, 2010). Other laudable benefits of networking among scientists, organizations as well as nations includes; progression of human capacity, exposure to advance technologies and instruments, financial possibilities, and exchange programmes among scholars

and partners (Bozeman *et al.*, 2013). Result of networking among nations is listed in Figure 4. In all, four (4) groups were presented in Figure 4. The node indicates each collaborating nation while the strokes that connects them together have varied thicknesses, indicating the importance of their networking among the countries. Nations shown in Figure 4 should naturally be presented in the correct format of alphabetic chronology, but by default, they were presented in small alphabetical letters (Liu *et al.*, 2019). Countries including China, Germany, USA and Pakistan were among those observed to be the highly relevant with the highest numbers of collaboration. Figure 4 also depict the most relevant regions of the world (nations) with robust networking with each other and all these nations are financially stable.

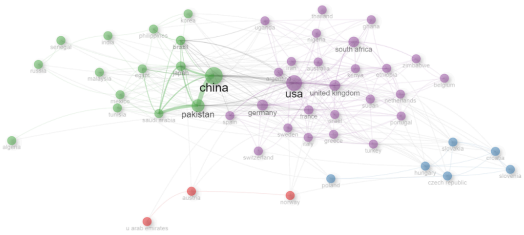

Fig. 4: Collaboration among nations doing research in goat and ticks from 1990 to 2024

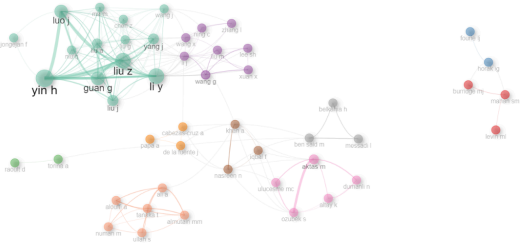

Fig. 5: Authors' network across several institutions and nations on goat ticks indexed in WOS between 1990 and 2024

In addition, the networking among top scientists in goat and ticks study is given in Figure 5 with regards to this study. The strength of networking among researchers is given by the thickness of the lines and size of the nodes connecting the various countries. Different clusters in the diagram, as shown by the different colours represents each cluster of network. Researchers having same colours are partners within the alike groups (Sweileh *et al.*, 2016).

Article Journal Source Growth Evaluation of Goat Ticks Study

The evaluation of document growth of the 10 most performing outlets are listed in Figure 6. These journal outlets that reported on publications that were done on goat and ticks started at a minimal pace at the initial years. This trend then took a fast increase from 2012 – 2024, making them the most impactful publication outlets. Some of the journals including "Experimental and Applied Acarology", and "Onderstepoort Journal of Veterinary Research", among others have increased meaningfully as the years grows. Worthy of note is that, between 1990 and 2001, there were lesser article numbers on goat and ticks study. Conversely, more research in the discipline have been published of late which is pointing to the evidence that the field is drawing more interest by scientists as well as institutions.

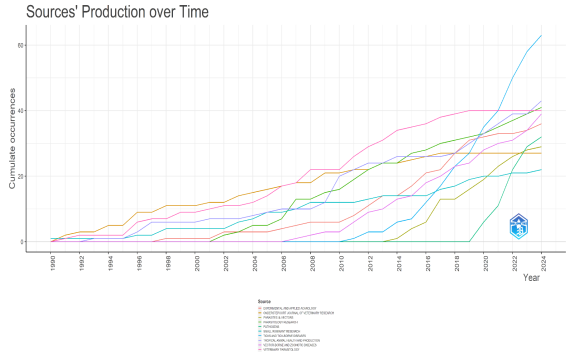

Fig. 6: Source growth of the incremental trend of the 10 topmost productive journals in goat ticks research from 1990 to 2024

Result on the increase in outputs on goat and ticks is not out of place. This is due to the fact that, the significance of tick pathogenic infections in goats has its inference as a predisposing aspect for other infections (including zoonosis). However, other related potential elements such as conditions of farm and management, climate, surrounding individual livestock conditions and other pathogenic infections are vital and should be reflected upon when researching the outbreak of tick-borne infections (Steun, 2007). Fresh investigations on goat and ticks study are also being done in more details to know the species level (with the help of gene sequencing methods) the right variant that result to tick-borne diseases. This information is essential due to the fact that different tick variants are known to act differently as well as intermingle contrarily in their animal or host (Steun, 2007).

Commonly Utilized Word Cloud and Co-occurrence Author's Keywords

Keywords are utilized as indicators for promoting subject topics in various field of study (Synnestvedt *et al.*, 2005). Several journals often require authors to enumerate the keywords on the subject of their manuscript so as to know whether their manuscript is suitable or not. Nevertheless, the keyword numbers needed for various journal source differs. Keywords by authors are important because it assist readers to identify the key areas of a scholarly study, which is commonly compulsory in the abstract of most articles (Okaiyeto and Oguntibeju, 2021). From this study, Figures 7 as well as 8 illustrates authors' keywords.

The important keywords as observed for most of the authors tick/s (n = 217), goat/s (n = 195), sheep (n = 147), pcr (n = 60), theileria (n = 57), anaplasma (n = 56), cattle (n = 52), prevalence (n = 50), coxiella burnetii (n = 49), and small ruminants (n = 48). Equally, it is important to be aware that the afore-mentioned keywords from authors have occurrences above n > 40 (Figure 7).

Fig. 7: Word cloud on goat tick research studies indexed in WOS from 1990 to 2024

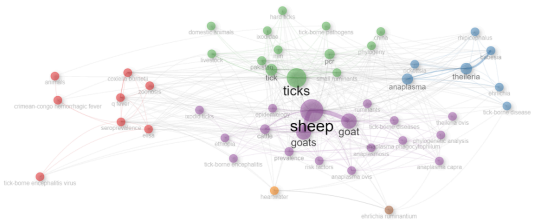

Fig. 8: Top author's keywords of goat ticks research studies indexed in WOS from 1990 to 2024

The diverse keyword groups as well as sizes of various colours as shown in the word cloud as well as collaboration presentation (i.e. Figures 7 and 8) shows the strength of connection of these keywords and the amount of their incidences in goat and ticks study as associated with the discipline. Likewise, results on the importance of the sizes as well as network of author keywords have been reported (Chen *et al.*, 2014; Altarturi *et al.*, 2023). From the keywords, the top authors in ticks and goat studies have reported findings with regards to infection outbreaks, types of diseases, identifications, transmissions, zoonotic transmission, methods of effective managements of livestock against ticks. For instance, the study by Mc Quiston and Childs (2002), reported incidences of tick infections through transmission of livestock to other livestock as well as humans which is zoonotic in nature.

In addition, a top leading author reported the incidence of "A capra" from goats as a cause of human diseases in the northern region of China which is a tick-borne related infection (Li *et al.*, 2015). Equally, the researcher again suggested precautionary approaches (e.g. avoidance of high risk areas and reduce human-livestock exposure) that could lessen the risk of infection to the ticks (Li *et al.*, 2015). The evolution of zoonosis connected to ticks, causing epidemics problems have risen, but the complete preventive method to address this threat are still scare (Debnath *et al.*, 2021). One way that have been recommended to control this ecto-parasites is by adopting an effective tick control scheme (Gopalakrishnan *et al.*, 2017; Khaskheli, 2020). Again, another approach researchers are looking for answer to tackle the threat of ticks in goats is to pinpoint the various types of tick species and then approving them via molecular characterization for effective management strategy and medications to affected livestock (Perveen and Khan, 2022). Conversely, the main limitation in tick management is their resistant trait to medications and chemicals during treatment (Ghosh *et al.*, 2006; Khaskheli, 2020). Again, the wrong use of chemicals with inappropriate dosage is another reason for tick control failure (Jariko *et al.*, 2020).

Limitations

Regardless of the vast profits of the present study on goat and tick, it is important to acknowledge limitations related to this study. The published articles related to goat tick study were assessed using WOS database. Nonetheless, there could be few oversights of some publications that are indexed in other academic archives but that are not in WOS data archives. As a result, this present investigation may have overlooked all the documents that should be accessible on the discussed discipline.

Conclusion

This study discussed the trends of a global evaluation on ticks with bulk of the research carried out in high-income countries in comparison to low-income nations. Our observations also revealed limited authors as well as institutional partnership among high income and developing nations. In addition, there was rise in research on goat ticks over the years giving credence to the fact that research in this niche area is growing globally. This observation may be as a result of the significant consequences of ticks associated with goat husbandry. Top rated scholars from our findings also showed how influential they are in the niche area of goat tick research with some of them having high h-index of above 15, and with very high article citations. Researchers from both high and low-income nations are encourage to collaborate in research.

Future Perspectives and Recommendations on Goat Ticks Research

As a result of the huge loss that may come from ticks in relation to goat husbandry, some workable actions are required to control this threat. For instance, research on

goat ticks should use an all-inclusive strategies, combining both practical and theoretical innovations in science and technology to solve the problem of ticks. This approach can be done by focusing on some of the following;

- By adopting advanced control methods.
- By having a full knowledge on tick-host interactions.
- By monitoring tick-borne disease dynamics as well as evaluating the economic impacts of ticks.
- By researching on the utilization of natural enemies or parasites that are precisely targeted towards ticks without causing harms to goats.
- By carrying out research into advance effective chemical compounds that are active against eradicating tick species but, safe-guarding goats and their surrounding environment.
- By developing standardized etiquettes for tick research, surveillance, as well as control measures to guarantee uniformity and comparability of research data among nations of the world and in different regions.
- By encouraging research that will develop vaccines for the treatment and cure of tick-borne pathogens.
- By investigating several other novel therapeutic ways to manage tick infestations such as phytochemicals as well as traditional therapies.
- By employing the use of mobile apps and other digital platforms for goat farmers to report all forms of tick infestations on their farms and receive real-time professional advice from tick experts and veterinarians.
- By exploring latest genetic origin of goat resistance to tick infestations e.g. the use of selective breeding schemes.

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Author's Contributions

All authors contributed equally.

Ethics

This paper is the authentic work of the authors and it does not contain unpublished document. The authors confirm that the manuscript was read and approved by both of us and no ethical issues are involved. Furthermore, this research adhered to all ethical rules as well as approval by our university.

Conflict of Interests

There are no conflicting interests declared by authors.

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