Vol.3, No.3, Page 891- 897, 2025 https://doi.org/10.59628/jast.v3i3.1672 ISSN 2958-9568 JAST

SUN PUBLISHER

مجلة جامعة صنعاء للعلوم التطبيقية والتكنولوجيا

Sana'a University Journal of Applied Sciences and Technology

https://journals.su.edu.ye/index.php/jast/

A systematic review of the prevalence of *Campylobacter jejuni* in chicken populations within Middle East and North Africa (2014–2025)

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Abstract

Campylobacter jejuni is a leading bacterial agent of foodborne illnesses worldwide, with poultry serving as its primary reservoir. This systematic review aimed to document and compare the prevalence of *C. jejuni* in chickens across countries in the MENA region from 2014 to early 2025. A structured search of the PubMed, Scopus, and Google Scholar databases was conducted to identify peer-reviewed studies that reported prevalence data. Twenty-eight studies from 13 MENA countries met the inclusion criteria, covering a range of sample types and diagnostic methods, including culture and PCR. The reported prevalence varies widely, from as low as 6% to over 80%, largely influenced by sampling methods, biosecurity practices, and environmental conditions. Algeria and Iran are among the countries with the highest reported prevalence rates. A meta-analysis was not feasible owing to methodological heterogeneity. Therefore, the findings were synthesized descriptively. The results emphasize significant gaps in poultry hygiene practices and surveillance infrastructure, which may contribute to the ongoing public health burden of *C. jejuni* in the region. Additionally, this review highlights emerging antimicrobial resistance trends associated with poultry farming. These findings underscore the urgency of coordinated regional efforts to enhance epidemiological monitoring and implement evidence-based poultry safety measures.

Article Info

Keywords:
Campylobacter jejuni, Prevalence, Middle East, Poultry, Food safety

Article History:
Received: 1-April-2025,
Revised: 3-May-2025,
Accepted: 10-June-2025,
Available online: 30-June-2025.

1. INTRODUCTION

Campylobacter is a gram-negative, non-spore-forming, curved or spiral bacillus that is oxygen-sensitive and prefers to grow under microaerobic conditions. Some Campylobacter species are thermotolerant; for instance, *Campylobacter jejuni* (*C. jejuni*) and *Campylobacter coli* (*C. coli*), which are of critical importance to food safety, grow optimally at 42 ℃ [1].

C. jejuni functions as a major bacterial foodborne illness agent which creates significant issues for public health. The pathogen is linked to a wide range of gastrointestinal problems, such as diarrhea and abdominal cramps with fever, but also produces Guillain-Barré syndrome as a rare outcome [2], [3].

The main source that harbors *C. jejuni* infections resides in poultry especially chickens and contamination frequently occur because of intensive farming practices and processors. Human infection often results from inadequate handling, undercooked poultry, or cross-contamination during processing[4], [5].

Epidemiological patterns of *C. jejuni* in North Africa are shaped by regional poultry production practices, cultural food preferences, and varying levels of biosecurity. In particular, infection rates in North African poultry populations show considerable variation owing to differences in hygiene protocols, climatic conditions, and surveillance efforts. The scarcity of quantitative data and limited molecular characterization of *Campylobacter* strains in the region highlight the urgent need for comprehensive epidemiological studies [6],[7]. Dense animal populations maintained in commercial farms are more prone to contamination, resulting in elevated prevalence rates[8],

[9].

Live-poultry markets and high-density poultry farming can greatly enhance bacterial proliferation and contamination risks by mixing birds from diverse sources. Variations in food safety regulations and enforcement across regions complicate the control of contamination risks. Additionally, environmental factors such as warm and humid climates favor the survival and transmission of *C. jejuni* in poultry. Epidemiological evidence indicates that communities living near intensive poultry operations may face higher rates of campylobacteriosis and related gastrointestinal illnesses, highlighting important public health concerns linked to industrial poultry production [10].

Within the broader MENA region, some countries face more acute public health challenges due to socio-political and economic instability. Yemen has demonstrated heightened vulnerability to various infectious diseases, as evidenced by multiple studies reporting the prevalence of *Brucella*, *Cytomegalovirus*, *Herpes simplex virus*, *Rubella*, and *Helicobacter pylori* infections among different population groups [11], [12], [13], [14], [15], [16]. These findings reflect the broader structural weaknesses in the country's public health infrastructure and disease surveillance systems.

In addition, microbiological assessments of food products in Yemen have revealed concerns regarding hygiene and contamination levels, underscoring poor food safety oversight and limited enforcement capacity [17]. Such conditions may also facilitate the transmission of foodborne pathogens, such as *Campylobacter jejuni*. Furthermore, constraints on healthcare access and the limited availability of effective antimicrobial treatments continue to burden public health services.

C. jejuni isolates developing antimicrobial resistance in regions that use antibiotics regularly for poultry farming remains a serious concern for medical professionals. Current studies reveal that *C. jejuni* shows worrisome drug resistance patterns, especially toward fluoroquinolones and macrolides [18], [19]. This trend underscores the need to address Antimicrobial Resistance (AMR) in prevalence studies.

Given the public health importance of *Campylobacter jejuni* as a major cause of foodborne illness, this review aimed to systematically compile and descriptively analyze published prevalence data from MENA countries between 2014 and early 2025. It further sought to identify and compare variations in the reported prevalence rates, diagnostic methods, and sampling strategies across different studies. By consolidating the available evidence, this review provides a regional epidemiological overview intended to support future research and promote greater awareness of poultry safety in the region.

2. MATERIALS AND METHODS

2.1. Study Design and Scope

This study followed a systematic review approach, focusing on collecting and descriptively presenting published data on the isolation of *C. jejuni* from chickens in various populations across the MENA region. The review includes studies published between January 2014 and February 2025. Given the diversity of data sources and methodological differences in sample collection and detection techniques, no statistical pooling or meta-analysis was conducted.

2.2. Eligibility Criteria

Studies that were found to be eligible for inclusion were observational studies (cross-sectional or cohort studies) performed in MENA countries that clearly reported the prevalence of *C. jejuni* in chickens (commercial or backyard poultry, regardless of type). Only peer-reviewed studies published in English or with accessible English abstracts were included in the study. The exclusion criteria included review articles, non-peer reviewed publications, conference abstracts, the studies that were only focused on other Campylobacter species without data presented for *C. jejuni.*

2.3. Information Sources and Search Strategy

An electronic database search, such as PubMed, Scopus, and Google Scholar, was performed for a structured literature search. Combination of search terms were: "*Campylobacter jejuni*, chicken, poultry, prevalence, and specific country names within the MENA region.' This search was limited to January 2014 to February 2025. Moreover, references of previously identified relevant articles were manually screened to identify further eligible studies.

2.4. Study Selection and Data Extraction

The titles and abstracts of all retrieved studies were independently screened for eligibility by two reviewers. Full-text articles of potentially relevant studies were reviewed in detail. Any disagreements between the reviewers were resolved by discussion or, if needed, a third reviewer was consulted. Structured forms were used to extract the following: first author, year of publication, country, sample source, sample size, detection method (culture and/or PCR), and reported prevalence of *C. jejuni*. The data were arranged into a summary table for comparison across studies.

2.5. Data Synthesis

Such a meta-analysis was not feasible because of significant variations in diagnostic methods, sample sizes, and data reporting. Instead, the findings were synthesized descriptively and presented in tabular form to highlight the regional *C. jejuni* prevalence and laboratory approaches used in the studies.

2.6. Results and discussion

This review included 28 studies on *C. jejuni* from 13 MENA countries published between 2014 and February 2025, focusing on its prevalence in chicken populations. The sample sizes ranged from 40 to 1,400 birds per study, reflecting a high degree of methodological diversity (Table 1). However, this variability limits the comparability between studies. While this heterogeneity contributes to enriching the regional dataset, it also simultaneously poses substantial limitations on direct cross-country comparability due to differences in the detection techniques of samples used and environmental contexts**.** In general, Algeria has been reported to have some of the highest prevalence rates among surveyed countries, with 80.1% of cloacal swabs, 74.4% of cecal contents, and 56.8% of neck skin samples from broiler farms positive for *C. jejuni* [20] Essentially, colonization of the GI tract and possible post-slaughter contamination were found, and these findings point to a breakdown of biosecurity and hygiene protocols. Similarly, a notably high prevalence of 76.8% using conventional culture methods was demonstrated [21] in Iran, a finding that deserves urgent public health attention due to the known virulence and antimicrobial resistance potential of *Campylobacter species* in poultry chains.

In Egypt, reported prevalence rates of *C. jejuni* in chicken samples varied significantly across studies, ranging from 6% in 2015 [22] to 63.6% in 2020 [25]. Earlier studies relying primarily on culture methods reported lower prevalence rates, such as 6% [22] and 23.5% [24], whereas studies employing both culture and PCR techniques tended to yield higher detection rates, including 63.6% [25]. Interestingly, a more recent study from 2025 reported a notably lower prevalence of 6.67% [27], which may reflect improvements in poultry hygiene practices, enhanced biosecurity measures, or differences in sampling strategy and diagnostic sensitivity. These temporal and methodological variations underscore the importance of standardized protocols in prevalence studies.

The data from Iraq revealed fluctuating trends. In 2022, *Campylobacter* spp was found in 68.4% of local chickens but only in 7.89 per cent of imported chickens [29]. Despite this, the disappearance of imported chickens gradually increased (66.6%) compared to that of local poultry (53.3%) [28] The origin of these changes may be reflected in different import sources or may represent a different level of import surveillance rigor or a change in cold-chain management.

In Jordan, two separate studies performed in Irbid and Amman reported relatively low prevalence rates of 17% [30] and 14.44% [31] respectively. These somewhat lower figures are attributable to better poultry industry practices or climatic influences; however, the small sample size prevents generalization.

In Lebanon, reported prevalence rates varied significantly depending on the sample type and study location, ranging from 8.37% in neck skin samples [32], 10.66% in broiler samples [33], and up to 45.5% in retail chicken meat [2], indicating a moderate to high food safety risk in consumer-level poultry products.

Prevalence rates for the situation in Morocco were notably more variable, ranging from 6.0% [34] to 40.2% [35] which is most likely due to differences in season, sample source (retail vs. farm), or diagnostic method. A 2016 study that included the use of both culture and PCR reported a prevalence of 36.5% in Qatar [36] which agrees with moderate contamination risks.

In Saudi Arabia, prevalence rates fluctuated over time, decreasing from 52.2% in 2014 [5] to 10% in 2021 [38], and rising again to 26.4% in 2025 [37]. These shifts may reflect changes in food safety regulations, enforcement practices, or industry-level interventions

In Turkey, prevalence rates showed a notable decline from 66.6% in 2014 using PFGE and PCR [39] to 24.3% in 2015 using culture and PCR [40], suggesting potential improvements in poultry hygiene or differences in sampling and detection methods[46]. In Tunisia, the prevalence of *C.jejuni* in poultry decreased from 16.3 % in 2017 to 15.2% in 2018 [42] and 12.8% in 2022 [41]], indicating a gradual decline over time, although contamination remains a public health concern.

The prevalence reported for the United Arab Emirates (UAE) was the lowest at 2% [44] possibly because of advanced poultry production systems, rigorous import controls, or more efficient sanitation practices. A 2015 study in Yemen also reported differential contamination of tissues, with 54.55% contamination in muscle samples and 19% in liver and heart samples [45] which clearly indicates the importance of choosing the sampling site when evaluating *Campylobacter* prevalence. In Yemen, the population generally lacks adequate awareness of infectious diseases, particularly zoonotic diseases. This situation is further exacerbated by current practices involving close and regular contact with domestic animals [47] and a high rate of poultry consumption. These behavioral patterns may increase the risk of transmission and contribute to the wider spread of infections within the community. Moreover, the lack of targeted public health education and limited veterinary oversight may further complicate efforts to control the prevalence of *C. jejuni* and similar pathogens.

The variation in prevalence rates is considerably in-

Table 1. : Summary of Included Studies on ***C. jejuni*** Prevalence in MENA Chickens

Country	Year	Sample Sources	Sample Size	Methods	Prevalence %	Reference
Algeria	2020	Broiler farms	960	Culture	Cloacal swabs (801) Ceacal contents (74.4) Neck skin (56.8)	[20]
Egypt	2015	Chicken	400	Culture + PCR	6	[22]
Egypt	2015	Chicken	287	PCR	18	[23]
Egypt	2015	Chicken	379	Culture	23·5	[24]
Egypt	2020	Chicken	360	Culture + PCR	63.6	[25]
Egypt	2021	Chicken	200	Culture + PCR	17	[26]
Egypt	2025	Chicken	120	Culture + PCR	6.67	[27]
Iraq	2023	Chicken local and imported	225 150 75	Culture + PCR	48 Local 53.3 Impor 66.6	[28]
Iraq	2022	Chicken local and imported	4040	Culture	Local 68.42Impor 7.89	[29]
Iran	2014	Chicken	250	Culture	76.8	[21]
Jordan, Irbid	2020	Chicken	177	Culture + PCR	17	[30]
Jordan, Amman	2022	Chicken	90	Culture + PCR	14.44	[31]
Lebanon	2019	Chicken	454 227 227	Culture + PCR	Cecum 26.43 Neck skin 8.37	[32]
Lebanon	2019	Chicken	75	Culture + PCR	10.66	[33]
Lebanon	2019	Chicken	150	Culture + PCR	45.5	[2]
Morocco	2021	Chicken	248	Culture + PCR	6.0	[34]
Morocco	2020	Chicken	140	Culture + PCR	40.2	[35]
Qatari	2016	Chicken	400	Culture + PCR	36.5	[36]
Saudi Arabia	2025	Chicken	212	Culture + PCR	26.4	[37]
Saudi Arabia Al-Riyadh	2021	Chicken	50	Culture + PCR	10	[38]
SaudiArabia	2014	Chicken	99	PCR	52.2	[5]
Turkeya	2014	Chicken	150	Pulsed-Field Gel Electrophoresis (PFGE) + PCR	66.6	[39]
Turkeya	2015	Chicken	362	Culture + PCR	24.3	[40]
Tunisia	2022	Chicken	257	Culture + PCR	12.8	[41]
Tunisia	2018	Chicken	590	Culture + PCR	15.2	[42]
Tunisia	2017	Chicken	250	Culture + PCR	16.3	[43]
UAE	2023	Chicken	315	Culture	2	[44]
Yemen	2015.	Poultry Muscles 100 Liver and heart 100	200	Culture	Muscles 54.55 Liver and heart 19	[45]

fluenced by the diagnostic methods used. Studies have shown that results obtained through conventional methods, such as serology or culture, should ideally be confirmed using more sensitive techniques. For example, in a study comparing the standard agglutination test (SAT) with the enzyme-linked immunosorbent assay (ELISA),

ELISA showed higher sensitivity, indicating the need to validate SAT findings using more reliable tools[48]. In line with this, molecular diagnostic techniques such as polymerase chain reaction (PCR) are increasingly favored for their superior sensitivity and specificity in detecting bacterial pathogens, including *Campylobacter spp.* This is particularly important when dealing with viable but nonculturable (VBNC) forms that escape detection by culture-based methods. Recent studies have highlighted the effectiveness of PCR-based methods in identifying *C. jejuni* in poultry products and clinical samples, reinforcing their role in modern epidemiological surveillance systems [49]. Furthermore, sample type variability (e.g., cloacal swab vs. muscle tissue), environmental conditions (e.g., ambient temperature and humidity), and poultry marketing systems (e.g., traditional live bird markets vs. industrial slaughterhouses) create additional variability in the data. Notably, countries with a higher prevalence were warmer and had less stringent regulatory frameworks, consistent with the association between environmental temperature and Campylobacter survival in the food system.

There were encouraging trends in the temporal analysis. In some countries, such as Egypt and Saudi Arabia, where the prevalence has decreased, this may imply some improvement in hygienic processing. However, there are still reversals and increases in other settings, as illustrated by the increase in imported poultry contamination in Iraq, raising concerns over external sourcing and potential gaps in international scrutiny.

Several constraints of this study should be acknowledged. First, many studies had scant metadata that were inadequate for statistical comparisons, such as sample size and poultry type. Second, language bias (only English) may have prevented the inclusion of relevant regional data. Third, overall methodological heterogeneity across studies in terms of sample type and detection techniques makes the pooled inferences relatively weaker. Fourth, although there has been increased concern regarding resistant strains of *Campylobacter* in MENA, few studies have included antimicrobial resistance profiling[20] [50]. Additionally, given the limited data on antimicrobial resistance (AMR) and the rising concern over multidrug-resistant *Campylobacter* strains in the MENA region, there is a pressing need to explore alternative antimicrobial strategies. One promising avenue is the use of natural products with documented antimicrobial properties, such as plant-derived extracts (PDEs). For example, *Boswellia sacra* (frankincense) has shown notable antibacterial activity in previous studies and may offer a sustainable, low-resistance-inducing alternative to conventional antibiotics [**<empty citation>**][51]. Future research should investigate the efficacy of such natural compounds against *C. jejuni* strains in poultry production settings, particularly in the context of integrated, One Health–oriented AMR mitigation strategies.

Considering these findings, it is clear that *C. jejuni* represents a significant but increasing public health risk in the MENA region. This highlights the need for an urgent increase in standardized molecular diagnostics and the One Health approach for surveillance across borders. Future efforts should incorporate longitudinal studies to evaluate the effectiveness of interventions and monitor the evolution of antimicrobial resistance among poultry isolates.

3. CONCLUSION

To mitigate the significant zoonotic risk posed by *C. jejuni*, regional collaboration and sustained investment in food safety infrastructure are imperative. This review highlights the substantial variability in the reported prevalence across MENA countries, often driven by differences in sampling strategies, diagnostic methods, and biosecurity conditions. The lack of standardized protocols limits meaningful cross-country comparisons and hampers the regional risk assessment. Therefore, policymakers must act based on scientific evidence by enforcing stricter hygiene protocols, expanding diagnostic capacity, and establishing harmonized risk-based surveillance systems. Without coordinated intervention, Campylobacter-associated gastroenteritis will remain a persistent and costly public health challenge in the MENA region.

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