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Review Article

# Epidemiological and Diagnosis Status of *Mycoplasma gallisepticum* in Chickens around the globe

**Muhammad Farhan Qadir[1]*, Sandhya Ashok[2] and Quratulain[3]**

[1]*College of Animal Science and Veterinary Medicine, Shanxi Agricultural University, Taigu, China*

[2]*Department of Microbiology, University of Karachi, Pakistan*

[3]*Para Veterinary Institute Karor (Layyah Campus) University of Veterinary and Animal Sciences, Pakistan*

***Corresponding Author**: Muhammad Farhan Qadir, College of Animal Science and Veterinary Medicine, Shanxi Agricultural University, Taigu, China.

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## Abstract

Chickens are suffered with several diseases in which Mycoplasma gallisepticum diseases is one of great importance. Infected chickens can be diagnosed on the basis of history, clinical signs, postmortem and microscopic examination and diagnostic methods. After observation of clinical signs, necropsy practice is the best tool to differentiate the disease on the basis of type of lesions. On postmortem examination airsacculitis is regarded as characteristic lesion. Microscopic changes can be observed in trachea, lungs and air sacs. Diagnosis of *Mycoplasma* can be done by several tests including serological tests and molecular tests. Serological tests are used for early diagnosis of the disease. Different disease status was observed in various countries like Bangladesh, India, Iran, Egypt, China and some other countries. Infection can be controlled by proper screening the breeder flock, vaccination of layer chicks and culling of infected flocks because if flock is infected, it remains for whole life, so eliminate all the flock to avoid the further losses due to *Mycoplasma*.

***Keywords:*** *Mycoplasma gallisepticum; MG; Diagnosis; Epidemiology; Chickens; Mycoplasmosis*

## Background

Poultry industry is fast growing sector in Pakistan but beyond this fast growth of poultry industry, it is prone to lot of infectious and non-infectious threats which causes huge economic losses. It is actually a very risky business due to less measures adopted by the farmers to prevent the disease. Great number of viral and bacterial pathogen effect the birds in which mycoplasmosis is of great importance. Birds of all ages are prone to *Mycoplasma* infection but young birds are more effected than mature ones [1]. *Mycoplasma* pathogens are gram negative and belong to class Mollicutes, order-I Mycoplasmatales, family-I Mycoplasmataceae and genus *Mycoplasma*. Mycoplasmas are small size bacteria, without cell wall and having a triple layer plasma membrane [2]. Mycoplasmosis includes four major infectious, highly prevalent species including *Mycoplasma gallisepticum* (MG), *M. synoviae* (MS), *M. meleagridis* (MM) and *M. iowae* (MI). MG and MS mostly effect the chickens but MM and MI are produce disease in turkeys [3]. It is also known as chronic respiratory disease (CRD) of poultry. *Mycoplasma* colonies have a typical fried egg appearance on culture media [4]. MG can be transmitted by both ways either horizontal or vertical. Horizontal transmission can be possible within a flock by direct or indirect contact, direct contact by feces or respiratory secretions and indirect contact through contaminated feed, water, equipment and human cloths etc., while transmission of MG between the flocks is possible through wind. MG is transmitted vertically from parents to offspring through eggs [5,6]. Disease is distributed worldwide and affects both the broiler and layer birds. Significant economic losses occurring due to decrease in egg production and egg quality, embryonic mortality, poor hatchability, high morbidity, decrease weight gain and medication costs [7]. Disease status varies in different areas depends on age, sex, flock size and season [8]. Present study will explain the current MG status can be seen around the globe.

### MG diagnosis

There are different serological techniques to detect MG at initial stages i.e. Serum plate agglutination (SPA) test [9], Haemagglutination inhibition (HI) test [10] and Enzyme linked-Immunosorbant assay (ELISA) [11]. Molecular techniques are good alternatives for

conventional diagnostic methods. Specific primers target specific genes of MG [12]. Real time PCR is considered as fast and sensitive test to detect MG infected flocks [13]. Loop-mediated isothermal amplification (LAMP), is another method to diagnose MG, was developed in 2000. LAMP depends on an auto-cycling strand displacement DNA synthesis performed by *Bst* DNA polymerase large fragment under isothermal conditions of 60 - 65°C. This assay is highly specific, and the amplification efficiency is equal to that of PCR based methods. Moreover, LAMP method synthesizes large amounts of DNA that can be easily detected by turbidity or fluorescence so, gel electrophoresis is not required [14].

## MG prevalence in different countries

MG prevalence was different in various countries, even at different regions in same country, like Bangladesh, India, Iran, Egypt, China and some other countries table 1-6 respectively.

| City/State/Region | Bird's type | Samples collected | Diagnostic tests | MG prevalence or incidence (%) | Paper references |
|---|---|---|---|---|---|
| Feni Sadar thana and Chhagoalnaiya thana districts | Breeder poultry farms | 382 sera samples | SPAT | 58.90% overall disease but 62.44% and 53.10% in winter and summer season while 59.90% and 48.57% in female and male birds respectively. 62.80% in Feni sadar and 53.45% in Chhagoalnaiya thana districts. | [15] |
| Lohagara and Satkania Upazila of Chittagong district | Chickens | 400 | SPAT | 73% in layer and 53% in broiler birds at Lohagara whereas 60% in layer and 465 in broiler chickens at Satkania Upazilla region. | [16] |
| Rajshahi district | Chickens | 575 sera samples | SPAT | 55.13% overall disease while 61.48% in winter and 47.74% in summer. 62.86% in large flocks and 52.00% in small flocks. | [17] |
| Rajshahi and surrounding districts | Layer chicken | 605 sera samples | SPAT | 71.7% in young and 50.4% in adult birds. 68.6% in large flocks and 50% in small flocks. 61.6% in winter (autumn 56.9%, 55% rainy) and 49.6% in summer | [18] |
| Bhola district, Bangladesh | Chicken (backyard and commercial layer | 480 blood samples | SPAT | Overall 55.83% (268/480) while 62.5% in backyard chickens and 53.61% in commercial farming system. 60.63% in pullets, 55.63% in adults and 51.25% in old birds. 60.42% in winter and 51.25% in summer season. | [19] |
| Five upazilas (Sadar, Sariakandi, Gabtoli and Sherpur) of Bogra District | commercial layer chickens | 563 blood samples | SPAT and iELISA | Overall 64.47% and 56.13% by iELISA and SPAT. 70.13% in December followed by November (68%), October (65.67%), August (63.46%), September (58.54%) and July (51.78%). 69.63% in large flocks and 56.82% in small flocks. | [20] |
| kotwali thana in Chittagong | Chickens | 455 including live, sick and dead birds | SPAT | Overall mycoplasmosis was 15.38%. 73% in broiler and 27% in layer chickens. 49% in 8-21 days age group followed by 21 % in 22-35 days age group, 21% in 0-7 days age group, 6% in 36-60 days age group and 3% in above 60 days age group. 33% in January, 30 February, 23 March, 13 December and 1% in November. | [21] |

***Table 1:*** *MG prevalence in Bangladesh.*

| City/State/Region | Samples collected | Diagnostic tests | MG status (%) | Paper references |
|---|---|---|---|---|
| Different regions of India | 1715 Choanal cleft swabs | Isolation of MG, PCR | 10.38% | [22] |
| Namakkal (Tamil Nadu) | 103 sera samples | iELISA | 53.40% | [23] |
| Rewa region of Madhya Pradesh | 98 sera samples | ELISA | 21.40% | [24] |
| Seven states of India | 1285 serum samples | ELISA | 32.06% MG | [25] |
| Hyderabad | 13,394 dead chickens | Necropsy examination | 11.50% | [26] |
| Haryana | 98 | SPAT | 22.40% | [27] |
| Haryana | 92 | PCR | 27% | [28] |
| Different Districts of Tamil Nadu | 1350 sera samples | SPAT<br>ELISA | 55.5% (SPAT)<br>42.1% (ELISA) | [29] |
| Telangana, Karnataka, Tamilnadu, Gujarat,<br>Odisha Himachal Pradesh, West Bengal | 309 Choanal swabs | PCR | 11.6% | [30] |

***Table 2:*** *MG prevalence in India.*

| City/State/Region | No. of Samples | Diagnostic tests | MG status (%) | Paper references |
|---|---|---|---|---|
| Center north of Iran | 2000 serum samples | SPAT | 6.25% | [31] |
| Chaharmahal Va Bakhtiari province | 324 | PCR | 30.50%, 38.55%, 22.81% and 18.60% MG in Shahrekord, Borujen, Farsan and Lordegan areas, respectively | [32] |
| Mazandaran province, north of Iran | From 2002 to 2008 different flocks | SPAT and ELISA | Positive agreement between these two methods was 33%, depending upon age, sex, flock size and season with different positive rates and risk factors | [33] |
| Kerman Iran | 88 isolates | Culture and nested PCR | 69% by culture and 100% by nested PCR. | [34] |

***Table 3:*** *MG prevalence in Iran.*

| City/State/Region | Diagnostic tests | MG status (%) | Paper references |
|---|---|---|---|
| Egypt | Culture and PCR | 20% by culture and 33.3% by PCR | [34] |
| Egypt | SPAT and ELISA | 69.9% layers were positive by ELISA and 58.3% by SPAT. 60% broiler farms were positive by ELISA and 48.7% by SPAT. | [35] |
| Egypt | Culture and PCR | 40% by both | [36] |
| El-Sharkia governorate, Egypt | Culture, GIT, ELISA | 23.3%, 11.6% and 8.3% samples were positive by culturing air sacs, trachea and lungs respectively. 16.5% by GIT and 48.3% by ELISA. | [37] |
| Egypt | PCR, conventional cultivation method and direct PCR. | 70.9% by PCR, 65.45% by direct PCR and 17.66 by conventional cultivation method. | [38] |

***Table 4:*** *MG prevalence in Egypt.*

| Country/Province/ Region | Bird's type | Samples No. | Tests used | MG status (%) | References |
|---|---|---|---|---|---|
| Chongqing | Chickens | 907 and 882 in 2012 and 2013 respectively | ELISA | 62.62% AND 72.45% in 2012 and 2013 respectively. 59.08% and 68.97% in spring and 65.89 and 75.65% in winter season in 2012 and 2013 respectively. 50.28%, 68.51 and 17.5% in 2012 and 57.89%, 78.14% and 20% in 2013 in broilers, breeders and backyard farms respectively. | [39] |
| China (Shanghai) | Chicken | 183 swab samples | Loop-mediated isothermal amplification (LAMP), PCR | 20.2% by LAMP and 13.1% by PCR. | [14] |
| Guizhou province | Poultry birds | 801 serum samples | ELISA | 43.07 % | [40] |

***Table 5:*** *MG in China.*

| Country/ State/Region | Bird's type | No. of samples | Tests used | MG % | References |
|---|---|---|---|---|---|
| Nakornpathom province, Thailand. | Chickens | 30 flocks, 15 birds from one flock (450 birds) | SPAT, ELISA and PCR | 18.2-40%, 16.7-40% and 18.2- 40% MG +ve samples by SPAT, ELISA and PCR at the age of 1 month, 1-2, 2-3 and 3-4 months respectively. | [41] |
| Northern and Central Jordan | Chickens | 115 flocks | PCR for MG, RT- PCR for NDV, APV and IBV | 14.8% positive flocks for MG+IBV, 5.2% for MG+NDV and 6% for MG+APV. | [42] |
| São Paulo, Paraná and Pernambuco states of Brazil | Chickens | 1046 | Multiplex PCR | 72.7% | [43] |
| Argentina (for 3 time period in different counties) | Chicken | 2411 sera samples | SPAT | 32.8%, 55.1%, and 76.2% MG for 1st, 2nd and 3rd study period respectively. | [44] |
| Algeria | Chicken | 505 serum samples | SPAT | Overall MG % was 69.90%. 61.48% in winter and 47.74% in summer. | [45] |
| Algeria | Chicken | 18 tracheal swab | Culture<br>SPAT PCR | 72.22%, 61.11% and 63.63% by culture, SPAT and PCR respectively | [46] |
| Few states of Peninsular Malaysia | Chickens | 300 | Real time RCR | Out of total, 94 samples were tested positive for MG. | [47] |
| Niger State, Nigeria | Chickens | 552 blood and 138 swab samples | MG/MS ELISA, Culture | 91.83% by MG/MS ELISA. Out of total, 126 swab samples showed fried egg appearance on mycoplasma agar plate. | [48] |
| Triângulo Mineiro, Brazil, State of Minas Gerais | Chicken | 120 samples | SPAT<br>HI | 18% by SPAT and 0 % by HI. | [49] |
| Valenciana (Spain) | Broilers | 7363 samples | ELISA | One region showed an average ELISA titer values of more than 500 in the study period, which indicate any previous infection of MG in broiler birds. | [50] |

***Table 6:*** *MG prevalence in other countries.*

## Conclusion

MG is prevalent in many countries time to time. It causes great economic losses to the poultry industry. It should be controlled at hatchery level and on other hand horizontal transmission can be controlled by good biosecurity measures. First, monitoring of whole flock should be done to know the disease condition time to time and to remove the diseased birds, otherwise all the flock should be removed to control the further spread of this disease. Serological tests are very fast to detect MG status in any flock. Timely vaccination and detection is helpful to control the disease at early stages. There is also need to educate the farmer regarding biosecurity and preventive measures to reduce the economic losses occurring due to this disease. However, more epidemiological studies should be done to check the disease status at specific regions.

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