

4-22-2025

Serological detection of *Toxoplasma gondii* in local duck birds, and *Gallus gallus* in Basrah Province, Iraq

Ameer Ibrahim Abdulzahra

Department of Science, College of Basic Education, University of Babylon, Babylon, Iraq.,
bsc.st.amer.ebadi@uobabylon.edu.iq

Alaa Ismail Saood

Department of Diseases and Poultry Diseases, College of Veterinary Medicine, University of Basrah, Basrah, Iraq.

Afaq Talib Farhood

Department of Pathological Analysis, College of Science, University of Thi-Qar, Thi-Qar, Iraq.

Follow this and additional works at: <https://bsj.uobaghdad.edu.iq/home>

How to Cite this Article

Abdulzahra, Ameer Ibrahim; Saood, Alaa Ismail; and Farhood, Afaq Talib (2025) "Serological detection of *Toxoplasma gondii* in local duck birds, and *Gallus gallus* in Basrah Province, Iraq," *Baghdad Science Journal*: Vol. 22: Iss. 4, Article 11.

DOI: <https://doi.org/10.21123/bsj.2024.8884>



RESEARCH ARTICLE

Serological Detection of *Toxoplasma Gondii* in Local Duck Birds, and *Gallus gallus* in Basrah Province, Iraq

Ameer Ibrahim Abdulzahra¹, Alaa Ismail Saood², Afaq Talib Farhood^{3,*}

¹ Department of Science, College of Basic Education, University of Babylon, Babylon, Iraq

² Department of Diseases and Poultry Diseases, College of Veterinary Medicine, University of Basrah, Basrah, Iraq

³ Department of Pathological Analysis, College of Science, University of Thi-Qar, Thi-Qar, Iraq

ABSTRACT

Toxoplasma gondii was widely spread in humans and other animals, including domestic poultry, worldwide and depends on a unique collection of secretory and cytoskeletal organelles for host cell invasion. The meat of *T. gondii* infected poultry which includes chickens and ducks was widely consumed in most countries and was known as a primary source of human infection. In Iraq generally and in Basrah province especially, the prevalence of *T. gondii* in local ducks (*Anas platyrhynchos domesticus*) and domestic chicken (*Gallus gallus*) was scarcely known. In the current study, the Latex Agglutination Test (LAT) and (TOX) *Toxoplasma* IgM/IgG Antibody Rapid Test Kit (Immunoassay) were used to examine antibodies to *T. gondii* in 40 local duck birds and 62 domestic chickens from different regions in Basrah Province. Antibodies to *T. gondii* (LAT) were found in 14 (35%) of 40 local duck birds, and 23 (37.09%) of 62 domestic chickens. While the *T. gondii* antibodies (Rapid Test) were detected in 10 (25%) of 40 local duck birds and 17 (27.41%) of 62 domestic chicken. The findings showed that the soil was contaminated by *T. gondii* oocysts represented a food source for domestic chicken and local duck birds due to the birds feeding on the ground. It suggested that the meat from domestic poultry may be an important source of human *T. gondii* infection in Iraq. This study was the first study in Basrah province to detect toxoplasmosis in domestic chicken and local duck birds.

Keywords: Ducks, *Gallus gallus*, Latex agglutination test, Rapid test, *Toxoplasma gondii*

Introduction

Toxoplasmosis is a widespread zoonosis illness brought on by the parasite *Toxoplasma gondii*, an obligate intracellular coccidian parasite that infects most avian and mammalian species and is thought to manipulate in intermediate hosts' behavior for easier transmission into feline hosts. Although intermediate hosts can retain infective tissue cysts, felines are the only animals that discharge oocysts in their feces as definitive hosts for this pathogen.¹⁻⁵ The parasite is more prevalent in warm and humid areas compared to dry areas.⁶ The parasite alters the conduct of its in-

termediate hosts by decreasing their natural aversion to cat odors, potentially boosting the likelihood that the infected host will be eaten by the definitive host. The parasite depends on a unique set of cytoskeletal and secretory organelles for host cell invasion.⁷⁻⁹

Birds including chickens are important *T. gondii* reservoirs because they are often hunted by felids; they reproduce out of control as they are not eclectic about food, eating food waste that may be polluted with *T. gondii*. Furthermore, because they can fly long areas and eat on the soil, they could be prospect hosts for this coccidian.^{10,11} Tissue cysts of *T. gondii* (bradyzoites) found in undercooked or raw meat from many

Received 9 April 2023; revised 16 September 2023; accepted 17 September 2023.
Available online 22 April 2025

* Corresponding author.

E-mail addresses: bsc.st.amer.ebadi@uobabylon.edu.iq (A. I. Abdulzahra), pgs2175@uobasrah.edu.iq (A. I. Saood), afaq.path78@sci.utq.edu.iq (A. T. Farhood).

<https://doi.org/10.21123/bsj.2024.8884>

2411-7986/© 2025 The Author(s). Published by College of Science for Women, University of Baghdad. This is an open-access article distributed under the terms of the [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

sources, including birds, are thought to be important sources of infection in humans.¹²

In the epidemiology of *T. gondii* infection, poultry is one of the most significant hosts because they are the effective source for infection cats that excrete the environmental factors resistant oocysts, also humans can contract the parasite by eating undercooked infected chicken meat.¹³

Toxoplasmosis mostly affects the central nervous system, although it can also impact the skeletal muscles reproductive system, and visceral organs in mammals, birds, and reptiles.¹⁴ Myositis in the skeletal and cardiac muscles, diarrhea, nonsuppurative meningoencephalitis, nephritis, and focal nonsuppurative hepatitis are some of the clinical symptoms of toxoplasmosis in chickens.¹⁵

In Iraq, the consumption of chicken and duck meat has increased, so, this could be one of the sources of human infection.¹⁶ The objective of the current study is to determine the prevalence of *T. gondii* in local duck species and *Gallus gallus* in the province of Basrah. *Toxoplasma* IgM/IgG Antibody Rapid Test Kit (Immunochromatography) and the latex agglutination (IgM and IgG) test (LAT) were used to detect antibodies (Abs) to the parasite in the serum of local duck species and domestic chickens, due to the economic significance of these species and their proximity the presence of a human, which acts as a carrier and intermediary for the parasite as well as cats.

Materials and methods

Collection of samples

Domestic chickens (*Gallus gallus*)

A total of 62 domestic chickens' samples were cluster screened randomly purchased from different locations in the province of Basrah from March to November 2022.

Local ducks (*Anas platyrhynchos domesticus*)

A total of 40 local duck birds were purchased from rural areas and Basrah bird sale places from August 2022 to February 2023.

Blood collecting and separation of serum

Brachial vein blood samples (between 2–4 mL) were taken. Blood samples were centrifuged for 6–10 minutes at 4000 rpm to separate the serum, which was then put into Eppendorf tubes and stored in the freezer at -20 °C until the experiment day.

Test for Latex Agglutination (LAT)

The idea behind this test was that when latex particles coated with soluble *T. gondii* antigen were mixed

with anti-*Toxoplasma* antibody samples, they accumulated. The Campbell¹⁷ method was followed when conducting the latex agglutination test (Toxo-latex, Spinreact, Spain). On the day of the latex agglutination test experiment, the serum was kept at room temperature. About 50 µl of the serum and 25 µl of the reagent were used. The mixture was mixed thoroughly with the plastic sticks included in the test kit and then left for 5 minutes. Positive samples showed clear agglutination in the latex agglutination test, whereas the reagent did not adhere to negative samples.

(TOX) *Toxoplasma* IgM/IgG Antibody Rapid Test Kit (Immunochromatography)

Toxoplasma IgM/IgG Antibody Rapid Test Kit (HIGHTOP, China) was carried out according to the manufacturer's instructions. The plastic dropper was filled with serum, the dropper was vertically, and three full drops 80–100 µL of serum, making sure that there were no air bubbles (bubbles may prevent the complete transfer of the sample and invalidate the test), reading the results within 15–30 minutes, and positive results may appear within one minute.¹⁸ The use of the latex agglutination test (LAT) and the Rapid Test Kit for the diagnosis of *T. gondii* due to their ease of use and low cost in addition to saving the time and effort required to perform them. The test result appears after 5–15 minutes. It does not require expensive equipment.¹⁹

Results and discussion

Latex agglutination test (LAT)

Results showed that antibodies were detected in 14/40 local duck birds (35%), and 23/62 domestic chickens (37.09%).

(TOX) *toxoplasma* IgM/IgG antibody rapid test kit (immunochromatography)

According to the type of antibodies in local duck birds toxoplasmosis, samples using rapid test kit (Immunochromatography) results indicated that ten samples out of 40 (25%) were found positive, however IgG, IgM, and IgG plus IgM were found in 20%, 10%, and 70% respectively. While results of domestic chickens indicated that 17 samples out of 62 (27.41%) were found positive, however IgM, IgG, and IgG plus IgM were found in 17.64%, 11.76%, and 70.58 respectively (Table 1). It was clear from the results that the percentage of the presence of antibodies together (IgG & IgM) higher than the presence of one them, which indicates the presence of both

Table 1. Infection rate with *T.gondii* according to the type of antibodies using the rapid test kit.

samples	Total sample number	a positive number (%)	Antibody Type		
			IgG	IgM	IgG + IgM
Local duck birds					
No.	40	10	2	1	7
%		25	20	10	70
Domestic chickens					
No.	62	17	3	2	12
%		27.41	17.64	11.76	70.58

recent (acute) and latent (chronic) infections, while the latent or chronic infections (IgG) were higher than the acute infections (IgM).

The outcome of the latex agglutination test was for immunological detection, and *Toxoplasma* IgM/IgG. Antibody Rapid Test Kit (Immunochromatography) demonstrated that *T. gondii* incidence in local duck birds and domestic chickens were higher than the percentage that was recorded in Iraq by Mikaeel, and Al-Saeed²⁰ of local chickens in Duhok Province using the enzyme linked immunosorbent assay (ELISA) (IgG) is 22.8%, and Issa *et al.*²¹ of chickens, turkey, geese, and ducks in Duhok Province using (ELISA) which is 21.1%.

The incidence rate recorded in the current study was higher than the percentage, which was recorded by Adhoi and Mahmood¹⁶ of chickens in Tikrit Province using the latex agglutination test, (LAT) which was 32.1%, and Mohammed²² of domestic chickens in Sulaimani Province (LAT) was 25.64%.

Additionally, the rate of infection was higher than the percentage that was recorded in several studies in the world,, including Yan *et al.*²³ on chickens and ducks in China using the modified agglutination test (MAT) was 11.4%, 16%, and Puvanesuaran *et al.*²⁴ on ducks in Malaysia using (MAT) which was 14.63%. As well as Mahmood *et al.*²⁵ on *Gallus domesticus* in Pakistan using indirect hemagglutination antibody (IHAT) was 18.85%, and Zhao *et al.*²⁶ on chickens in China using the *Toxoplasma* circulating antibodies (TCAb) and (ELISA) were 16.97% and 5.88%.

Also, the percentage recorded in the current study was higher than the percentage recorded by Li *et al.*²⁷ on chickens, and ducks in Northeastern China using indirect hemagglutination antibody (IHA) 10.6%, 21.0%, and Saichua *et al.*²⁸ on chickens in Thailand using (LAT) was 10.1%, and Xu *et al.*²⁹ on Chickens in China using (MAT) which was 18.8%.

Infection incidences were lower than the percentages noted in several studies by Mohammed²¹ on chickens in Sulaimani Province using (LAT) was 60%. In addition to the percentages recorded in some

studies, including Namroodi *et al.*³⁰ on ducks in Iran using (MAT) was 63.3%, and Harfoush and Ael-N³¹ on domestic ducks in Egypt using (IHAT) which was 55, 38%.

The variance in *T. gondii* infection rates in the studies mentioned above can be attributed to differences in number of the samples examined, the sensitivity of the diagnostic tests used, and variations in the geographical and environmental location of those locations.³²

Conclusion

This study can be a first step in Basrah province to determine the prevalence of toxoplasmosis in local duck birds and domestic chickens by (TOX) *Toxoplasma* IgM/IgG Antibody Rapid Test Kit (Immunochromatography). The results confirmed that toxoplasmosis was common in ducks and free range poultry. To limit the danger of toxoplasmosis infection, efforts must be taken to obtain agreeable control over food safety and stray cats.

Acknowledgment

We give our appreciation and gratitude to the Diseases and poultry diseases Lab. Staff in the Department of Diseases and poultry diseases at the College of Veterinary Medicine at the University of Basrah for their support in accomplishing this work.

Authors' declaration

- Conflicts of Interest: None.
- We hereby confirm that all the Figures and Tables in the manuscript are ours. Furthermore, any Figures and images, that are not ours, have been included with the necessary permission for re-publication, which is attached to the manuscript.

- The author has signed an animal welfare statement.
- Ethical Clearance: The project was approved by the local ethical committee in University of Basrah.

Authors' contribution statement

A. I. A., A. I. S., collected samples, performed the experiments, and wrote the manuscript, and A. I. A., A.T. F. designed the work, directed it, and corrected the paper.

References

1. Aguirre AA, Longcore T, Barbieri M, Dabritz H, Hill D, Klein PN, et al. The one health approach to toxoplasmosis: epidemiology, control, and prevention strategies. *Ecohealth*. 2019;16(2):378–390. <https://doi.org/10.1007/s10393-019-01405-7>.
2. Saheb EJ, Al-Issa YA, Mussa IS, Zghair KH. Incidence of toxoplasmosis in psoriasis patients and possible correlation with tumor necrosis factor- α . *Baghdad Sci J*. 2020;17(1):0214–0214. [https://dx.doi.org/10.21123/bsj.2020.17.1\(Suppl.\).0214](https://dx.doi.org/10.21123/bsj.2020.17.1(Suppl.).0214).
3. Gering E, Laubach ZM, Weber PS, Soboll Hussey G, Lehmann KD, Montgomery TM, et al. *Toxoplasma gondii* infections are associated with costly boldness toward felids in a wild host. *Nat Commun*. 2021;12(1):1–8. <https://doi.org/10.1038/s41467-021-24092-x>.
4. Gazzonis AL, Villa L, Lubian E, Ressegotti S, Grilli G, Raimondi S, et al. Molecular survey on *Toxoplasma gondii* and *Neospora caninum* infection in wild birds of Prey Admitted to Recovery Centers in Northern Italy. *Microorganisms*. 2021;9(4):736. <https://doi.org/10.3390/microorganisms9040736>.
5. Abdulzahra AI, Abdullah BH. Molecular and Serological detection of *Toxoplasma gondii* in three species of wild birds of Babylon province, middle Iraq. *Iraqi J Vet Sci*. 2023;37(1):39–44. <https://doi.org/10.33899/ijvs.2022.133394.2219>.
6. Hajizadeh M, Falaki R, Tavakoli-Yaraki M, Hosseinzadeh R, Alipour M, Ahmadpour E, et al. *Toxoplasma gondii* infection in patients with malignant and benign bone tumours. *Russ J Infect Immun*. 2021;11(6):1083–1088. <https://dx.doi.org/10.15789/2220-7619-TGI-1660>.
7. Al-Mashhadany RI, Hussein AJ, Al-nusear ANB. A Molecular and histological study of Turkey birds infected with toxoplasmosis. *J Phys.: Conf Ser*. 2019;1294(6):1–8. <https://doi.org/10.1088/1742-6596/1294/6/062065>.
8. Tong WH, Pavey C, O'Handley R, Vyas A. Behavioral biology of *Toxoplasma gondii* infection. *Parasit Vectors*. 2021;14(1):1–6. <https://doi.org/10.1186/s13071-020-04528-x>.
9. Delgado IL, Zúquete S, Santos D, Basto AP, Leitão A, Nolasco S. The apicomplexan parasite *Toxoplasma gondii*. *Encyclopedia*. 2022;2(1):189–211. <https://doi.org/10.3390/encyclopedia2010012>.
10. Galeh TM, Sarvi S, Khalilian A, Hosseini SA, Daryani A. Genetic diversity of *Toxoplasma gondii* isolates from birds in the world: A systematic review. *Exp. Parasitol*. 2023;28:248:108480. <https://doi.org/10.1016/j.exppara.2023.108480>.
11. Duong HD, Appiah-Kwarteng C, Takashima Y, Aye KM, Nagayasu E, Yoshida A. A novel luciferase-linked antibody capture assay (LACA) for the diagnosis of *Toxoplasma gondii* infection in chickens. *Parasitol Int*. 2020;77: 1–8. <https://doi.org/10.1016/j.parint.2020.102125>.
12. Stelzer S, Basso W, Silván JB, Ortega-Mora LM, Maksimov P, Gethmann J, et al. *Toxoplasma gondii* infection and toxoplasmosis in farm animals: Risk factors and economic impact. *Food Waterborne Parasitol*. 2019;15:e00037. <https://doi.org/10.1016/j.fawpar.2019.e00037>.
13. Hamilton CM, Robins R, Thomas R, Oura C, Oliveira S, Villegas I, et al. Prevalence and Genetic Diversity of *Toxoplasma gondii* in Free-Ranging Chickens from the Caribbean. *Acta Parasit*. 2019;64: 738–744. <https://doi.org/10.2478/s11686-019-00071-7>.
14. Stacy NI, Pendl H, Wencel PM. Reptiles and birds. Chapter 61. *Veterinary Cytology*, First Edition. Edited by Leslie C. Sharkey, M. Judith Radin, and Davis Seelig. John Wiley & Sons, Inc. 2020;828–868. <https://doi.org/10.1002/9781119380559.ch61>.
15. Atasever A, Ekebas G, Gram DY. Spontaneous toxoplasmosis in a chicken. *Ankara Univ Vet Fak Derg*. 2020;67(1):101–105. <https://doi.org/10.33988/auvfd.570289>.
16. Adhoi H, Mahmood OI. Seroprevalence and Histological Study of *Toxoplasma gondii* in Chicken (*Gallus domesticus*) in Tikrit City, Iraq. *Indian J Public Health Res Dev*. 2018;9(11):463–467. <https://doi.org/10.5958/0976-5506.2018.01499.7>.
17. Campbell T. *Avian Hematology and Cytology*. Iowa State University press. 1995. No. 2nd Ed 104pp.
18. Mario H. TOXO Toxoplasma Antibody Test IgG/IgM Rpid Test Kit. Qingdao Hightop Biotech Co.,Ltd, China, 2016.
19. Zia-Ali N, Keshavarz-Valian H, Rezaian M, Khorramizadeh MR, Kazemi B, Fazaeli A, et al. Molecular characterization of *Toxoplasma gondii* from bird hosts. *Iran J Public Health*. 2005;34(3):27–30.
20. Mikaeel FB, Al-Saeed AT. Molecular detection and seroprevalence of Toxoplasmosis in free range local chickens (*Gallus domesticus*) in Duhok province, Iraq. *Iraqi J Vet Sci*. 2020;34(2):247–252. <https://doi.org/10.33899/ijvs.2019.125885.1173>.
21. Issa NA, Mikaeel FB, Shaquli AM, Ibrahim MA, Ali SO. Seroprevalence of *Toxoplasma gondii* in Free-range Local birds in sumel district, Duhok Province, Iraq. *Explor Anim Med Res*. 2020;10(1):55–59.
22. Mohammed AA. Diagnostic study of Toxoplasmosis in domestic chickens in Sulaimani province. *AL-Qadisiya J Vet Med Sci*. 2013;12(2):63–69.
23. Yan C, Yue CL, Yuan ZG, He Y, Yin CC, Lin RQ, et al. *Toxoplasma gondii* infection in domestic ducks, free-range and caged chickens in southern China. *Vet Parasitol*. 2009;165(3-4):337–340. <https://doi.org/10.1016/j.vetpar.2009.07.015>.
24. Puvanesuaran VR, Noordin R, Balakrishnan V. Isolation and genotyping of *Toxoplasma gondii* from free-range ducks in Malaysia. *Avian Dis*. 2013;57(1):128–132. <https://doi.org/10.1637/10304-071212-ResNote.1>.
25. Mahmood ZU, Zahid M, Sthanadar AA, Shah M, Hussain A. Seroprevalence of *Toxoplasma gondii* infection in *Gallus domesticus* of district Mardan, Khyber Pakhtunkhwa, Pakistan. *Pak J Zool*. 2014;46(6):1705–1710.
26. Zhao G, Shen B, Xie Q, Xu LX, Yan RF, Song XK, et al. Detection of *Toxoplasma gondii* in free-range chickens in China based on circulating antigens and antibodies. *Vet Parasitol*. 2012;185(2-4):72–77. <https://doi.org/10.1016/j.vetpar.2011.10.031>.

27. Li MH, Yang BT, Yin ZW, Wang W, Zhao Q, Jiang J. A seroepidemiological survey of *Toxoplasma gondii* and Chlamydia infection in chickens, ducks, and geese in Jilin province, northeastern China. *Vector Borne Zoonotic Dis.* 2020;20(11):825–830. <https://doi.org/10.1089/vbz.2020.2614>.

28. Saichua P, Jumnainsong A, Tantrawatpan C, Kiatsopit N, Kopolrat K, Suwannatrat A, et al. Seroprevalence of *Toxoplasma gondii* in free range chickens (*Gallus domesticus*) in Khon Kaen province, Thailand. *Trop Biomed.* 2017;34(2):419–424.

29. Xu P, Song X, Wang W, Wang F, Cao L, Liu Q. Seroprevalence of *Toxoplasma gondii* infection in chickens in Jinzhou, northeastern China. *J Parasitol.* 2012;98(6):1300–1301. <https://doi.org/10.1645/GE-3164.1>.

30. Namroodi S, Poorghaz F, Akbarnejad F, Kheirabadi V. *Toxoplasma gondii* serosurvey in domestic ducks (*Anas platyrhynchos domesticus*) and long-legged buzzard (*Buteo rufinus*), Golestan Province, North Iran. *Int J Mol Clin Microbiol.* 2018;8(1):931–935.

31. Harfoush M, Ael-N T. Seroprevalence of *Toxoplasma gondii* antibodies in domestic ducks, free-range chickens, turkeys and rabbits in Kafr El-Sheikh Governorate Egypt. *J Egypt Soc Parasitol.* 2010;40(2):295–302.

32. Hamza HM, Dakhel MH. Isolation of *Toxoplasma gondii* histocysts from Local Chickens, Wild and Domestic Pigeons. *QJPS.* 2017;17(4):36–47.

الكشف المصلّي عن المقوسة الكوندية في البط المحلي والدجاج المحلي في محافظة البصرة، العراق

أمير ابراهيم عبد الزهره¹، علاء اسماعيل سعود²، آفاق طالب فرهود³

¹قسم العلوم، كلية التربية الأساسية، جامعة بابل، بابل، العراق.

²قسم الأمراض وأمراض الدواجن، كلية الطب البيطري، جامعة البصرة، البصرة، العراق.

³قسم التحاليل المرضية، كلية العلوم، جامعة ذي قار، ذي قار، العراق.

الخلاصة

تنتشر المقوسة الكوندية على نطاق واسع في البشر والحيوانات الأخرى، بما في ذلك الدواجن، في جميع أنحاء العالم وتعتمد على مجموعة فريدة من العضيات الإفرازية والهيكلية الخلوية لغزو الخلايا المضيفة. يتم استهلاك لحوم الدواجن المصابة بالمقوسة الكوندية والتي تشمل الدجاج والبط على نطاق واسع في معظم البلدان وهي معروفة كمصدر رئيسي للعدوى البشرية. في العراق بشكل عام وفي محافظة البصرة على وجه الخصوص، نادرًا ما يُعرف عن انتشار المقوسة الكوندية في البط والدجاج المحلي. في الدراسة الحالية، تم استخدام اختبار تلازن اللاتكس (LAT) ومجموعة الاختبار السريع لل أجسام المضادة لطيفي المقوسة الكوندية في 40 طائر من البط المحلي و 62 دجاج المحلي من مناطق مختلفة في محافظة البصرة. تم العثور على الأجسام المضادة لطيفي (LAT) في 14 (35٪) من 40 طائر بط محلي ، و 23 (37.09٪) من 62 من الدجاج المحلي. بينما تم الكشف عن المقوسة الكوندية للطيفي (الاختبار السريع) في 10 (25٪) من 40 طائر بط محلي و 17 (27.41٪) من 62 من الدجاج المحلي. أظهرت النتائج أن التربة ملوثة بالكيسات البيضية للطيفي التي تمثل مصدراً غذائياً للدجاج والبط المحلي نظراً لتجذب الطيور على الأرض. وتشير الدراسة إلى أن لحوم الدواجن قد تكون مصدراً مهماً للعدوى البشرية بالطيفي في العراق. تعتبر هذه الدراسة هي الدراسة الأولى في محافظة البصرة للكشف عن داء المقوسات في الدجاج والبط المحلي.

الكلمات المفتاحية: المقوسة الكوندية، الدجاج المحلي، البط المحلي، اختبار تلازن اللاتكس، الاختبار السريع لل أجسام المضادة.