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Chicken Toxoplasmosis in Different Types of Breeding: A Seroprevalence Survey in Southern Iran

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Abstract: Since the meat of chicken is considered one of the sources of the human infection, this study was undertaken to compare the prevalence of toxoplasmosis in free-ranging with semi-industrial and industrial chickens (*Gallus gallus domesticus*) in Shiraz, Southern, Iran. 203 serum samples from free-ranging chickens of sub-urban districts, 50 serum samples of semi-industrial chickens which rearing in restricted location and 444 serum samples of industrial chickens from slaughters were collected and tested for toxoplasmosis by IFAT. Overall the rate of *Toxoplasma* infection in chicken was 10.04%. The prevalence of toxoplasmosis among free-ranging chickens was 27.1% but the rate in semi-industrial and industrial chickens was 12% and 2.02% respectively. The rate of seropositive chickens in titers of 1/16, 1/32, 1/64, 1/128, 1/256 and 1/512 was 5.88 %, 2.44 %, 1 %, 0.57 %, 0 %and 0.14 % respectively. Considering the high prevalence of toxoplasmosis in chickens, in the regions under study, control measures should be taken to prevent transmission of the infection to the animals and humans by Health and Veterinary organizations.

Key words: Breeding, chicken, Iran, seroprevalence, toxoplasmosis

INTRODUCTION

Toxoplasma gondii is an obligate intracellular protozoan that infects humans and a wide range of mammalian and bird (Smith and Reduck, 2000). Clinical signs of toxoplasmosis in chicken include anorexia, emaciation, reduced egg production, ataxia, blindness and even mortality rate may be as high as 50% (Kaufmann, 1996). The parasite is known to cause congenital disease and abortion both in humans and livestock (Dubey and Beattie, 1988; Remington and Desmonts, 1990). Maternal toxoplasmosis during early pregnancy of human may leads to death of fetus or cause chorioretinitis, hydrocephaly, microcephaly and jaundice in neonates (Joynson and Wreghitt, 2001). Acquired toxoplasmosis has mild flu like symptoms in immunocompetent humans, but the disease is severe in immunocompromised persons, for example 23% of HIV-positive patients will develop toxoplasmic encephalitis (Oksenhendler *et al*., 1994). Human seropositivity in northern and southern parts of Iran using indirect fluorescent antibody technique was reported to be 55% and 29% respectively and a seroprevalence of 51.8% was also reported for all parts of Iran (Ghorbani *et al*., 1978; Sedaghat *et al*., 1978; Assmar *et al*., 1997). The disease occurs mostly through ingestion of undercooked meat or by the oocyst excreted by infected cat as a definitive host (Dubey, 1998). Infected chicken is considered as an important source of *T. gondii* worldwide (Tenter *et al*., 2000). On the other hand, the rate of toxoplasmosis in chicken as an intermediate host of *T. gondii* is one of the good indicators of environmental contamination because of eating habits (Devada *et al*., 1998). The worldwide prevalence of anti-*T.gondii* antibodies in chicken were reported from nil to 40% by different methods and using different cut off points (Tenter *et al*., 2000). Since chicken breeding is common in these areas, considering that contaminated chicken is one of the sources of human infection, this study was aimed to compare the *T. gondii* prevalence in industrial chickens with free-ranging chickens (*Gallus gallus domesticus*) by IFAT.

MATERIALS AND METHODS

Free-ranging chicken samples: A total 203 blood samples were cluster screening randomly collected from farm chickens of sub-urban geographical properties of Shiraz city (Fars Province Center) in 2005 year. Since female gender ranged 2-5 years old was destined for meat and egg production, they were dominated more than 96% in this work.

Semi-industrial chicken samples: 50 blood samples were collected from chickens that were reared at locations where are restricted with fence in sub-urban areas.

Industrial chicken samples: Totally 444 blood samples were collected from five industrial abattoirs. These chickens were bred at Industrial saloons in geographically different regions.

Indirect fluorescent antibody test: The cut off of IFAT for

T.gondii was considered 1:16 dilution (Garcia *et al.*, 2000). The sera were diluted 1:16 in PBS (0.1 M phosphate, 0.33 M NaCl, PH 7.2) for preliminary screening and the positive samples were two folds serially diluted up to 1:512 to obtain the real titer of IgG antibody. RH strain tachyzoites of *T. gondii* were used as antigen (Pasteur Institute, Tehran, Iran), fixed on wells of immunofluorescent slides. Ten micro-liters of each diluted serum was placed on the well of the slides and incubated in a humidified chamber at 37°C for 30 minutes. Slides were washed in PBS (two times 7 minutes), dried, and were incubated for 30 minutes, at 37°C with Rabbit anti-chicken IgG conjugate (Bethyl Co.) diluted 1:200 and Evans Blue solution diluted 1:10000. Slides were washed and air dried. A drop of glycerol buffer was added and each slide was covered with a cover- slip. Finally, the samples were observed under the immunofluorescent microscope (Zeiss HBO 50).

Analysis of data: The results were analyzed by SPSS software using Chi-Square test and a P value <0.05 was considered statically significant.

RESULTS

Using the IFAT, from overall tested samples, the average anti-IgG prevalence of toxoplasmosis among chickens was 10.04%. The rate of seropositive chickens in 1/16, 1/32, 1/64, 1/128, 1/256 and 1/512 was 5.88 %, 2.44 %, 1 %, 0.57 %, 0 % and 0.14 % respectively (Table 1). The prevalence of toxoplasmosis among free-ranging chicken was 27.1% but the rate in semi-industrial and industrial chickens was 12% and 2.02% respectively (Table 2). Chi-square testing showed that the highest frequency of infection was in free-ranging chickens (27.1%, P=0.000). However, the lowest seropositivity was found in industrial chicken (2.02%, P=0.000). On the other hand, the titers <1/32 were observed only in free-ranging chickens.

Table1: The rates of toxoplasmosis titer in Free-ranging, Semi-Industrial and Industrial chickens

Titer	Free-ranging	Semi-Industrial	Industrial	Total
>1/16	72.9%	88%	97.98%	89.96%
1/16	14.3%	10%	1.57%	5.88%
1/32	6.9%	2%	0.45%	2.44%
1/64	3.4%	0%	0%	1.00%
1/128	2%	0%	0%	0.57%
1/256	0%	0%	0%	0%
1/512	0.5%	0%	0%	0.14%

Table 2: The rate of toxoplasmosis in different kinds of chickens

Chicken	Number	Positive	Percent
Free-ranging	203	55	27.1%
Semi-Industrial	50	6	12%
Industrial	444	9	2.02%
Total	697	70	10.04%

DISCUSSION

The sources of infection for humans, worldwide, vary greatly with culture, ethnic, geographical location and eating habits differences (Tenter *et al.*, 2000). Jacobs and Melton (1966) found *T.gondii* in ovaries, oviduct and muscle of chicken by using inoculation into mice. Boch *et al.* (1968) isolated *T.gondii* from the brain and heart of hens in Germany. Thus meat of chicken must be considered as a source of infection in human. Although the infection in ovary and oviduct is possible, chicken eggs must not be considered as a source of infection for human (Dubey *et al.*, 2005a). Furthermore, all of genetic types (I, II, III) of Toxoplasma gondii isolates of patients that have been classified on the basis of restriction fragment length polymorphism (Howe and Sibley, 1995; Howe *et al.*, 1997) were reported in free-range chickens (Dubey *et al.*, 2003a; Dubey *et al.*, 2004a). On the other hand, the rate of toxoplasmosis in free-ranging chicken is an important indicator of environmental contamination because of food habits (Devada *et al.*, 1998).

This study has found a high seroprevalence of 27.1% in free-ranging chicken that is close to that of Dubey *et al.* (2004b) found 26% in these chickens in Peru. However, the prevalence is markedly below the values detected in the chickens from Chile (Dubey *et al.*, 2006) and Colombia (Dubey *et al.*, 2005b) found 55.39% and 44.4% respectively. The prevalence rate in these chickens were reported 17%, 36.3% and 40% in United State (Dubey *et al.*, 2003b), Austria (Dubey *et al.*, 2005a) and India (Devada *et al.*, 1998) respectively. The prevalence in Middle East countries was reported 40.4% (Dubey *et al.*, 2003c) and 46.9% (Dubey *et al.*, 2004a). However, the rate of the infection in Sub-urban areas from Tehran (Ghorbani *et al.*, 1990) and Shiraz (Asgari *et al.*, 2006) cities of Iran was reported 33%, 36.1% respectively.

The prevalence of infection in industrial chickens was 2.02% that is close to that of Inci *et al.* (1998), Meireles *et al.* (2003) and Zaki (1995) found 2%, 0%, 0% in these chickens from abattoirs of Turkey, Brazil and Pakistan countries respectively.

The many factors such as management and hygienic standards in breeding, density of cats and environmental conditions are effective on the acquisition of *T.gondii* oocysts by animals (Tenter *et al.*, 2000). Humidity and temperate temperature favor the oocyst survival. Shiraz city is situated in Southern, Iran where has dry and sub-Saharan environment with an average annual rainfall not over 350 mm. However other climatic characters such as temperature and altitude in these areas are different, for example Southern parts are warmer than others. The majority of free-chicken in these areas are raised for meat and egg production by people living in villages and sub-urban regions of Shiraz. Although the semi-industrial chickens are reared at

locations where are restricted with fence in sub-urban areas and less exposed to feces of cats, the prevalence of infection in these chickens seems above. Probably these chickens were primarily bred in sub-urban environments or nutrient material was contaminated by cat feces.

Since industrial chickens that are reared in saloons rose for meat production in short duration and not exposed to cat feces, these chickens had the lowest prevalence.

Based on cultural and food habits in this area, meat and viscera of chicken may be important source of infection in human when consumed semi-raw.

Considering the above mentioned findings, hygienic standards in chicken breeding, education of environmental health personnel and standardization, preparation and handing techniques are health prevent human infection.

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