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Research Article

EPIDEMIOLOGICAL STUDIES ON VISCERAL GOUT IN BROILER CHICKEN FLOCKS IN HARYANA STATE

SUMITRA PANIGRAHI, NARESH JINDAL*, BABU LAL JANGIR[1], YOGESH BANGAR[2] and RENU GUPTA
Department of Veterinary Public Health and Epidemiology, [1]Department of Veterinary Pathology,
[2]Department of Animal Genetics and Breeding, College of Veterinary Sciences,
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125004, India

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ABSTRACT

The present study was carried out to determine the risk factors associated with visceral gout in broiler chickens in Haryana. Data pertaining to visceral gout in broiler chickens from July, 2010 to June, 2016 were collected and statistically analyzed. Disease investigation was undertaken in19,727 broiler chicken flocks during July, 2010-June, 2016 in different parts of Haryana. Of these, 7.06% flocks (1393) were affected with gout. The epidemiological indices, viz., percent morbidity, mortality and case fatality rate in gout affected flocks were 4.42, 2.93 and 66.25, respectively. Winter season had highest morbidity (OR=1.75, 95%: 1.73, 1.76) and mortality (OR=1.58, 95%: 1.56, 1.59) as compared to summer and spring/autumn seasons. Chicks of 1 to 10 days of age showed greatest risk for occurrence (1.37 times) and deaths (1.39 times) due to gout as compared to other age groups, and risk rates decreased with the advancement of age. The present study revealed more occurrence of gout in young to very young birds and that too in winter season.

Keywords: Chicken, Epidemiology, Haryana, Visceral gout

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Gout is a common metabolic disorder that results in abnormal accumulation of urates in birds. It is one such a disease whose causes are both infectious and non-infectious.Factors that can precipitate gout are high calcium and vitamin D3 with low phosphorous in diet, excess of sodium bicarbonate, water deprivation, vitamin A deficiency, mycotoxins, antibiotics such as sulfonamides and amino glycosides, etc. (Schmidt *et al.*, 2003). In addition, certain infectious agents [infectious bronchitis virus (IBV), avian nephritis virus (ANV) and chicken astro virus (CAstV)] can cause gout in poultry (Bayry *et al.*, 2005; Bulbule *et al.*, 2013; Gogoi *et al.*, 2017, Panigrahi *et al.*, 2019).

Gout in poultry usually occurs in two forms: articular gout and visceral gout. The latter form is invariably acute and more common form of gout as compared to the former one. Occurrence of gout has been reported in poultry (Amaravathi *et al.*, 2015; Al Mamun *et al.*, 2019), however, studies on risk factors associated with visceral gout are very much limited. Knowledge of risk factors may help in initiating preventive measures at an early stage. Hence, the present epidemiological study was undertaken to determine the occurrence of visceral gout in broiler chicks and to study the risk factors associated with this disease condition.

MATERIALS AND METHODS

Broiler chickens from different parts of Haryana are brought to the Disease Investigation Laboratory of this department for disease investigation. Different diseases were diagnosed on the basis of history, clinical signs, pathological findings and/or other laboratory investigations. Data pertaining to visceral gout in broiler chickens from July, 2010 to June, 2016 were collected. The data parameters included: time of occurrence of cases, clinical manifestations, post-mortem findings, total population, number affected and died, age of the birds etc. Tissue samples from 10 gout-affected flocks were collected in 10% formalin for histopathology. Formalin fixed tissues were processed and 5-6 µm thick sections were stained with routine haematoxylin and eosin stain (Luna, 1968).

A year was divided into four seasons: winter (December, January and February months), summer (April, May and June months), rainy (July, August and September months), autumn/spring (March, October and November months) for season-wise analysis of the data. To study the effect of age, a flock was divided into four age groups, viz., 1-10, 11-20, 21-30 and more than 30 days of age. The six years data were compiled and analyzed for apparent morbidity, mortality and case fatality rate (CFR) as described by Thrusfield (2005). The data were analyzed statistically using statistical package SPSS version 16.0. Statistical analysis of vital measures of disease was done using Microsoft Office 10 Excel software. Statistical analyses were carried out using STATA™ (Stata Corp, College Station, TX). Binary logistic regression was used to determine the significant association of gout with year, season and age. Variables with a P-value less than 0.05

*Corresponding author: nareshjindal1@gmail.com

were considered significant.

RESULTS AND DISCUSSION

Year-wise data analysis: Birds from 19,727 broiler chicken flocks were presented for disease investigation during six years' period; of which 1,393 (7.06%) flocks were affected with gout. Of the 1,393 gout-affected flocks, maximum number (539; 10.27%) was in the year 2010-11 (Table 1). During the six years period, overall morbidity and cumulative mortality due to gout varied between 3-5% (mean 4.42%) and 2-3% (mean 2.93%), respectively (Table 1) and overall CFR was 66.25%. The disease was observed throughout the study period. Al Mamum *et al.* (2019) reported an incidence of 4.68% of visceral gout in broiler chicken in Kishoregonj district in Bangladesh. In the present study, information was collected at one time point when the farmers presented birds for disease investigation; however, follow up studies may reveal a better picture of epidemiological indices.

Effect of season: Season-wise analysis of data (Table 2) revealed that out of the 4,967 flocks presented during winter season, 519 (10.4%) flocks suffered from gout. In summer season, only 4.78% (327/6831) flocks were affected with gout. Number of gout affected flocks was significantly higher in winter season as compared to other seasons. Cumulative mortality was the highest in winter season (3.81%). Similarly, percent morbidity was higher in winter season (5.73%) as compared to other seasons. The CFR was the highest in spring/autumn (73.0%) and the lowest in summer season (62.6%) (Table 2). The findings of this study are similar to those of Singh *et al.* (2013). Significantly higher percent mortality and cumulative mortality during winter months in the present study are consistent with the findings of Karasawa *et al.* (1991). High prevalence of gout in winter could probably be due to the use of plastic tanks for storage of drinking water by the farmers in the study area. In winter season, water in these tanks becomes very cold thereby leading to decreased water consumption and ultimately predisposing chicks to gout.

Effect of age: Of the 6229 flocks (having birds less than 10 days of age) during six years' period, 10.99% had gout. Likewise, of the 5107 flocks with birds between 11-20 days of age, 7.79% had gout (Table 3). Morbidity, cumulative mortality and CFR had higher values in chicks of 1 to 10 days of age as compared to other age groups. Based on total gout cases in six years' period, 49.17% cases were seen in birds up to 10 days of age, while 28.57% cases were in birds of 11-20 days of age. The findings of this study revealed that the occurrence of gout was higher in young birds of less than 3 weeks of age which are consistent with those of Olsen *et al.* (2012) and Singh *et al.* (2013). Higher brooder temperature can cause dehydration which may ultimately lead to gout in birds.

Risk analysis: The risk analysis of occurrence and mortality due to gout with respect to year, season and age group in the study area was undertaken using logistic regression. All factors (year, season and age group) had significant ($p<0.001$) association with morbidity and mortality due to gout (Table 1). The likelihood of disease was significantly ($p<0.001$) higher during 2010-2011

Table 1

Epidemiological indices of gout during the period from July, 2010 to June, 2016

Year	Total flocks	Gout affected flocks (%)	Total flock strength	Epidemiological indices of gout affected flocks*								Case fatality rate (%)
				Morbidity				Cumulative mortality				
				Morbidity (%)	Odds Ratio (OR)	95% C.I. for OR	p Value	Mortality (%)	Odds Ratio	95% C.I. for OR	p Value	
2010-11	5,247	539 (10.27)	29,04,015	1,58,559 (5.46)	1.68	1.65	<0.001	1,03,964 (3.58)	1.792	1.761	<0.001	65.56
011-12	4,566	133 (2.91)	8,68,240	40,373 (4.65)	1.42	1.39	<0.001	26,047 (2.99)	1.493	1.462	<0.001	64.51
2012-13	3,266	252 (7.71)	20,83,925	76,688 (3.68)	1.11	1.09	<0.001	50,639 (2.43)	1.202	1.18	<0.001	66.03
2013-14	3,312	248 (7.48)	20,23,425	82,151 (4.06)	1.23	1.21	<0.001	56,858 (2.81)	1.395	1.37	<0.001	69.21
2014-15	1,828	95 (5.19)	8,60,800	37,014 (4.30)	1.30	1.28	<0.001	25,308 (2.94)	1.462	1.432	<0.001	68.37
2015-16	1,508	126 (8.35)	7,08,050	23,578 (3.33)	1.00			14,373 (2.03)	1.0			60.95
Total	19,727	1,393 (7.06)	94,48,455	4,18,363 (4.42)				2,77,189 (2.93)				66.25

C.I. = Confidence interval

Table 2

Temporal distribution of gout in broiler chickens from July, 2010 to June, 2016

Year	Total flocks	Gout affected flocks (%)	Total flock strength	Epidemiological indices of gout affected flocks*								Case fatality rate (%)
				Morbidity				Cumulative mortality				
				Morbidity (%)	Odds Ratio (OR)	95% C.I. for OR	p Value	Mortality (%)	Odds Ratio	95% C.I. for OR	p Value	
Winter (Dec-Feb)	4,967	519 (10.4[a])	30,27,227	1,73,507 (5.73[a])	1.75	1.73	<0.001	1,15,412 (3.81[a])	1.58	1.56	<0.001	66.5
Summer (April-June)	6,831	327 (4.78[c])	28,93,780	1,21,241 (4.18[a])	1.26	1.25	<0.001	75,974 (2.62[a])	1.07	1.06	<0.001	62.6
Rainy (July-Sept)	3,523	227 (6.44[bc])	14,72,430	54,503 (3.7[a])	1.11	1.09	<0.001	35,396 (2.40[a])	0.98	0.97	<0.01	64.9
Spring/ Autumn (Oct, Nov, March)	4,406	320 (7.26[b])	20,55,018	69,112 (3.36[a])	1.00			50,407 (2.45[a])	1.00			73.0
Total	19,727	1,393 (7.06)	94,48,455	4,18,363 (4.42)				2,77,189 (2.93)				66.25

*Values with different superscripts (a, b, c) within in columns differ significantly for that parameter
C.I. = Confidence interval

Table 3

Distribution of gout in different age groups of broiler chickens from July, 2010 to June, 2016

Age group (days)	Total flocks	Gout affected flocks (%)	Total flock strength	Epidemiological indices of gout affected flocks*								Case fatality rate (%)
				Morbidity				Cumulative mortality				
				Morbidity (%)	Odds Ratio (OR)	95% C.I. for OR	p Value (%)	Mortality	Odds Ratio	95% C.I. for OR	p Value	
1-10	6,229	685 (10.99[a])	50,05,522	2,59,197 (5.17[a])	1.37	1.35	<0.001	1,74,781 (3.49[a])	1.39	1.36	<0.001	67.43
11-20	5,107	398 (7.79[b])	30,14,323	1,15,147 (3.81[ab])	0.99	0.98	0.30	73,549 (2.43[a])	0.96	0.94	<0.001	63.80
21-30	5,245	186 (3.54[c])	7,41,483	17,588 (2.37[b])	0.61	0.60	<0.001	11,363 (1.53[a])	0.60	0.58	<0.001	64.60
>30	3,146	124 (3.94[c])	6,87,127	26,431 (3.84[ab])	1.00			17,496 (2.54[a])	1.00			66.19
Total	19,727	1,393 (7.06)	94,48,455	4,18,363 (4.51)				2,77,189 (2.93)				66.25

*Values with different superscripts (a, b, c) within in columns differ significantly for that parameter
C.I.=Confidence interval

(OR=1.65, 95%, CI: 1.65, 1.70) followed by 2011-2012, 2014-2015, 2013-2014 and 2012-13 as compared to 2015-16 (OR=1.00). Similar pattern was also observed for risk of mortality with highest risk during 2011-12 (OR=1.79, 95% CI:1.76, 1.82).

As compared to spring/autumn season (OR=1.00), the risk for disease was higher during winter season (OR=1.75, 95% CI: 1.73, 1.76) followed by summer and rainy season (Table 2). Similarly, higher risk of mortality was observed during winter (OR=1.58, 95%: 1.56, 1.59) and summer (OR=1.07, 95%: 1.06, 1.09) seasons, while it was the lowest during rainy season (OR=0.98, 95%: 0.97, 0.99).

Analysis of data with respect to age revealed that the likelihood of disease was found to have declining trend from day 1 to day 30 (Table 3). Chicks of 1 to 10 days of age showed greatest risk for occurrence (1.37 times) and deaths (1.39 times) due to gout, whereas, chicks aged between 21-30 days showed less risk for occurrence (0.61 times) and death (0.60 times) as compared to chicks of more than 30 days (OR=1.00).

Clinical findings and pathological changes: The clinical signs in affected flocks included: Dullness and depression, anorexia, chalky white droppings, increased thirst,

Fig. 1. Urate deposits on pericardium, proventriculus and intestine of a broiler chick affected with visceral gout

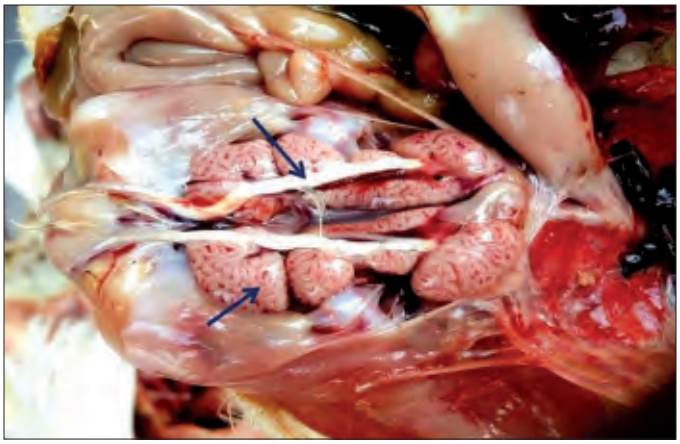

Fig. 2. Swollen kidney and prominent ureter with urate depositionin a broiler chick affected with visceral gout

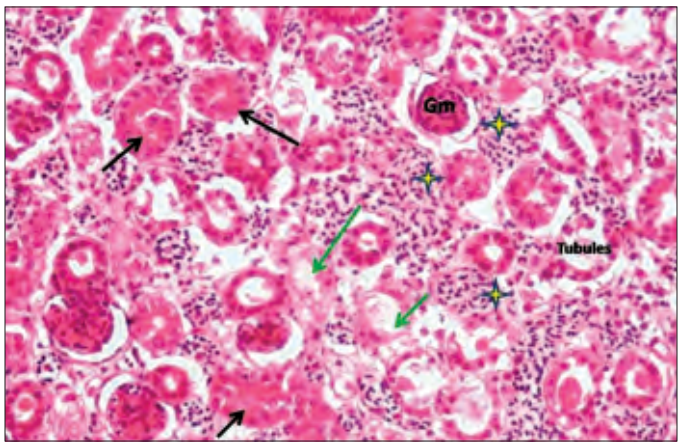

Fig. 3. Section of kidney of a broiler chick showing congestion in renal capillaries(star), cellular swelling (black arrow) and necrosis (green arrow) in few renal tubules H&E X400

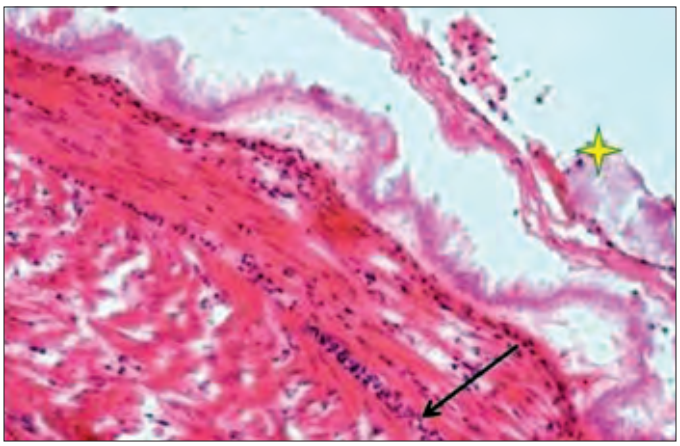

Fig. 4. Section of heart of a broiler chick showing mild infiltration of mononuclear cells in cardiac muscles (arrow) and deposits of urates (star) H&E X400

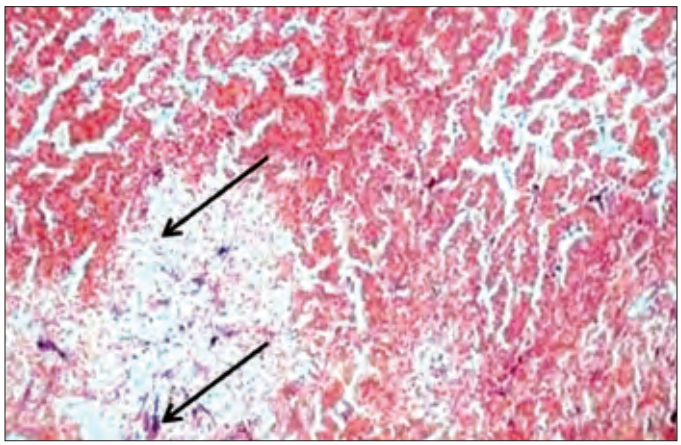

Fig. 5. Section of liver of a broiler chick showing focal necrosis and accumulation of urate crystals (arrow, purple colour) in focal area H&E X400

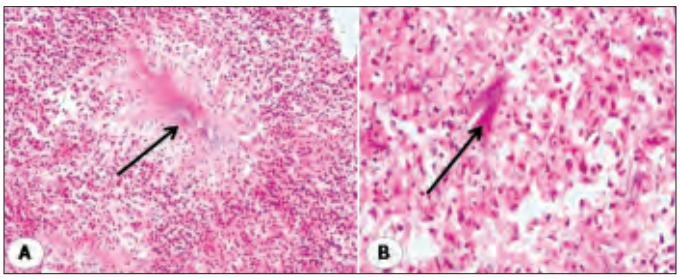

Fig. 6. Section of spleen of a broiler chick showing focal area of necrosis and accumulation of urates (arrow) A: H&E × 200 and B: H&E ×400

decreased appetite, lethargy, and weight loss followed by death. In almost all the flocks affected with gout, the droppings were chalky white. Whitish chalky deposits on serous membranes, heart (Fig. 1) and liver were main gross changes. Kidneys were swollen, mottled and grayish with dilated ureters (Fig. 2). Urate deposits were observed on kidneys, proventriculus, gizzard and intestine.

Microscopically, kidney sections revealed varying degrees of congestion accompanied with haemorrhages and degenerative changes (Fig. 3). The renal tubules and glomeruli were necrotic and had inflammatory cellular reaction with lymphocytic infiltration. The heart specimens revealed pericarditis with urate deposits in pericardium (Fig. 4). Necrosis and infiltration of inflammatory cells in liver was also seen along with the accumulation of urate crystals (Fig. 5). Spleen showed

depletion of lymphocytes along with the presence of needle-like urate crystals (Figs. 6a and 6b). The clinical findings and/or gross pathology observed in this study were consistent with earlier reports (Karasawa *et al.*, 1991; Saif, 2008; Amaravathi *et al.*, 2015; Mudasir *et al.*, 2017).

As mentioned earlier, gout in poultry is multifactorial in nature. In recent years, infectious agents especially CAstV and ANV have been detected from cases of gout in broiler chickens (Bulbule *et al.*, 2013). Both these viruses have been reported to cause considerably high morbidity and mortality in chicks (Bulbule *et al.*, 2013; Zhang *et al.*, 2018).We have also observed that viral etiology especially CAstV or ANV can cause gout (Panigrahi *et al.*, 2019). Kidney samples from gout-affected broiler chicken flocks were found positive for CAstV and/orANV (Panigrahi *et al.*, 2019). Thus, the present study reveals more occurrence of gout in birds of less than three weeks of age and in winter season. While formulating strategies for disease prevention, possible risk factors should be taken into consideration so that the economic losses to the poultry farmers due to gout can be minimised.

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