Journal of Animal and Veterinary Advances 6 (2): 164-167, 2007

Prevalence of *Salmonellae* in Broiler Chicken Carcasses and Poultry Farms in the Central Region, K.S.A.

A.M. Saad, D.M. Almujali, S.H. Babiker, M.A.M. Shuaib K.A. Abdelgadir and Y.A. Alfadul
Administration of Veterinary Laboratories, Ministry of Agriculture,
Riyadh, Kingdom of Saudi Arabia

Abstract: A total of 5028 samples comprising broiler chickens carcasses, cloacal swabs, poultry feed, drinking water and environmental swabs were collected and examined for detection of *Salmonella*. The samples were collected from retail stores and 26 poultry farms located in the central region of the kingdom of Saudi Arabia. Prevalence of *Salmonellae* in broiler chickens carcasses collected from local markets was 17.53 and 7.29% in broiler carcasses collected directly from poultry farms slaughterhouses. Chilled carcasses showed a contamination rate of 13.83% compared to 8.23% in frozen carcasses. Prevalence of *Salmonellae* in cloacal swabs from live broiler flocks was 4.87%, whereas cloacal swabs from parent flocks showed a prevalence of 2.19%. The percentage *Salmonella* positive swabs collected from slaughterhouses environment was 10%, swabs collected from hatcheries environment showed a contamination rate of 1.65%. A total of 267 *Salmonella* isolates were recovered from 5028 samples examined. Out of the 267 isolates 179 isolates were serotyped and were found to belong to 24 different *Salmonella* serovars. The most prevalent serovar was S.munchen (16.2%) followed by *S. livingstone* (15.64%), *S. entertidis* (14.52%), *S. infantis* (11.73%), *S. emek* (10.05%), *S. virchow* (8.93%) and *S. java* (7.26%). Other *Salmonella* serovars were detected in smaller percentages and seven new serovars were reported for the first time in the Kingdom of Saudi Arabia.

Key words: Cloacal swabs, *Salmonella*, broiler, flocks, hatcheries

INTRODUCTION

Salmonellae could be found in the,water,vegetation and in many cold and warm blooded vertebrates including humans,animals,birds, fishes,rodents and insects (Nagaraja *et al*., 1999).They could also be found as contaminant in many types of food such as red meat, fish,poultry,eggs,milk,milk products, vegetables, fruits, cereals, cereal products, frozen foods and foods for infants and children (Brooks *et al*., 2001; Refai, 1979).

Probably all Salmonellae can transiently infect poultry and thus constitute a human health hazard (Jordan, 1990). In England and Wales it was estimated that 75% of food poisoning cases in humans were attributed to Salmonellae and 41% of these cases were associated with poultry (Nagaraja *et al*., 1999). In the U.S.A. it was estimated that two millions cases of human salmonellosis occur annually with 2000 deaths. In the Kingdom of Saudi Arabia the reported cases of human salmonellosis has decreased from 1336 cases in 1990 to 973 cases in 1991 and then increased gradually to reach 2197 cases in 1995 and decreased again to 1927 cases in the year 2001 (M.H,1990-2001).

The isolation of *Salmonella* serovars from poultry and its environment were reported before in K.S.A. (Barbour and Nabbut., 1982; Barbour *et al*., 1983; AL-Nakhli *et al*., 1999). This survey was conducted in 26 poultry farms located at the central region of KSA during the years 2002-2004 to detect the prevalence of *Salmonella* in live chickens, poultry farms environment, broiler carcasses and to identify the existing *Salmonella* serovars in addition to the possible causes or sources responsible for transmission of infection or contamination.

MATERIALS AND METHODS

Samples: A total of 5028 randomly collected samples (comprising chilled or frozen broiler chicken carcasses cloacal swabs, environmental swabs, poultry feed and drink water) were examined for presence of *Salmonella* microorganisms. Poultry carcasses were collected either from retail shops in the local markets in Riyadh city or directly from slaughterhouses of poultry farms at the rate of 5 chicken carcasses from each weight within the range 600-1200 g. Cloacal swabs were collected from live broiler chickens and parent flocks.

Correspondening Author: A.M. Saad, Department of Pathology, Faculty of Vet Medicine, University of Khartoum, P.O. Box 32, Postal Code 13314-Khartoum North, Sudan

Table 1: Types, sources of samples and prevalence of infection and contamination with *Salmonella* bacteria in samples collected from poultry farms and local markets in KSA (2002-2004)

Source of samples	Types of samples	No. samples examined	No. positivie samples	Positive (%)
Local market	Broiler chicken carcasses	422	74	17.53
Poultry farm	Broiler chicken carcasses	987	72	7.29
Poultry farm	Cloacal swabs	3049	101	3.31
Poultry farm	Poultry feed	103	3	2.91
Poultry farm	Drink water	116	2	1.72
Poultry farm (hatcheries)	Enviromental swabs	241	4	1.65
Poultry farm (saughterhouse)	Enviromental swabs	110	11	10.0
Total		5028	267	5.31

Table 2: Prevalence of contamination with *Salmonella* in chilled and frozen chicken broiler carcasses in KSA (2002-2004)

Types of broiler chicken carcasses	No. of samples examined	No. *Salmonella* positive samples	Positive samples (%)
Chilled carcasses	535	74	13.83
Frozen carcass	874	72	8.23
Total	1409	146	10.36

Table 3: Prevalence of infection and contamination with *Salmonella* in poultry and poultry environment in KSA during 2002-2004

Source of swab samples	No. of swabs examined	No. *Salmonella* positive samples	% of *Salmonella* positive swabs
Cloacal swabs (parent flocks)	1776	39	2.19
Hatcheries	241	4	1.65
Cloacal swabs (broilers)	1273	62	4.62
Slaughterhouses	110	11	10.0
Total	2170	57	2.62

Environmental swabs were collected from walls, floors and surfaces of hatcheries and slaughterhouses. Samples from poultry feed and drinking water were also collected. Table 1-3 show the sources, types and numbers of samples collected from 26 poultry farms in KSA during the period 2002-2004. Laboratory work was done at the veterinary diagnostic laboratories in Riyadh and Algaseem, KSA.

Processing of broiler chicken carcasses: A rinse technique was done by washing the whole chicken carcass in sterile plastic bags using 400 mL of sterile peptone water. The plastic bags were shaken manually for three min and the rinse solution was collected and used for detection of Salmonellae.

Cloacal and environmental swabs: Cloacal and environmental swabs were collected and immediately immersed in sterile tubes containing sterile 9 mL of peptone water.

Poultry feed and water: Twenty five g of poultry feed and 25 mL of drink water samples were collected aseptically and transferred to sterile plastic bags containing 225 mL of sterile peptone water.

Laboratory investigations: The Saudi Arabian standard procedure for detection of *Salmonella* in poultry (SASO, 1994) was followed. All samples cultured in peptone water were incubated at 37°C for 24 h after which they were inoculated in Tetrathinate Broth (TTB) and Selenite Cysteine Broth (SCB) at the ratio of 1: 10 V/V and incubated at 43 and 37°C, respectively for 24 h. Brilliant green agar, *Salmonella* shigella agar and McConkey agar plates were streaked with culture broth. *Salmonella* suspect colonies on agar plates after 24 h incubation at 37°C were inoculated on Triple Sugar Iron agar (TSI) and incubated for 24 h. Suspect *Salmonella* cultures from TSI slants were tested biochemically using API-E20 strips (Biomerieux-France) and Enterotube 11 system (BBL-U.S.A.). Identification of *Salmonella* positive cultures was confirmed by the slide agglutination test using poly O (A-I and Vi) and poly H (A-Z) diagnostic antisera (Difco Labs., U.S.A.). Typing of *Salmonella* cultures was done at the reference Central Veterinary Laboratories at Weybridge, U.K.

RESULTS

Table 1 shows that a total of 267 *Salmonella* organisms were isolated from a total number of (5028) different samples examined. The number of *Salmonella* positive broiler chicken carcasses collected from local markets was 74 with a prevalence of (17.53%) compared to 72 chicken carcasses collected from slaughterhouses (7.29%). The total number of Salmonellae isolated from cloacal swabs was 101 (3.31%).Three feed samples were found to be *Salmonella* positive (2.91%).

Table 2 shows that the number of *Salmonella* positive samples from chilled broiler chicken carcasses was 74 (13.83%) compared to 72 (8.23%) from frozen carcasses.

Table 3 shows that the number and percent *Salmonella* positive samples collected from slaughterhouses environment was 11 isolates (10%),

Table 4: *Salmonella* serovars isolated from poultry and poultry environment KSA during (2002-2004)

Salmonella serovar	No. of isolates	(%)
S. munchen	29	16.2
S. livingstone	28	1564.0
S. entertidis	26	14.52
S. infantis	21	11.73
S. emek	18	10.05
S. virchow	16	8.93
S. java	13	7.26
S. schwarzengrund	7	3.91
S. munster	5	2.79
S. blockly	3	1.67
S. goldesberg	3	1.67
S. anatum	2	1.11
S. bredeny	2	1.11
S. hadar	2	1.11
S. albany	1	0.55
S. corvallis	1	0.55
S. concord	1	0.55
S. give	1	0.55
S. senftenberg	1	0.55
S. panama	1	0.55
S. oranienberg	1	0.55
S. mbandaka	1	0.55
S. vleuten	1	0.55
S. worthington	1	0.55

followed by cloacal swabs from broiler chickens 62 isolates (4.87%), 39 isolates from cloacal swabs of parent chicken flocks (2.19%) and 4 environmental swabs from hatcheries (1.65%).

Table 4 shows that 179 *Salmonella* isolates were serotyped and found to belong to 24 different serovars. The most prevalent serovar was *S. munchen* 29 isolates comprising (16.2%) of the total isolates. *S. livingstone* ranked second 28 isolates (15.64%), followed by *S. entertidis* 26 isolates (14.52%), *S. infantis* 21 isolates (11.73%), *S. emek* 18 (10.05%), *S. virchow* 16 (8.93%), *S. java* 13 (7.26%), *S. schwarzengrund* 7 (3.91%), *S. munseter* 5 (2.79%), *S. blockly* 3(1.67%) and *S. goldesberg* 3 (1.67%). Thirteen other serovars were detected at lower percentages.

DISCUSSION

Other than the human adapted serovars of *Salmonella* which cause enteric fevers most *Salmonella* serovars (serotypes) are associated with gastroenteritis in humans resulting from food poisoning (Brooks *et al*., 2001). In our present notion all *Salmonella* serotypes are potentially pathogenic for humans depending on the degree of virulence of the strain, health status of the infected individual, age and infectious dose (Duell and Cliver, 1990) People at risk are children, elderly and immunocompromised patients.

In this study the highest rate of contamination with Salmonellae was found in broiler chicken carcasses collected from retail shops in local markets (17.53%) compared to broiler carcasses collected directly from poultry farms slaughterhouses (7.29%).

Al-Nakhli *et al*. (1999) reported that 42.9% of the broiler chicken carcasses examined in KSA during the period 1988-1997 were found positive for *Salmonella* c ontamination. In the U.S.A. Prevalence with *Salmonella* contamination of 20% and 44% were detected in broiler chicken and turkey carcasses respectively (McNamara and Levine, 1998). It seems that there is a decrease in the rate of broilers carcass contamination with *Salmonella* in KSA probably due to improvement in implementing hygiene measures during carcass processing at slaughterhouses over the past few years.

Table 2 shows that the prevalence of *Salmonella* was higher in chilled broiler chicken carcasses (13.83%) compared to frozen carcasses (8.23%). This is probably due to inappropriate temperatures of chilled chicken during transportation and storage in retail shops which may have favored multiplication of contaminating bacteria.Contamination with *Salmonella* was detected in all weights of broiler carcasses regardless of the source or type of carcasses examined, however contamination was more frequent in lighter and medium weights (range 600-900 g) compared to heavier weights (range: 1000-1200). This is probably due to mechanical contamination of small and medium sized carcasses during evisceration because of improper fittings. Contamination with Salmonellae was higher in broiler carcasses whether chilled (13.8%), frozen (8.23%), collected from local retail shops (17.53%), or collected directly from slaughterhouses (7.29%) when compared to samples collected from live broiler chickens or parent flocks (average 3.53%). This finding could be explained by the fact that a broiler carcass could have been already infected during life time or contaminated after being slaughtered during evisceration, washing or packing in a contaminated slaughterhouse while a live chicken should only be infected to be detected as positive,in addition to this cloacal swabs are not good indicators of infection because infected chickens excrete Salmonellae intermittently in their faces and hence a positive case may pass inspection undetected.

It was demonstrated in this study that poultry feed, hatcheries, slaughterhouses could be a possible source of contamination because Salmonellae were isolated from all

these sources. High levels of contamination were detected in environmental swabs collected from slaughterhouses (10%) which could be the major source of contamination. These findings are in agreement with Al-Nakhli *et al.* (1999), Cox (1998), McLory (1998), Wray and Davies (1998).

In this study a total of 179 *Salmonella* isolates were serotyped.The results showed that the isolates belong to 24 serotypes. *S. munchen* ranked first with a prevalence rate of (16.2%). *S. livingstone* ranked second (15.64%) and *S. entertidis* the most serious cause of human food poisoning ranked third (14.52%). Other Salmonellae with relatively high prevalence include *S. infantis* (11.33%), *S. emek* (10.05%), *S. virchow* (8.93%) and *S. java* (7.26%). Seventeen other serovars were detected at prevalence rates less than 4% for each serovar. These findings are similar to findings reported previously from KSA (Barbour and Nabbut, 1982; Barbour *et al*., 1983; AL-Nakhli *et al*., 1999.) However new serovars were detected in this study these include *S. schwarzengrund*, *S. munster*, *S. goldesberg*, *S. corvallis*, *S. panama*, *S. vleuten* and *S. worthington*. It could be concluded from this study that the high prevalence of *Salmonella* contamination in broiler chicken carcasses constitute a serious public health hazard which have to be dealt with at different levels in an appropriate manner for effective control.

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