CAMPYLOBACTER AND SOME FOOD POISONING BACTERIA IN BROILER CHICKEN CARCASSES

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Salwa Abd El-Salam Hindawy

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مقدمة من

ط.ب./ سلوى عبد السلام هنداوى

2006

Advisors' Committee

Prof. Dr. Mohamed Mohamed Mousa

Professor of Meat Hygiene

Faculty of Veterinary Medicine

Alexandria University

Dr. Abdel Rasheed Fathy Abdel Moghney

Chief Researcher

Animal Health Research Institute

Damanhour Branch

لجنة الإشراف

الأستاذ الدكتور/ محمد محمد موسى
أستـــاذ الرقابة الصحية على اللحوم و منتجاتها
كلية الطب البيطرى
جامعة الأسكندرية

الدكتور/ عبد الرشيد فتحى عبد المغنى
باحث أول بمعهد بحوث صحة الحيوان
فرع دمنهـــــور

بسم الله الرحمن الرحيم

و ما أوتيتم من العلم إلا قليلاً

صدق الله العظيم
سورة الإسراء الآية رقم 85

Dedicated To
My Family

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1.0 INTRODUCTION

Poultry meat is an important food item in most countries due to its contribution in solving the problem of animal food shortage. Poultry meat contains high amount of protein of high biological value which contains essential amino acids. Also, it contains many vitamins and minerals which are required for human nutrition ***(Mountney, 1966)***.

Campylobacter species are major contaminants of poultry carcasses. Eating undercooked chicken and handling raw poultry have been identified as risk factors for campylobacteriosis in human being ***(Dickins et al., 2002)***.

Campylobacter species are among the most frequently reported causes of enteritis in the developed countries ***(Nielsen et al., 2000)*** where the number of human cases of campylobacteriosis has been steadily increased recently in many countries ***(Ring and Atanassova, 2001)***. ***WHO (2002)*** reported that there is linear relationship between prevalence in broiler flocks and probability of human campylobacteriosis ***(WHO, 2002)***.

Raw poultry meat contaminated with shiga toxin producing by *E. coli* O_{157} (O_{157} STEC) will remain hazard even if the meat is held at low or freezing temperature ***(Conner and Hall, 1996*** and ***Heuvelink et al., 1999)***. The spectrum of clinical illness of *E. coli* O_{157} ranges from mild diarrhoea through to diarrhoea and haemorrhagic uraemic syndrome (HUS) and thrombotic thrombocytopenic purpura (TTP) ***(Locking et al., 2001)***.

Contamination of retail poultry by Campylobacter species and *Salmonella enterica* is a significant source of human diarrhoeal disease ***(Hong, 2003)***. Salmonella and Campylobacter species continue to be the major foodborne pathogens and raw poultry meat is considered to be an important source of these bacteria ***(Jorgensen et al., 2002)***.

Staphylococcus aureus food poisoning affects hundreds of thousands of people each year. *Staphylococcus aureus* also causes invasive disease such as septicaemia in humans ***(Hazariwala et al., 2002)***.

Salmonella infection is the second most prevalent cause of foodborne illness in most developing countries. Meat, poultry and dairy products are frequently implicated in outbreaks ***(Favrin et al., 2003)***.

The present study was designed to investigate the prevalence of Campylobacter, Salmonella species, *Staphylococcus aureus* and *E. coli* O_{157} in broiler chicken carcasses.

2.0 REVIEW OF LITERATURE

2.1. Campylobacter:

2.1.1. Sources of contamination:

Simmons and Gibbs (1977) believed that wild birds are the reservoir of Campylobacter organisms which are transmitted to human by healthy poultry, meat and possibly even by other foodstuffs contaminated with bird droppings and inadequately cleaned. They examined the caecal contents of 50 freshly slaughtered and apparently previously quite chickens and found Campylobacter in seven (14%).

Skirrow (1977) stated that Campylobacters are very small highly motile spiral or S–shaped Gram–negative bacteria easily recognized after overnight incubation. He explained the animal sources of Campylobacter infection where three patients were apparently infected from chickens and the other three patients were presumed to have been infected from handling dressed chickens. Moreover, dogs with diarrhoea were thought to have been source of infection in three cases of Campylobacter enteritis. He also added that food and water have been implicated as being important vehicles for transmitting Campylobacters to susceptible individuals. Fever, malaise, profuse diarrhoea and severe abdominal pain were the most common symptoms of human Campylobacter enteritis.

Oosterom (1981) concluded that undercooked ground beef had been implicated as a vehicle of Campylobacter infection in a large outbreak among military personnel.

Luechtefeld and Wang (1982) reported that incidence of *Campylobacter jejuni* in faecal samples obtained from cattle, sheep and swine was 43, 23 and 66%, respectively, consequently contamination may be transferred from faeces to carcasses of slaughtered animals during handling and processing.

Horbach (1983) mentioned that contaminated meat, meat products and edible offals were considered as the main sources of Campylobacter food infection for humans.

Edmound and Lorraine (1990) believed that red meat was though to be an important vehicle of infection with Campylobacters, although relatively few outbreaks had been directly attributed to such foods. Instances of outbreaks include undercooked beef burger, sliced beef and lamb kebabs. Also, they had been recorded due to consumption of raw meat.

Skirrow (1991) mentioned that the intestinal tract could harbour *C. jejuni* and *C. coli* with no evidence of illness in a wide variety of wild and domestic warm–blooded animals.

Norcross et al. (1992) stated that Campylobacter may infect man after direct contact with animals or indirectly via contaminated water, milk or meat.

Gracey and Collins (1994) reported that the main cause of campylobacteriosis is *C. jejuni* but also may be due to *C. fetus* and *C. coli*. Poultry and cattle are the main reservoirs for human infection which is acquired by ingesting raw milk, undercooked chicken or other food contaminated in kitchen. However, direct faecal–oral spread from animals occurs especially from handling puppies and from person to person besides,

large water–borne outbreaks have occurred. The authors revealed that the incubation period is 1 – 10 days, usually 3 – 5 days. There is acute onset of fever, abdominal pain and diarrhoea which may be blood–stained but which usually resolves within 10 days. Moreover, it may cause pseudoappendicitis and rarely septicaemia and arthritis.

Young et al. (2000) reported that *C. jejuni* and *C. coli* located in the intestinal tract of animals can contaminate food of animal origin. These species of Campylobacter are recognized as cause of human diarrhoeal disease and hence their presence in food represents a possible health hazard.

Jacobs–Restima (2000) reported that Campylobacter species are zoonotic for many animals serving as reservoir for human disease. Reservoirs of infection include rabbits, rodents, wild birds, sheep, horses, cows, pigs, poultry and domestic pets. Campylobacters are frequently isolated from water and water supplies which have been a source of infection in some reported outbreaks.

Berrang et al. (2001) found that the increase in the recovery of Campylobacter after defeathering may be related to escape of contaminated faeces from the cloaca during defeathering.

Newell et al. (2001) found that Campylobacter of same subtype as those recovered from the carcasses were isolated from the crates used to transport the birds in one case. This crate contamination was shown to be present before the birds were loaded.

Dickins et al. (2002) found that Campylobacter species are major contaminants of poultry. Eating undercooked chicken and handling raw poultry have been identified as risk factors for campylobacteriosis in human.

Decesare et al. (2003) found that many cases of Campylobacter and *Salmonella enteritidis* have been attributed to undercooking of poultry and other foods, cross contamination between raw and cooked foods via contact surfaces and worker contact has also been identified as significant risk factor.

Miwa et al. (2003) suggested that the carcasses of *C. jejuni* negative flocks were contaminated with *C. jejuni* strains originating from intestines of previously processed *C. jejuni* positive flock.

Yang et al. (2003) concluded that retail chicken meat, raw milk and environmental water are commonly contaminated with *C. jejuni* and could serve as potential risk for consumer in eastern China, especially if proper hygiene and cooking conditions are not monitored.

Berrang et al. (2004) indicated that even small (5 mg) amounts of caecal contents can cause significant increase in number of Campylobacter on eviscerated broiler carcass.

Minihan et al. (2004) found that Campylobacter species should be considered as a pathogen shed in faeces of animals. However, with good hygiene practices during harvest, a very low level of this pathogen can be achieved on dressed carcasses.

2.1.2. Public health hazard of Campylobacter in poultry meat:

Kwiatek et al. (1990) mentioned that *C. jejuni*, *C. coli* and *C. laridis* were recognized as causes of alimentary infections in human which were most often transmitted by food of animal origin, undercooked poultry and unpasteurized milk were frequently implicated vehicles.

Skirrow (1990) stated that Campylobacter is most common cause of infectious diarrhoea in many developed countries although infections tend to be manifested as sporadic cases rather than outbreaks. Sporadic cases have been linked primarily to consumption of poultry.

Butzler and Oosterom (1991) found that *C. jejuni* and *C. coli* have been recognized as important causative agents of foodborne disease. They are among the most important enteric pathogens for human because they are the commonest identifiable cause of infectious diarrhoea. Poultry, meat and meat products are highly contaminated with Campylobacter consequently reduction or elimination of this potential pathogen would decrease human exposure to Campylobacter.

Pazzaglia et al. (1991) stated that in Cairo Campylobacter was the most common bacterial enteropathogens isolated from diarrhoeal stool samples of children up to 5 years old. The overall prevalence of Campylobacter isolation was 25.9% from stool of diarrhoeal children compared with 15.2% of non–diarrhoeal control. *C. jejuni* was isolated from 22.5% and 21.5% among diarrhoeal and non–diarrhoeal children aged 2 years and from 6.7% among children aged 5 years. Children less than one year of age were at greatest risk of Campylobacter infection, 32.6% of diarrhoeal patients cultured positive. Results led to the conclusion that Campylobacter infection among children in Cairo was major health problem contributing substantially to childhood morbidity and mortality.

Neimann et al. (1998) found that from May 1996 to September 1997, 585 cases of sporadic campylobacteriosis in Denmark were recorded. These cases have been linked to consumption of undercooked poultry.

Friedman et al. (2000) stated that from 1978 to 1996 there were 27 cases of a total of 111 outbreaks due to campylobacter enteritis reported to the centers for disease control prevention were related to consumption of chicken and turkey.

Kramer et al. (2000) found that Campylobacter species are the major cause of acute bacterial enteritis reported in United Kingdom.

Humphrey (2001) found that In England and USA, Campylobacter enterocolitis is more frequent than Salmonella and it is causing over 50,000 confirmed cases of infection in England and Wales each year.

Cox et al. (2002) stated that *C. jejuni*, a foodborne pathogen closely associated with market poultry is considered to be the most frequent agent of human gastroenteritis in the United States.

Ali et al. (2003) found that *C. jejuni* is a frequent cause of diarrhoea, dysentery in children often related to pets keeping and chicken meat consumption.

Schonberg et al. (2004) found that eating undercooked meat and drinking dug–well water were considered as important risk factors for Campylobacter infection.

2.1.3. Incidence of Campylobacter in poultry meat:

Stern et al. (1984) analysed about 800 fresh and frozen meat and poultry samples for *C. jejuni*. Isolation levels of *C. jejuni* from fresh tissues were more than five times (12.1%) as high as those from frozen tissues (2.3%) in the analysed samples. The prevalence of *C. jejuni* in fresh tissues according to species was avian 21.3%, bovine 4.7%, porcine 8.6% and ovine 20%.

Kwiatek et al. (1990) in a Polish survey found that Campylobacter species was recorded in 80.3% of chicken, 84% of duck and 38% of goose carcasses, but from only 3% of turkey, 2.9% of pork and 0.5% of beef carcasses.

Asif and Bari (1992) found that out of 55 samples of grilled chicken, 2 (3.46%) were positive for *C. jejuni* which may be due to cross contamination between raw and grilled chicken. This was attributable to poor food hygiene, neglected food handling and defective method of manual preparation of grills where the same person handles the raw and prepared meat. On the other hand, cured chicken samples did not reveal any positive results.

Yassien et al. (1994) could isolate *C. jejuni* from 15, 10 and 5% of examined breast meat of roasted chicken, ducks and pigeon, respectively. Isolation of *C. jejuni* from examined roasted poultry samples may be attributed to unexpected parts of skin like under the thigh or the wing.

Houf et al. (1998) reported that Campylobacter was isolated from 71% of neck skin samples from broiler chickens, from 91.7% of neck skin samples from laying hens, from 61.7% of chicken liver, from 80.8% of deboned meat and from 72.5% of neck skin samples from turkeys with the biotyping method, almost 63% as *Campylobacter coli*.

Berrang et al. (2000) stated that six carcasses were collected after exiting bleed tunnel at commercial broiler plant on each of three visits. Five locations were sampled aseptically from each carcass. Average sample weight (grams) was as follows feather 1.5, skin 6.5, crop 5.1, caeca 7.8 and colon 3.1. Campylobacter populations (mean $\log_{10}$ colony forming unit per gram of sample) found were feather 5.4, skin 3.8, crop 4.7, caeca 7.3 and colon 7.2.

Sallam (2001) investigated the prevalence of Campylobacter species in 110 whole carcass samples of fresh retailed chickens (50), frozen chickens (25), stir–roasted (15) and home–cooked chickens (20) purchased from Mansoura retail shops, supermarkets and restaurants. The incidence of Campylobacter contamination was 78, 56, 13.3 and 0% in fresh, frozen, stir–roasted and home–cooked chickens, respectively with higher frequency of *C. jejuni* (66%) than other species.

Wilson (2002) carried out a prospective survey between 1995 and 2000 to investigate the level of contamination of raw retail chicken with Campylobacter. The level of contamination over 6–year period was 57% for Campylobacter. Contamination remained high and ranged from 47 to 81% between different producers.

Saleh et al. (2003) examined 60 broiler chicken samples for Campylobacters at Alexandria and El–Behera governorates. The results revealed that the incidence was 30% in case of live poultry and 78% on their carcasses after processing.