Poultry Meat – as a Source of *Campylobacter* spp., Infection in Humans

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Abstract

Current studies indicate that *Campylobacter* spp. is the most common cause of gastroenteritis in humans in both developed countries and worldwide. This explains the ever-increasing interest of the researchers in the eradication of digestive disorders caused by *Campylobacter* spp. and also to identify the risk factors involved in prevention of human infections. Because birds are considered a major source of *Campylobacter jejuni* contamination in humans the purpose of this paper is to summarize the literature in regards to the incidence of campylobacter related infections in humans, identify the risk factors but mostly to describe the implications of poultry meat contamination during preparation for the consumer. Herein we refer to the applicable strategies in poultry farms as the introduction of competition between microbial populations in the gut, the use of new management practices in raising chickens and better hygiene to reduce the rate of gastrointestinal colonization with *Campylobacter* spp. in broilers and hens.

Keywords: *Campylobacter jejuni*, epidemiology, poultry meat

The purpose of this paper is to review the cause of *Campylobacter* spp. infections and the role of poultry as a risk factor in contributing to the development of campylobacter related gastroenteritis in humans. Thus the DEFRA report 2012 [1] show that campylobacter continues to be the most commonly reported human gastrointestinal pathogen, but reported human cases increased only slightly during 2012 compared to 2011 (72,592 from 72,266). But an additional significant number is not documented and in reality their number may be much higher being appreciated at more than 500,000 cases a year (Tam et al., 2012) [2]. In the United States *Campylobacter* is recognized as the "leader" of bacterial caused gastroenteritis in humans with 40,000 cases certified annually (Keener et al., 2004) [3].

In Romania, *Campylobacter* spp. was monitored during 2009-2011, in broiler carcasses (chickens and turkeys) during an annual monitoring program, ANSVSA. Thus in 2009 and 2010 a total of 447 samples were analysed, from broiler carcasses in the slaughterhouses. Of the 447 samples analysed, to identify the presence of *Campylobacter* spp., 182 samples were positive (*C. jejuni*, *C. coli* and *C. lari*). In 2011, at retail level, during a basic shelf control, from 490 analysed samples (dressed poultry meat, portioned, frozen from broilers and turkeys), *Campylobacter* spp. was identified in 115 samples [4].

The symptoms of human campylobacteriosis include diarrhea, abdominal pain, nausea and vomiting, which tend to last 5-7 days and can recur in 15-25% of cases with approximately 10% of these being hospitalized (Bessell et al., 2010)
Various species of Campylobacter are ubiquitous in the environment, suggesting that people are frequently exposed to these pathogens. Surveillance studies identified as risk factors for contamination with Campylobacter: climate, water, food processing, animal husbandry practices, different eating habits, and cooking, pet and host susceptibility (e.g., immunity, host-genetic) and risk awareness activities in human communities. Another category of factors includes the specific consumption of meat and meat products at home and in restaurants, daily contact with animals and drinking of unpasteurized milk. C. jejuni is a commensal organism that can be found routinely in domestic animals including: cattle, sheep, and swine but especially in birds. Most avian species are hosts for C. jejuni possibly because they have higher body temperature (Skyrrow, 1977) [6].

C. jejuni has 2 modes of transmission to other animals and humans: horizontal and vertical. Horizontal transmission is believed to occur mainly through contaminated water, manure, insect, wild birds, rodents, and by direct contact with farm workers in their shoes. Vertical transmission occurs very quickly (Beery et al., 1988) [19]. One bird in a compartment is colonized with C. jejuni, and other birds become infected. The contamination for the other birds in the batch. If one bird in a compartment is colonized with campylobacter, the infestation of the other bird occurs very quickly (Beery et al., 1988) [19].

The interval May-October represents the most “popular” period for campylobacter contamination in poultry. During these months, 87-97% of the samples tested were positive with C. jejuni (Willis and Murray, 1997) [17]. They have also found a substantial variability in intestinal colonization by C. jejuni of different series of broilers at different ages during the productive cycle. In birds, Campylobacter colonizes the intestinal mucus, in the intestinal epithelial crypts. Campylobacter has 2 modes of transmission to other birds ranging from horizontal to vertical.

Horizontal transmission is believed to occur mainly through contaminated water, manure, insect, wild birds, rodents, and by direct contact with farm workers in their shoes (Aarts et al., 1995) [18]. Young broilers can harbour high levels of Campylobacter in the intestines (9.0 log 10 CFU/g in the cecal contents being a source of contamination for the other birds in the batch). If one bird in a compartment is colonized with campylobacter, the infestation of the other bird occurs very quickly (Beery et al., 1988) [19].

Other reports show (van de Giessen et al. 1992) [20], that vertical transmission is possible. C. jejuni isolates from the parent flock where found to be the same clonal origin as those from the offspring in a broiler flock. The incidence of C. jejuni in birds has been the subject of numerous research studies: Pezzotti et
and important cause of enteritis caused by consumption of contaminated poultry meat is contaminated meat. The study argues that the 218 cases immediately after consumption of caused enteritis in humans. They have investigated as a possible source of infection with Harris et al., 1986 [9], established the role of meat 2325 broilers).

(2002) [23], estimated an incidence of 41% (in 2325 broilers). Harris et al., 1986 [9], established the role of meat 2325 broilers).

from broilers is associated with transmission of Campylobacter spp. (Skyrrow, 1982) [28]. A large number of C. jejuni serotypes isolated from chicken carcasses are often linked to human cases of gastroenteritis which confirms that birds play an important role in the epidemiology of the disease in humans (Stern and Kazmi, 1989) [14]. Rosenquist et al., 2013 [29] in Denmark established that organic chicken meat at the end of processing was more frequently contaminated with Campylobacter spp., than conventional carcasses from farm chickens (the annual average incidence of Campylobacter associated enteritis (relative risk = 7.6%). Incidence of pathogenic bacteria in chicken meat, varies from 83% (Jorgensen et al. 2002) [24] to 77% in chilled chicken (More et al. 2002) [25]. In chicken carcasses incidence was 76% (Vellinga and Butler 2000) [26]. Epidemiological studies also show that improper preparation of products from broilers is associated with transmission of Campylobacter spp., in humans (Adak et al. 1995) [27]. Most campylobacter infections are sporadic, arising from individual cases. Infections can occur due to improper manipulation of raw chicken carcasses from eating insufficiently cooked chickens and living off other foods cross-contamination through contact with utensils used in the preparation of fresh chickens. A reduction in cross contamination in chicken carcasses can be achieved by improving sanitation carcasses during processing, possibly by eliminating populations of campylobacter in poultry prior to processing (Keener at al. 2004) [3]. Other studies suggest that consumption of under cooked poultry as well as handling raw meat are risk factors that lead to the installation of gastrointestinal infections caused by Campylobacter spp. (Skyrrow, 1982) [28]. A large number of C. jejuni serotypes isolated from chicken carcasses are often linked to human cases of gastroenteritis which confirms that birds play an important role in the epidemiology of the disease in humans (Stern and Kazmi, 1989) [14]. Rosenquist et al., 2013 [29] in Denmark established that organic chicken meat at the end of processing was more frequently contaminated with Campylobacter spp., than conventional carcasses from farm chickens (the annual average of colonization with Campylobacter (Kenner et al., 2004) [3]. Poultry farmers will have to implement some strategies, aiming to reduce the rate of contamination. One measure consists in the stimulation of competition between microbial populations in newly hatched chicks, chlorination of drinking water and selection of chicken breeds resistant to pathogens. Implementation of a better hygienic management in poultry farming will be effective in limiting the occurrence of Campylobacter in chicken flocks (Saleha et al., 1998) [32]. Farms applying these practices tend to have low rates in intestinal colonization with Campylobacter spp., (Kazwala et al., 1993) [33]. A better and more scientific feeding strategy represents a promising and ecological way of reducing Campylobacter spp., colonization of
intestinal mucosa in poultry. We are currently undertaking research, at USAMV Timisoara, aiming to investigate the role of probiotic bacteria in reducing the level of colonization with C. jejuni in poultry. We are involving molecular and microbiological techniques that will allow us to understand the mechanisms involved in the reduction of C. jejuni colonization of the poultry intestinal mucosa. All these data together with the epidemiological investigation in the western part of Romania will provide valuable data for the field of Campylobacter research.

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