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Survey of campylobacter contamination in poultry meat and by-products in Dezful province

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Abstract: Campylobacter species are common bacterial pathogens associated with human gastroenteritis which are generally transmitted through foods of animal origin. This study was carried out to determine the prevalence of Campylobacter species in poultry meat and by products in the city of Dezful in Iran. Since April 2012 to July 2013, a total of 400 samples including meat (n = 100), liver (n = 100), gizzard (n = 100), and poultry heart (n = 100), were randomly collected from Dezful industrial poultry abattoir and were experimented in order to investigate presence of Campylobacter species. According to culture test, 251 samples out of 400 samples under study (69%) were contaminated with Campylobacter species. The highest prevalence of Campylobacter species was observed in poultry's liver (78.3%) and then in gizzard (75.8%), heart (65%) and meat (56.7%). The most common isolated Campylobacter were C. jejuni (90.9%) and the rest were C. coli (9.1%). There was a significant difference ($P<0.05$) in the prevalence of Campylobacter species between the meat samples taken in the summer (86.7%). The results of this study indicate the importance of edible offal of poultries as the potential source of Campylobacter infections.

Key words: *Campylobacter jejuni, Campylobacter coli, Poultry, Meat, Products*

1. Introduction

Poultry meat is one of the most widely consumed sources of protein in many countries of the world including Iran. Poultry meats are rich not only in protein but also in essential fatty acids, vitamins, and minerals. Poultry by-products such as liver, heart, and gizzard have a lot of fans among various classes of society due to their low prices, high nutrition values, and different and favorite tastes (Bokaeian et al., 2006; Suzuki et al., 2009). On the other hand, poultry mat and by-products are considered as the most important sources of food poisoning microorganisms such as *Salmonella, Campylobacter, Listeria, and Escherichia coli* enteropathogen and there are a lot of reports about the prevalence of *Campylobacter Enteritis* after the consumption of poultry meat and by-products all around the words (Frederick and Huda, 2011 ; Horrocks et al., 2009) therefore, the quality control of such products at different production and distribution stages is highly important. The consumption of medium-done poultry meat and its products is the most important source of human infection although the meat of other types of livestock, milk, and dairy products are the other potential sources of this pathogen. Although there are many studies on prevalence of campylobacter contamination in poultry meats in Iran (Rahimi and Ameri, 2011; Rahimi and Tajbakhsh 2008; 19 Soltan Dallal., et al. (2010), and Taremi M., et al (2006) and other countries such as Korea (Han et al, 2007), Japan (Suzuki H. and Yamamoto S. 2009), Canada (Valdivieso-Garcia et al. 2007), Ireland (Whyte P et al., 2004), Pakistan (Hussain I et al., 2007), and Belgium (Gonzalez I et al., 1997), little information on the prevalence of campylobacter contamination in poultry meat by-products such as liver, gizzard, and heart in Iran made the authors study and investigate the contamination of these products.

2. Materials and Methods

Since April 2011 to July 2013, a total of 400 samples including liver, heart, gizzard, and poultry meat (neck and wing) were randomly collected from Dezful industrial poultry abattoir (Table 2).The samples of liver, heart, gizzard, and poultry meat were equally collected in the spring, summer, and winter. The samples were immediately transported to the laboratory under aseptic conditions and in the vicinity of ice and were experimented right away.

2.1. Isolation and Differentiation of Campylobacter Species

All samples were homogenized and 10 g of each homogenized sample was enriched by 90 ml Campylobacter enrichment broth (Preston enrichment broth base, Himedia, Mumbai, India,M899) that was enriched by campylobacter selective supplement (Himedia, Mombia, India, FD042) and 25 ml of defibrinated sheep blood was added to each 475 ml of the medium. After 24 hours

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of incubation at 42C, 0.1 mm of it was cultured in the selective Campylobacter medium (Himedia, Mumbai, India, M994) enriched by Antibiotic supplement (Himedia, Mumbai, India, FD006) and 5% of defibrinated sheep blood and were incubated at 42 C for 48 hours.

Single-grown colonies were studied for confirmation and differentiation of Campylobacter species in terms of gram staining, production of catalase, oxidase, hippurate hydrolysis, and resistance to cephalothin (Bolton F.J et al., 1992).

The results were statistically analyzed by SPSS software SPSS/15(Chicago, IL) and the full square test and Fisher's exact test at 5% level of confidence were performed.

3. Results

251samples (69%) out of the total 400 experimented samples of poultry liver, heart, gizzard, and meat were positive in terms of the presence of Campylobacter species. Table (1) summarizes the prevalence of contamination of poultry meat, liver, heart, and gizzard with Campylobacter species.

Table1: Prevalence of Campylobacter Sp in Vital organ of poultry

Positive samples (%)			number sample	
Campylobacter Coli	Campylobacter Jejuni	Campylobacter sp		
(10.5)	(90.4)	(75)	100	Liver
(9)	(91)	(62)	100	Heart
(9.9)	(89)	(72)	100	Gizzard
(7.4)	(93)	(55)	100	Meat
(9.1)	(92)	(68)	400	Total

The prevalence of Campylobacter contamination in samples of poultry liver, heart, gizzard, and meat was 78.3, 65, 75.8, and 56.7%, respectively. Among the total 251 Campylobacter strains isolated from the examined samples in the study, 221 strains (90.9%) were Campylobacter jejuni and the rest (9.1%) were Campylobacter coli.

The results of investigating the prevalence of seasonal contamination of the samples showed that there was a significant difference in the prevalence of Campylobacter contamination in samples in different seasons of the year ($P<0.05$).Table (2) displays the seasonal prevalence of Campylobacter species contamination in the samples of poultry meat, liver, heart, and gizzard.

Table2: Seasonal prevalence of Campylobacter in Vital organ of poultry

Campylobacter Coli	Campylobacter Jejuni	Positive samples	Sisson
(10.5%) 8	(89.5%) 68	(63.3%)76	Spring
(10.6%) 11	(89.4%) 93	(86.7%)104	Summer
(7.7%) 7	(92.5%) 84	(75.8%)91	Autumn
(6.7%) 4	(93.7%) 54	(50%) 60	Winter

4. Discussion

The results of the present study showed that 48 samples out of 100 samples of poultry meat (48.7%) were contaminated with Campylobacter jejuni and Campylobacter coli. Similarly, previous studies indicated that the rate of prevalence of Campylobacter contamination in poultry in Iran was as 56.1 % in Esfahan (Rahimi E. and Tajbakhsh E. (2008). 47.0% in Shahrekord (Rahimi E. and Ameri M. (2011), 63.2% and 49.5% in Tehran (Soltan Dallal et al., (2010), (Taremi et al 2006) and 76% in Mashhad (12 Kang Y.S., et al. (2006)). The prevalence of Campylobacter species contamination in poultry meats in other countries has been reported to be about 30-90 percent. This rate has been reported to be 91.8% in Turkey (Yildirim M., et al (2005), 68.3% in Korea (Han K., et al (2007), 62.4% in Canada (Valdivieso-Garcia A et al., 2007), about 60% in Japan (Rahimi E. and Tajbakhsh E. 2008), (Suzuki H. and Yamamoto S. 2009), 49.90% in Ireland (Whyte P., et al 2004) and 48% in Pakistan (Hussain I., et al 2007).Despite numerous studies on the prevalence of Campylobacter species contamination in poultry meat, there are few scattered reports on the prevalence of Campylobacter contamination inedible offal of poultries. In a similar study conducted by Rahimi during 2006 to 2008 on the prevalence of Campylobacter jejuni and Campylobacter coli in the liver of poultries in Esfahan, the rate of contamination in 205 samples of the examined poultries' livers was 49.3% and the rate of contamination in the liver of chicken, turkey, and ostrich separately was 63.6, 40, and 16.7%, respectively (Rahimi E. and Tajbakhsh E. (2008). Shakerian et al., (2004) also investigated the rate of campylobacter contamination in the poultry liver in Shahrekord. They found that 259 samples out of 400 samples of the poultry (64.8) that were examined were contaminated with Campylobacter jejuni.

Ghafir et al. (2007) reported that the rate of contamination in poultry meat distributed in the capital of Belgium during 1997 to 1999 was 68.7%.

In that study, the rate of contamination in poultry liver during 1997 and 1998 was 61.7% (74 out of 120) and 74.6% (106 out of 143) respectively which is consistent with the results of present study (Gonzalez I., et al 1997). Sallam et al., 2007 reported that the rate of contamination in poultry meat and edible offal was ranged from 40 to 77%, and the rate of contamination in breast meat, thighs, wings, liver, gizzard, and heart separately was 64.4%, 70%, 77.1%, 64%, 45%, 40%, respectively. Suzuki and Yammamto (2009) reported that the rate of contamination in poultry meat, gizzard, liver, and heart was 59%, 62.2%, 62.3%, and 33.3%, respectively. In both studies like the present study, the highest rate of contamination was related to liver samples and the lowest rate of contamination was observed in heart samples. It could be due to higher contact level of the liver with contaminant compared to the heart and its further manipulation.

The differences between the reported results from different regions can be attributed to the rate of development of contamination among the poultries in different regions, intervals between studies, differences in killing methods, and observing hygienic principles during different stages of killing, sampling seasons, and sensitivity of testing methods.

The results of the study showed that90.9% of isolated Campylobacter species belonged to Campylobacter jejuni and the rest (9.1%) belonged to Campylobacter coli. Other studies also showed that C. jejuni were the most common isolated Campylobacter from nutrients of animal origin. For example, Hussain et al. (2007) in their study reported that the rate of prevalence of Campylobacter jejuni and Campylobacter coli in food samples of animal origin was 70.6% and 29.4%, respectively. In the same study, the rate of prevalence of Campylobacter jejuni and Campylobacter coli was respectively 72% and 28% in poultry meat, 65% and 35% in lamb, and 79% and 21% in mutton and beef. The review of Campylobacter species contamination in poultry meat samples in different seasons showed that threat of contamination in the summer was significantly more than other seasons ($p<0.05$). In general, there was no significant difference in the prevalence of Campylobacter contamination in autumn and winter. The high prevalence of contamination with campylobacter species in warm seasons of the year has been reported in various studies (Jamshidi A et al 2008), Rahimi E. and Tajbakhsh E. (2008). High prevalence of contamination in warm seasons might be attributed to high temperature of environment and provision of suitable conditions for growth of such bacteria and the probability of transferring contamination by insects in such seasons.

In summary, the results of investigating the rate of Campylobacter species contamination in poultry meat and by-products in this study showed that a relatively high percentage of samples particularly the liver samples had been contaminated with this pathogen. Therefore, in order to decrease the rate of Campylobacter species and other similar microorganisms' contamination in poultry meat and its by-products it is necessary to follow principles of environmental sanitation and personal hygiene in abattoirs, to follow HACCP principles in the chain of killing livestock and poultry, to minimize carcasses contamination by preventing the carcass and edible offal from coming into contact with the contents of gastrointestinal tract, to minimize the carcasses contact with each other, to minimize manipulation, and to use drinking water in killing process. Moreover, following hygienic principles at segmentation, packaging, and transportation processes and keeping the cold chain during the meat maintenance until it is delivered to the consumer are highly important in reducing the contamination of carcasses with these pathogens.

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