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Detection of campylobacter infections in patients with gastrointestinal symptoms in Baghdad: an antigenic stool - based study

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Abstract

Campylobacter infections are extremely common worldwide, although exact figures of incidence are not available. Asymptomatic campylobacter infections are uncommon in adults. Nonetheless, when acquired immunity wanes in adults, symptomatic infections can occur. The study aimed to determine the frequency of campylobacter infections in pediatric as well as adult patients with acute gastrointestinal tract disease symptoms in Baghdad. The study was carried out at AL-Kadhymia Pediatric Hospital, AL-Elweya Pediatric Hospital and Children Welfare Teaching Hospital (Baghdad) during the period from February to October 2015. Campylobacter antigens in fecal samples of 125 symptomatic pediatric and adult patients with acute gastroenteritis were detected by immunochromatographic assay (ICA). Their age ranged from less than one month to those adult patients aged from 18 -57 years.

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Introduction

Globally, Campylobacter is the most common bacterial cause of human gastroenteritis (European Food Safety Association report (EFSA). 2010)., constituting 1 of 4 key causes of diarrheal diseases (Fact sheet, 2017) (Kaakoush *et al.,* 2015). The most commonly and globally reported zoonotic diseases that affecting ruminant animals and from which transmitted directly or indirectly to humans (Ekdahl and Andersson 2004; Sahin *et al.,* 2017; Tang *et al.,* 2017), with 25 species and 8 subspecies included in the genus Campylobacter (Gilbreath *et al.,* 2011; Man 2011). Campylobacter are typically Gram negative, non-sporulating, comma-shaped, or helical bacilli (Allen *et al* 2007; El-Baaboua *et al.,* 2017). Although some species may tolerate aerobic conditions and even tend towards anaerobiosis (Carlone and Lascelles 1982). Advances on molecular biological and culture methodologies have led to isolation of a range of an emerging Campylobacter species including C. concisus, C. upsaliensis and C. ureolyticus which in some instances extragastrointestinal diseases (Butzler 20044; Oporto and Hurtado 2011; Cha *et al.,* 2016; Johnson *et al.,* 2017).

This foodborne pathogen is ubiquitous, resides in the gastrointestinal tract of in chickens, pigs, and cattles and also in their nature (Oporto and Hurtado 2011; El-Baaboua 2017), and therefore human Campylobacter gastroenteritis is usually caused mainly by handling or consuming undercooked (Mullner *et al.,* 2009; Mughini-Gras *et al.,* 2012; Taylor *et al.,* 2013; Johnson *et al.,* 2015; Di-Giannatale *et al.,* 2016; Meunier *et al.,* 2016). United States Centers for Disease Control in 2017 stated that Campylobacter does not usually spread from one person to another but other activities, as changing diapers as well as sexually from an infected person, can spread infection (Multistate Outbreak of Multidrug-Resistant Campylobacter Infections Linked to Contact with Pet Store Puppies. 2017). (Engberg *et al.,* 2004). However, the importance of Campylobacteriosis comes from that C. jejuni causes extra-intestinal infections leading to long-term complications, including septicemia, meningitis, pancreatitis, abortion of pregnant women, reactive arthritis, Guillain-Barré syndrome, Miller Fisher syndrome, etc... (Hannu *et al.,* 2005).

Due to the hyper-mutable nature of Campylobacter, multiple independent studies have demonstrated rapid emergence of antibiotic mutants in animals, where C. coli has been known to be more likely to acquire antibiotic resistance than C. jejuni (Bae *et al.,* 2005; Gibreel and Taylor 2006). Many molecular characterization and subtyping methods of Campylobacter spp. are fundamental to our understanding of its clinical pathogenesis and molecular epidemiology, yet few of them are in common use (Taboada *et al.,* 2013; Noor mohamed and Fakhr 2014). Tracing sources is challenging for the large numbers of human cases and high prevalence of Campylobacter infection in a wide range of animal species. However, advances in the molecular biology of Campylobacter have lagged behind other enteric pathogens fields (Poly F, Guerry P. 2008; Di-Giannatale *et al.,* 2016).

In respect to this preview, the present study was designed to determine the percentage of campylobacter infections among pediatric as well as adults patients who were presented with acute gastrointestinal tract disease symptoms in Baghdad.

Materials and Methods

A prospective study was carried out during the period from February to October 2015, on a total number of 125 symptomatic pediatric and adult patients (their age ranged from less than one month to those aged from 18 -57 years) presented with acute gastroenteritis to the outpatient clinics of AL-Kadhymia Pediatric Hospital and Children Welfare Teaching Hospital (Baghdad) as well as many private clinics (Baghdad).

As an inclusion criteria, this research included those children and adult patients who were acutely presented with diarrhea or any other *gastrointestinal symptoms* whereas the exclusion criteria of this study

was neither to include those with *hemorrhagic diarrhea* nor those parasitic infections. Stool samples were collected in a specified clean labeled screw- cap container. After *macroscopical* and *microscopical* laboratory examinations of stool samples have done, an *immunochromatographic assay* (purchased from CerTest, Spain) was used and was tested in this study for antigenic detection of Campylobacter which was applied according to the instructions of the manufacturer company.

Campylobacter antigen in fecal samples was detected by *immunochromatographic as say (ICA)*. This qualitative immuochromatographic as say is designed for determination Campylobacter antigen in fecal samples, where mouse monoclonal Campylobacter antibodies react against these antigens present on the pre-coated test band region.

The stool samples are allowed to move upward across the membrane (according to the capillary action) to react with the colored conjugate (*anti-Campylobacter mouse monoclonal antibodies-red microspheres* which was pre-dried on the specified test region) so as a red colored line then being visible. When this mixture again moves upward to the immobilized antibody placed in the control band region, a green-colored band appears, validating then a qualified procedural achievement.

Regarding Campylobacter antigen detection, approximately 100 mg or 100 microliter of each stool sample was taken in specified collecting tube which contains the diluent.

Then 100 microliter was dispensed in S circular window in the card waiting for the appearance of red and green - colored bands after 10 minutes.

Negative results indicated by the appearance of only one green band (control line). A total absence of control band, irrespective to the resulted test lines, was validated as an invalid result.

The T, ANOVA, and Chi square were the statistical tests which were applied for analysis of the results using Excel and SPSS program (version-19) applications.

Results

Association between sex and campylobacter infection

There is a significant association between sex and campylobacter infection in favor of female predominance of patients studied. 29/81(35.8%) of females with AGIT symptoms had campylobacter positive stool antigen test, while 13/64 (20.3%) males had positive test (Figure 1 & 2).

Table 1. Associations between campylobacter with gender and age of patients with acute gastrointestinal tract infection symptoms.

	Campylobacter	Mean	SD	Significance
Duration of vomiting (days)	Positive	2.76	2.162	0.24
	Negative	2.32	0.899	
Spells of vomiting/day	Positive	1.50	0.834	0.08
	Negative	1.70	0.979	
Duration of diarrhea (days)	Positive	3.57	3.059	0.74
	Negative	2.73	1.227	
Spells of diarrhea/day	Positive	5.28	1.446	0.05
	Negative	5.18	1.491	

AGIT: acute gastrointestinal tract symptoms.

Association between age and campylobacter infection

A significant association was also observed between age and campylobacter infection in favor of advancing age. 4/32 (12.5%) of children aged 0-15 years had campylobacter, while 24/66 (63.4%) of adults above 30 years had campylobacter, as seen in Table -1.

Diarrhea, Fever & Vomiting

The mean duration of vomiting and diarrhea and the mean number of diarrheal stools per day were higher in campylobacter infection than that for non-campylobacter, and as seen in Table -2.

In addition to diarrhea which is the most frequent presenting complaint of studied patients, fever and vomiting were less frequent symptoms in the campylobacter AGIT infections group than those with non-campylobacter AGIT infections. The difference of vomiting scored a significant p value.

Table 2. Independent samples T-test of means differences for cases of campylobacter and non-campylobacter infections.

Demographic Characteristics		Campylobacter AGIT)*	(Non-campylobacter (AGIT)*	Total (145)	Significance
Gender	Male	13 (20.3%)	51 (79.7%)	64 (100%)	0.03
	Female	29 (35.8%)	52 (64.2%)	81(100%)	
Age Stratification	0-15 years	4 (12.5%)	28 (87.5%)	32(100%)	0.05
	16-30 years	14 (29.8%)	33 (70.2%)	47(100%)	
	> 30 years	24 (36.4%)	42 (63.6%)	66(100%)	

Macroscopical & Microscopical

Similar results are seen regarding gross, macroscopical and microscopical findings of stool, where gross blood and mucus in stools were less frequently seen in campylobacter AGIT infections group than other group. Microscopical pus cells and RBCs in stools were also less in campylobacter AGIT infections group than non-campylobacter group, and as seen in Table -3.

Table 3. Associations between the presenting symptoms and stool findings for cases of campylobacter and non-campylobacter infections.

		Campylobacter AGIT Infections	Non- campylobacter AGIT Infections	Significance
SYMPTOMATIC PRESENTATIONS				
Fever	Yes	31 (28.2%)	79 (71.8%)	0.43
	No	11 (31.4%)	24 (68.6%)	
Vomiting	Yes	35 (34.3%)	67 (65.7%)	0.02
	No	7 (6.3%)	36 (83.7%)	
Abdominal pain	Yes	23 (29.5%)	55 (70.5%)	0.51
	No	19 (28.4%)	48 (71.6%)	
Diarrhea	Yes	36 (30.3%)	83 (69.7%)	0.31
	No	6 (23.1%)	20 (76.9%)	
Gross blood in stool	Yes	0 (0.0%)	1(100.0%)	0.71
	No	42 (29.2%)	102 (70.8%)	
Gross mucus in stool	Yes	38 (31.7%)	82 (68.3%)	0.08
	No	4 (16.0%)	21 (84.0%)	
MICROSCOPICAL FINDINGS				
Gross pus in stool	Yes	1 (10%)	9 (90.0%)	0.15
	No	41(30.4%)	94 (69.6%)	
Pus cells in stool	Yes	42 (29.8%)	99 (70.2%)	0.25
	No	0 (0.0%)	4(100.0%)	
RBC in stool	Yes	42 (29.2%)	102 (70.8%)	0.710
	No	0 (0.0%)	1(100.0%)	
	Yes	5 (20.8%)	19(79.2%)	0.241
Entamoeba cyst	No	37 (30.6%)	84 (69.4%)	

With advancement of age the campylobacter infection becomes more and more frequent compared to that of non- campylobacter, as seen in figure -3.

Discussion

The present research work was conducted as a clinical- and laboratory-based survey on 125 children and patients suffering from gastrointestinal symptoms to explore the percentage of Campylobacter infections among such populations in relation to their clinical as well as laboratory findings from whom stool samples and clinical data were collected.

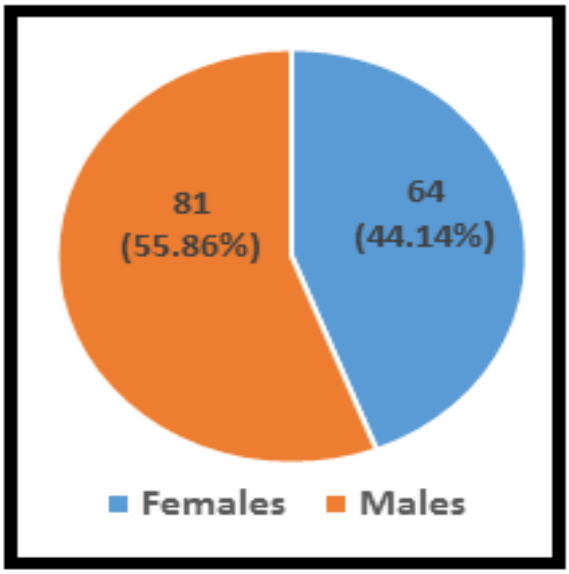

Fig. 1. Depicts sex distribution of cases of GIT symptoms.

Results of this study reveal that out of 125 analyzed patients with any AGE symptoms, the overall detection rate of campylobacter antigen in fecal samples was found 33.6% (42 out of 125 AGE cases).

This high number of stool samples with positive Campylobacter antigen detection in the studied cases of AGE, albeit limited to only 125 samples and from a restricted areas of Baghdad and in that confined time of this research work, might be an evidence confirming the high rates of *Campylobacter* in our societies. Really, and similar to what Galanis proposed in 2007 (Galanis 2007), the demonstrated cases of Campylobacter gastroenteritis herein might represent only a fraction of the high actual numbers in our societies.

In this respect, in 2009 Wardak (Wardak *et al.,* 2009) have studied diarrheal cases in Poland and from August 2006 to July 2009, they isolated Campylobacter spp. from stool samples of 45.4% - 51.5% of these cases.

However, Wasfy in Egypt, (Wasfy *et al.,* 2000) isolated Campylobacter strains (63% C. jejuni and 37% C. coli) in 2.3% stool specimens of patients presented with acute enteric infections.

Sorokin (Sorokin *et al.,* 2007) found that the prevalence of campylobacteriosis in Romania was10.5%, while Jain (Jain *et al.,* 2005) isolated Campylobacter species from (13.5%) patients with diarrhea in north India.

Among total group of patients, studied herein, who have symptoms of AGE infections and revealed positive fecal campylobacter antigen in their stool samples, pediatric patients constituted (11.1%) while young as well as older adults patients constituted (27.8%) and (61.1%) , respectively.

In addition, in developing countries, Campylobacter infections are also still an important cause of childhood morbidity caused by diarrheal illness (Allos 2001).

Our results are compatible to Jafari (Jafari *et a.l,* 2009) who recovered out Campylobacter from fecal samples of (10.8%) of Iranian children with acute diarrhea.

Bodhidatta (Bodhidatta *et al.*, 2002) reported a Campylobacter detection rate of 28% (80% C. jejuni and 20% C. coli) in Thailand, so as to be the most common bacterial enteric pathogens in children of Thailand with acute dysentery.

Jain (Jain *et al.,* 2005) from India found Campylobacter infection significantly higher in children aged less than 5 years.

Galanis in 2007 (Galanis 2007) and Sorokin (Sorokin *et al.,* 2007) have found the prevalence of campylobacteriosis to decline with age, showing an unimodal age-specific distribution of Campylobacter gastroenteritis cases where the highest rates of Campylobacter gastroenteritis were observed among children less than 5 years old and young adults, particularly men, aged 20–29 years .These aspects were epidemiologically resembled reports from develoing countries on campylobacteriosis.

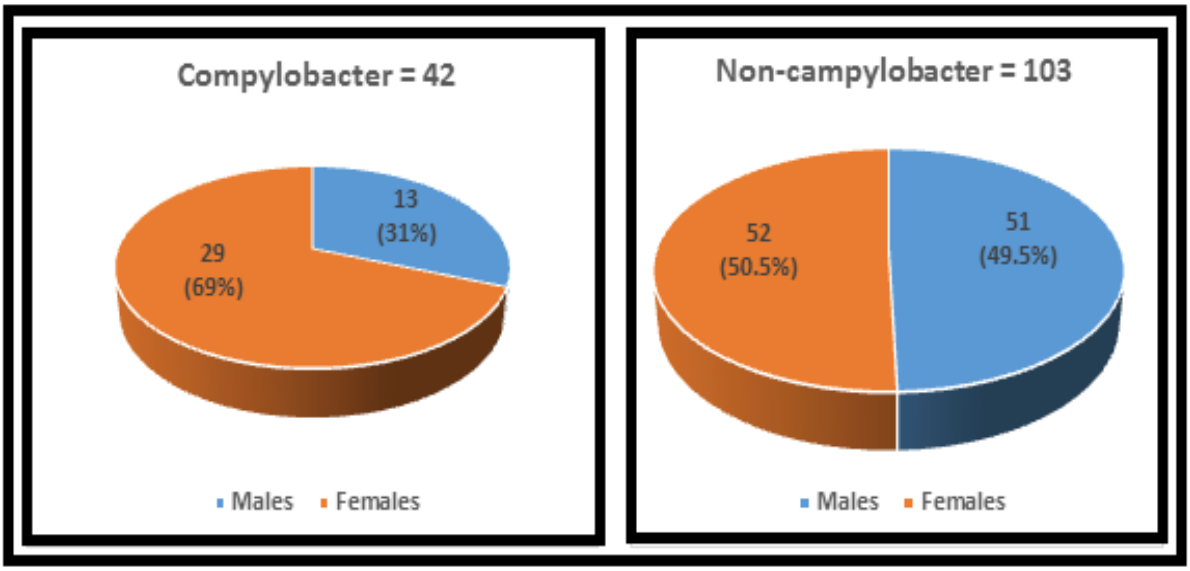

Fig. 2. Depicts sex distribution of cases of campylobacter and non-campylobacter infections.

It was found that most of the Campylobacter spp. in a selected region in Poland was isolated from children under the age of 2 years, with a seasonal peak between July and December in 2009 (Wardak *et al.,* 2009).

It was known from old an current studies that Campylobacter illness is characterized by fever, diarrhea, which may be bloody, severe abdominal pain and tenderness, and rarely vomiting. Some patients may be asymptomatic.

Among patients with Campylobacter enteritis, 50% were presented with outstanding abdominal pain that mimicked acute abdominal emergencies. However, the diagnosis might hampered by the late onset, or even absence, of diarrhea (Pönkä *et al* 1981; Bodhidatta *et al* 2002; Upadhyay *et al.,* 2017).

In humans, Campylobacter jejuni adheres and invades intestinal epithelia leading to toxin-mediated, cytolethal cell death and severe gastroenteritis, manifested as fever, diarrhea, and abdominal cramps (Upadhyay *et al.,* 2017).

However, Campylobacter infections are generally mild, but can be fatal among very young children, elderly, and immunosuppressed individuals (Allos 2001).

Obtaining cultures of the organism from stool samples remains the best way to diagnose this infection (Allos 2001).

In this study, the duration of both vomiting and diarrhea as well as number of daily spells of diarrheal stools were higher in campylobacter diarrhea than that for non-campylobacter diarrhea, while number of daily spells of vomiting and fever presentations were

less frequent symptom in the campylobacter group than those with non-campylobacter diarrhea group. Microscopical pus cells and RBCs were also less in campylobacter- positive stools group than non-campylobacter group. In Thailand, Bodhidatta *et al* (2002) (43) reported the following clinical presentations of Campylobacter infections: abdominal colic (62%), bloody stools (52%), vomiting (38%) and fever (28%).

To trace the source as well as the resistant clones of Campylobacter in human cases as well as different infection reservoirs, molecular and sequencing typing methods are often used (Chattaway *et al.,* 2016; Magana *et al.,* 2017).

As insufficient attention has been given to these molecular methods, we recommend more research in this area using multi locus sequence typing (MLST) and pulsed-field gel electrophoresis (PFGE).

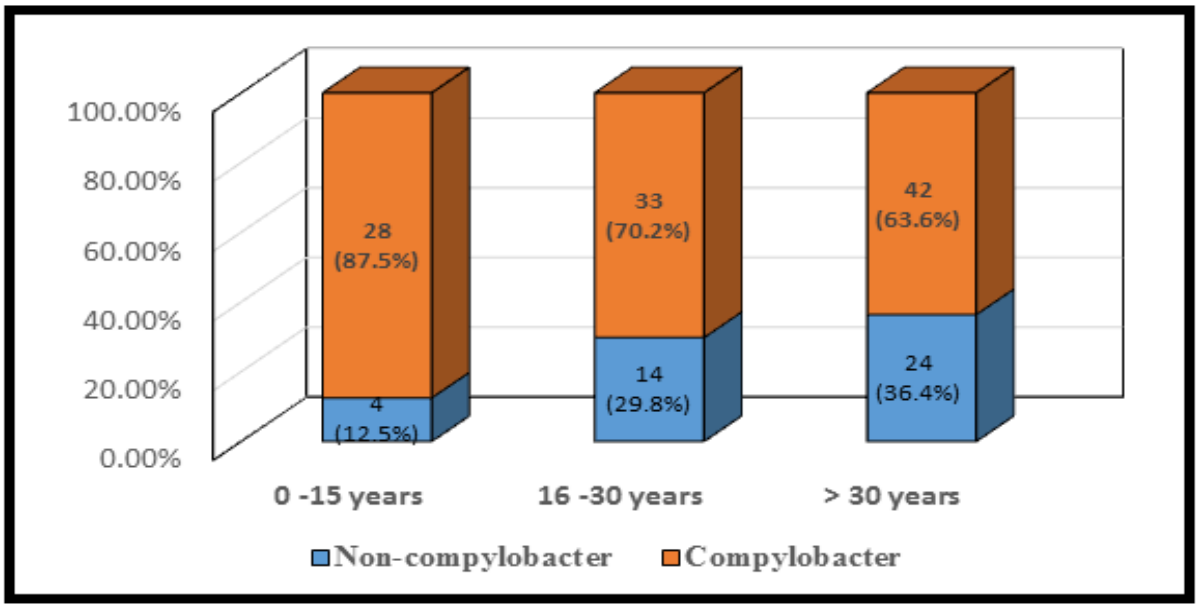

Fig. 3. Age groups distribution of cases of campylobacter and non-campylobacter infections.

The gathered results of this study reveal the infectious agent in the etiology of gastroenteritis cases presented as acute diarrhea to develop the surveillance program at the national levels of campylobacter infections through food borne pathogens to improve prevention and controlling measures, the development of broadly protective vaccines may be more effective approaches for curbing morbidity as well as mortality.

Conclusions

Campylobacter infections increased significantly with advancing of patients from pediatric to adult age.

Patients with campylobacter infection have presented clinically with more severe acute gastroenteritis signs and symptoms than non-campylobacter counterpart. New information and methods in the coming years will be available to provide important tools to further understanding the pathogenesis of this elusive pathogen.

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