Original Article

Assessing Physicians' Diagnostic Practices on Foodborne Illnesses in Saudi Arabia: A Cross Sectional Study

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Abstract

Background: Foodborne illnesses are significant public health issues given they contribute to increasing the global burden of diseases. Incidents of Foodborne diseases are increasing due to the presence of newly emerging pathogenesis. Appropriate diagnostic practices among physicians reduce the magnitude of the problem nationally. Therefore, the aim of the current study is to evaluate the diagnostic practices of Foodborne illnesses among public and private primary health care physicians in the Kingdom of Saudi Arabia.

Methodology: A cross-sectional study was conducted in thirty public and private primary health care centers in the city of Abha during the period of October 2017 to March 2018. A structured questionnaire was developed based on the previously published literature and was used to collect the data related to the diagnostic practices among the physicians.

Results: One hundred and twenty-five physicians participated in this study. Approximately 49% of the physicians had 'adequate' diagnostic practicing skills. No significant difference in diagnostic practice of foodborne illness between the public and private health care physicians. However, the study found a positive correlation between the level of clinical practice, age, gender, area of speciality, years of experience and the number of patients per week.

Conclusion: Given that the diagnostic practice skills among physicians were 'adequate', there has been a recommendation for newly hired physicians to enroll in a diagnosis and management of Foodborne diseases training program to improve their diagnostic practices.

Key Words: Diagnostic Practices, Foodborne diseases, Primary health care, Saudi Arabia.

الملخص

مقدمة: تعتبر الأمراض التي تنتقل عن طريق الأغذية من القضايا الصحية العمومية الهامة نظراً لأنها تسهم في زيادة العبء العالمي للأمراض. حالات الاصابة الأمراض التي تنتقل عن طريق الأغذية آخذه بالإزدياد بسبب نشوء مسببات امراض حديثة. الممارسات التشخيصية المناسبة بين الأطباء تقلل من حجم المشكلة على الصعيد الوطني. ولذلك ، فإن الهدف من الدراسة الحالية هو تقييم الممارسات التشخيصية للأمراض التي تنتقل عن طريق الأغذية بين أطباء الرعاية الصحية الأولية العامة والخاصة في المملكة العربية السعودية.

المنهجية: أجريت دراسة مستعرضة على ثلاثين مركزًا للرعاية الصحية الأولية العامة والخاصة في مدينة أبها خلال الفترة من أكتوبر ٢٠١٧ إلى مارس ٢٠١٨. تم تطوير استبيان منظم بناءً على الدراسات المنشورة سابقًا وتم استخدامه لجمع البيانات المتعلقة بالممارسات التشخيصية بين الأطباء.

النتائج: شارك مائة وخمسة وعشرون طبيبًا في هذه الدراسة. ما يقارب من ٤٩ ٪ من الأطباء يمتلكون مهارات كافية في تشخيص هذه الأمراض. لا يوجد فرق كبير في الممارسة التشخيصية للأمراض التي تنتقل عن طريق الأغذية بين أطباء الرعاية الصحية العامة والخاصة. ومع ذلك ، اشارت الدراسة الى وجود علاقة إيجابية بين مستوى الممارسة السريرية والعمر والجنس ومجال التخصص وسنوات الخبرة وعدد المرضى في الأسبوع. الخلاصة: نظراً لأن مهارات ممارسة التشخيص بين الأطباء كانت " كافية" ، فقد كان هناك توصية للأطباء المعينين حديثاً للتسجيل في برنامج تدريبي عن تشخيص وادارة الأمراض التي تنتقل عن طريق الأغذية لتحسين ممارساتهم التشخيصية.

Introduction

Foodborne diseases are one of the major community health problems internationally. However, all the diseases that arise due to contamination of food can be easily prevented [1]. Foodborne diseases are caused by the contamination of food items and by the presence of various Foodborne pathogens comprising of bacteria, viruses and parasites. The toxic substances present in food items also cause several diseases [2] . More often, symptoms associated with gastro-intestinal systems that include nausea, vomiting and diarrhea, are commonly reported among patients with Foodborne illnesses [3] . Given that the gastrointestinal symptoms are not specific to Foodborne diseases, clinicians should consider other factors like history and other objective findings in order to make an appropriate diagnosis [4].

According to the World Health Organization report on global estimates of foodborne diseases, approximately one in every ten people suffers from Foodborne illnesses globally, and the mortality rate due to Foodborne diseases are about 420,000 per year [5]. The Kingdom of Saudi Arabia started experiencing rapid industrialization, globalization and westernization. As a result, there has been a drastic change in life-style, which has sharply increased the intake of fast food, which ultimately increased the rate of Foodborne illnesses [6].

A study conducted by Al-Mazrou described food poisoning as being a very serious public health issue due to the increase in cases throughout the Kingdom [6] . The study also pointed out that a higher number of cases were reported during the Hajj season and summer months due to the increased consumption of meat and chicken by the population and due to the increase in temperature [6].

A study carried out in Jeddah by Iyer et al. reported an outbreak of Foodborne illness in several meat outlets [7]. This was diagnosed to be Salmonella and E. coli species, mainly due to the improper handling and inadequate storage of meats in the local butcheries [7]. Similarly, another study by Bharathirajan et al [8] described an increased number of cases of Foodborne illness due to Listeria and Salmonella species in the Kingdom of Saudi Arabia.

A report specific to the Ahad Rafidah, Asir region from the Saudi Epidemiology Bulletin, Kingdom of Saudi Arabia reported twenty seven cases of Foodborne diseases in the year 2009 [9]

An article related to the management of Foodborne illness also recommends the physicians to follow the primer developed by center for disease control and prevention for diagnosis and management of foodborne illness and also advocate the physicians to report the cases of foodborne illness to the local health authority in case of two or more patients present with a similar illness [10].

To our knowledge, this is the first population-based study that assesses the diagnostic practices of Saudi primary health care physicians

concerning Foodborne illness. Therefore the specific objectives of this study is to assess the diagnostic practices of Foodborne illness among both the public and private primary health care physicians and to evaluate the correlation between the diagnostic practices of Foodborne illnesses among the public and private primary health care physicians.

Materials and methods

Study design: This is a cross-sectional study.

Study setting: This study was conducted in the selected public and private primary health care centers in the city of Abha located in the south western region of Asir in the Kingdom of Saudi Arabia from October 2017 to March 2018.

Participants: The sample size was calculated by using the Raosoft sample size calculator. With a 5% margin of error confidence interval of 95%, a response distribution of 50% and a total population size of 180; the minimum sample size was 123 and the sample size was rounded to 125.

Multistage cluster sampling was used in the study to select participants. An official permission was obtained from the Ministry of Health-Asir region (REC# 2017-03-08) to conduct this study in the public and private primary health care centers in the city of Abha. A list of all public and private primary health care centers in Abha was compiled. There are approximately 45 government owned primary health care centers and 43 private primary health care clinics. Abha city was divided into the center, east, west, north and south administrative regions, and both the governmental and non-governmental primary health care centers were listed, based on the above mentioned five administrative regions. Fifteen public and fifteen private primary health care centers, based on these regions were selected by using the simple random sampling method. The selected public primary health care centers were contacted to participate. A separate permission letter from the administration of the respective private primary health care clinics was acquired for collecting the data. The physicians from the particular public and private primary health care centers were enrolled in the study by using the simple random sampling technique.

Ethical Permission: Ethical permission was obtained from the research ethics committee, College of Medicine, King Khalid University, Abha, Kingdom of Saudi Arabia.

Inclusion Criteria: Physicians who agreed to participate in the study with written informed consent were included.

Tools for Data Collection: Each physician was interviewed using the structured questionnaire.

Socio-demographic Questions: There were seven questions in this section that included age, gender, physician specialty, primary setting of clinical practice, number of years' experience, number of patients seen per week and number of cases treated for Foodborne

illness (per week).

Practice Questions: This section comprised of ten questions and included history about eating, ordering stool culture, ordering stool culture for different species, reasons for not ordering the stool culture, prescription of antibiotics without ordering a stool culture, asking patients about food hygiene or prevention of foodborne illness. The questionnaire was administered in English.

Reliability: Test-retest reliability was conducted by Alpha (Cronbach's) test reliability for internal consistency and equaled 0.741. Test reliability was applied on a pilot of 15 public and private primary health care physicians before the study. 10% of the total sample of 13 physicians was rounded to 15 physicians, and these had all been administered with this questionnaire for the purpose of validation.

Data Analysis: The data analysis was carried out by using SPSS (Version 16.0, SPSS Inc. Chicago, IL, USA). Frequency tables were used to describe the diagnostic practices of Foodborne illness among the public and private primary health care physicians. Qualitative data was summarized in percentages and non-parametric tests of significance (Chi square test) were applied to nominal scales. Pearson Correlation between two variables was applied. The p-value was two-tailed and statistical significance was set at <0.05.

Scoring system for practice:

There were twenty questions scored; '1' & '0' for right and wrong answers respectively. The total scores ranged from 0 to 17. Each score was divided into three categories Inadequate Practice (<6), Adequate Practice (6-11) and Good Practice (12-17).

Results:

Table 1: Demographics for study participants (n=125)

Age	25-34 35-44 45-54 >54	18 (14.4%) 52 (41.6%) 42 (33.6%) 13 (10.4 %)
Gender	Male Female	86 (68.8%) 39 (31.2%)

Which of the following best describes your area of specialty?	Emergency medicine Family medicine Internal medicine Pediatric medicine OB/GYN Others	20 (16.0%) 44 (35.2%) 17 (13.6%) 23 (18.4 %) 06 (4.8%) 15 (12.0%)
What is the primary setting of your practice?	Public hospital Private hospital	62 (49.6%) 63 (50.4%)
How long have you been practicing your specialty?	<5 Years 6-10 Years 11-15 Years >15 Years	29 (23.2%) 38 (30.4%) 30 (24.0%) 28 (22.4 %)
On average, how many patients do you see per week?	1-10 11-25 26-50 51-75 >75	06 (4.8%) 17 (13.6%) 21 (16.8%) 13 (10.4 %) 68 (54.4 %)
Each week, approximately how many patients with a foodborne illness do you treat?	1-5 6-20 21-50 51-100 >100	68 (54.4%) 40 (32.0%) 13 (10.4%) 01 (0.8%) 03 (2.4 %)

Table 2: Physicians' responses for questionnaire regarding diagnostic practices about food borne illness (n=125)

Would you ask the history of eating when you make a diagnosis?	Always Sometimes Rarely Never	74 (59.2%) 40 (32.0%) 08 (6.4%) 03 (2.4 %)
A 40-year-old male presents with a 3-day history of diarrhea, fever, anorexia, and malaise. There is no history of bloody stools, and the patient is not significantly dehydrated. His symptoms are gradually improving. His occupation is listed as 'chef.' After addressing his clinical concerns, what recommendation would you make to him?	He may return to work if he observes strict hand hygiene He should stay home from work until his employer gives him approval to return He should stay home from work until diarrhea has completely resolved None of the above	46 (36.8%) 13 (10.4%) 54 (43.2%) 12 (9.6 %)

Do you order a stool culture when you diagnose a suspected case?	Always Sometimes Rarely Never	19 (15.2%) 61 (48.8%) 31 (24.8%) 14 (11.2 %)
Campylobacter		
Clostridium difficile		47 (37.6%)
	Yes	25 (20.0%)
	No	53 (42.4%)
	Unsure	
E. coli O157; H7		
	Yes	46 (36.8%)
	No	14 (11.2%)
	Unsure	65 (52.0%)
Gardia lambila		
	Yes	73 (58.4%)
	No	17 (13.6%)
	Unsure	35 (28.0%)
Listeria		
	Yes	36 (28.8%)
	No	26 (20.8%)
	Unsure	63 (50.4%)
Norovirus	Yes	38 (30.4%)
	No	28 (22.4%)
	Unsure	59 (47.2%)
Rotavirus		
	Yes	14 (11.2%)
	No	29 (23.2%)
Salmonella	Unsure	82 (65.6%)
	Yes	32 (25.6%)
	No	21 (16.8%)
Shigella	Unsure	72 (57.6%)
	Yes	63 (50.4%)
	No	13 (10.4%)
Vibro	Unsure	49 (39.2%)
	Yes	67 (53.6%)
	No	08 (6.4%)
Yersina	Unsure	50 (40.0%)
	Yes	34 (27.2%)
	No	21 (16.8%)
	Unsure	70 (56.0%)
	Yes	21 (16.8%)
	No	29 (23.2%)
	Unsure	75 (60.0%)

State the reason for not ordering the stool culture.	Diagnosis is clear Symptoms are slight Patients are not willing to cooperate high cost Others	69 (55.2%) 23 (18.4%) 25 (20.0%) 05 (4.0 %) 03 (2.4 %)
Do you prescribe antibiotics without ordering a stool culture?	Always Sometimes Rarely Never	33 (26.4%) 47 (37.6%) 27 (21.6%) 18 (14.4 %)
How often do your patients ask you about food safety or prevention of foodborne illness?	Always Sometimes Rarely Never	31 (24.8%) 57 (45.6%) 37 (29.6%) 0 (0.0 %)
Does anyone in your health center provide information on foodborne illness or prevention of foodborne illness to your patients?	Yes No	52 (41.6%) 73 (58.4%)
Who provides foodborne illness prevention information to your patients?	Yourself (physician) Nurse or Nurse-practitioner Dietician or Nutritionist Other Not sure	92 (73.6%) 08 (6.4%) 11 (8.8%) 01 (0.8 %) 13 (10.4 %)
How is information about foodborne illness provided to your patients?	Verbally, with an extensive discussion) Verbally, with a brief discussion Brochure/Patient fact sheet Poster in office / waiting room other self-help materials	40 (32.0%) 67 (53.6%) 13 (10.4%) 02 (1.6 %) 03 (2.4 %)

Table 3: Distribution of physicians according to diagnostic practices about food borne illness (n=125)

Food Borne Illness **Practice Score**	**Total (Percentage)**
Inadequate Practice (<6)	55 (44%)
Adequate Practice (6-11)	61 (48.8%)
Good Practice (12-17)	09 (7.2%)

Table 4: Correlation between the diagnostic practice of physicians about food borne illness and general demographic variables (n = 125)

		Practice Score			Total (Percent)	P Value
		Inadequate	Adequate	Good		
Age	25-34	04 (3.20%)	11 (8.80%)	03 (2.40%)	18 (14.40%)	<0.001*
	35-44	28 (22.40%)	22 (17.60%)	02 (1.60%)	52 (41.60%)	
	45-54	16 (12.80%)	22 (17.60%)	04 (3.20%)	42 (33.60%)	
	>54	07 (5.60%)	06 (4.80%)	0 (0.00%)	13 (10.40%)	

Gender	Male Female	39 (31.20%) 16 (12.80%)	41 (32.80%) 20 (16.0%)	06 (4.80%) 03 (2.40%)	86 (68.80%) 39 (31.20%)	0.037*
Area of Specialty	EM FM IM PM OB/GYN Others	04 (3.20%) 23 (18.40%) 08 (6.40%) 11 (8.80%) 02 (1.60%) 07 (5.60%)	14 (11.20%) 15 (12.0%) 08 (6.40%) 12 (9.60%) 04 (3.20%) 08 (6.40%)	02 (1.60%) 06 (4.80%) 01 (0.80%) 0 (0.00%) 0 (0.00%) 0 (0.00%)	20 (16.0%) 44 (35.20%) 17 (13.60%) 23 (18.40%) 06 (4.80%) 15 (12.0%)	<0.001*
Settings	Public hospital Private hospital	23 (18.40%) 32 (25.60%)	34 (27.20%) 27 (21.60%)	05 (4.0%) 04 (3.20%)	62 (49.60%) 63 (50.40%)	0.291
Years of Practice	<5 Years 6-10 11-15 >15	09 (7.20%) 23 (18.40%) 15 (12.0%) 08 (6.40%)	12 (9.60%) 14 (11.20%) 15 (12.0%) 20 (16.0%)	08 (6.40%) 01 (0.80%) 0 (0.00%) 0 (0.00%)	29 (23.20%) 38 (30.40%) 30 (24.0%) 28 (22.40%)	<0.001*
Patients seen per week	1-10 11-25 26-50 51-75 >75	03 (2.40%) 03 (2.40%) 09 (7.20%) 08 (6.40%) 32 (25.60%)	03 (2.40%) 11 (8.80%) 10 (8.0%) 05 (4.0%) 32 (25.60%)	0 (0.00%) 03 (2.40%) 02 (1.60%) 0 (0.00%) 04 (3.20%)	06 (4.80%) 17 (13.60%) 21 (16.80%) 13 (10.40%) 68 (54.4%)	<0.001*
Patients with Food borne illness seen and treated per week	1-5 6-20 21-50 51-100 >100	36 (28.80%) 14 (11.20%) 01 (0.80%) 01 (0.80%) 03(2.40%)	27 (21.60%) 22 (17.60%) 12 (9.60%) 0 (0.00%) 0 (0.00%)	05 (4.0%) 04 (3.20%) 0 (0.00%) 0 (0.00%) 0 (0.00%)	68 (54.40%) 40 (32.0%) 13 (10.40%) 01 (0.80%) 03 (2.40%)	<0.001*

*P<0.05, Statistically Significant

One hundred and twenty-five physicians from the selected 30 public and private primary health care centers participated in this study. Table 1 shows the demographic characteristics of the physicians. 41.6% of physicians were 35 to 44 years of age, and 33.6% of them belong to 45 to 54 years of age. 69% of the primary health care physicians were males. 35.2% of the physicians were practicing family medicine. 30.4% of the physicians in have been practicing for 6 to 10 years.

Physicians' responses to the questionnaire regarding the diagnostic practices of Foodborne illness are presented in Table 2. 59.2% of the physicians from both public and private primary health care centers reported that they always ask about the history of eating while making a diagnosis. 15.2% of the physicians from both public and private primary health

care centers ordered the stool culture test during diagnosis of the suspected cases. Half of the physicians, from both public and private primary health care centers, were unsure about ordering stool cultures for diagnosing the *Gardia lambila* pathogens. 30.4% of the physicians from both public and private primary health care centers ordered routine stool cultures for diagnosing *Listeria.* 65.6% and 57.6% of physicians from both public and private primary health care centers were unsure about ordering stool cultures for diagnosing the *Norovirus* and the *Rotavirus* respectively. 55.2% of the physicians from both public and private primary health care centers stated that the reason for not ordering the stool culture test as a diagnosis was clear. 37.6% of physicians, from both public and private primary health care centers, sometimes prescribed antibiotics without ordering the stool culture test. 45.6% of physicians from both public and private primary health care centers reported that the patients sometimes asked about food hygiene or prevention of foodborne illness.

Table 3 shows the distribution of physicians according to diagnostic practices about Foodborne illness. Only 7.2 % physicians from both public and private primary health care centers have good practice skills, in terms of the diagnosis of Foodborne diseases, 49% of physicians have 'adequate' practice skills for diagnosing Foodborne illness.

The correlation between diagnostic practice of physicians about Foodborne illness and general demographic variables is described in Table 4. The most important finding of this study is that the diagnostic practices related to Foodborne diseases do not vary between the public and private primary health care centers. A positive significant association was established between the practice score of physicians regarding Foodborne diseases and several general demographic characteristics such as age ($p<0.001$), gender ($p=0.037$), area of speciality ($p<0.001$), number of years of practice ($p<0.001$), the number of patients per week ($p<0.001$), and number of patients with Foodborne illness in a week ($p<0.001$).

Discussion

This study was conducted in the fifteen public and private primary health centers in Abha, Kingdom of Saudi Arabia. Overall, one hundred and twenty-five physicians from both the public and private primary health care centers participated in this survey.

Almost half of primary health care physicians in both the public and private sectors in the current study usually ordered the stool culture test for suspected cases, much higher than in the study conducted by Paula Clogher et al in the United States. Their study found that only 10% of physicians regularly ordered the stool culture test [11].

Likewise, a study carried out by Lyn James et al. reported that approximately 67% of physicians believed that species like *Salmonella, Shigella and Campylobacter* were often ordered for a routine stool culture without special request from their health

center laboratory. This is similar to the results of the present study. However, the physicians in the above-mentioned study were unsure about the routine stool culture for *Gardia lambila, Norovirus* and *Rotavirus* which was also in accordance with the results of the current study [12] .

37.6% of physicians from both the public and private primary health care centers in the study, prescribed antibiotics without ordering the stool culture test at times. Similarly, the study carried out by Carpenter et al found that around 90% of the cases of antimicrobial infections were given antibiotics without the results of the stool culture test, which is much higher than the results of the current study [13] .

Embrical antibiotics such as fluoroquinolone, trimethoprim or sulfamethoxazole is generally recommended for the suspected cases of Foodborne illness if the patient is febrile and symptoms are persistent for more than one week and the choice of therapy depends on the pathogens that should be identified by a stool culture test. The drug resistance is often reported in the case of Foodborne diseases which is a consequence of inappropriate use of antibiotics [14].

Despite its effectiveness in treating the dehydration many physicians are unwilling to prescribe oral rehydration therapy which is highly recommended by the World Health Organization, the American Academy of pediatrics and the center for disease control and prevention for treating mild and moderate dehydration especially among infants and children. Oral rehydration therapy has also proven to be effective against dehydration among patients of all ages [15].

Several studies proved that probiotics can be used to improve the diarrheal symptoms among the patients with irritable bowel syndrome [16] , antibiotic- associated diarrhea among children [27], infectious diarrhea among infants and children [17] . The physicians in the study were the primary source of information regarding the Foodborne illness in the present study. A study conducted by Hiddink GJ et al [18] pointed out that dieticians were the primary source of information related to Foodborne diseases, which contrasts with the results of this study.

The results of this study showed that about 49% of the primary health care physicians had adequate practice which is comparatively less to that reported in the study conducted by AlAteeq in the Kingdom of Saudi Arabia, where 64% of primary health care physicians had favorable practices [19] .

The results of this study proved that practice varies according to the age of the physicians, which is also supported by a similar study that revealed tenured physicians in Saudi Arabia showed more favorable clinical practice when compared to younger primary health care physicians [19].

A study conducted in Riyadh among primary health care physicians by Al-Amri et al, found that the level of clinical practice differed based on the area of speciality. The above-

mentioned study reported that physicians with a family medicine speciality had better clinical practice in comparison to the other areas of speciality, which is similar to the results of the current study [21].

The current study showed that the level of practice varied according to the number of years of experience among the primary health care physicians. This strong positive association was established between the years of experience and the level of practice in a study carried out by Al-Amri et al [21] and AlAteeq [19] in the Kingdom of Saudi Arabia, which is in concurrence with the present study.

Conclusion

The diagnostic practice level among public and private primary health care physicians about Foodborne diseases is not satisfactory. The study established a statistically positive correlation between the level of practice and the age, gender, area of speciality, number of years of experience and the number of patients per week. It is evident from this research that more experienced primary health care physicians had good clinical practice, so there is a need for a training program for the younger physicians working at primary health care centers, regarding the diagnosis and management of food borne diseases.

The study also showed that there were no differences in the diagnostic practices in Foodborne illnesses between the public and private primary health care centers. There is a need for having transparent and much clearer procedures for the diagnosis and management of Foodborne diseases in both of these sectors.

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REFERENCES

[1] World Health Organization. Food safety and food-borne illness. Factsheet No 237. 2007; Available at: http://www.wiredhealthresources.net/resources/NA/WHOFS_FoodSafety Foodborne Illness.pdf. Accessed May 18 2018.

[2] Al-Goblan AS, Jahan S. Surveillance for foodborne illness outbreaks in Qassim, Saudi Arabia, 2006. Foodborne Pathogens and Disease, 2010; 7:1559-1562.

[3] Arendt S, Rajagopal L, Strohbehn C, Stokes N, Meyer J, Mandernach S. Reporting of foodborne illness by US consumers and healthcare professionals. International journal of environmental research and public health. 2013; 10:3684-714.

[4] Switaj TL, Winter KJ, Christensen SR. Diagnosis and Management of Foodborne Illness. American family physician. 2015; 92:358-65.

[5] World Health Organization. WHO's first ever global estimates of foodborne diseases. 2015; Available at: http://www.who.int/mediacentre/news/releases/2015/foodborne-disease-estimates/en/ Accessed May 18 2018.

[6] Al-Mazrou YY. Food poisoning in Saudi Arabia: Potential for prevention? Saudi Medical Journal. 2004; 25: 11-14.

[7] Iyer A, Kumosani T, Yaghmoor S, Barbour E, Azhar E, Harakeh S. Escherichia coli and Salmonella spp. in meat in Jeddah, Saudi Arabia. The Journal of Infection in Developing Countries. 2013; 7: 812-818.

[8] Bharathirajan R, Gopinathan R, Prakash M . Microbial management of household cold storage exploratory study in Jeddah, Saudi Arabia. International Journal of Current Microbiology and Applied Sciences. 2012; 1: 50-55.

[9] Saudi Epidemiology Bulletin. Foodborne outbreak in Ahad Rafidah, Saudi Arabia. Saudi Epidemiology Bulletin, 2009;16:1 Available from http://fetp.edu.sa/downloads/articles/y2009/A2009-V16-2-00222.pdf.

[10] Sharma VK, Savalia CV and Darekar SD. Management of Foodborne illness. Veterinary World, 2008; 1:55-58.

[11] Clogher P, Hurd S , Hoefer D, Hadler JL , Pasutti L , Cosgrove S et al. Assessment of Physician Knowledge and Practices Concerning Shiga Toxin–Producing Escherichia coli Infection and Enteric Illness, Foodborne Diseases Active Surveillance Network (FoodNet). CID.2012; 54:446-452.

[12] James L, Roberts R, Jones RC, Watson JT, Hota BN, Kampe LM et al. Emergency Care Physicians' Knowledge, Attitudes, and Practices Related to Surveillance for Foodborne Disease in the United States. FOOD SAFETY • CID 2008;46:1264-1270.

[13] Carpenter LR, Pont SJ, Cooper WO, Griffin MR, Dudley JA, Arbogast P et al. Stool Cultures and Antimicrobial Prescriptions Related to Infectious Diarrhea. BRIEF REPORT .JID 2008;197:1709-1712.

[14] Phoon YW, Chan YY, Koh TH. Isolation of multidrug-resistant Salmonella in Singapore. Singapore Med J. 2015; 56:142–e144.

[15] Switaj TL, Winter KJ, Christensen SR.Diagnosis and Management of Foodborne Illness. American Family Physician. 2015; 92:358-365.

[16] Whelan K. Probiotics and prebiotics in the management of irritable bowel syndrome: a review of recent clinical trials and systematic reviews. Curr Opin Clin Nutr Metab Care 2011; 14:581–7.

[17] Szajewska H, Mrukowicz JZ. Probiotics in the treatment and prevention of acute infectious diarrhea in infants and children: a systematic review of published randomized, double-blind, placebo- controlled trials. J Pediatr Gastroenterol Nutr 2001; 33:17–25.

[18] Hiddink GJ, Hautvast JJ, van Woerkum CK, Fieren CJ, van't Hof MA. Nutrition guidance by primary-care physicians: LISREL analysis improves understanding. Prev Med 1997; 26:29–36.

[19] AlAteeq M, Alrashoud AM, Khair M, Salam M. Smoking cessation advice: the self-reported attitudes and practice of primary health care physicians in Saudi Arabia. Patient Preference and Adherence 2016; 10:651-658.

[20] Al-Hazmi Ahmad Homoud. Knowledge, attitude, and practice of primary health care physicians in the management of osteoarthritis in Al-Jouf province, Saudi Arabia. Niger Med J. 2012; 53:213–219.

[21] Fahad Al-Amri, Ashry Gad, Dina Al-Habib, Ahmed Khair Ibrahim. Knowledge, Attitude and Practice Regarding Vitamin D Among Primary Health Care Physicians in Riyadh City, Saudi Arabia. World Journal of Food Science and Technology 2017; 1:47-55.