

## Food Hygiene in Past Ten Years in Saudi Arabia

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### Abstract

Currently food hygiene and issues related to food borne outbreaks have become a matter of great concern for governments and food producing companies in general, and for food supply chains in particular. Food contamination involving food poisoning has raised alarm in Saudi Arabia. During the past ten years, a number of incidents of food borne outbreaks were reported in some regions. In 2006, during the annual Hajj pilgrimage, a group of Saudi soldiers were diagnosed for having gastroenteritis following a rice lunch contaminated with *Bacillus cereus* and *Clostridium perfringens*. In 2007, Najran city registered 92 cases of food poisoning outbreaks. Similar outbreaks occurred in some other parts of Saudi Arabia like, Al-Hofuf in 2009, Sulayyil, a town near Riyadh in 2010, and Qassim House of Social Education in 2011. Different sources of infections were reported following the outbreaks. In a cross section study conducted around a catchment area involving seven primary health care centers, food handlers, specifically raw food handlers of certain nationalities, were found to be the major source of food contamination. A cross section study was conducted in Jazan city to ascertain the knowledge and practices of street vendors. The results obtained showed low to middle level of KAP among them. In Jeddah, butchers were found to be mainly involved in contamination practices. Critical food control infractions and fraud have been repeatedly spotted at restaurants inspected in different parts of Saudi Arabia.

**Keywords:** Food; Hygiene; Outbreak; Hajj; Saudi Arabia

### Background

The health authorities in Saudi Arabia pay special attention to food safety and hygiene [1] because food borne diseases are considered a major public health problem as it is responsible for substantial rise in disease rate and mortality [2]. Food borne diseases are preventable diseases [3] (This sentence is out of place. Please reconsider its position) Causative agents of food borne diseases are killing 1.8 million patients annually [4]. A large section of Saudi Arabian population tend to consume food items prepared at restaurants and public kitchens. Health authorities in different parts of the Kingdom reported several incidents of food borne outbreaks in the past few years. In 2010, 1647 food borne diseases were registered with 62% of patients (n1029) getting infection from food points. Other statement of 255 incidences with 2066 cases were reported [5]. Internationally some 3.5 billion people are affected by intestinal parasitic infections; 450 million are showing symptom and deaths were reported among 200,000 them [6] in 2005 none million and eight hundred deaths were reported following diarrheal disease following ingestion of contaminated food resulted [3]. Studies that investigated foodborne outbreaks traced their origin to food establishments [7-12]. According to statistics, up to seventy percent of foodborne illness that spread in

developed countries are linked to food preparation at food establishments [11,13-14]. This percentage is quite alarming considering the development in food safety regulations and food checking processes. In the developing countries about 2.2 million people are reported to die every year due to contamination of food and drinking water [15], whereas according to the World Health Organization, more than one-third of the population experience food borne illnesses. In a different showed food handlers as a major cause of contaminated food [16]. There are many factors responsible for issues related to food safety and hygiene such as contamination of food and water, improper storage and transportation of food, unhygienic food processing/preparation practices, lack of cleanliness at food serving places, etc. Food borne diseases are highly spread in developing countries [17].

Most of food borne illnesses can be prevented by implementing preventive measures particularly hygienic practices during food handling and processing [18-20]. Saudi Arabia established surveillance system in 1984 [21,22]. Millions of Muslims come together to Makkah AL Mukarramah to perform the annual hajj pilgrimage. Normally, food handlers undergo medical examination before getting a job. However, during the peak seasons of Hajj and Umrah, some companies employ temporary food handlers, who are not trained in food handling processes and hygienic behaviors; thereby resulting in infection with microorganisms, both causing food spoilage and food poisoning [23]. These unintentional unhygienic practices of food handlers involving contamination of raw food and equipment, and selling expired products make them a major source of contaminated food [24]. "Food poisoning is a group of illnesses acquired by consumption of foods contaminated with a variety of causes ranging from infective organisms or their toxins to chemical contaminants whether metallic or organic" [25]. Use of poor quality groundwater can effect food quality during the pre-harvest phase. The number of reported foodborne diseases has steadily been rising for more than a decade reported by Ministry of Health in Saudi Arabia [25].

### Outbreak of Food Borne Diseases

The study of food borne diseases is of paramount importance in Saudi Arabia, particularly in the holy city of Makkah, which hosts millions of pilgrims round the year. Moreover, there are millions of expatriates residing and working in Saudi Arabia, where most of the restaurants and food points employ these foreigners as managers, cooks or waiters irrespective of their qualification, skills or experience. An outbreak was recorded during Hajj in 2006 in a group of Saudi soldiers who suffered from gastroenteritis due to contaminated rice containing *Bacillus cereus* and *Clostridium perfringens* as shown in table 1 [26]. Surveillance of food borne outbreak was done in Qassim area in 2006, where the results obtained showed that 64.5% of both male and female suffered from gastroenteritis. The main causative agent was *Salmonella* spp then *Staphylococcus aureus* as in table one [27]. The outbreak an incident of food poisoning occurred in Taif city in 2006 when an extended family reported to the hospital with gastroenteritis symptoms. 39 of 64 members of the family were found sick of which one patient died within three days of the incident. The outbreak was attributed to *Escherichia coli*, which was isolated from raw milk as shown in table 1 [28]. In another incident that occurred in Bisha in 2007, 55 people suffered from food poisoning after eating Russian salad. The outbreak was caused by *Salmonella enteritidis*, which was isolated from all 55 cases either from stool or from rectal? as mentioned in table 1 [29]. The same year, in an outbreak of food poisoning in Riyadh, *Salmonella enteritidis* group D which was isolated from 56% of patients was identified as the causative agent [30].

Case control was done in Najran city in 2008 after an outbreak affecting 92 people, who complained about gastroenteritis. *Salmonella enteritidis* group D was isolated from 80% of patients as found in table 1 [31]. Gastroenteritis outbreak caused by *Salmonella* spp and *Amoeba* in Ahad Rafidah in Asir region was reported in which About 27 individuals out of 35 showed different symptoms of food poisoning with attack rate of 77.1% as shown in table 1 [32]. An outbreak of food poisoning occurred in Al-Hofuf in 2009 associated with eating chicken shawarma from a restaurant [33]. In the Khaiber valley in 2009, about 55 cases of gastroenteritis were reported after the victims had a meal in a restaurant [34]. In an outbreak at a college restaurant in Riyadh, 200 students suffered after eating *Salmonella enteritidis* and Umm Ali sweet [35]. Another outbreak of food poisoning involving 33 cases was reported in Al-Ahsa in which the patients had developed gastroenteritis which associated due to *Salmonella enteritidis* group D [36].

In 2010, another foodborne outbreak was reported during wedding ceremony in small town near Riyadh called Sulyyel. People who attended the wedding ceremony suffered from gastroenteritis 21 hours after the meal. Investigation done in Sulyyel hospital showed that *Salmonella* spp was the causative agent of this outbreak as mentioned in table one [37].

| Area of Outbreak | Year of Outbreak | The causative agents                                      | The mortality case | The morbidity rate | Reference                     |
|------------------|------------------|---|--------------------|--------------------|-------------------------------|
| Makkah (Mina)    | 2006             | <i>Bacillus cereus</i> and <i>Clostridium perfringens</i> | 0                  | 39%                | Al-Joudi, 2007                |
| Qassim           | 2006             | <i>Salmonella</i> spp and <i>Staphylococcus aureus</i>    | 0                  | 64.5%              | Al-Goblan and Jahan 2010      |
| Taif             | 2006             | <i>Escherichia coli</i>                                   | 1                  | 60.9%              | AlMazroua and Al Hamadan 2006 |
| Bisha            | 2007             | <i>Salmonella enteritidis</i>                             | 0                  | 100%               | Al-Honazil, et al. 2008       |
| Riyadh           | 2007             | <i>Salmonella enteritidis</i> group D                     | 0                  | 62%                | AlMazroua and Al-Hamdan 2008  |
| Najran           | 2008             | <i>Salmonella enteritidis</i> group D                     | 0                  | 80%                | Alfara and Al Mazroua 2008    |
| Ahad Rafidah     | 2009             | <i>Salmonella</i> spp and <i>Amoeba</i>                   | 0                  | 77.1%              | Al-Alwy, et al. 2009          |
| Al-Hofuf         | 2009             | <i>Salmonella enteritidis</i>                             | 0                  | 56%                | Elyani and Nooh 2009          |
| Khaiber          | 2009             | <i>Salmonella enteritidis</i>                             | 0                  | 100%               | Alotaibi and AlMazroa 2010    |
| Riyadh           | 2009             | <i>Salmonella enteritidis</i>                             | 0                  | 200 cases          | Al-Mazroa., et al. 2010       |
| Al-Ahsa          | 2010             | <i>Salmonella enteritidis</i> group D                     | 0                  | 33 cases           | Al Bakheet., et al. 2010      |
| Sulyyel          | 2010             | <i>Salmonella</i> spp                                     | 0                  | 64.5%              | Al-Joudi., et al. 2010        |
| Hail             | 2011             | <i>Salmonella enteritidis</i> group D                     | 0                  | 100%               | Al-Jasser and Al Mazroa 2011  |
| Hail             | 2011             | <i>Staphylococcus aureus</i>                              | 0                  | 39 cases           | Maslamani., et al. 2011       |
| Abha             | 2011             | <i>Salmonella enteritidis</i>                             | 0                  | 26 cases           | AlOmari., et al. 2011         |

**Table 1:** Outbreaks Happened in Saudi Arabia in Last Ten Years.

In 2011, in the Hail city of Saudi Arabia, there was an outbreak of food poisoning in which 47 patients showed the signs of gastroenteritis after they ate shawarma from the same restaurant. *Salmonella enteritidis* group D was isolated from those patients as mentioned in table one [38]. In the same year, another outbreak attacked construction workers in Hail in the company's restaurant. Approximately 39 cases were developed gastroenteritis. The case control studied explored that the outbreak was associated with *Staphylococcus aureus* in green salad as mentioned in table one [39]. A food poisoning incident occurred in 2011 in Abha affecting visitors from the Qassim House of Social Education. About 26 cases developed gastroenteritis after eating their dinner in two famous restaurants in Abha. The outbreak was associated with *Salmonella enteritidis* but the source of infection was not known [40].

### Intestinal parasitic infections among food handlers in KSA

During the past ten years, food handlers, especially those handling raw food are playing a significant role in the diffusion of food-borne diseases. Symptomatically ill food handlers can easily be detected and excluded from work duties which involve working directly with food products, but the danger lies in the carriers [41]. Therefore, a number of studies about spread of parasitic disease among food han-

dlers in Saudi Arabia were conducted during the past ten years. In Al Jubail military area, among 194 food handlers, 10.56% (n93) were found to be having intestinal *Helminthes*, 7.38% (n65) were having protozoal infection, 4.9% (n44) were having bacterial infection. Most of them were having single organism infection, (83.94%) were having double infections and (1.55%) were having triple infections. *Ascaris lumbricoides* was reported in 47.14% of the total food handlers (n33), *Giardia lamblia* was reported in 43.40% (n23) and salmonella was most prevalent and was reported in 87.18% (n34).

When food handlers from different areas of the globe were compared, the South Asian was found to be carrying infection more than those coming from the Arab World. Among south Asians, infection was found as high as 17.4% (n151) among Bangladeshi followed by Indian 1.93% (n17) and Pakistani food handlers with 1.25% (n11) [41]. In 2007, during hajj season, a study was conducted in Makkah among food handlers and samples of 504 participants from around the world were examined for parasitic intestinal infection using different stool examination techniques. Almost a one third (31.94%) were found to carry intestinal parasites. The parasites found were Hook worms, *Endolimax nana*, *Entamoeba coli*, *Entamoeba histolytica*, *Giardia lamblia*, *Entamoeba hartmanni*, *Schistosoma mansoni*, *Strongyloides stercoralis*, *Iodamoeba buetschlii*, *Ascaris lumbricoides*, *Hymenolepis nana*, *Dientamoeba fragilis* and *Enterobius vermicularis* with different percentages consecutively ranging from 10.7% to 0.2% [42]. A cross sectional study was conducted in Riyadh by examining a fresh stool of randomly selected food handlers (n700) from catchment areas around 7 health centers to look for parasitic infections. The results showed that: 12/8% (n59) were positive for parasites. The greatest number of infected nationals were Bengalis with 20.2% followed by Indian, Turk and Arab with 18.9%, 10% 3.4%, respectively. The commonest intestinal parasites isolated were *Giardia lamblia* (33.8%), and *Enterobius vermicularis* (27.4%). When 1,091 medical files of non-Saudi food handlers in Al-Khobar in 2005 were studied, parasitic infection was found among one third of them (31.4%). 22.3% were single infection and 9.1% multiple infections. Participants were found to be more from South East Asian origin [44]. In 2009, in Alnoor Specialist Hospital in Makkah city, parasitic and bacterial infections were found to be 9%, 4.5% and 56% for *Giardia lamblia*, *Entamoeba histolytica* and staph infection respectively [45].

From October 2011 to June 2012, samples of 811 Saudi women, 80% of whom were educated, were examined for food KP (food safety knowledge and practices). Results suggested a big difference between the level of knowledge and their practices reporting higher mean knowledge and practice (63.4% and 73.8%; respectively) [46]. In 2013, 2732 stool samples were examined for intestinal parasites of which 407 stool samples (14.9%) were found positive. Infection was higher in young people 20 - 29 (18.5%) age groups and tended to be less in older people > 50 years (11.8%). Pakistanis were found to be highly infected (23.2%), and Sudanese were the lowest (18.7%) [47].

### Food Establishment Hygiene in the Past Ten Years in Saudi Arabia

Critical food control infractions and fraud in Saudi Arabia have been repeatedly spotted during surprise inspection of the restaurants on various occasions. The result of this study some factors can lead to the continuity of these encroachment, restaurant general regulations and violation fines, Food transportation, design and equipment, restaurant workers, worker health certificates, worker salary and benefits, restaurant inspection, worker training, foodborne disease surveillance, Consumer protection and consumer awareness. The study revealed that some factors that might contribute to the causes of these violations include: out laws of labor, low salaries of workers, lack of relevant qualification, training and skills on the part of workers, and some departmental issues, like low fines, disease surveillance issues, and lack of consumer awareness [48]. Another cross-section study was conducted among street vendors in Jazan city to determine their food safety knowledge and practices. The study revealed that majority of the vendors were primary school graduates (38%); more than fifty percent of street vendors agreed that washing of hands was necessary, (47%) bathed regularly, 76% of the study sample washed kitchen equipment with detergents, some of them were aware about food-borne diseases, and the most popular contaminants were colors, flavors and spices of food (70%). Sixty-two food samples were taken (30 grams each) in sterilized bottles. Different types of food were examined to isolate and identify *Staphylococcus aureus*, *Salmonella* spp, *Escherichia coli* and *Bacillus* spp bacteria [49]. A cross-section survey was done in Riyadh on 127 Saudi girls (13 - 18 years) and 69 Saudi women (19 - 29 years) to study their fast food habits by comparing the set of results of the two age groups. The study revealed that 95.4% of respondents consumed fast food from res-

restaurants and 79.1% ate food prepared quickly at least once a week. Hygiene and quality of food in the restaurants was the main concern of the 62.2% of the female participants. 70.9% of respondents preferred to buy fast food from international restaurants, whereas 29.1% preferred local restaurants [50].

### Intestinal Bacteria in Saudi Arabia During the Past 10 Years

The Ministry of Health (MOH) as well as the local food industry is cognizant of the threats posed by the food born diseases and infections to the citizens and residents in the Kingdom. They strive to identify the bacteria that cause food borne diseases. This study attempts to look into the incidence of food borne diseases on different occasions and in different cities in the Kingdom in the light of studies already conducted at national and international level. In this study, we have tried to focus on the causative agents of bacteria that cause responsible for food borne diseases like *Salmonella typhimurium*, *Salmonella enteritidis*, *Clostridium botulinum*, *Clostridium botulinum*, *Clostridium botulinum*, *ETEC*, *EPEC*, *Shigella*, *Vibrio cholera*, *S. aureus*, *C. perfringens* [27].

In the case control study conducted, *Salmonella enteritis*'s group D was isolated from 80% of the patients who consented to give their stool or rectal swab specimens [51].

*Salmonella* was responsible for a mass gastroenteritis as reported by Sulyyel hospital authorities following an indigestion caused by contaminated food in a wedding party [37].

Another study was carried out by King Abdul-Aziz University, Jeddah, which reported contamination in groceries and hypermarkets to a lesser degree than in butchers shops, that were found to be positive for *E. coli* and *Salmonella* spp. [52,53]. In infection incidents among 270 children in Jeddah and Makkah hospitals, 106 were found to be positive for parasitic, bacterial and viral infections (39%). Viral infection was found to be caused by Rotavirus type A (22%), Astrovirus (7%), Adenovirus (4%), while 9 *Salmonella* species and *Shigella* species were isolated from (3%) and (2%) respectively [54]. In 2009 (1430 H) in Riyadh, a number of students went to a college polyclinic with symptoms of GIT infection and fever. Out of them, 77 were referred to different hospitals in Riyadh where they were admitted and treated before being discharged without any complications. Following this incident, the concerned authorities at the college restricted the served meals to yoghurt and white cooked rice for the next two days. *Salmonella enteritidis* group D among 3 (2.9%) was isolated from food handlers who had developed gastrointestinal symptoms. In addition, five (2.5%) students who agreed to give stool or rectal swab specimens were also positive for *Salmonella enteritidis* group D. The same organism was also isolated from served food [37]. Health authorities in Khaiber reported that 55 patients were found to be positive for *Salmonella* infection in one day following a surveillance report. The patients reported that they visited the same restaurant on the day before the onset of symptoms, where Mayonnaise salad was prepared using eggs as the main ingredient [34].

### Food Hygiene Knowledge, Attitudes and Practices of the Food Handlers During the Past Ten Year

Food handlers play an important role in ensuring food safety during food handling and processing, and ignoring hygienic procedures and protocols on their part can lead to food contamination with ultimate harm to the food consumers. Some women in Saudi Arabia have practice and experience that can cause food Contamination during purchasing, storage, cooking and catering food. For example, during salad preparation at room temperature, freezing or thawed [55]. For example, not paying attention to expiry date during purchasing or paying spoiled food Other practices that can cause contamination happen during storage of food when women mix food of different origins at the same place or at wrong temperature. Other malpractices can be noticed during food preparation or storage, cooked food in addition to lack of food hygiene [56]. On of one of great people combination with large amounts prepared and consumed of food, people world in handling food may ignoring, practice of hygienic and also may be considered as A main source of food contamination; they might contaminate the basic material from which a product is made., equipment 'sand expired food products and usually disappearance lesions [57]. During Hajj season, food handlers become under controlling to prepare huge amount of food. Also, bad habits such as nose picking,

releasing nasal secretions and spitting on the floor could cause rise in the incidence of food poisoning by staphylococcal [58]. Eating out at schools and universities' canteens is one of the major causes of food poisoning. The factors responsible for the occurrence include: lack of relevant knowledge and undesirable habits on the part of food handlers; not wearing uniforms, caps, gloves, mask while handling food; not washing hands after sneezing, smoking, coughing; and wearing unwanted things like rings, jewelry and watches. Food can also get contaminated during working when the workers do not wash their hands during food handling and processing, specially before foods handling, after eating, touching polluted materials, using the toilet, not fully known temperatures foods danger zone and by keeping the temperature low than the normal range in refrigerators. Food handlers with scraping, or breaks on fingers and hands handling foods, refreezing thawed food, not using separate kitchen equipments and cutting tables for cooked and raw food, using one towel to clean many places, not checking the expiry date to discard the expired food items, etc [59].

### Conclusions

Food safety and hygiene is one of the top most priorities of health authorities in Saudi Arabia. The most important results of this scientific article review of food hygiene in the past ten years in Saudi Arabia. Firstly, regarding outbreak of foodborne diseases. During Hajj in 2006 the group of Saudi male Soldiers who suffered from gastroenteritis by contaminated rice with *Bacillus cereus* and *Clostridium perfringens*, food poisoning outbreak was occurred in 2007. The outbreak referred to *Salmonella enteritidis*, in Najran city after an outbreak of 92 patients complaining from gastroenteritis in 2008, in Hail city in 2011. Outbreak of food poisoning was appeared and 47 patients showed the signs of gastroenteritis. In 2011 About 26 cases developed gastroenteritis after eaten their dinner in two famous restaurants in Abha. The outbreak associated with *Salmonella enteritidis* but the source of infection was not known. Secondly food handlers play a significant role in the transmission of food-borne illness, A cross sectional survey was conducted in Riyadh city. 700 food handlers working in restaurants were randomly selected from the study area, about 66% of them complied in bringing fresh stool specimens (12.8%) of the specimens were positive for parasites, in 2005 among expatriate workers in Al-Khobar, a major city in the Eastern Province of Saudi Arabia the prevalence of parasitic infection is 31.4%. From which 22.3% were single infection and 9.1% with multiple infections (double and triple and quadruple), another study was conducted in 2013 in Al-Madina Al-Munawarah revealed that A total of 2732 stool samples were screened for intestinal parasites. Positive cases by some parasites were recorded among 407 stool samples (14.9%). Thirdly health requirements for food establishments play a big role in the health and food safety activities, study conducted among street vendors in Gizan city showed that most of these vendors have primary school certificate (38%), more than fifty percent of street vendors agreed that washing of hand was necessary, (47%) were bathing regularly, 76% of the respondents washing utensils with soap. Fourthly the infections of food borne diseases and intoxications are much important to MOH of KSA and industrial food factory in Sulyyel hospital an outbreak investigation was conducted to identify its source, to assess its extent and to make recommendations on the prevention of such outbreaks in the future, *Salmonella* was considered the causative agent of this food-borne outbreak. Finally, food handlers' knowledge, attitudes and practices play a significant role in ensuring food safety throughout the chain of Producing, processing, storage and preparation and disregard for hygiene measures on their part may result in food contamination and its attendant consequences. Through Hajj periods food handlers become under pressure to prepare big amount of food. Also, bad behavior such as; picking nose (fingering the nose), nasal excretion and spitting on the ground could be the source for raising the ratio of staphylococcal intoxication.

### Recommendations

- 1- Epidemiology Department at the Ministry of Health (MOH), KSA may upgrade its surveillance system for food-borne diseases, especially food poisoning.
- 2- The Health Environment Department in the Ministry of Health need to expedite their efforts to ensure neat and clean environment at places preparing, serving and delivering food stuff.

- 3- The Health Environment Department in collaboration with the Food and Drug Authority may run a campaign to create awareness in the concerned quarters for preventing food contamination.
- 4- The aforesaid departments may collaborate to organize short training courses for both the food handlers and consumers to create awareness among them about food hygiene and to reduce the consumption of fast foods in Saudi community.
- 5- The application of HACCP in food establishments and follow this issue by food department of food hygiene and food safety in Ministry of health in KSA.

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