

Community based Survey of Typhoid Fever in Fayoum, Egypt. Awareness, Assessment and Food Handlers' Appraisal

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1. Introduction:

1.1 Typhoid fever is considered to be a significant, systemic public health disease; caused by *Salmonella enterica* serotype Typhi (*Salmonella* Typhi) especially in countries with limited resources (Claire et al. 2014; Polonsky et al. 2012). The risk of infection is related to socio-demographic factors such as; poor sanitation and hygiene, which are associated with the unavailability of pure water supply (Vollard et al. 2004).

1.2 *S. Typhi* world-wide is estimated to cause 21 million new infections annually, which could result in severe complications such as; bleeding and perforation of the gastrointestinal tract that in turn may lead to 200,000–600,000 deaths (Buckle et al. 2012; Crump et al. 2004). Environmental sanitation techniques, such as ensuring water and food safety and vaccination at risk areas are the strategies approved by the WHO (World Health Organization) to control the disease (Crump et al. 2010; Ochiai et al. 2008).

1.3 The sustainable development goal 6.1 and 6.2 (SDGs) noted that by 2030, it will achieve universal and equitable access to safe and affordable drinking water for all, also will achieve access to adequate and equitable sanitation and hygiene for all and as well as paying special attention to the needs of women and girls and those in vulnerable situations (United Nations, 2016).

1.4 Food safety has been one of the paramount concerns in this century; because eating food prepared outside the home is a risk factor for foodborne diseases and has been responsible for nearly 70% of outbreaks (Mulgeta and Bayeh 2012; Chapman et al. 2010). Food handlers play an important role in ensuring food safety throughout the chain of production, processing, storage and preparation (Dozie et al. 2009). The global strategy of

the WHO is to decrease the risk of foodborne diseases and to train food handlers with simple health messages known as “The Five Keys to Safer Food” (WHO, 2006). These messages explain the basic principles for prevention of foodborne diseases, through understanding the chain of safety starting from farm (site of production) to table (site of consumption), as this was the theme of World Health Day 2015, which focused on demonstrating the importance of food safety right through the whole food chain (WHO, 2015).

1.5 Fayoum, nonetheless, stands among the consistently lowest ranking five governorates. In 2008, it reached 20th in Egypt's human development index and remained in this low position for several years. Such deteriorating situation is related to several factors, on top of them are high illiteracy rates and poverty. Strong traditional belief such as; early marriage, is closely connected to the rural community, especially to women and is still practiced in this area (Human Development Report, 2008).

1.6 This study aims to estimate the knowledge and awareness of Typhoid fever amongst the Fayoum community. It endeavours to assess the food handlers' practice and to evaluate the sanitary condition of food establishments.

2. Methods:

2.1 This research was a cross sectional descriptive study, conducted over a period of three months (April-June 2014) in Fayoum governorate, Egypt. Egypt ranks 108th out of 187 countries in the 2014 Human Development Index (HDI). There are many developmental challenges opposing Egypt, including that 26.3% of Egyptians live below the poverty line, and 28% of people aged 15 and older are illiterate (Human Development Report 2015). Fayoum is one of the 29 governorates of

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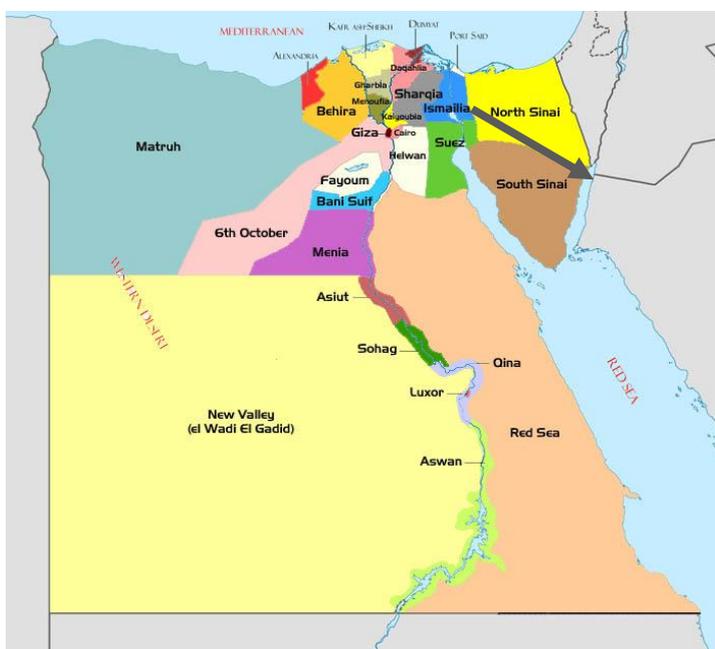
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Egypt, and one of the North Upper governorates. Fayoum governorate's total population is 2,511,027, according to the Egyptian census conducted in 2006. About 1,945,852 live in rural areas, while the other 565,175 live in urban areas. About (22.5%) of the Egypt population is categorised as living in urban areas, with the rest in rural communities.

2.2 In Egypt, incidence estimates have been derived primarily from hospital-based surveillance, which may not be a true representation of the population with typhoid fever. In 2010, the estimated incidence of typhoid fever was calculated to be 7 cases per 100,000 persons (per year) (National bulletin for communicable diseases, 2011). However, according to a study conducted in Fayoum in 2006, the estimated incidents of typhoid fever were 59 cases per 100,000 persons (per year) (Srikantiah et al. 2006).



Map for Egypt (Fayoum governorate)

2.3 In order to achieve our objective of gaining knowledge concerning Typhoid fever amongst the Fayoum community, we used multistage cluster systematic random sampling to select the study population. The first stage, Fayoum Governorate was divided into 6 districts: Fayoum, Etsa, Sinnuris, Tamiya, Abshoay, and Youssef Sadiek. We chose Fayoum district because it is the largest district representing (27.7%) of the total population, and has characteristics of both urban and rural populations based on the last CAPMAS (Central Agency for Public Mobilization and Statistics) report 2006 (CAPMAS, 2006).

2.4 The second stage, we chose four primary health care (PHC) facilities; two rural PHC units named Seila and Demo, and two urban PHC centres named El-Hadah and El-Sheik Hassan were selected, based on their adjacent geographical location. Three days per week were selected to collect data based on outpatients' clinic schedule from 8 o'clock am to 2 o'clock pm; data was collected from paediatric, internal medicine and endemic disease clinics.

2.5 The third stage was to choose population from different clinics by systematic random sampling (i.e. every third person). Participants were required to answer the questionnaires on the spot, which were subsequently collected after completion. A total of 1500 questionnaires were distributed; 1441 participants completed their questionnaires. A pre-prepared, structured questionnaire form was developed in Arabic after reviewing a myriad of international researches and questionnaires to cover the study objective.

2.6 The validity of the questionnaire was tested by experts in the field of epidemiology and statistics with focusing on simplicity and precision in the words of questions, and to what extent questions achieved objectives. The questionnaire was then piloted with 50 respondents for its acceptability and reliability. The questionnaire form was then edited (rewording along with addition and deletion of some questions). For assessment of internal consistency, Cronbach's alpha was used with $\alpha = 0.80$.

2.7 The questionnaire consisted of two main parts: initially, socio-demographic items were collected, such as age, gender, residence, educational status, occupation, monthly income, household crowding index. The household crowding index (HCI) was defined as the total number of co-residents per household, excluding the new born infant, divided by the total number of rooms, excluding the kitchen and bathrooms. The continuous variable was re-grouped into three distinct categories: (1) <1, (2) 1-2, and (3) >2 residents per room.

2.8 The second part addressed knowledge of typhoid fever through 8 questions including; if typhoid fever is an infectious disease and if it has a genetic element, also it consisted of questions assessing knowledge about acquisition of the disease; through eating contaminated food, drinking infected water, role of flies and insects in the transmission of typhoid fever, the importance of food handlers and hand contact with patients in the spread of typhoid fever, and if vaccine for typhoid fever exists. Finally source of knowledge was identified. The knowledge scores were determined by counting the number of correct answers on Typhoid fever as a score, on a scale of 0-16. Each correct answer was scored as 2,

'I don't know' was scored as 1 and an incorrect answer was scored as 0.

2.9 The mean score was used as the cut off point for defining good or poor levels of knowledge. Participants awarded an average score or above were considered to have good knowledge, whilst participants who registered below the mean score were deemed to have poor knowledge.

The food service establishments were randomly chosen according to the different types of food being served [fast food, traditional (Tamiya, Koshari), oriental (meat, poultry) and Fish]. The size of the establishment (small, and medium sized) was taken into consideration. Selection of food establishments in the study went through multiple stages, first stage was stratified random sample according to type of food, and second stage was systemic random sample after listing food establishments in each food type (i.e. every fourth establishment).

3. The sanitary condition of the facility was evaluated by an observational checklist based mainly on the Codex Alimentarius General Principles of Food Hygiene (FAO and WHO 2009), as observed by the researcher at the time of visit. All the facilities under study was checked for 18 items; the status of cleanliness and maintenance of the premises (floors, walls, ceilings, lighting, ventilation, insect protection), condition and cleanliness of the equipments, cleanliness of surfaces, presence of sanitary facilities with drainage system, presence of safe water supply, presence of refuse respectable, if respectable are tightly covered and finally presence of separate room for clothing, resting and placing of clothes for workers. A scoring system was formulated and utilised as follows: one point if the item was present, and none if the item was absent. A total score and respective percentages were calculated with a maximum score of **18** points. The observational checklists were filled from 72 small to medium-sized food businesses in Fayoum.

3.1 A pre-prepared self-administered structured questionnaire was used to assess the food handlers practice at their work place, with a total of 113 food handlers in Fayoum Governorate. The questionnaire was thus divided into two main parts; the first part was with reference to personal hygiene & protection in 12 items with respect to hand washing before work beginning, hand washing during work when needed, hand washing after coming out from bathroom, nail cleaning, checking cleanness of clothes, wearing hair cover, wearing gloves, not eating or smoking during work, not licking finger during work, periodic examination and taking vaccinations, presence of a health license for work and finally checking self-health condition (fever, diarrhea, injury) every

working day. The second part was in relation to the safety of raw food used during preparation, cooking and storage in 9 items as following; checking safety of raw foods, checking safety of canned foods, washing fresh vegetables and fruits before use, no foods or utensils on the kitchen floor, thawing food as much as a need, cooking it immediately and properly, if not cooked storing it in refrigerator after thawing, checking safety of foods before refrigeration, checking and verifying whether temperatures of refrigerators and freezers are appropriate. The three points Likert Scale was used as each question comprised of three choices (always, sometimes, and never) and the respondents who answered 'always' scored 2 marks, 'sometimes' 1 mark, and 'never' zero marks. The maximum obtainable score for practice measures was 42.

4.Data entry and statistical analysis:

Data were collected, coded and analysed using SPSS (Statistical Package for Social sciences) software (Version 18) on Windows 7, and a simple descriptive analysis in the form of percentage distribution, means and S.D. (Standard Deviation) was executed. The first step is to test normality of data to select the suitable techniques in statistical analysis. Categorical data was analysed by computing percentages, and consequent differences were tested statistically by applying chi square tests for comparisons between groups; students' T-test to compare between two groups, and ANOVA (Analysis of variance) test to compare more than two groups of quantitative variables, a p-value of <0.05 was considered statistically significant. Forward step-wise logistic binary regression analysis using "Wald" statistics was done to control confounders and identify the related factors to poor knowledge about typhoid fever among general population. Independent variables were regressed on dependent variable that was knowledge (poor =1, good=0). Estimated relative risk or odds ratio (OR) and confidence interval (95%) were estimated for each independent variable.

5. Results

5.1 This study was conducted on 1441 community members who agreed to completely fill the questionnaire from with a response rate of 96.1%. Their ages ranged from 15 to 70 years old with a mean of 32.8 ± 14.3 years old. 55.0% were males. Inhabitants of rural areas numbered 36.2% while 63.8% were from urban areas. The household crowdedness index (HCI) was 87.4% equal to or less than 2, while 12.6% had crowdedness index > 2 . With regards to education, 16.9% received primary or preparatory school education, 31.1% attained secondary school education, 40.9% achieved university education, and 11.2% were currently being

educated. The occupation of people in the study group was as follows: 37.8% were not working, 34.8% were employed as clerks (administrative) or were manual workers (carpenter, plumber...), and 16.2% had a professional occupation (doctor, engineer, professor...), and 11.2% were still students.

5.2 With respect to knowledge of the study group about Typhoid fever, the mean score was 10.97 ± 3.14 with a range from 0 to 16. Out of the study population, 57.7% had good knowledge while 42.3% had poor knowledge. Most of them, i.e. 64.9% were aware that typhoid fever is an infectious disease. Also, the majority i.e. 74.5% were aware that Typhoid fever could be transmitted by eating contaminated food, and 66.1% knew that it could be transmitted by drinking infected water. In addition, 56.6% of participants implied the role of flies and

insects in the transmission of typhoid fever. However, a compelling number of 49.7% and 35.5% denied, or did not know the importance of food handlers and hand contact with patients in the spread of typhoid fever respectively. More than half of the study group i.e. 56.6% mentioned that a vaccine for typhoid fever exists.

5.3 Regarding knowledge about typhoid fever, there was a statistically significant association with residence, crowdedness index, education, and occupation, ($P < 0.0001$, < 0.0001 , < 0.0001 , and 0.008) respectively. Poor knowledge was prevalent among rural residents 52.9%, participants with high crowding index >2 , 62.4%, primary and preparatory school 58.4%, and not working 45.7% as shown in Table (1).

Table (1): Relation between Knowledge of Participants regarding Typhoid fever and Socio-demographic Characteristics

Variables	Good (N=831)		Poor (N=610)		P-value
	Mean	SD	Mean	SD	
Age					
Mean \pm SD	33.1	14.7	32.4	13.7	0.306
Variables	N	%	N	%	P-value
Sex					
Male	451	56.9	342	43.1	0.499
Female	380	58.6	268	41.4	
Residence					
Rural	246	47.1	276	52.9	<0.0001*
Urban	585	63.7	334	36.3	
Crowdedness index					
≤ 2	654	51.9	606	48.1	<0.0001*
> 2	68	37.6	113	62.4	
Education					
Primary and Preparatory school	101	41.6	142	58.4	<0.0001*
Secondary schools	240	53.6	208	46.4	
University education	388	65.9	201	34.1	
Currently educated	102	63.4	59	36.6	
Occupation					
Not working	296	54.3	249	45.7	0.008*
Employee & manual workers	279	55.7	222	44.3	
Professional occupation	154	65.8	80	34.2	
Student	102	63.4	59	36.6	

*P <0.05 is considered significant.

Age in mean and SD, other variables in number and percentage

5.4 All study participants had heard about Typhoid fever from different sources; dealing with Typhoid fever patients was a common source of information among 25.1% of survey participants, followed by mass media (TV/Radio) 23.2%, multiple sources of

information 20.8%, reading 20.2% and lastly information received from friends 10.7%.

5.5 As shown in Table (2), multivariate logistic regression analysis determined that there was about 100% increase risk of poor knowledge about typhoid

fever when the participant was unemployed or worked in a manual occupation [OR-1.32 (95% CI 1.04; 1.70)], also having low education had about

200% increase risk of poor knowledge [OR 2.04-95% CI (1.53; 2.72)].

Table (2): Multiple Logistic Regressions factors associated with poor knowledge of general population about Typhoid fever

Factors	Significance	Estimate relative risk (95 % CI)
Knowledge regarding typhoid fever		
Occupation (not working & manual vs. Others)	0.026	1.32 (1.04-1.70)
Education (low vs. high education)	<0.0001	2.04 (1.53-2.72)

5.6 A total of 72 food establishments were visited to study the sanitary conditions. Table (3) revealed that the mean score for observation was 10.55 ± 3.58 out of maximum score 18 points. There was a statistical highly significant difference between establishments located in urban and rural areas (mean value was

lower in rural than in urban areas), as well as those serving traditional and fast foods versus others (P-value= 0.033 and 0.001 respectively). On the other hand, public places had a lower score than private ones but the difference was not statistically significant (P= 0.606).

Table (3) Observation score and relative percentages of food establishments in relation to place, ownership pattern and type of food

Variables	Observation score		P-value
	Mean	SD	
Total	10.55	3.58	
Place of work			
Urban	10.78	3.61	0.033*
Rural	8.36	2.54	
Ownership pattern			
Public	10.31	3.84	0.606
Private	10.68	3.46	
Type of served food			
Oriental	12.52	4.04	0.001*
Traditional	8.62	3.59	
Fast	10.29	2.83	
Fish	13.17	5.15	

*P <0.05 is considered significant.

5.7 A total of 113 food handlers working at selected food establishments were interviewed to assess their practices. Table (4) showed that the mean score of practice was 27.26 ± 8.55 out of 42 points. In comparison with practice scores, there was a statistical highly significant difference between food handlers working in urban and rural areas (mean

value was lower in rural than in urban areas), as well as those working at establishments which served traditional and fast food versus others (P-value < 0.0001). On the other hand, food handlers working at public places had a lower score than those working at private places, but the difference was not statistically significant (P= 0.090).

Table (4) Practice of food handlers about typhoid fever according to place, owning pattern and type of food

Variables	Practice score		P-value
	Mean	SD	
Total	27.26	8.55	
Place of work			
Urban	28.25	8.29	<0.0001*
Rural	18.18	5.08	
Ownership pattern			
Public	25.38	9.39	0.090
Private	28.26	7.97	
Type of served food			
Oriental	32.95	8.39	<0.0001*
Traditional	21.76	6.21	
Fast	26.49	7.96	
Fish	35.00	6.99	

*P <0.05 is considered significant.

6. Discussion:

6.1 The risk of Typhoid fever infection is related to various socio-demographic factors such as poor food and water sanitation, a poor standard of personal hygiene (Vollard et al. 2004) and the lack of knowledge amongst community members (Hatta et al. 2009). The current study was conducted to provide information on Typhoid fever related knowledge amongst the Fayoum community. It also focussed on the sanitary conditions of some food establishments and the practice of food safety among food handlers.

6.2 The present work revealed that all participants knew about typhoid fever. This finding was higher than the reported figure from Tanzania, in which 87.5% of the respondents were aware of the typhoid fever disease (Malisa and Nyaki 2010). Our research established that their main source of information was through meeting a person who had contracted the disease 25.1%, followed by mass media (TV/Radio) 23.2%. This finding probes the limited role of mass media in shaping people's awareness and level of knowledge regarding typhoid fever in our community. Comparable findings were reported in Naqqash et al. (2014) which stated that 39.0% of the surveyed people got information about typhoid fever from personal experience.

6.3 With regard to knowledge of study participants about the typhoid fever disease, our work showed that 57.7% had good knowledge. This finding was lower than a cross-sectional survey in Pakistan which established that 69.2 % of the surveyed population had good information about typhoid fever (Khan et al. 2005).

6.4 In relation to the mode of transmission of typhoid fever, the current study showed that 74.5% and 66.1% of participants were aware that typhoid fever

could be transmitted by eating contaminated food and water respectively. These results are in accordance with findings of a cross-sectional survey conducted on female university students in Pakistan which showed that most of the students knew that typhoid fever could spread by consuming contaminated food 71% and by drinking contaminated water 74%. However, an important proportion 49.7% of our study population was ignorant of the role of food handlers in the transmission of typhoid fever. In contrast to our results, only 39% of female university students in Pakistan displayed a high awareness about the food handler risk during disease transmission (Khan et al. 2005), this difference in the results is due to the difference in the age; knowledge of the participants and also different in methods of conducting the study.

6.5 On the other hand, 42.6% of the study population did not take care about the personal hygiene of food handlers. Thus, improving knowledge about typhoid fever is an effective public health strategy for nurturing favourable attitudes, which can be considered a step forward in behavioural changes for more healthy practices.

6.6 The knowledge and awareness of our study population was significantly affected by the level of education and employment status. This was in agreement with a study conducted in rural areas in Qalyubia Governorate, Egypt which detected that there was a noteworthy relation between ones educational level and having adequate knowledge about the disease (Abdel Hamid, 2011). In contrast to our findings, a study conducted in Lusaka, Zambia (Passmor, 2011) showed that the level of education did not affect the level of knowledge regarding typhoid fever. This difference is attributed to the variation of the method and tool between different studies.

6.7 With respect to sanitary conditions in food establishments, results of this work revealed that the observation score was low (10.55 ± 3.58 out of maximum 18 points). The score was even lower in establishments that served traditional and fast foods versus others. These places were frequented by a large segment of people of different social classes which further increased the risk of contracting typhoid fever among them.

6.8 Furthermore, the results of the current study indicated that food handlers may have low mean practice score (27.26 ± 8.55 from maximum 42 points). Similar figures were reported from Turkey, as mean practice score of studied food handlers was 48.4 ± 8.8 from 100 possible points. Our results also demonstrated that the practice score was lower among food handlers who serve traditional and fast foods versus others. Comparable results were shown in a Turkish study, in which food handlers at takeaway establishments had a lower score than in other establishments (Bas et al. 2006).

7. Conclusions:

7.1 This study displayed good knowledge of Fayoum community members for the typhoid fever. However, more than two-thirds of them remained ignorant to the fact that food handlers play an integral role in the spread of the disease. The practice of food handlers that were working in urban and private establishments was better than those who were working in public and rural areas.

7.2 This study recommended, conduction of the health education campaigns to the general population; for raising their awareness about the spread of typhoid fever, to ensure proper prevention of the disease. As well as, regular supervision of the food establishments, which ensures the safety of food preparation by governmental authorities. This can be done; through process checklist for each activity designed according to the results of the study. Moreover, obligatory basic food hygiene training courses, for food handlers, must be established on a regular basis allowing them to update their professional license.

8. Ethics:

This study was reviewed and approved by the Fayoum University-Faculty of Medicine (Research Ethical Committee). The official approval was procured from the directors of health facilities and food establishments.

9. Consent to participate:

The study was conducted after explaining its objectives and all confidentiality was conveyed to the participants. Verbal assents were taken from participants before distributing the questionnaire then

written consent obtained. All participants had the right to not participate in the study.

10. Declaration:

The authors declare that this manuscript did not previously publish or considered for publication in any other journal. The authors do not hold any stocks or shares, fees, funding or salary from any organization that may in any way gain or lose financially from the publication of this manuscript, either now or in the future.

11. List of Abbreviations:

- S. Typhi: Salmonella Typhi
- WHO: World Health Organization
- MDGs: Millennium Development Goals
- HDI: Human Development Index
- CAPMAS: Central Agency for Public Mobilization and Statistics
- PHC: Primary Health Care
- HCI: Household Crowding Index
- SPSS: Statistical Package for Social Sciences
- SD: Standard Deviation
- ANOVA: Analysis of variance
- OR: Odds Ratio
- CI: Confident interval

12. Competing Interests: There is no conflict of interest as there are no commercial or financial relationships from any institution or organization that could be construed as a potential conflict and all the expenses are covered by the authors.

13. Consent to Publish: Not applicable

14. Availability of data and materials:

All the data are available on an excel sheet and also SPSS format and if needed the corresponding author is welcome to send it upon request.

15. Authors Contributions:

NE: conceived the study, design; carried out the questionnaire design, made the pilot testing of the questionnaire, and shared in drafting, editing and revision of the manuscript. MM: calculation of sample size, participated as interviewer of the questionnaire (data collection), performed statistical analysis and shared in drafting the manuscript. AY: participated as interviewer of the questionnaire (data collection), performed statistical analysis and shared in drafting the manuscript. All authors read and approved the final manuscript.

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food handlers that allow us to take of their time and attention.

17. Key points:

- People are working in food establishments, do not know about the safety measures of food or did not have the facilities to ensure the safety of the food during preparation, there is no training program for food handlers and any one can work in food processing especially in rural areas.
- We do not currently have health education program to increase awareness about the potentiality adverse effect of some infectious diseases.
- So it is a very important issue to be studied in our community to take our culture results to implement a public health strategy at the level of the PHC units and to increase awareness about the health hazards as it is more common in our rural community.

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