Prevalence and Effectiveness of an Education Program on Intestinal Pathogens in Food Handlers

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Objectives : *To assess the prevalence of intestinal pathogens and the effectiveness of an education program in food handlers in a tertiary care hospital.*
Material and Method : *The prevalence of intestinal pathogens in food handlers was done by stool cultures for bacteria and microscopy for parasites. Treatment was given to those who had a positive stool examination. An education program on the acquisition of the pathogens and their prevention were given by lecture and distribution of handouts. Efficacy of the education program was evaluated by assessing the knowledge and the presence of pathogens before and after the education program.*
Results : *The study was done from January 2002 to March 2004. Risk factors for acquiring intestinal pathogens among food handlers were high regarding education level, housing, food hygiene and personal hygiene. Diarrheal diseases were common in food handlers and their relatives. Before the education program, 40.8% had intestinal pathogens, bacteria and parasites in almost similar proportions. Most common bacteria were Vibrio parahemolyticus, Plesiomonas shigelloides and Salmonella spp.; Blastocystis hominis, Giardia lambria and Endolimax nana were the frequently found intestinal parasites. Food handlers with the pathogens in stool were treated. After the education program subsequent investigation showed a significant reduction in stool pathogens and parasites but their knowledge and hand hygiene practice did not improve.*
Conclusion : *The present study showed a high prevalence rate of intestinal pathogens in food handlers of a tertiary care hospital. The education program failed to improve their knowledge and hand hygiene practice for the prevention of the pathogens.*

Keywords : *Intestinal pathogens, Food handlers*

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Diarrhea is a common nosocomial infection in developing countries. In Thailand, it is the 4th to 5th in rank[1,2]. It can be estimated that there were about 40,000 cases of nosocomial diarrhea with 2,000 deaths and an economic burden of 400 million baht (10 million U.S. dollar) per year.

The main cause of nosocomial diarrhea is the consumption of contaminated water and food. The latter can be contaminated with pathogens or their toxins in growing fields, shops, packaging, transportation, storage, cooking and serving to patients. Food handlers are responsible for the hygiene of the food served in hospitals. They must choose the proper materials and avoid contamination in the cooking process. Any contamination of raw materials, equipment and utensils, or the hands of food handlers can result in a major outbreak of food poisoning in hospitals[3]. Food handlers with infectious diarrhea and asymptomatic carriers may contaminate food with the pathogens that subsequently infect patients[4,5]. If a kitchen employee carries an enteric pathogen and he does not comply with hand hygiene guideline, the chance the food will be contaminated is high. The authors studied the prevalence of enteric bacteria and parasites in food handlers

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in a tertiary care hospital. The efficacy of an education program to reduce the pathogens in their stool was also evaluated.

Material and Method

The study was done from January 2002 to March 2004 in a tertiary care hospital in Thailand. The kitchen employed about 200 workers, most of them were temporarily-hired personnel. A consent form was distributed to all and those who volunteered to this project were asked to sign. The study was endorsed by the Ethic Committee on Research of the hospital. A set of questionnaires was sent to the workers. They were requested to submit their stools for examination, 1 specimen per month for 6 consecutive months. Those who had pathogens were treated as appropriate. At the end of the 6th month, an education program on the prevention of diarrhea was given by lecture and handouts. During the 13th and 18th months, the subjects were requested to send their stools monthly for 6 months for examination. The study by the same set of questionnaires was repeated at the 24th month.

Identification of enteric bacterial pathogens was done in the microbiology laboratory of the hospital. Blood agar was used to identify *Staphylococus aureus*, S.S. and MacConkey agars for *Salmonella* and *Shigella* spp. and T.C.B.S. agar for *Vibrio* species. Both direct plating onto the agars and culturing in GN broth and alkaline peptone prior to plating were done. Identification of bacterial pathogens was done by conventional methods[6]. Parasites were identified by microscopy.

Data analysis was performed using SPSS Version 10.0(SPSS, Chicago, IL). Categorial variables were compared using Chi Square Test or Fisher Exact test. All P values were two tailed; $P<0.05$ was considered statistically significant.

Results

Pathogens in stools were found as high as 40.8% of food handlers before the education program (Table 1). Pathogenic enteric bacteria were accountable for 18.4%, parasites 21.1% and both bacteria and parasites 1.3%. After the education program, positive stool examination fell to 26.4% ($p = 0.01$) and parasites decreased to 8.5% ($p = 0.002$). However, the reduction of pathogenic bacteria in the stool was not statistically significant ($p = 0.684$). *Vibrio parahemolyticus* was the most common bacteria in the pre-education period (31.4%) and *Plesiomonas shigelloides* in the post-education period (58.6%). Other common bacteria were *Salmonella* spp, *Vibrio fluvialis* and *Aeromonas* spp. It is notable that *Vibrio cholerae* Non-01 were also isolated in both periods and *Vibrio cholerae*, Eltor enaba were found in the pre-education stool samples (Table 2).

Table 3 demonstrates the parasites in stools of the food handlers. *Blastocystis hominis* was the most common parasite, accountable for 42.1% and 50.0% of all parasites in the pre-and post-education periods respectively. Other important parasites were *Giardia lambria*, *Endolimax nana*, *Trichomonas hominis*, *Strongyloides stercolaris* and *Entameba coli*. Hand hygiene practices of the subjects were not appropriate in a high proportion. Less than 60% washed their hands before meals; and about 15% did not wash their hands after passing stools. Not all who washed their hands ever used soap (Table 4). Knowledge in infectious diarrhea assessed by a set of questionnaires, the results are shown in Table 5. Scores of over 75% were considered good. It is interesting that only 18% of food handlers knew the route of entry of intestinal pathogens. Very few knew about the vectors of diarrhea disease, how to prevent diarrhea at home and how to prevent food contamination at work. Their knowledge did not improve after the education program. Diarrhea is a common illness in these food handlers (Table 6). During 3 months before answering the questionnaires, about one third of food handlers had diarrhea, in many, more than one episode. The incidence of diarrhea was twice as high in their spouses and other family members.

Discussion

Nosocomial diarrhea is a common complication, especially in developing countries. Food served in hospitals can be contaminated by pathogens in raw material, during preparing and delivery processes. Food handlers are directly responsible for the prevention of food contamination. They should be free of enteric pathogens and should strictly adhere to proper hand hygiene practices[7,8]. Epidemics of food borne illness have been frequently reported[3,9-11]. In some outbreaks, they were associated with the identification of the same pathogens in stools of food handlers[3,4,12]. They should be screened for these pathogens and infected or carrier staff should refrain from preparation or delivery of food[7,8].

The present study signifies the magnitude of problems of intestinal pathogens in food handlers in a tertiary hospital. Up to 40 per cent of food handlers had pathogens in their stool (Table 1). Pathogenic bacteria and parasites were discovered in similar propor-

tion. *Vibrio* species were the most common isolates in pre-education period and *Plesiomonas shigelloides* in the post-education period (Table 2). It is notable that *Vibrio* cholerae Eltor enaba were isolated and the food handlers were working on the days they submitted stool samples. They might be asymptomatic carriers or they had less severe symptoms for job leave. Parasites were found in many of the food staff. *Blastocystis hominis* was the predominant parasite (Table 3). An education program on diarrhea regarding causative agents, food and water contamination, symptoms, prevention and appropriate practices in hospital kitchens was given by lecture and distribution of handouts. Follow-up stool examination showed a significant decline in total pathogens and parasites in stools after the education program (Table 1). Even so, upto 26.4% of nutrition staff had enteric pathogens acquired during 6-12 months in the post-education period. This reflects a high incidence of acquiring these pathogens among the subjects. The personnel responsible for food preparation and delivery were mostly temporary employees with low socio-economic and education backgrounds. Their knowledge in health, especially that related to their job was very limited (Table 5). The education program failed to improve their knowledge in diarrhea and its prevention. Their hand hygiene practices did not improve after the education program (Table 4). With a high percentage of haboring enteric pathogens in stools

Table 1. Intestinal pathogens in food handlers before and after the education program (%)

Intestinal Pathogens	Before (N=152)	After (N=129)	p-value
Bacteria	18.4	17.8	0.980
Parasites	21.1	8.5	0.005
Bacteria+Parasites	1.3	-	-
Total	40.8	26.4	0.016

Table 2. Bacterial pathogens in stools before and after the education program (%)

Bacteria	Before (N=28)	After (N=28)
Vibrio parahemolyticus	31.4	17.2
Plesiomonas shigelloides	17.1	58.6
Solmonella spp.	17.1	6.9
Vibrio fluvialis	11.4	10.3
Aeromonas spp.	8.6	3.5
Vibrio cholerae Non-01	5.7	3.5
Vibrio cholerae Eltor enaba	5.7	-
Plasiomonas trota	2.9	-

Table 3. Parasites in stools of the food handlers before and after the education program (%)

Parasites	Before (N=32)	After (N=11)
Blastocystis hominis	42.1	50.0
Giardia lambria	13.2	-
Endolimax nana	13.2	16.7
Trichomonas hominis	7.9	8.3
Strongyloides stercolaris	7.9	8.3
Entameba coli	5.3	16.7
Hookworm	2.6	-
Taenia spp.	2.6	-
Opisthorchis viverini	2.6	-
Dientameba fragilis	2.6	-

Table 4. Hand hygiene practice in food handlers before and after the education program (%)

Handwashing	Before (N=56)	After (N=72)	p-value
Before eating	57.1	54.2	0.882
Use of soap	46.4	37.5	0.405
After passing stools	83.9	86.1	0.923
Use of soap	53.6	48.6	0.702

Table 5. Knowledge in infectious diarrhea before and after the education program (%)

Knowledge	Before (N=56)	After (N=72)	p-value
Route of entry of pathogens	17.9	26.4	0.354
Route of spread of pathogens	73.2	81.9	0.335
Vectors	10.7	4.2	0.281
Prevention at home	23.2	15.8	0.364
Prevention of food contamination at work	28.6	27.8	0.922

Table 6. History of diarrhea in the past 3 months before and after the education program (%)

Diarrhea	Before (N=56)	After (N=72)	p-value
Food handlers	33.9	30.3	0.837
Spouse	66.1	61.1	0.691
Other family members	62.5	79.2	0.059

combined with a low percentage of handwashing practice, the chance of contaminating food by these nutrition staff is conceivable. Diarrhea is a common illness among the food handlers and their family members (Table 6). Efforts should be made to better educate these food handlers on the prevention of diarrhea if the food hygiene in hospital is to be improved. Frequent stool screening, educating, auditing their performance are all needed.

Conclusion

Enteric pathogens were found in a high percentage of food handlers in a tertiary care hospital. Low socio-economic and education level were contributory factors in acquiring these pathogen. The education program failed to improve their knowledge in diarrhea and hand hygiene practice. Other approaches are to be sought.

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อัตราชุกและผลของการให้การศึกษาเกี่ยวกับเชื้อก่อโรคระบบทางเดินอาหารของบุคลากรฝ่ายโภชนาการ

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วัตถุประสงค์ : *ศึกษาอัตราชุกของการติดเชื้อก่อโรคระบบทางเดินอาหารและผลของการให้การอบรมแก่บุคลากรฝ่ายโภชนาการในโรงพยาบาลตติยภูมิแห่งหนึ่ง*

วัสดุและวิธีการ : *ตรวจเชื้อก่อโรคในอุจจาระโดยการเพาะหาเชื้อก่อโรคและตรวจหาพยาธิโดยใช้กล้องจุลทรรศน์ ผู้ที่มีเชื้อก่อโรคจะได้รับยาเพื่อขจัดเชื้อ การให้การศึกษาเกี่ยวกับโรคอุจจาระร่วงโดยเฉพาะการป้องกันการรับเชื้อและถ่ายทอดเชื้อ กระทำโดยการบรรยายและแจกเอกสาร ประเมินประสิทธิผลของการให้การศึกษาโดยเปรียบเทียบความรู้และเชื้อในอุจจาระในช่วงก่อนและหลังให้การศึกษา*

ผลการศึกษา : *การศึกษาระหว่างเดือนมกราคม พ.ศ. 2545 ถึงมีนาคม พ.ศ. 2547 ปัจจัยเสี่ยงต่อการได้รับเชื้อก่อโรคในหมู่บุคลากรนี้มีสูงทั้งด้านความรู้, ที่อยู่อาศัย, ความสะอาดของอาหารและสุขลักษณะส่วนตัว โรคอุจจาระร่วงพบได้บ่อยในบุคลากรและสมาชิกในบ้าน ก่อนให้การศึกษา, ร้อยละ 40.8 ของบุคลากรมีเชื้อก่อโรคโดยเป็นแบคทีเรียและพยาธิในสัดส่วนใกล้เคียงกัน. แบคทีเรียที่พบบ่อยคือ Vibrio parahemolyticus, Plesiomonas shigelloides และ Salmonella spp. ส่วนพยาธิที่พบบ่อยคือ Blastocystis hominis, Giardia lambria และ Endolimax nana. ผู้ที่พบเชื้อจะได้รับการรักษาด้วยยาที่เหมาะสม หลังให้การศึกษา, พบเชื้อก่อโรคและพยาธิในอุจจาระลดลงอย่างมีนัยสำคัญ แต่ความรู้และพฤติกรรมการล้างมือไม่ดีขึ้น*

สรุป : *การศึกษานี้พบเชื้อก่อโรคระบบทางเดินอาหารของบุคลากรฝ่ายโภชนาการในโรงพยาบาลตติยภูมิแห่งหนึ่งในอัตราสูง การให้การศึกษาไม่ทำให้ความรู้และพฤติกรรมล้างมือดีขึ้น*