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Personal hygiene and behavior among cake bakeries in cake making plants in Gaza Governorate, Gaza Strip

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***Abstract**: In Personal hygiene and behavior among 90 cake bakeries in cake making plants in Gaza Governorate, Gaza Strip were assessed. A cross section of cake bakeries was asked to fill in a questionnaire. Data were computer analyzed using SPSS/PC statistical package version 18.0. Descriptive statistics, Chi-square ($\chi 2$) and Yates's continuity correction test, $\chi 2$ (corrected) were applied. The mean age of cake bakeries was 29.9±8.7 years. None of bakeries was illiterate and 71 (78.9%) of them were smokers. Fifty two (57.8%) of cake bakeries were not trained. Health status of bakeries showed that 11 (12.2%) stayed at work while they have been infected. Regarding personal cleanliness, 20 (22.2%) of bakeries changed their dress when it becomes dirty. Fifty four cake bakeries (60.0%) claimed that they wear gloves during work. Good personal hygiene in respect to hand washing was reported. Personal behavior showed that 13 (14.4%) bakeries wear rings during work. Eight (8.9%) admitted smoking, spotting and eating in the area of the work. Training seems to have a positive influence on personal hygiene and behavior among cake bakeries and this interaction was statistically significant for stay at work in case of infection ($\chi 2$ corrected=4.198, P=0.040), changing dress when dirty ($\chi 2$ =5.469, P=0.019) and wearing gloves ($\chi 2$ =5.132, P=0.023). Most bakeries admitted that the cake making plants have smooth and easily cleaned floor, enough ventilated and well lightened. Bakeries' response on water facility revealed that plastic water tanks were commonly used (85, 94.4%), and changing and disinfecting them were frequent (81, 90.0%). Seventy two (80.0%) bakeries mentioned that plant tools are made of stainless steel and 88 (97.8%) stated that they were smooth.*

***Key words:** Hygiene and behavior, cake bakeries, Gaza Strip.*

Introduction

Human handling of food may be the source of pathogenic microorganisms in foods that later caused food borne diseases, especially with ready to- eat foods. Poor personal hygiene contributes largely to such diseases and contaminated hands may be the most important means by which enteric viruses are transmitted [1,2]. The presence of minor cuts and infection in hands and face and mild generalized diseases can amplify the situation. Infected food handlers are the source of most reported food borne outbreaks [3].

Pathogens of all kinds can be also transferred to food through inadequate personal behavior. It was recommended that people engaged in food processing should avoid any behavior that could result in food contamination [4]. Smoking, spitting, chewing or eating, sneezing or coughing directly over food is unacceptable because it increases the probability of contamination. Personal effects such as jewelry, watches and pins should not be worn or brought into food handling areas if they pose a threat to the safety and suitability of food.

Cake making plant should be located, constructed and maintained according to sanitary-design principles. Adequate ventilation system and natural or artificial lighting should be provided to enable the undertaking to operate in a hygienic manner [5]. Food contact surfaces in the cake plant are a particularly important potential source of contamination, and sanitation (cleaning and disinfection) is the major day-to-day control. However, food residues on that surfaces during production can provide the opportunity for microbial growth, which could then be a source of recontamination to the product [6,7].

Although the incidence rate of food poisoning that caused by microbial contaminated food was estimated at 27.1 per 100.000 in the year 2005 in Palestine [8], there are no data on personal hygiene and behavior among cake bakeries in cake making plants in the Gaza Strip. Cake plant environment was also not investigated before. Therefore, this is a pioneer study on such issue that may develop a solution based on scientific research findings, as well as putting forward recommendations that help in improving food hygiene and safety.

Subjects and Methods

Study design and target population

This investigation was a cross sectional study. The target population was cake bakeries in cake making plants in Gaza Governorate of the Gaza Strip. The workers who did not meet the criterion of being involved in the work in the cake making plants during the 6 months period from January to June, 2008 were excluded. For ethical consideration, the necessary approval to conduct the study was obtained from Helsinki committee in the Gaza Strip.

Sample size and sampling

The estimated number of cake making plants registered in Gaza Governorate in the year 2008 was 34 distributed in various suburbs of Gaza Governorate of the Gaza Strip (Gaza Municipality, Personal Communication). The estimated total number of workers in these cake plants was around 130 workers. A convenient sample size of 90 cake workers was randomly selected from these plants at a rate of 2 or 3 workers/plant based on the number of workers in each plant.

Questionnaire interview

A meeting interview was used for filling in the questionnaire. All interviews were conducted face to face by one investigator himself. This will minimize the source of error and bias. The questionnaire was designed according to the recommended code of good manufacturing practice [4]. The questionnaire was validated by six specialists in the fields of food safety and control, environment and public health, and most of their notes were followed. Most questions were one of two types: the yes/no question, which offers a dichotomous choice; and the multiple choice question, which offers several fixed alternatives [9]. A questionnaire was piloted among 10 bakeries not included in the sample, and modified as necessary for improving reliability. The questionnaire included questions related to: personal profile such as age, gender and education; work experience and training; personal hygiene such as health status and personal cleanliness; personal behavior; and cake plant facilities.

Data analysis

Data were computer analyzed using SPSS/PC (Statistical Package for the Social Science Inc. Chicago, Illinois USA, version 18.0) statistical

package. Simple distribution of the study variables and the cross tabulation were applied. Chi-square (χ^2) was used to identify the significance of the relations, associations, and interactions among various variables. Yates's continuity correction test, $\chi 2$ (corrected), was used when not more than 20% of the cells had an expected frequency of less than five and when the expected numbers were small [10]. The result was accepted as statistically significant when the p-value was less than 5% ($p<0.05$).

Results and Discussion

Personal profile of the study population

Table 1 shows that the age of the cake bakeries (n=90) ranged between 19 and 60 years with mean age ±SD 29.9±8.7 years old. Almost all the study subjects were males 89 (98.9%). This could be attributed to cultural reasons where females are not engaged in such activities in our society. Analysis of the educational status of the cake bakeries showed that 19 (21.1%) had a university degree, 37 (41.1%) had finished secondary school, 25 (27.8%) had finished preparatory school, and 9 (10.0%) had passed primary school.

Table 1. Personal profile of the study population (n=90)

Personal profile	**No. (%)**
Age (Year)	
≤20	11 (12.2)
21-30	42 (46.7)
31-40	29 (32.2)
>40	8 (8.9)
Mean±SD (range)	29.9±8.7 (19-60)
Gender	
Male	89 (98.9)
Female	1 (1.1)
Education	
University	19 (21.1)
Secondary school	37 (41.1)
Preparatory school	25 (27.8)
Primary school	9 (10.0)
Smoking	71 (78.9)

It is worth mentioning that none of the cake bakeries was illiterate indicating a well educated community. Such finding may give the impression that the high rate of educated cake bakeries is a result of them not getting another job because of the unemployment crisis in the Gaza Strip [11]. In addition, Gaza Strip is a poor area suffering from a long-term pattern of economic stagnation and plummeting development indicators [12]. Seventy one (78.9%) of the study population were smokers.

Work experience and training among the study population

As indicated in Table 2, more than half of the cake bakeries 53 (58.9%) had experience for 5 years or less, 13 (14.4%) had experience for 6-10 years, 19 (21.1%) had experience for 11-20 years and 5 (5.6%) had experience for more than 20 years. Regarding training, 38 (42.2%) cake bakeries were trained whereas 52 (57.8%) were not. It was pointed out that although the majority of food handlers adhered to basic hygiene principles, there is definitely a need for proper and continuous training in personal and general hygiene, not only for food handlers, but also for management [13].

Table 2. Work experience and training among the study population (n=90)

Item	No. (%)
Work experience (Year)	
≤5	53 (58.9)
6-10	13 (14.4)
11-20	19 (21.1)
>20	5 (5.6)
Training	
Yes	38 (42.2)
No	52 (57.8)

Personal hygiene of the study population

Health status

When questioned about medical examination (Table 3), 70 (77.8%) cake bakeries reported that they had medical examination. Fourteen of them (20.0%) had got medical prescription for treatment.

They were forbidden to continue their work until recovery. World Health Organization stated that food handlers may act as a source of food contamination through inadequate personal hygiene or when handling food while they are medically unfit [14]. Concerning infection, 11 (12.2%) cake bakeries stayed at work while they have been infected. Five (45.5%) of them changed their duties whereas 6 (54.5%) did not. In addition, the number of cake bakeries who stayed at work and protected their injuries or abscesses was 22 (24.4%). It was found that workers with infection, who stayed at work and did not change their duties, could be a potential source of cake contamination [15]. Cake contamination by the cake handler with neck infection was also reported [16].

Table 3. Health status of the study population (n=90)

Health status	**No. (%)**
Have medical examination	70 (77.8)
Got medical prescription	14 (20.0)
Stay at work in case of infection	11 (12.2)
Stay but change duties	5 (45.5)
Stay but not change duties	6 (54.5)
Stay at work and protect injuries or abscesses	22 (24.4)

Personal cleanliness

Personal cleanliness of the study population is summarized in Table 4. The number of cake bakeries reported wearing special white uniform and keeping work clothes in special place were 67 (74.4%) and 70 (77.8%), respectively. Around half of the cake bakeries (47.8%) changed their dress daily. However, 20 (22.2%) of bakeries changed their dress when it becomes dirty. Fifty four cake bakeries (60.0%) claimed that they wear gloves during work. The remaining bakeries (40.0%) who did not wear gloves and those who changed their dress when it becomes dirty could be a potential source of cake contamination. It was reported that food poisoning with norovirus by cake consumption was mainly caused by hand contact during preparation [17]. Most of cake bakeries (97.8%) cut their nails. Concerning hand washing, the number of bakeries who mentioned hand washing before starting work, after toilet, after smoking, after

touching clothes and hair, after changing duties, after eating, after removing wastes and after dealing with raw materials were 82 (91.1%), 90 (100%), 58 (81.7%), 68 (75.6%), 75 (83.3%), 86 (95.6%), 90 (100.0%), and 86 (95.6%), respectively. Fifty seven (63.3%) bakeries used antiseptic after hand washing. These data indicated that cake bakeries had good personal hygiene in respect to hand washing. Dumavibhat and his colleagues revealed one to eight bacterial species harbored hands and nails of food handlers before hand washing. However, after hand washing disappearance of one to four bacterial strains from hands and nails were found in 47.6% of those food handlers [18]. It was reported that microbial contaminant easily transmitted to any food by handling and poor hygienic practices [16,19].

Table 4. Personal cleanliness of the study population (n=90)

Personal cleanliness	**No. (%)**
Wearing special white uniform	67 (74.4)
Keeping work clothes in special place	70 (77.8)
Changing dress	
Daily	43 (47.8)
Every 2 days	14 (15.6)
Every 3 days	8 (8.9)
Weekly	5 (5.6)
When dirty	20 (22.2)
Wearing gloves	54 (60.0)
Changing gloves	49 (90.7)
Cut nails	88 (97.8)
Hand washing	
Before starting work	82 (91.1)
After toilet	90 (100)
After smoking	58 (81.7)
After touching clothes and hair	68 (75.6)
After changing duties	75 (83.3)
After eating	86 (95.6)
After removing waste	90 (100)
After dealing with raw materials	86 (95.6)
Using antiseptic after washing hands	57 (63.3)

Personal behavior

Table 5 illustrates personal behavior of cake bakeries during the work. Thirteen (14.4%) bakeries mentioned that they wear rings and 8 (8.9%) admitted smoking, spotting and eating in the area of the work. In addition, 84 (93.3%) bakeries covered mouth and nose when coughing or sneezing and 77 (85.6%) washed their hands after sneezing. Although the majority of cake bakeries display good personal behavior, still some of them showed unacceptable behavior and they constitute a real source of cake contamination. It was recommended that people engaged in food processing should avoid any behavior that could result in food contamination [4]. Smoking, spitting, chewing or eating, sneezing or coughing directly over food is unacceptable because it increases the probability of contamination. Personal effects such as jewelry, watches, pins or other such items should not be worn or brought into food handling areas.

Table 5. Personal behavior of the study population (n=90) during work

Personal behavior	No. (%)
Wearing rings	13 (14.4)
Smoking, spotting and eating	8 (8.9)
Covering mouth and nose when coughing or sneezing	84 (93.3)
Washing hands after sneezing	77 (85.6)

Personal hygiene and behavior among cake bakeries in relation to training

In general, training seems to have positive influence on personal hygiene and behavior among cake bakeries (Table 6). However, such interaction was statistically significant for stay at work in case of infection (χ^2 corrected=4.198, P=0.040), changing dress when dirty (χ^2 =5.469, P=0.019) and wearing gloves (χ^2 =5.132, P=0.023). It was reported that although the majority of food handlers adhered to basic hygiene principles, there is definitely a need for proper and continuous training in personal and general hygiene, not only for food handlers, but also for management [13].

Table 6. Personal hygiene and behavior among cake bakeries (n=90) in relation to training

Personal hygiene and behavior	**Have training (n=38) No. (%)**	χ^2	**p value**
Stay at work in case of infection			
Yes *(n=11)*	1 (9.1)	4.198	0.040*****
No *(n=79)*	37 (46.8)		
Changing dress when dirty			
Yes *(n=20)*	13 (65.0)	5.469	0.019
No *(n=70)*	25 (35.7)		
Wearing gloves			
Yes *(n=54)*	28 (51.9)	5.132	0.023
No *(n=36)*	10 (27.8)		
Cut nails			
Yes *(n=88)*	37 (42.0)	0.249	0.618*****
No *(n=2)*	1 (50.0)		
Hand washing before starting work	36 (43.9)	0.433	0.511*
Yes *(n=82)*	2 (25.0)		
No *(n=8)*			
Hand washing after touching clothes and hair			
Yes *(n=68)*	32 (47.1)	2.668	0.102
No *(n=22)*	6 (27.3)		
Hand washing after sneezing			
Yes *(n=77)*	36 (46.8)	3.293	0.070*
No *(n=13)*	2 (15.4)		
Wearing rings			
Yes *(n=13)*	3 (23.1)	1.458	0.227*
No *(n=77)*	35 (45.5)		
Smoking, spotting and eating			
Yes *(n=8)*	2 (25.0)	0.433	0.511*
No *(n=82)*	36 (43.9)		
Covering mouth and nose when coughing or sneezing			
Yes *(n=84)*	37 (44.0)	0.782	0.377*
No *(n=6)*	1 (16.7)		

* p value of χ^2 (corrected) test

Cake making plant facilities

As presented in Table 7, the number of cake bakeries who said that the plant has smooth and easily cleaned floor, enough ventilated, well lightened and with concrete ceiling were 83 (92.2%), 85 (94.4%), 79 (87.8%) and 89 (98.9%), respectively. Bakeries' response on water facility revealed that the municipal water was the main source of water in the plant (88, 97.8%), plastic water tanks were commonly used (85, 94.4%), and changing and disinfecting of them were frequent (81, 90.0%). Regarding plant tools, 72 (80.0%) workers mentioned that plant tools made from stainless steel and 88 (97.8%) stated that they were smooth. The above mentioned data display that most cake plants facilities in Gaza Governorate are more or less constructed and maintained according to sanitary-design principles. Adequate ventilation system and natural or artificial lighting should be provided to enable the undertaking to operate in a hygienic manner [5]. It was recommended that hand-washing facilities should be adequate and convenient and be furnished with running water at a suitable temperature [20]. Compliance with this requirement may be accomplished by providing: hand-washing and hand-sanitizing facilities at each location in the plant.

Table 7. Cake making plant facilities as reported by cake bakeries (n=90)

Plant facility	No. (%)
Floor	
Smooth and easily cleaned	83 (92.2)
Not smooth	4 (4.5)
With cleavages	3 (3.3)
Ventilation	
Enough	85 (94.4)
Not enough	5 (5.6)
Lightening	
Good	79 (87.8)
Acceptable	9 (10.0)
Not acceptable	2 (2.2)
Type of ceiling	
Concrete	89 (98.9)
Metal	1 (1.1)
Source of water	
Municipality	88 (97.8)

Special well	2 (2.2)
Type of water tank used	
Plastic	85 (94.4)
Metal	5 (5.6)
Changing and disinfecting water tank	
Yes	81 (90.0)
No	9 (10.0)
Tools made from	
Stainless steel	72 (80.0)
Aluminum	15 (16.7)
Iron	3 (3.3)
Tools smoothness	
Yes	88 (97.8)
No	2 (2.2)

Recommendations

1. Training programs of cake bakeries on personal hygiene and behavior are needed.
2. Frequent change of dress, wearing gloves and not stay at work in case of infection are recommended.
3. Wearing rings, and smoking, spotting and eating during work must be avoidable.

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