Comparison of hygiene standards and food safety practices between sole-proprietor and corporate-managed restaurants in Lebanon

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Comparison of hygiene standards and food safety practices between sole-proprietor and corporate-managed restaurants in Lebanon

Abstract

Purpose: The objectives of this study were to compare the hygiene standards and food handling practices between sole-proprietor and the corporate-managed restaurants in Lebanon and to determine whether the variations between both groups are explained by and directly related to the type of management.

Design/methodology/approach: An in-depth observation assessment of food safety environment and practices was conducted on a convenient sample of 50 food businesses in Beirut which are typical of foodservice outlets in Lebanon and in many countries of the Middle East. The observation assessment checklist comprised six constructs of 2-7 components for analysis. It covered all areas including documentation and record-keeping requirements which are crucial parts of a food safety system.

Findings: There was a significant difference in the visual assessment score between sole-proprietor (77.9 ± 18.4) and corporate group (48.5 ± 12.8). Food handlers’ behaviour and hygiene standards were significantly associated with the type of management. However, there were still critical gaps in the food safety performance of the corporate group suggesting other underlying factors than the type of management.

Practical implications: additional elements were drawn from this study for future food safety culture research. Understanding the food safety attitudes and perception of risks of the management representatives, leaders, or food business owners is vital to develop appropriate food safety interventions and foster a positive food safety culture in the foodservice industry.

Originality/value: This study is the first to measure the association of management type, i.e. sole-proprietor management and corporate management, with the food hygiene standards and food safety practices in the foodservice establishments.

Keywords: Foodservice; observational assessment; food safety practices; hygiene standards; food safety standards
1. Introduction

Several studies showed that restaurants are important settings for foodborne disease transmission (Luo et al., 2017; Lee and Hedberg, 2016). Foodborne outbreaks linked to food consumed in foodservice establishments (FSEs) were reported worldwide ranging from 25% in Europe to more than 50% in the United States (US) (Gould et al., 2013; EFSA and ECDC 2016). The typical causes of the microbial contamination of foods are an unsafe source of foods, cross-contamination, poor personnel hygiene practices, inappropriate food storage temperatures, and insufficient cooking (Jones et al., 2008; Todd et al. 2010; Gould et al., 2013). Food safety problems arising from food handlers’ malpractices are thought to be preventable with strategies focusing on education and training. The latter proved to be efficient in enhancing food safety knowledge, but not necessarily in promoting safer practices (Soares et al., 2012) due to various constraints. These included the work pressure, financial resources and organizational factors such as the safety climate (Abidin et al., 2014).

It is widely accepted that organizational food safety culture is a vital factor for improvement in food safety practices (Pragle et al., 2007; Abidin et al., 2014). In this context, top management’s role and responsibilities in providing a supportive environment and adequate resources and skills to their managers are essential to create and maintain a positive food safety culture at all levels (Griffith et al., 2010a). The terms food safety culture/climate have been used interchangeably in the literature. Flin (2007) and Guldenmund (2000) proposed that the safety climate is a situation determined by employees’ attitudes toward the organization’ safety at a given point in time based on a specific criterion. Neal et al. (2000) consider this to be a snapshot of the prevailing aspects of an organization's safety culture. However, Abidin et al. (2014) consider food safety culture is more complex to measure than simple snapshots. This culture is a behaviour-based system that focuses not only on the processes but also on the people and the organizational culture of the establishment.
Maintaining a positive food safety culture requires that businesses perceive food safety as equally important as their other business priorities. To be effective, this attitude needs to be translated in specific objectives, that have high levels of compliance with documented systems and management sharing effective food safety systems and practices at all levels of the organization, not only management (Griffith et al., 2010a; Neal et al., 2012). Griffith et al. (2010b) identified six indicators or components in relation to food safety performance: management system and style, leadership, communication, sharing of knowledge and information, accountability, risk perception, and work environment as perceived by food preparation staff. Poor management commitment, limited support, and communication policy were demonstrated as causes of foodborne illness outbreaks and to a prevailing poor food safety culture (Powell et al., 2011). Further contribution by understaffing could hinder and discourage food handlers from applying proper practices (Green et al, 2007) and effective food safety documentation systems (Griffith et al., 2010). This is much likely to be the case in small sole-proprietor food businesses, where structured management, understaffing and delegation of responsibilities prevail (Fairman, 2004), hampering a culture of food safety. Furthermore, the implementation of approved food safety systems is more often perceived as a burden for small and medium-sized enterprises (SME) than for larger companies or food manufacturers (Fairman and Yapp, 2004; Charalambous, 2011). Both SMEs and larger companies share factors that can interfere with a commitment to a positive food safety culture, including an incomplete understanding of the perception of the risks throughout by the company workforce, incomplete incorporation of food safety parameters into business objectives, and infrequent monitoring and optimizing the organization’s food safety performance (Nyarugwe et al., 2016; Park, Lee, Hong, & Ghim, 2019). Ownership could bring specific values to an enterprise, a report by Cascino et al (2010) showed that determinants of accounting quality differ across family and nonfamily firms, with family-
owned business conveying financial information of higher quality than their counterpart. On the other hand, Jim and Weil (2015) discussed how franchising ownership was more likely to promote non-compliance with regulations and wages standards in fast-food outlets, in contrast with company-owned establishments. While the dynamics of self and family-owned businesses are complex (Goel at al. 2014), the values and styles are likely to affect service and products. To date, the direct influence of business ownership and type of management (sole-proprietor management and corporate management) on industry food hygiene standards and practices have not been studied. While the experience and attitude of the owner-manager is a major determinant on management strategies, problem-solving and training in SME’s were shown to be more successful when customized to suit the specific situation (Macpherson and Jayawarna, 2007). Some studies have assessed the management commitment to food safety and support, however based on employees’ perceptions (Abidin et al., 2014; Neal, 2012). Employees’ perceptions of management commitment and onsite support are not a reliable indicator being shaped by the level of their knowledge in food safety and awareness of management role in food safety (Faour-Klingbeil et al., 2015). Therefore, an empirical assessment and direct observation of the relationship of management to food safety practices are instrumental to gain insights into what hinders compliance with the basic requirements of food safety and deters organizations from attaining a positive food safety culture.

The objectives of this study were to compare the hygiene standards and handling practices between sole-proprietor and corporate managed restaurants and to measure whether the type of management is associated with the differences in food safety performance between both groups.
2. Material and Methods

2.1. Selection and sampling processes

An in-depth observation assessment of food safety environment and practices was conducted on a convenient sample of 50 food businesses in Beirut which are typical of foodservice outlets in Lebanon and in many countries of the Middle East (Faour-Klingbeil et al., 2015, 2016).

Beirut is a city where identification of corporate- managed outlets is not complex in view of their market standing, network with food professionals and reputation. The corporate- managed FSEs operate several food outlets in different geographical areas and within the same city through central management. The sole-proprietor food businesses are individual or family-owned businesses managed by the owner or by a head chef with assistants. They are often small bistros, café restaurants, or traditional fast food street outlets, and usually known by family names or as time-honoured local restaurants. The traditional or sole-proprietor food businesses tend to be informal and lack management structure, they also share common socio-economic features.

The sampling method involved two-stage samplings (cluster sampling), first, by concentrating on a geographical area, second, sampling respondents (businesses) within those areas. The choice of the geographical area was affected by 3 factors: i) businesses that are more readily accessible due to limited information on locations and addresses in other geographical areas, ii) limited fund and time frame of the funded project, iii) the fact that the selected area is well-known for being a hub of a high number of restaurants business of all levels and types of cuisines.

The selection of participants was based on the size of the establishment, i.e. micro-small, small, medium as per the classification criteria in Table I, the types of food served, i.e. raw vegetable.
salads in addition to other varieties of hot and cold RTE foods, and the high number of customers at peak hours which was estimated by observation and local knowledge.

**Table I. Classification of SMEs into sizes according to EC criteria**

<table>
<thead>
<tr>
<th>Criterion of SMEs</th>
<th>Micro</th>
<th>Small</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of employees</td>
<td>&lt;10</td>
<td>&lt;50</td>
<td>&lt;250</td>
</tr>
<tr>
<td>Maximum turnover</td>
<td>≤ € 2 m</td>
<td>≤ € 10 m</td>
<td>≤ € 50 m</td>
</tr>
<tr>
<td>Balance sheet total</td>
<td>≤ € 2 m</td>
<td>≤ € 10 m</td>
<td>≤ € 43 m</td>
</tr>
</tbody>
</table>

(Source: EC, 2015)

A greater percentage of the participating FSEs (70%) were of micro-sized businesses employing less than 10 food handlers, 22% were small-sized with 10-15 food handlers, and 8% were medium-sized food businesses.

Owners and directors of the food service establishments (FSEs) were contacted by phone to introduce the project objectives and to obtain permission to conduct the interview and observations on-premises. Some businesses were approached by email.

The survey, including follow-up calls and meetings with owners/managers, was carried out over a period of four months.

In our study, the term “food handlers” refers to executive chefs, chefs, assistant chefs, and owners involved in different functions of food handling i.e. receiving, storing, preparing and cooking food.

### 2.2. Survey design

This study complements earlier works on the hygienic status of food establishments in Beirut (Faour-Klingbeil et al., 2015, 2016). The present data were extracted from the questionnaires employed for the face-to-face interviews (Faour-Klingbeil et al., 2015) and the observational assessment checklist (Faour-Klingbeil et al., 2016).
2.2.1. The development of the food safety practices questionnaire

The questionnaire used for collecting data on food safety practices consisted initially of four sections designed to be administered in a face-to-face interview with food handlers (n=80) to study the food safety knowledge, attitudes and practices of food handlers (Faour-Klingbeil et al., 2015).

- Section one: this was designed to obtain demographic information and each food handler's profile such as gender, age, education, working experience, food safety training course attendance.

- Section two: this contained 16 multiple-choice questions (each with four or five possible answers), three closed questions and one open question to assess food handlers' knowledge on food poisoning, cross-contamination prevention, temperature control, personal hygiene, and sanitation. In order to avoid chances that food handlers select correct answers and any answer by chance, the multiple-choice answers included “I do not know”.

  The questions were based on the content of a basic level training courses in food safety and adapted from the work of Tokuç et al. (2009) and Walker, Pritchard, and Forsythe (2003) with some modifications.

  Section three: this aimed at understanding food handlers' attitudes on a Likert-type Scale that indicates the degree of agreement of respondents to 16 statements on food safety using a three-point rating scale (disagree = 1, uncertain = 2, agree = 3). The score ranged between 0 and 48. The sum of scores was converted to 100 points.

  Section four: this demonstrated the frequency of safe handling practices. It included 19 questions on sources of personal hygiene, and temperature control, cross-contamination prevention, cleaning, storage and display of food on a five-point rating scale (never = 1,
rarely = 2, sometime = 3, often = 4, and always = 5). The score range was standardized between 0 and 100.

Only the data obtained in section four were included in this study.

The attitudes and practices questions were adapted from the work of Angelillo, Viggiani, Greco, and Rito (2001) with some modifications.

A separate letter of consent for owners and for the participants was read explaining the objectives of the research and signed by the researcher and participants.

The questions were clearly read to the respondents in a private setting to avoid discomfort or peer and management influence.

The same questionnaire comprised an open question on the barriers against the implementation of hygienic and safe practices. The respective answers were analysed and included in this study.

A pilot study was conducted on seven restaurants, but results were not usable because additional questions were later considered, and the questionnaire was subjected to a few modifications in the section related to practices. It was resubmitted for the ethical approval committee at the American University of Beirut and Plymouth University.

In general, the interview took approximately 45 min depending on the level of knowledge and education of the interviewees (Faour-Klingbeil et al., 2015).

2.2.2. Observational assessment

The observational checklist comprised essential components in which the Good Hygiene Practices (GHP) and other prerequisites proposed by the Codex Alimentarius (1969) were included for the general assessment criteria (Faour-Klingbeil et al., 2016). It covered all areas
including documentation and record-keeping requirements which are crucial parts of a food safety system (CAC, 2010). The criteria defined for each component are available as supplementary materials (Appendix A). The observation assessment checklist comprised six constructs of 2-7 components for analysis (Faour-Klingbeil et al., 2016) (Table II).

A reliability analysis test was performed to measure the internal consistency in the survey questionnaire. Cronbach's Alpha was 0.928 which indicates a high level of internal consistency for our scale (Faour-Klingbeil, et al. 2016).

To ensure consistency and unbiased data records, the data collection and visual assessment were carried out by one of the authors, a registered experienced auditor.

3. Statistical analysis

All data were analysed using the IBM SPSS version 22. Data were collected and grouped according to foodservice management type, i.e., sole-proprietor or corporate-managed food businesses.

Observational assessment of 26 components was based on a three-level scale (adequate=3, incomplete=2, inadequate=1) for each one. The sum of the awarded points (total score) on the adequacy level for each sampling location ranged between 26 and 78 points, and it was converted to 100-point scale before further analysis.

Components that were either “not observed” or “not applicable” were not included in the statistical comparisons or tabulations, hence omitted from scoring.

The frequency of rating on adequacy level in each component was obtained and an independent t-test was also used to determine differences in total score on a visual assessment of all components between corporate-managed and sole-proprietor-managed FSEs. The frequency of food businesses in each adequacy level for each category was calculated.

Spearman’s rho correlation test was performed to examine the strength of association between types of management and scores on the visual assessment of overall components.
### Table II. The six different constructs comprised in the visual assessment survey in SMEs

<table>
<thead>
<tr>
<th>Inspection constructs</th>
<th>Individual Inspection Components</th>
</tr>
</thead>
</table>
| 1: Structural compliance                          | a. General maintenance conditions and evidence of pest in the production environment  
b. Zoning (separation of fresh produce from raw meat and poultry)  
c. All major pieces of equipment such as fridges, freezers ovens, hot holding equipment, cold holding equipment are fitted with working temperature monitoring gauges  
d. Availability of proper handwashing sink                                                                                                                                 |
| 2: Personal hygiene                               | a. Wearing a hair cap  
b. Appropriately clean personnel protective clothing                                                                                                                                                                 |
| 3: Sanitation                                      | a. Clean floors, walls, overall facilities and implements  
b. Waste containers are covered, kept clean  
c. Sanitizers for work surfaces readily available for use during food preparation  
d. Containers used to drain vegetables are kept clean                                                                                                                                 |
| 4: Evidence of procedures and management system control | a. Records keeping for verification of temperature monitoring and system audits (during cooking, cooling, storing)  
b. Cleaning system and schedule  
c. Where a chemical sanitizer is used, there are records to show levels are maintained                                                                                                                                 |
| 5: Contamination and cross-contamination control measures | a. Staff cleaning tools are stored in an appropriate manner and not at risk of contaminating food or equipment during preparation  
b. Staff personal belongings are stored in an appropriate manner and not at risk of contaminating food or equipment during preparation?  
c. Received fresh vegetable are stored in protected areas  
d. Washing sink designated for fresh produce only  
e. Unprocessed raw vegetables are prepared so that contamination and cross-contamination does not occur (separate cutting boards and utensils)  
f. Visitors or unauthorized staff are granted protective clothing upon entry  
g. Entry for authorized personnel only                                                                                                                                 |
| 6: Safe and hygienic handling practices            | a. Appropriate use of gloves and handwashing  
b. Frozen food is properly thawed  
c. Vegetable sanitizers are made up correctly  
d. Food on hold is covered                                                                                                                                                                                                 |

(Source: Faour-Klingbeil et al., 2016)
For further understanding at the level of each single component, Chi-square cross-tabulations
Fisher exact tests in addition to Somers’ Delta (Somers’ D), an ordinal measure of association
appropriate to distinguish between a dependent and independent variable, was used to
understand the association pattern between types of management operating food production
and the adequacy level of conditions and handling practices.
Logistic regression was performed to test the extent management can be an explanatory or
predictor to total inspection score.

4. Results

4.1. General hygiene conditions and safe practices
In general, the t-test revealed a statistically significant difference between both types of
management in relation to their overall visual assessment score across all components of
hygienic conditions and practices on premises (t=5.91, df=48, p < 0.001). Premises operated
by corporate companies reflected a better commitment to hygienic conditions and practices
and had a higher mean score in the overall visual assessment (77.8±18.4) than food
businesses operated by sole-proprietor (48.5±12.85) (Table III).

Table III. Mean value of scores on the visual assessment of overall components in SMEs

<table>
<thead>
<tr>
<th>Management type</th>
<th>N</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate</td>
<td>12</td>
<td>77.88a ± 18.45</td>
</tr>
<tr>
<td>Sole-proprietor</td>
<td>38</td>
<td>48.47b ± 12.83</td>
</tr>
<tr>
<td>Total SMEs surveyed</td>
<td>50</td>
<td>55.53 ± 19.01</td>
</tr>
</tbody>
</table>

† over possible 100 points
different superscript letters above the means in the same column denote statistically significant differences at
p < 0.05 t=6,206, df=48, p < 0.05, with a mean difference of 29.41
More specifically, the mean scores on adequacy level for each of the six different constructs assessed during the observation were significantly higher for premises managed by corporates than those managed by sole-proprietors in relation to structural conditions of premises (t=7.07, df=37, p < 0.001), cleanliness and sanitation (t=5.91, df=37, p < 0.001) and cross-contamination preventive measures (t=5.86, df=26.5, p < 0.001) (Figure 1) and for individual component levels (Table IV); there was significant difference in the mean of scores across the personal hygiene indicators indicating greater commitment observed in corporate-managed locations in terms of personal hygiene protective clothing (t=3.63, df=25.924, p < 0.001) and wearing hair cap (t=4.29, df=48, p < 0.001), and correct use of gloves during salad vegetables handling (t=4.76, df=15.0, p < 0.001).

Figure 1. The mean score of hygiene and safe handling compliance by type of management based on three units’ scale (adequate=3, incomplete=2, inadequate=1)

However, despite marked differences between both groups and the higher performance level of the corporate group with respect to sanitation and cross-contamination preventive measures, there was a lack of evidence of internal records and audits for internal control by
the management. Recording and monitoring the temperature of foods during holding, cooling and cooking were not adequately performed in both groups (Figure 2).

Table IV. Mean value of adequacy level in practices related to cross-contamination, safe handling, and sanitization by type of management

<table>
<thead>
<tr>
<th>Conditions and practices</th>
<th>Management</th>
<th>N</th>
<th>Mean* ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food handlers wearing gloves correctly and appropriately</td>
<td>Corporate</td>
<td>12</td>
<td>2.42^a ± 0.79</td>
</tr>
<tr>
<td></td>
<td>Sole-proprietor</td>
<td>38</td>
<td>1.24^b ± 0.59</td>
</tr>
<tr>
<td>Floors, work surfaces, utensils and equipment are kept clean</td>
<td>Corporate</td>
<td>12</td>
<td>3.00^a ± 0.00</td>
</tr>
<tr>
<td></td>
<td>Sole-proprietor</td>
<td>38</td>
<td>2.13^b ± 0.90</td>
</tr>
<tr>
<td>Correct use of cutting boards and utensils to prevent cross contamination</td>
<td>Corporate</td>
<td>12</td>
<td>2.83^a ± 0.58</td>
</tr>
<tr>
<td></td>
<td>Sole-proprietor</td>
<td>38</td>
<td>1.58^b ± 0.82</td>
</tr>
<tr>
<td>Premises structural conditions</td>
<td>Corporate</td>
<td>12</td>
<td>3.00^a ± 0.00</td>
</tr>
<tr>
<td></td>
<td>Sole-proprietor</td>
<td>38</td>
<td>1.92^b ± 0.09</td>
</tr>
<tr>
<td>Sanitizers use for work surfaces</td>
<td>Corporate</td>
<td>12</td>
<td>2.83^a ± 0.57</td>
</tr>
<tr>
<td></td>
<td>Sole-proprietor</td>
<td>38</td>
<td>1.55^b ± 1.06</td>
</tr>
</tbody>
</table>

* Different superscript letters above the means in the same column indicate significant difference within groups at p < 0.05

Due to restricted access or activities not performed at the time of the visit, one sole-proprietor was not observed for temperature monitoring activity during storage and two corporate-managed estuans were not observed.

Figure 2. Distribution of adequacy level in temperature monitoring by type of management.
However, despite marked differences between both groups and the higher performance level of the corporate group with respect to sanitation and cross-contamination preventive measures, there was a lack of evidence of internal records and audits for internal control by the management. Recording and monitoring the temperature of foods during holding, cooling and cooking were not adequately performed in both groups (Figure 2). Food handlers in the sole-proprietor group relied on the external digital thermometer display of cooling appliances or their own experience by touching and feeling to tell if foods were properly cooled or hot. About one third (37%) and an additional 16% did not have properly functioning temperature monitoring gauges or internally fitted thermometer in all or in at least one of their cooling appliances, respectively, which was predominantly observed in sole-proprietor group (Figure 2).

As a result of limited working spaces commonly observed in sole-proprietor locations, various risk factors inside food preparation premises were observed. A large proportion of sole-proprietor restaurants (71%) did not have separate areas for food handlers’ personal clothing and shoes and for cleaning tools that were seen kept on shelves nearby implements or food ingredients in the food production areas. In addition, high-risk and low-risk risk foods and appetizers were prepared at the same time in a very small area that hardly fit a handwashing sink in 65.8% and 8% of sole-proprietor and corporate-managed businesses, respectively (Table V).

Chi-square and Fisher’s exact test showed a significant association between the type of management and the adequacy level of compliance. More specifically, there was a significant association between the type of management and the adequacy level of premises, e.g., well-maintained walls, drains, protection against pest entry, and measures taken to ensure separate preparation of raw and cooked foods (p < 0.001).
Table V. The distribution of adequacy level in hygienic and safe practices by type of management

<table>
<thead>
<tr>
<th>Observation components</th>
<th>Visual Assessment Rating</th>
<th>% of total corporate-managed food businesses (n= 12)</th>
<th>% of total sole-proprietor - managed food businesses (n=38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoning and space</td>
<td>Adequate</td>
<td>41.3</td>
<td>13.2</td>
</tr>
<tr>
<td>There are hand-washing facilities in food handling areas supplied with warm soap and disposable towels</td>
<td>Adequate</td>
<td>75.0</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>Not observed</td>
<td>0.0</td>
<td>10.5</td>
</tr>
<tr>
<td>The cleaning schedule is visible</td>
<td>Adequate</td>
<td>33.3</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Not observed</td>
<td>33.3</td>
<td>13.2</td>
</tr>
<tr>
<td>Sanitisers for work surfaces are readily available for use during food preparation</td>
<td>Adequate</td>
<td>91.7</td>
<td>10.5</td>
</tr>
<tr>
<td></td>
<td>Not observed</td>
<td>0.0</td>
<td>10.5</td>
</tr>
<tr>
<td>Floors, work surfaces, utensils and equipment are clean</td>
<td>Adequate</td>
<td>100.0</td>
<td>39.5</td>
</tr>
<tr>
<td>Waste containers are covered, kept clean</td>
<td>Adequate</td>
<td>91.7</td>
<td>29.7</td>
</tr>
<tr>
<td>Food handlers use gloves appropriately and correctly</td>
<td>Adequate</td>
<td>58.3</td>
<td>7.9</td>
</tr>
<tr>
<td>Unprocessed raw vegetables prepared so that contamination and cross contamination does not occur</td>
<td>Adequate</td>
<td>91.7</td>
<td>13.2</td>
</tr>
<tr>
<td>The received fresh produce is stored in protected areas</td>
<td>Adequate</td>
<td>91.7</td>
<td>31.6</td>
</tr>
<tr>
<td></td>
<td>Not observed</td>
<td>8.3</td>
<td>15.8</td>
</tr>
<tr>
<td>There is a washing sink designated for fresh fruits and vegetables only</td>
<td>Adequate</td>
<td>75.0</td>
<td>7.9</td>
</tr>
</tbody>
</table>

Not observed: The component under assessment was not existing/taking place at the time of the observation assessment
This was also found in relation to adequate use of washing sinks designated for fresh fruits and vegetables and of sanitizers use for contact surfaces and implements on premises at a value of 22.9 and 25.8 (p< 0.001), respectively. Cramers’v and Phi tests values indicated generally strong relationships (0.67-0.75). In parallel to Chi-square analysis, Somer’s D test also indicated a strong and statistically significant association between assessment components and type of management. Somers’ D coefficient ranged between 0.52-0.78 (p < 0.05) for all components with exception to components related to temperature monitoring and record systems and use of sanitizers (0.18-0.36) (Supplementary materials – Table 1S-2S).

Accordingly, it was shown that more than 50%-78% of the adequacy level on the different constructs are explained by the type of management. Additionally, Spearman’s rho correlation indicated a statistically significant association between management and overall adequacy score (rs=0.571, p < 0.001).

The regression analysis showed that management could statistically and significantly predict the total inspection score, F (148) = 38, 51, p < 0.001 and accounted for 44.5% of the explained variability in the overall score.

In our earlier work, the self-reported handling practices of the same studied groups were determined via the 19 questions on sources of personal hygiene, and temperature control, cross-contamination prevention, cleaning, storage and display of food, and analysed on a five points rating scale (never = 1, rarely = 2, sometime = 3, often= 4 and always = 5). The score range was standardized between 0 and 100 (Faour-Klingbeil et al., 2015). We ran a comparison between the self-reported data (Faour-Klingbeil et al., 2015) and those obtained by the actual observation of this study. The observational assessment showed inconsistency and disparity in handling practices across different indicators related to personal hygiene, safe handling of food and risk control measures when compared to self-reported practices in the same facilities (Figure 3). Self-reported practices concerning compliance to the use of
protective clothing and gloves, the use of separate cutting boards for raw meat and vegetables, and the application of disinfection as well as storing of fresh vegetables in protected areas were not consistent with the results obtained during the simultaneous observation of the same respondents on the same day of the interviews. There was a great discrepancy between those who reported that they wore protective gloves to prevent cross-contamination and those very few who were observed performing crucial tasks wearing the gloves. The frequency level of essential practices for ensuring safe food production was reported by food handlers in 36 to a maximum of 42 surveyed food service businesses. In contrast, respondents did not show and translated what they reported in practice. Correct practices were visually assessed as “adequate” in only 10 to a maximum of 20 inspected locations (Figure 3).

Figure 2. Self-reported food handlers’ practices as frequently performed (i.e., always) in comparison to actual practices assessed by observation
4.2. Perceived Barriers

The interview with food handlers identified several barriers to implement basic food safety requirements. Many respondents (21%) expressed discouragements due to a lack of space and limited resources. In addition, to the 16 percent of the food handlers who did not have the expertise and education to know how their actions can affect the safety of the food they handle, 13% considered that time and work pressure, especially in peak hours of food production, are hurdles to follow safe food handling practices, which are particularly challenging because of understaffing. A 12% percent of the respondents believe that the improvement of the work environment and implementation of food safety systems are not possible because of the high cost and lack of financial support by owners to maintain the facility and equipment in good conditions or to provide the necessary tools. The access to food safety information and guiding procedures was the main concern for 10% of respondents in the sole-proprietor FSEs. They stated that information resources and guidance for the understanding and implementation of hygiene procedures are not available. Guidance is needed to attain adequate hygienic conditions and practices.

Ten percent of the respondents in the sole-proprietor group complained about the inefficient role of local health authorities’ inspectors which encourages non-compliance. The health inspectors issued reports with no subsequent follow-ups or guidance for corrective measures. In addition, 12% commented on the deficits in the food safety control system throughout the food supply chain, thus the application of food safety preventive measures on premises are not necessary. For instance, it was stated that:” The system is lacking across the supply chain and it already predisposes our own raw materials to unavoidable hazards.”. The lack of management support was also cited as a barrier by the remaining few food handlers, while others did not give an answer.
5. Discussion

According to the international recommendations on the general principles of food hygiene, (CAC/RCP 1-1969), the sole-proprietor businesses showed critical gaps in food handling and general hygiene conditions, i.e., poor cross-contamination preventive measures, deficient storage, and inadequate conditions, lack of handwashing sinks, small food preparation areas, and poor cleanliness; in addition, this group was characterized by a common lack of specialists in food safety and quality, and understaffing. The food handlers in this group are reportedly involved in multiple tasks at one time and have inadequate knowledge in food safety due to limited resources and no access to information and guidance on food safety (Faour-Klingbeil et al., 2015). Understaffing and limited resources in the sole-proprietor group constitute a major barrier for training food handlers in food safety (Faour-Klingbeil et al., 2015). Similarly, Fairman (2004) showed that understaffing and limited management structure in small restaurants are major constraints to safer practices.

Conversely, the corporate group showed remarkable compliance with proper structural and sanitary conditions, higher hygiene standards, and adherence of food handlers to personal hygiene and safer food preparation practices. This group provided a supportive environment for food production through adequate spaces for food preparations, equipment provisions, staff training on food safety and food safety management that oversees hygiene standards and communicates top management decisions to food handlers (Faour-Klingbeil et al., 2015). The FDA (2011) emphasized that the supervisory function is key for ensuring improved food safety practices and that the manifestation of effective management control through active engagement in the implementation of the food safety practices and fostering supervisory control functions are regarded pivotal for maintaining safe practices. Bran et al. (2010) made an interesting observation that the size of a company is a driver for environmental performance because large enterprises are more visible. This observation can also explain the
higher standards of the corporate-managed group compared to sole-proprietor driven by their brand image and market standing. FSEs with renowned eateries are exposed to the market and to the attention of health inspectors. In this sense, they are driven to maintain clients’ trust and legal expectations by ensuring appropriate structural and hygiene operations. Moreover, the food outlets of the corporate group are directly managed by the food operations management that acts as a link between the corporate central management and the production unit to ensure proper implementation of management decisions and execution of corporate policy. The firm size and the type of products (e.g., branded products/services) are proven to be incentives that influence the motivation and perception of benefits for the adoption of food safety quality assurance systems (Seddon et al., 1993; Macheka et al., 2013). Hence, a small firm handling an undifferentiated product will likely have a different perspective from a large firm handling a differentiated product.

Regression analysis showed that the type of management explains 44.5% of the variations in the overall assessment of practices and the food safety environment and hygiene standards, suggesting other underlying factors that should be explored at the level of the organizations. For instance, the corporate-owned food outlets did not have adequate preventive measures to minimize the risk of foodborne illnesses, which explains the weak correlation between the type of management and the assessment components related to documented temperature control and internal control records. The poor implementation of food safety documentation systems and lack of internal controls may suggest a limited involvement of the top management in overseeing or managing food safety. Apparently, this group focuses on gearing the resources towards the pre-requisites for food safety systems by promoting environmental conditions that are favourable for food production, yet not all the way to prevention and control of food safety risks. During the interviews in one of the corporate-managed locations, the food safety officer mentioned that the top management gives the
highest priority to personnel hygiene and cleanliness in the restaurant instead of reinforcing a food safety program that is essential to control potential risks and hazards through the flow of the foodservice production (Faour-Klingbeil et al., 2015). Such a case reflects the importance of management commitment to establishing, implementing, and maintaining an effective food safety system (Clarke, 2000).

Accordingly, the corporate group fits with the classification of a proactive type of management defined by Wright (2013) as “Management provides a lead in encouraging compliance for sake of the business …but may not go beyond “good practice””. The limited involvement of the corporate group management in food safety is possibly attributed to its perception of food safety risks or the profit policy that overtakes food safety concerns. The corporates strategy is usually driven by stakeholders’ trust and protection of corporate brands or even the reputation for the adoption of sustainability issues (Manning, 2007; Todd 2017). Hence, additional factors such as the food safety knowledge, attitudes, and perception of risks of food business leaders and owners remain assumptions to be clarified in further research to understand what would drive food safety to be viewed as a critical issue.

The thermometers for monitoring food and storage temperature were lacking in almost all the locations surveyed in both groups which contradicts with the statements of a great majority of the respondents who agreed on the importance of controlling the temperature of food and that they receive management support to apply and improve food safety (Faour-Klingbeil et al., 2015). This study corroborates with the results of our earlier work and showed that food handlers’ perception of management support is affected by their limited knowledge in food safety and their food safety attitudes (Faour-Klingbeil et al., 2015).

Furthermore, the analysis showed that self-reported practices of food handlers did not parallel their actual practices, particularly in relation to personal hygiene practices and temperature control. The inconsistent translation of food handlers’ affirmative opinions towards food
safety into actual practices is documented (Manning, 1994; Neal et al., 2012; Abdullahi et al., 2016; Ovca, Jevšnik, & Raspor, 2018). Additionally, Bermudez-Millan et al. (2004) demonstrated through household observations that claims of food safety behaviours related to handwashing and sanitation were not necessarily put in practice.

There were several barriers that prevented food handlers from applying safe behaviours. These were consistent with numerous studies such as the lack of time, training, and resources, besides the inconveniently located hand sinks and lack of space (Howells et al., 2008; Wallace et al., 2018). Such shortfalls serve as barriers to proper handwashing, cleaning work surfaces and use of thermometer (Clayton et al., 2002; Green et al., 2006; Howells et al., 2008, Faour-Klingbeil et al., 2016).

6. Limitations

The limitation of this study is the relatively small sample size due to limited funds and the project timeframe. Despite the reliability of observational studies as a tool to capture food safety practices (Clayton and Griffith, 2004), they require intensive time and human resources. Getting approval from food businesses owner to enter their food premises was the main challenge in this work. This survey, including follow-up calls and meetings with owners/managers, was carried out over a period of 4 months. The rejection rate was 50% for several reasons including no interest to participate, no time, and work pressure or worries from suspected connections with local health authorities.

Even though all the interviews were conducted in the Beirut region, as mentioned in section 2.1, given that the corporate-managed FSEs manage all of their food outlets equally in different areas of Lebanon under the same central management system, and that sole-proprietor food businesses share common socio-economic features, the sample size would confer a reasonable degree of reliability to this work for the whole country.
7. Conclusion

The sole-proprietors’ businesses showed critical shortfalls in food safety that may predispose foods to microbial risks. Nevertheless, this study demonstrated that foods served in the (corporate-managed FSEs) may not be safer. The operators of the corporate-managed group were not proactive in the sense of implementing the necessary control measures to prevent, eliminate or reduce the risks of foodborne diseases.

The type of management was a significant predictor of food handlers’ behaviour and hygiene standards. Nonetheless, other confounding factors interfered with the degree of this association and these need to be explored in future research. For instance, despite adequate hygiene standards and the adherence to safer practices by food handlers in the corporate group when compared to their counterparts in the sole-proprietor group, food safety systems and internal control were not well implemented. We assume that this is attributed to the leaders/decision-makers’ lack of awareness of the risks associated with food safety or to the profit-oriented strategies or other interfering factors given the weak enforcement of the food safety law in Lebanon and the limited communication of food safety risks with the food industry (Bou-Mitri, Mahmoud, El Gerges, & Abou Jaoude, 2018).

The understanding of the food safety attitudes and the perception of risks of the management representatives, leaders, and food business owners is crucial in future research for developing appropriate food safety interventions and fostering a positive food safety culture in the foodservice industry.

On the other hand, drawing a generalization on the incompetency of sole-proprietor businesses is inaccurate because food safety performance can vary in different countries with different levels of regulatory enforcement activities. Therefore, our study underlined the need for necessary improvements in the sanitary conditions and hygienic practices in the sole-proprietor SMEs in Lebanon to reduce the risk of foodborne illnesses. The role of the local
authorities in bringing up incentives and benefits for SMEs to adopt robust food safety systems is imperative. An example is the Safer Food Better Business developed by the Food Safety Agency in the UK, which assisted small businesses in adopting safer practices (Food Standards Agency, 2018). This system offers a practical and simple documentation approach for the SMEs “diary” which is essential for food safety assurance. Although this study was carried out in the central, western and northern districts in Beirut, the methodology and recommendations are pertinent to all similar operations worldwide.

8. Acknowledgment

The study was partially funded by a grant from the Lebanese National Council for Scientific Research (CNRS) #102598.

9. References


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## Appendix A  Criteria

### Visual Assessment Components

<table>
<thead>
<tr>
<th>Inspection component</th>
<th>Criteria</th>
</tr>
</thead>
</table>
| 1. Are the premises looking in good repair with clean drains, clean walls, no peeling paint, no holes or gaps where pests might enter, evidence of pests etc. | **Adequate:** yes  
**Incomplete:** Partially fulfilled requirements (i.e., evidence of pests, open to external environment, open drain, equipment or garbage bins are left dirty while walls are clean and feature no hole or cracks). |
| 2. Is there a zoning in the food preparation facility?                               | **Adequate:** yes  
**Incomplete:** there is an attempt (i.e., proper segregation for one area but lacking complete zoning, or only separate vegetable area yet receiving and waste flow is not segregated. |
| 3. Are received fresh vegetables stored in protected areas?                          | **Adequate:** clean baskets, elevated from floor, stored in clean cold rooms, stored separately from raw meat/poultry/fish. |
| 4. Is the entrance to food service area controlled to staff only                     | **Adequate:** entry is permitted with protective clothing. Doors are kept closed |
| 5. Are unprocessed raw vegetables prepared so that contamination and cross-contamination does not occur? | **Adequate:** the vegetable preparation is area is kept clean, sanitized and separated from raw meat/poultry/fish. Use of separate utensils.  
**Incomplete:** There is an attempt to separate raw vegetable preparation yet there is a dirty surrounding or improper handling and use of unclean utensils.  
**Inadequate:** whole area unprotected from chemicals, cleaning tools/materials, pests, dirty surfaces, or prepared in non-isolated area from raw meat. |
| 6. Is frozen food thawed properly?                                                  | **Adequate:** Thawing in cold rooms/refrigerator |
| 7. Are staffs cleaning tools stored in appropriate manner and not at risk of contaminating food or equipment during preparation? | **Adequate:** Stored in separate areas from food production unit.  
**Incomplete:** There is a clear evidence of detergents, pesticides or other chemicals within food preparation areas and in close contact to food.  
**Inadequate:** There is an attempt (i.e., showing clean floors, partially clean surfaces, yet cutting boards have crevices; small/heavy equipment dirty). |
| 8. Are floors, work surfaces, utensils and equipment clean?                         | **Adequate:** yes  
**Incomplete:** There is an attempt (i.e., showing clean floors, partially clean surfaces, yet cutting boards have crevices; small/heavy equipment dirty). |

29
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Adequate:</th>
<th>Inadequate:</th>
<th>Incomplete:</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>All major pieces of equipment such as refrigerators, freezers, ovens, hot holding equipment, and cold holding equipment are fitted with working temperature monitoring gauges.</td>
<td>yes</td>
<td>no</td>
<td>at least one refrigerator has no apparent temperature gauges or an internally fitted thermomter.</td>
</tr>
<tr>
<td>10</td>
<td>Is there a washing sink designated for fresh produce only?</td>
<td>yes</td>
<td>no</td>
<td>when the designated sink for washing vegetable is kept unclean and/or exposed to external environment.</td>
</tr>
<tr>
<td>11</td>
<td>Are vegetable sanitizers made up correctly?</td>
<td>yes</td>
<td>no</td>
<td>at least one refrigerator has no apparent temperature gauges or an internally fitted thermomter.</td>
</tr>
<tr>
<td>12</td>
<td>Are staff personal belongings stored in appropriate manner and not at risk of contaminating food or equipment?</td>
<td>no</td>
<td>yes</td>
<td>There is a clear evidence of staff belongings and clothing in food preparation area.</td>
</tr>
<tr>
<td>13</td>
<td>There are hand-washing facilities in food handling areas supplied with warm soap and disposable towels</td>
<td>no</td>
<td>yes</td>
<td>There is no supply of soap or towel or it is not functioning properly.</td>
</tr>
<tr>
<td>14</td>
<td>The cleaning schedule is placed and visible</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Where a chemical sanitiser is used are there records to show levels are maintained?</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Are sanitisers for work surfaces readily available for use during food preparation?</td>
<td>yes</td>
<td>no</td>
<td>improper dilution or misuse.</td>
</tr>
<tr>
<td>17</td>
<td>Waste containers are covered and kept clean</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Containers used to drain vegetables are kept clean</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Food handlers use gloves appropriately and correctly</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Kitchen personnel wear appropriate protective clothing and protective head coverings</td>
<td>complete protective clothing</td>
<td>no</td>
<td>Staff wearing incomplete protective clothing; or only nylon apron above the regular daily clothing.</td>
</tr>
<tr>
<td>21</td>
<td>Hair covered by all staff in food preparation facility</td>
<td>no</td>
<td>yes</td>
<td>Production staffs are working with no protective clothing.</td>
</tr>
<tr>
<td>22</td>
<td>Visitors or unauthorized staff are granted protective clothing upon entry</td>
<td>yes</td>
<td>no</td>
<td>improper dilution or misuse.</td>
</tr>
</tbody>
</table>
Correct use of equipment/utensils/cutting boards for fresh produce to prevent cross-contamination

Adequate: Proper color coded separation and proper use.
Incomplete: The color coded concept/separation exists, yet there is evidence of misuse.
Inadequate: use of same CB for raw meat and raw vegetables

Are food on hold covered?
Adequate: yes
Inadequate: no

Is there evidence of temperature control during storing?
Adequate: Evidence of records

Is there evidence of temperature control during cooking?
Adequate: Evidence of records

Is there evidence of temperature control during cooling?
Adequate: Evidence of records

(Source: Faour-Klingbeil et al., 2016)

Supplementary materials

Table 1S. Statistical output of Somer’s D association test of inspection components with management types

<table>
<thead>
<tr>
<th>Visual assessment components†</th>
<th>1a</th>
<th>1b</th>
<th>1c</th>
<th>1d</th>
<th>2a</th>
<th>2b</th>
<th>3a</th>
<th>3b</th>
<th>3c</th>
<th>4b</th>
<th>5c</th>
<th>5d</th>
<th>5e</th>
<th>5f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somer’s D Coefficient</td>
<td>0.66</td>
<td>0.49</td>
<td>0.58</td>
<td>0.65</td>
<td>0.67</td>
<td>0.52</td>
<td>0.55</td>
<td>0.61</td>
<td>0.56</td>
<td>0.41</td>
<td>0.71</td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† Inspection components (dependent) were measured in relation to independent variable “Type of management” and coefficients showed a stronger association with components related to general hygiene practices, cleanliness, staff personal hygiene and well-maintained facilities

Table 2S. Measures of weak association of components rated by visual assessment with the type of management operating food service establishments

<table>
<thead>
<tr>
<th>Visual assessment components</th>
<th>4a cooking</th>
<th>4a cooling</th>
<th>4a storing</th>
<th>5g</th>
<th>6c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somer’s D Coefficient</td>
<td>0.35</td>
<td>0.32</td>
<td>0.38</td>
<td>0.18</td>
<td>0.26</td>
</tr>
<tr>
<td>Approx. sign</td>
<td>0.007</td>
<td>0.007</td>
<td>0.02</td>
<td>0.036</td>
<td>0.008</td>
</tr>
</tbody>
</table>