

VALIDATION OF THE ARABIC VERSION OF THE FOOD SAFETY AND HYGIENE QUESTIONNAIRE AMONG NUTRITION STUDENT

Nada El Darra

Dina Cheaib

LEILA ITANI

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VALIDATION OF THE ARABIC VERSION OF THE FOOD SAFETY AND HYGIENE QUESTIONNAIRE AMONG NUTRITION STUDENT

Abstract

There is shortage of data on food safety knowledge and practices among Lebanese food handlers due to the lack of a reliable tool. The aim of the current study is to determine the reliability as well as the validity of an adopted Arabic version of the Osaili et al (2013) food safety questionnaire. Translation and back translation and testing equivalence were done using standard accepted procedures. A total of 110 undergraduate Nutrition and Dietetics students completed the questionnaire consisting of five subscales that covers major food safety concepts including personal hygiene, safe storage, cross contamination prevention, knowledge of health problems affecting food safety and symptoms of foodborne diseases. Construct validity was tested using knowledgeable group analysis; internal consistency was determined using Cronbach's α and item-to-total correlation. Temporal stability was evaluated by test-retest reliability in a subgroup of 67 students. The results showed non-significant difference between scores of English and Arabic versions revealing equivalence. For the psychometric analysis, the significant statistical difference for most of food safety knowledge scores between lower and higher years of study indicates satisfactory construct validity. The test-retest reliability of the Arabic questionnaire showed a good temporal stability (ICC>0.8), while the Cronbach's α for the total scales ranged between 0.611 and 0.736 revealing an acceptable and satisfactory level of internal consistency for the items retained in the questionnaire. The translated Arabic version of the food safety questionnaire can be considered as a consistent and reliable tool, to be used as food safety knowledge assessment among food handlers.

Keywords

food safety, questionnaire, knowledge, nutrition, students

1. INTRODUCTION

Food safety has always been considered as a major health concern worldwide. It is defined as the practices that assure the quality of food without causing harm to human health or any type of foodborne diseases (Hassan & Dimassi, 2014; Zeeshan et al., 2017). According to WHO, more than 30% of people in developing countries are affected by food borne diseases causing several types of illnesses, disabilities or even deaths (WHO, Global burden of foodborne diseases, 2015).

In Lebanon, the Ministry of Public Health raised the alarm about the risk of foodborne diseases and has stepped up food safety monitoring, after an increase in foodborne outbreaks according to the data of the National Health Statistics Report in Lebanon. The inspection of restaurants, slaughterhouses, supermarkets and farms revealed that more than 1000 establishments presents unsatisfactory results (Institute of Health Management and Social Protection, USJ, WHO, & MoPH, 2012). This was mainly due to the breaking of the food safety rules (Millstone and van Zwanenberg 2002, Scallan et al. 2011). Food safety knowledge, attitude and behavior among food handlers are the main parameters controlling the occurrence of foodborne outbreaks (Arendt, Strohbehn, & Jun, 2015).

The World Health Organization recognized several factors important in prevention of foodborne diseases including poor respect of personal hygiene and sanitation; cross-contamination from other food sources; inadequate cooking time or temperature abuse during storage; and purchasing food from unsafe sources (WHO, 2006). All these factors are controllable in foodservice operations, except for the first practice related to employee food handling practices (Arendt et al., 2015). The violation of good hygienic rules by the food handlers might enhance the bacterial contamination of the food (Walker, Pritchard, & Forsythe, 2003). Therefore, to lower the risk of foodborne illnesses, it is essential to understand the correct knowledge and practices of food handlers. In order to record the food safety practices, various previous studies have showed that the practices of food handlers in catering establishments have insufficient knowledge concerning the basics of food hygiene including storage temperatures and critical cooking time, cross-contamination, as well as personal hygiene rules with a mean score of the food safety knowledge was around 60% (Jianu and Chiş 2012, Martins et al. 2012).

In view of the rising tide of foodborne illness and the increasing counteracting government directed actions, trainings and monitoring, there is a need for a reliable tool to assess the current knowledge of food handlers and evaluate the effectiveness of training efforts (Glenn Morris, 2011; World Health Organization, 2015). In the absence of valid and reliable tool, the needed evaluation and monitoring is difficult to achieve. Such data are limited due to the lack of a specific Arabic food safety questionnaire that can evaluate these factors. Several questionnaires assessing food safety knowledge and practices among food handlers have been developed and validated namely, the food safety knowledge questionnaire developed, in English, by Tareq M. Osaili et al., 2013 (Osaili et al., 2013).

This study attempts to assess and evaluate the reliability and validity of the Arabic version of the Osaili food safety questionnaire which could be used as a self-reported tool to evaluate food safety training and education programs.

2. METHODOLOGY

2.1. Study design

A cross-sectional study was conducted to determine the validity as well as the reliability of the translated version of the Osaili Food safety knowledge questionnaire. The study was undertaken between fall and spring 2018-2019.

2.2. Study participants

Nutrition and dietetics undergraduate students registered in the three academic years of the Nutrition and Dietetics program at Beirut Arab University were invited to participate in the study. Through this program, students study three courses that cover Food safety content during the second and third year. Hence, the students in the first year were considered as non-knowledgeable group (ND1) and students in the second and third year were considered

knowledgeable groups (ND2 & ND3). This proposition is justified by the report of Zeeshan et al in 2017, that Health science students acquire good knowledge related to food safety through the delivered curricula (Zeeshan et al., 2017). Participants were approached by the principle investigator who explained the study and requested their participation and obtained a written consent before completing the questionnaire. All students who approved to participate were included in the study giving a total number of 110 participants (ND1=50, ND2=22 & ND3=38). Sixty-seven students approved to complete the questionnaire twice for test retest reliability of the final Arabic version. Post hoc power analysis indicated an 90% power for a Cronbach's alpha of 0.60 and a scale of minimum 8 items.

2.3. Questionnaire content

The questionnaire items were adopted from the food safety questionnaire published by Osaili in 2013 (Osaili et al., 2013). The questionnaire originally consisted of five subscales that covers major food safety knowledge including personal hygiene (10 questions), cross contamination prevention (20 questions), safe storage (14 questions), knowledge of health problems affecting food safety (10 questions) and symptoms of foodborne illnesses (9 questions) (Table 1). The final version that was included in the current study consisted also of 5 scales and included items on personal hygiene (8 questions), cross contamination prevention (18 questions), safe storage (12 questions), knowledge of health problems affecting food safety (10 questions) and symptoms of foodborne illnesses (8 questions) (table 1).

Table 1. The number of items and sub items and the maximum and minimum possible score in each scale of the questionnaire

Scale	Number items in original scale	Number of items retained	Item score	
			minimum	Maximum
Personal hygiene	14	8	0	8
Cross contamination, prevention and sanitation	20	18	0	18
Safe storage, thawing, cooking, and reheating of the foods	14	12	0	12
Knowledge of health problems that would affect food safety	10	10	0	10
Knowledge of symptoms of foodborne illnesses	9	8	0	8
Total knowledge score of food safety	67	56	0	56

2.4. Translations and back-translations

The original questionnaire developed by Osaili *et al.* (2013) was translated to Arabic language using standard procedures (Koller et al., 2007). The forward translation was done by two of the investigators to ensure cultural appropriateness and good transfer of the content. The Arabic version was back-translated into English by an expert who had not seen the original English version. The investigators compared the back-translated copy to the original English version to detect incongruities. The Arabic translated version was then modified with corrective re-translation as necessary.

2.5. Psychometric Analysis

2.5.1. Construct validity

Construct validity was assessed using Knowledgeable group analysis (Cronbach & Meehl, 1955). Participants (n=110) were Nutrition and dietetics students randomly selected from the three academic years of the Nutrition and dietetics (ND) curriculum (ND1,ND2,ND3). Students were approached in class and the questionnaires were completed in the presence of the researcher after obtaining the written consent of the participants. The participants were able to complete the questionnaire within 20- 30 min. The mean scores for each scale were compared across the three academic years (ND1, ND2, and ND3). ANOVA was used to assess the difference across the three academic years. A significantly higher mean score of the different subscales in higher academic years indicated the ability of the subscale to measure the knowledge construct for personal hygiene; cross contamination, prevention and sanitation; safe storage; thawing; cooking and reheating of the foods; symptoms of health problems that would affect food safety; symptoms of foodborne illnesses.

2.5.2. Internal consistency

Internal consistency was determined using Cronbach's α and item-to-total correlation (Parmenter and Wardle 2000, Tavakol and Dennick 2011). Responses of the same participant group who participated in the knowledgeable group test were used to determine internal consistency (n=110). Cronbach's alpha is a measure of the internal consistency between several items, that estimates how reliable are the responses of a questionnaire (Cronbach, 1951). Cronbach's α was calculated for total scales and if an item was removed. Cronbach's α values between 0.5 and 0.7 indicated good consistency based on dimensionality of the scale (Bland and Altman 1997, Bowling 2002). An item was considered to have a good correlation with the scales if item-to-total correlation was higher than 0.2 (Kline, 1986). Items with item-to-total correlation below 0.2 were retained if Cronbach's α did not increase upon deleting these items (Nunnally & Bernstein, 1994). Items that contributed negatively to total Cronbach's α and did not fulfill the criteria indicated were removed. The final total number of items retained in the questionnaire and included in the analysis are shown in Table 1.

2.5.3. Test–retest reliability of the final questionnaire

A random sample of 67 students selected randomly from the nutrition & dietetics department at Beirut Arab University was used to study the temporal stability of the Arabic version of the questionnaire. The questionnaire was administered twice with a period of 2 weeks between the two sittings (T1 & T2). Pearson's correlation coefficient and intraclass correlation were calculated between the scores at T1 and T2. A paired t-test analysis was conducted to compare mean scores between the two sittings (T1 & T2). The criteria for interpretation of ICC used in section 2.4 above described by Fleiss et al(1988) were used (Fleiss, Wallenstein, Chillton, & Goodson, 1988).

2.6. Scoring of the Final Questionnaire

Each item was answered on a dichotomous scale (No, Yes). For all the sections of the questionnaire, questions were coded 0 and 1, for wrong and correct answers, respectively. The scores for each subscale were determined by summing up the scores for all the scale items. A total Knowledge score was calculated by summing up the scores of the five subscales. The scores (minimum and maximum) for each subscale and the total score are shown in table 1.

2.7. Data Analysis

All data were entered, cleaned, and analyzed using SPSS 21 (SPSS Inc., Chicago, IL, USA). Statistical significance was accepted at $p < 0.05$.

3. RESULTS

The Osaili 2013 Food safety questionnaire was translated and validated for use in assessment food handler's knowledge in Lebanese food industry. Based on the psychometric analysis, only items that revealed acceptable psychometric properties were retained in all scales. The items retained and the corresponding minimum and maximum scales are presented in table 1. The results revealed good temporal stability, construct validity and internal consistency in the retained items.

3.1. Construct Validity and Mean Food Safety Knowledge Across Academic Years of Study

The means of food safety knowledge attitude and practices scores among nutrition and dietetics students (n=110), in different academic years of study (ND1, ND2, ND3) are presented in Table 2. For the majority of food safety knowledge scales, the mean scores did not differ significantly between the first two academic years of study while students in the third year scored significantly higher on personal hygiene (6.12±1.19, 6.36±1.22 vs. 6.97±0.75), cross contamination (13.06 ±2.74, 13.32 ±2.68 vs. 14.82 ±2.58), safe storage, thawing, cooking, and reheating of the foods (7.56±1.88, 7.82±1.37 vs. 9.74±1.06) and knowledge of health problems that would affect food safety (6.88 ± 1.30, 6.27 ± 1.35 vs. 7.58 ± 1.03) except for knowledge of the symptoms of foodborne illness that did not differ across the three academic years (5.50±1.36, 6.18±1.33 and 6.18±1.29). However, the total knowledge score followed the same trend as the other subscales third year students scoring significantly higher than first- and second-year students (39.12±7.96, 39.95±4.04 vs. 45.29±45.29).

Table 2. Mean Food safety knowledge score among Nutrition and dietetics students in different academic years (n=110)

Score	ND 1 n= 50	ND 2 n= 22	ND 3 n= 38
Personal hygiene	6.12±1.19 ^a	6.36±1.22 ^a	6.97±0.75 ^b
Cross contamination, prevention and sanitation	13.06 ±2.74 ^a	13.32 ±2.68 ^a	14.82 ±2.58 ^b
Safe storage, thawing, cooking, and reheating of the foods	7.56±1.88 ^a	7.82±1.37 ^a	9.74±1.06 ^b
Knowledge of health problems that would affect food safety	6.88 ± 1.30 ^a	6.27 ± 1.35 ^b	7.58 ± 1.03 ^c
Knowledge of symptoms of foodborne illnesses	5.50±1.36	6.18±1.33	6.18±1.29
Total knowledge score of food safety	39.12±7.96 ^a	39.95±4.04 ^a	45.29±45.29 ^b

^{a,b,c} values with different superscripts are significantly different at p<0.05

3.2. Internal Consistency

The item-to-total score correlation and internal consistency for the Knowledge scale items is presented in Table 3. This table showed acceptable internal consistency measured by Cronbach's α for the item analysis of the five scales assessed in the questionnaire personal hygiene, cross contamination prevention, safe storage, knowledge of health problems affecting food safety and symptoms of foodborne illnesses. Table 3 has shown that the Cronbach's α for the five scales varied between 0.611 and 0.736 which is acceptable. Cronbach's α were 0.639, 0.736, 0.611, 0.675 and 0.652 for personal hygiene, cross contamination prevention and sanitation, storage, thawing, cooking and reheating of foods, knowledge of health problems affecting food safety, knowledge of symptoms of foodborne illnesses respectively.

Table 3. Item-to-total correlation and internal consistency for the Knowledge scale items (n=110)

	Item total correlation	Cronbach's Alpha if Item Deleted
Knowledge items		
<i>Personal hygiene</i>		
1. It is important to wash hands after touching money	0.249	0.627
2. It is important to wash hands after touching the body	0.601	0.513
3. It is important to wash hands during continuous food handling	0.393	0.598
4. It is important to wash hands after touching a clean countertop	0.221	0.656
5. It is important to wash hands after blowing of nose	0.398	0.599
6. It is important to wash hands after cleaning tables	0.343	0.615
7. It is important to wash hands after touching work clothes	0.321	0.621
8. It is necessary to wear gloves before touching ready to eat food products	0.249	0.627
Total scale Cronbach alpha		0.639
<i>Cross contamination prevention and sanitation:</i>		
1. Use same knife to cut raw meat or poultry and to chop vegetables	0.143	0.737
2. Wash knife used to cut raw meat or poultry with cold water before using it to chop vegetables	0.399	0.720
3. Wash knife used to cut raw meat or poultry with hot water before using it to chop vegetables	0.475	0.708
4. Wash knife used to cut raw meat or poultry with water and soap before using it to chop vegetables	0.203	0.738
5. Wash knife used to cut raw meat or poultry with water and soap then apply sanitizer before using it to chop vegetables	0.237	0.733
6. Wipe knife used to cut raw meat or poultry with a piece of cloth before using it to chop vegetables	0.530	0.705
7. Change knife to cut raw meat or poultry and to chop vegetables	0.091	0.740
8. Use same cutting board to cut raw meat or poultry and to chop vegetables	0.307	0.733
9. Wash cutting board used to cut raw meat or poultry with cold water before using it to chop vegetables	0.521	0.709
10. Wash cutting board used to cut raw meat or poultry with hot water before using it to chop vegetables	0.559	0.698
11. Wash cutting board used to cut raw meat or poultry with water and soap before using it to chop vegetables	0.461	0.709
12. Wash cutting board used to cut raw meat or poultry with water and soap then apply sanitizer before using it to chop vegetables	0.236	0.735
13. Wipe cutting board used to cut raw meat or poultry with a piece of cloth before using it to chop vegetables	0.493	0.711
14. Wash surface with water and soap then apply a sanitizer is the most effective method in cleaning and sanitize food contact surfaces	0.061	0.742
15. Store vegetables salad in the upper shelf in refrigerator if raw meat or chicken in middle shelf	0.390	0.720

	Item total correlation	Cronbach's Alpha if Item Deleted
16. Store vegetables salad in the lower shelf in refrigerator if raw meat or chicken in middle shelf	0.309	0.727
17. Store vegetables salad in meat or poultry refrigerator	0.288	0.728
18. Store vegetables salad in upper shelf in the meat or poultry refrigerator	0.089	0.749
Total subscale Cronbach alpha		0.736

<i>Safe storage, thawing, cooking and reheating of the foods</i>	Item total correlation	Cronbach's Alpha if Item Deleted
1. Thaw frozen raw meat or poultry in the refrigerator	0.356	0.567
2. Thaw frozen raw meat or poultry in running tap water	0.353	0.567
3. Thaw frozen raw meat or poultry in the microwave	0.482	0.529
4. Refrigerator operating temperature is 1-5 °C	0.267	0.593
5. Freezer operating temperature is -18 °C	0.142	0.611
6. Check poultry is sufficiently cooked by thermometer	0.371	0.563
7. Store leftover on steam table	0.115	0.615
8. Store leftover in the refrigerator	0.227	0.597
9. Store leftover on the countertop or table in the kitchen	0.282	0.590
10. Store leftover on the shelf in the kitchen	0.233	0.599
11. Store leftover in the oven	0.185	0.614
12. Reheat food to temperature of 73 °C	0.356	0.567
Total subscale Cronbach alpha		0.611

<i>Knowledge of health problems that would affect food safety</i>	Item total correlation	Cronbach's Alpha if Item Deleted
1. Sneezing would affect food safety	0.187	0.675
2. Coughing would affect food safety	0.180	0.677
3. Hypertension would affect food safety	0.491	0.626
4. Covered wound in the hand with wearing a glove would affect food safety	0.114	0.693
5. Fever would affect food safety	0.381	0.643
6. Anger would affect food safety	0.531	0.613
7. Sore throat would affect food safety	0.484	0.616
8. Vomiting would affect food safety	0.275	0.663
9. Diarrhea would affect food safety	0.453	0.625
10. Smoking would affect food safety	0.305	0.657
Total subscale Cronbach alpha		0.675

<i>Knowledge of symptoms of foodborne diseases</i>	Item total correlation	Cronbach's Alpha if Item Deleted
1. Abdominal pain is a symptom of foodborne illnesses	0.167	0.657
2. Vomiting is a symptom of foodborne illnesses	0.095	0.663
3. Nausea is a symptom of foodborne illnesses	0.199	0.651
4. Headache is a symptom of foodborne illnesses	0.441	0.592
5. Hypertension is a symptom of foodborne illnesses	0.537	0.560
6. Hypoglycemia is a symptom of foodborne illnesses	0.430	0.596
7. Pain in the bone is a symptom of foodborne illnesses	0.584	0.548
8. Coughing or sneezing is a symptom of foodborne illnesses	0.242	0.656
Total subscale Cronbach alpha		0.652

3.3. Test-retest reliability of the Arabic questionnaire

The results of test-retested reliability of the final Arabic questionnaire are presented in Table 4. The paired t-test showed that the mean scores between the two sittings (T1 & T2) did not differ significantly for all scales and the total knowledge score (P-value>0.05). Pearson's correlation showed good correlation between T1 and T2 scores for knowledge of personal hygiene ($\rho=0.792$; P-value<0.05), cross contamination prevention and sanitation ($\rho=0.722$;P-value<0.05), symptoms for food borne illnesses ($\rho=0.716$;P-value<0.05). A moderate correlation was shown for knowledge of safe storage, thawing, cooking and reheating of the food ($\rho=0.698$;P-value<0.05) and health problems that would affect food safety ($\rho=0.560$;P-value<0.05). A high correlation was shown for the total score ($\rho=0.844$; P-value<0.05). The results revealed an excellent consistency between the scores at the two sittings for the knowledge of personal hygiene (ICC=0.882), cross contamination (ICC=0.837), safe storage (ICC=0.821), and symptoms of foodborne illnesses (ICC=0.833). A good consistency was shown for health problems that would affect food safety (ICC=0.717). An excellent total consistency was shown for the total food safety knowledge score (ICC=0.914) between T1 and T2.

Table 4. Mean and standard deviations, Pearson's correlation coefficients and intraclass correlation for the scores of the final Arabic version at two sittings (n=67).

Scale	Mean Scores		Paired t-test	Correlation between scores at T1 and T2	Intraclass correlation (ICC)		
	T1	T2			ICC	95% CI	
	Mean±SD		P-value	Correlation coefficient		ICC	CI
Personal hygiene	5.39±0.95	5.42±1.05	0.708	0.792**	0.882	0.808- .927	<0.0001
Cross contamination, prevention and sanitation	14.60±2.02	14.63±2.23	0.879	0.722**	0.837	0.734- 0.900	<0.0001
Safe storage, thawing, cooking, and reheating of the foods	10.27±1.34	10.40±1.26	0.282	0.698**	0.821	0.709- 0.890	<0.0001
Knowledge of health problems that would affect food safety	6.63±1.20	6.54±1.20	0.526	0.560**	0.717	0.540- 0.826	<0.0001
Knowledge of symptoms of foodborne illnesses	6.51±1.27	6.37±1.20	0.244	0.716**	0.833	0.729- .898	<0.0001
Total knowledge score of food safety	43.33±3.99	43.42±4.33	0.756	0.844**	0.914	0.860- 0.947	<0.0001

* Correlation is significant at p<0.05

** Correlation is significant at p<0.01

4. DISCUSSION

The Arabic version of the *Osaili et al. (2013)* food safety questionnaire was adopted in need for a reliable tool to assess the current knowledge among food handlers as well evaluate ongoing training programs or curricula. The results indicate that the Arabic version of the questionnaire measured the construct of Food safety knowledge among the participants with good internal consistency, temporal stability, and is suitable for use as food safety knowledge assessment tool among food handlers.

The knowledgeable group analysis indicated significantly higher knowledge score on all scales among senior Nutrition and dietetics students (ND3) compared to junior (ND2) and sophomore students (ND1) asserting the ability of the questionnaire to measure food safety knowledge. This observation is justified by the fact the Nutrition and dietetics curriculum offers two compulsory courses that handle food safety namely “Food service management” and “Food safety” courses offered to senior students in the third year and deliver detailed knowledge on food safety. While sophomore students and Junior students are not offered any courses on food safety except for food technology course during the second year for Juniors. Hence, the students will acquire all food safety knowledge over the three academic years. The results are also in accordance with those of Zeeshan et al. (2017), Lazo et al. (2012) in Greece and (Cufaoglu, Ambarcioglu, & Ünsal Adaca, 2022) in Turkey reporting that students from health faculties and who have joined health-related programs have good knowledge related to food safety concepts (Lazou, Georgiadis, Pentieva, McKeivitt, & Iossifidou, 2012; Zeeshan et al., 2017). Moreover, the higher the year of study, the greater the knowledge score which is confirmed by Hassan and Dimassi (2014) (Hassan & Dimassi, 2014). However, only one food safety knowledge scale related to “health problems that would affect food safety” revealed statistically significant difference among the three years of study, the higher scores for senior students could be attributed to the knowledge acquired during the third year in one course (food safety course). The lower means of the first and second year could be attributed to the fact that most of the students live with their families which means that their meals are cooked and prepared by their mothers at home, where some food safety practices may be traditionally acquired from their mothers with low education background (Hassan & Dimassi, 2014; Osaili, Obeidat, Abu Jamous, & Bawadi, 2011).

The results showed an acceptable and satisfactory level of internal consistency for all the items assessed in the questionnaire measured by the item-to-total correlation and Cronbach’s α . Further analysis of item-to total correlation analysis reveals that each item belonged to its corresponding scale. Cronbach’s α for the total scales ranged between 0.639 and 0.736. Values of Cronbach’s alpha below 0.7 are common for one-dimensional scales with less than 10 items which is the case for “personal hygiene” (Cronbach’s alpha = 0.639) and “knowledge of symptoms of foodborne diseases” in the current study (Cronbach’s alpha= 0.652) (Cortina, 1993; Sijtsma, 2009). Loewenthal & Lewis (2018) demonstrated that the alpha coefficient could be lower if the scale had less than 10 items due to the effect of a small number of items on the alpha value (Loewenthal & Lewis, 2018). The other scales, demonstrated Cronbach’s alpha less than 0.7 namely the safe storage, thawing, cooking and reheating foods (0.611), knowledge of health problems (0.657) that would affect food safety with items of 12 or 10 items respectively. These were retained given the observed stability of Cronbach’s alpha when items were removed and the importance of the construct measured in addition to the demonstrated construct validity and temporal stability (Cortina, 1993). Further, the moderate Cronbach’s alpha for items on each scale or subscale indicate that items are satisfactorily interrelated with little redundancy (Panayides, 2013). Also, the lower item to total correlation indicates on each scale of the questionnaire, is preferable as it indicates lower homogeneity of items (Panayides, 2013).

Regarding temporal stability of the Arabic version revealed excellent stability as measured by paired t-test, and intraclass correlation and Pearson’s correlation. Thus, confirming the validity of the translated version to measure food safety knowledge over time.

The current study carries some limitations and strengths. The limitations reside in the small sample size and the use of a single setting and students from Health sciences to assess the performance of the questionnaire which limits generalizability of the results. The strength of the study stems from the fact that it provides a needed tool in Arabic language to evaluate current ongoing training activities or curricula at the country level.

5. Conclusion

The current study showed that the Arabic version of the *Osaili* Food safety questionnaire could be used as reliable and valid tool to assess food safety knowledge and practices among Food handlers in Lebanon and the Arab countries. The tool can be also used to evaluate current education and training programs and curricula targeting food handlers, students in the health field, and stakeholders in the food industry. Availability of such a tool can shed light on the gaps in training programs or curricula in higher institution targeting health professionals in different Arabic speaking-countries.

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