Abstract

Background: Food and kitchen hygiene are necessary conditions for safe food and prevent foodborne illnesses. The objective of this study was to identify the factors associated with caregivers' knowledge of kitchen hygiene in San Juan de Lurigancho (SJL).

Methods: This was a cross-sectional study. We surveyed 250 mothers at comedores populares (a sort of community kitchens which are very popular in Lima) and who were part of mothers' clubs in the areas of Huascar V and San Pablo, in SJL in Lima. The sample was selected through non-probability convenience sampling. A questionnaire with three dimensions (cleanliness, storage and contamination of children) was administered.

Results: On average, in Huascar and San Pablo, most caregivers were the children's mothers (93.2%); most of the caregivers were between 21 and 30 years old (54%); they had secondary level of education (70.4%); they were living in free union with their partners (69.2%); they were mainly housewives (80.4%); their houses were constructed with materials different from brick and cement (68.4%); and their houses had a bare floor (70.0%). They did not have drinking water in the kitchen (88.4%); they did not use a gas stove (88.4%), a refrigerator (50.0%), a radio (82.0%), or a microwave (16.4%). A good level of knowledge of food hygiene was found in 63.2% of caregivers. No predictive capacity of the assessed sociodemographic characteristics on the level of knowledge of kitchen hygiene was identified.

Conclusions: This study determined that the assessed sociodemographic variables were not significantly associated with the level of knowledge about kitchen hygiene. It is necessary to improve mothers' knowledge about the handling and consumption of spoiled food and their effect on children's health.
Keywords
knowledge, food, kitchen, cleanliness, storage

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Introduction
Poor food storage and handling as well as poor kitchen hygiene contribute to a large number of foodborne diseases (FDs). Up to 87% of food poisoning incidents originate at home due to improper food handling. FDs are a threat to public health in this century due to the role of the household in the transmission and acquisition of foodborne diseases. The most frequent causes are diarrheal pathogens, on contaminated surfaces such as kitchen towels and chopping boards in the kitchen as they can harbour a large number of coliforms. The most affected are children under 60 months old. In the event of the child having diarrhea mothers tend to offer less food and the nutrients needed for growth decrease, and can result in malnutrition and make them more prone to illnesses, infections, and inadequate development.

In many countries, hygiene and infant feeding processes become a highly vulnerable activities due to poor handling of the food, and affect 13.2% of children aged 6 to 60 months. Research in a peri-urban area of Lima reported that 21.8% of the children who required hospitalization were referred for diarrhoea.

Despite education efforts, consumers develop unsafe food storage and handling behaviors, contaminating sponges, cloths and kitchen towels, making them reservoirs and vectors of bacteria in the kitchen and contaminating other surfaces. Peru has a food sanitary regulation, published by the Dirección General de Salud Ambiental DIGESA, which regulates the products for sale and publishes a consumer defense code. The Health Ministry, Ministerio de Salud MINSA has published manuals on good food handling practices, aimed at restaurants, sale stores, but there are none designed and written for mothers in the home.

Mothers play an important role in the prevention and control of Foodborne illness with regard to hygiene measures, including production, storage, food handling and hygienic practices. Unwashed hands, fecal contamination, microbial load in water, flies, parasites, the presence of animals in the kitchen, poorly washed containers, and an unhygienic environment contaminate food. Studies of mothers in the rural jungle and highlands of Peru reported that only 20% of them washed their hands before touching food and only 6% of those who did wash their hands used soap. In other countries mothers who were observed to practice optimal cleaning of foods have been associated with better health and less disease in the children.

There is information showing that the economic and demographic aspects (e.g., rural living, poor access to water) are associated with mothers’ knowledge with regard to kitchen hygiene. In this study we proposed to establish whether the mothers’ sociodemographic characteristics were related to good knowledge about food management in the home or not, in a population of mothers in a peri-urban area of Lima. The results can be an opportunity to understand this group of mothers and their role in food management, since most of them are the mainly responsible for the preparation of meals for their families.

Methods
We conducted a cross-sectional observational study. The study was carried out in a peri-urban area in Lima, Peru in the human settlements of San Pablo and Huáscar V (SJL).

Participant selection
The population of interest was mothers with children, attending two comedores populares (locally run food kitchens) and/or mothers’ clubs. This was a non-probability convenience sample.

Mothers were approached at the comedores populares (community kitchens) as these are locally managed and staffed, often through mothers’ clubs. However, in the case of Huascar V, mothers who were in the waiting room of a local health post were interviewed as well, in order to complete the sample. Two experienced field workers helped with the face-to-face interviews.

Permission was requested from the comedores populares and the health facility before interviewing the mothers. We explained to mothers were explained about the questionnaire and they were asked to sign the informed consent form. The interviewers mentioned that the mothers were suspicious when listing the appliances they had in their homes but they accepted when we were able to reassure them that neither their names nor addresses would be made public.
A total of 250 women or caregivers were interviewed, distributed in the areas described (San Pablo = 125 and Huascar V = 125). Inclusion criteria were mothers who had a child under 60 months old and prepared food for them at home, and who voluntarily agreed to participate in the study by signing the informed consent form. Exclusion criteria included mothers or caregivers who had a child with a cognitive impairment.

Administration of the questionnaire
The questionnaire had three parts: the first assessed the kitchen hygiene process; the second dimension evaluated the storage of products; and the last dimension examined the food-disease relationship based on the ingestion of spoiled products (Cleanliness has 4 statements, Storage has 4 statements, Contamination of the child: 2 statements). Due to the dichotomous nature of variables, we applied a principal components analysis (Kuder-Richardson KR-20) was applied due to the dichotomous nature of variables, to define the internal validity; finally, the Kaiser-Meyer-Olkin (KMO) test and Barlet's test of sphericity were applied to define and further check the validity of the test. The test results showed the following: KMO = 0.549; Barlet’s 591.678; gl =136, (p < 0.05). The three components (kitchen hygiene, product storage and disease from ingestion of spoiled foods), these factors explained 66.75% of the total variance of the test.19 In this study, we needed to use the sum of the replies to the each dimension to calculate the total score, according to Table 1. The answers, yes (affirmative answer) and no (negative answer) were tabulated.

The knowledge variable was measured as follows:

Good knowledge of food hygiene: If the participant had more than seven “YES” answers out of 10 questions, it was considered good knowledge of food hygiene in the home.

Not so good knowledge of food hygiene: If the participant had fewer than or seven “YES” answers out of 10 questions, it was considered not so good knowledge of food hygiene in the home.20

Sample
A convenience sample was determined for this study using the following sampling proportion formula for a finite population.

\[ n = \frac{Z^2 p q N}{N e^2 + Z^2 p q} \]

Where:

\[ Z = \text{confidence level} = 1.96 \quad \alpha = 0.05 \]

\[ p = \text{Probablility in favour} = 50\% \text{ of kitchen hygiene knowledge} \]
q = Probability against = 50% kitchen hygiene knowledge

N = Universe

e = estimation error

n = sample size

We adopted a non-probabilistic sampling strategy to compare knowledge according to sociodemographic profile. The final sample for the study consisted of 250 mothers or caregivers who attended the comedores populares (community kitchens) and mothers’ clubs in the areas of San Pablo and Huáscar, in each area we included 125 participants.

**Variables**

Dependent variable (Y1): Knowledge of kitchen hygiene.

Independent variables (X1): Education level, occupation of the mother, marital status, caregiver (refers to the person who has a child, and takes care of him or her, not necessarily the mother can be just a caregiver), age of the mother, house building material, house floor material, drinking water, owning a gas stove, owning a refrigerator, a radio or television set, or a microwave.

**Research execution**

We visited the mothers’ clubs and comedores populares (community kitchens) in Huáscar V and San Pablo, in San Juan de Lurigancho (a large relative poor “shanty town” communities in the outskirts of Lima city, to ask permission from the people in charge of these organizations and to inform them about the activities that were going to be carried out. This included approaching the mothers during the morning shift, very close to lunchtime. Only in Huascar V, the sample was completed interviewing mothers at the health facility where mothers take their children for health checks, doctor appointments and vaccinations. Two local field workers assisted with the face-to-face interviews. Prior to starting the questionnaire (as described in Table 1), the informed consent process was conducted. Detailed information about the study was provided to each potential participant, who was given the opportunity to ask questions and clarify doubts. After that, if they agreed to participate, they proceeded to sign the informed consent form. The questionnaires were completed in almost two months between April and May, 2018. Mothers were interviewed at the comedores (local community kitchens) or, if necessary, at home.

**Analysis plan**

The analysis was conducted using Stata/SE 15.0 software for Windows, at the Universidad Peruana Cayetano Heredia (UPCH). Categorical variables were described as frequencies. The influence of sociodemographic variables or independent variables (education level, occupation of the mother, marital status, caregiver, age of the mother, house building material, floor material, drinking water, gas stove, refrigerator, radio or television set, microwave) on the dependent variable (knowledge of kitchen hygiene) was assessed through logistic regression analysis. Odds ratios (ORs) with 95% confidence intervals are reported. A p-value lower than 0.05 was considered statistically significant.

**Ethical considerations**

This study was approved by the Institutional Ethics Committee (IEC) of Universidad Peruana Cayetano Heredia. An informed consent form was prepared, explained, and was signed by all the mothers and/or caregivers. Before signing, they were given information about the study, the use of the answers, and how the information obtained will be kept coded so that the completed questionnaires were anonymous. Finally, if they decided to participate and be interviewed, they were asked to sing the consent form.

**Results**

A total of 250 caregivers were interviewed: 91.2% (114) of them were mothers living in the Huascar V and 95.2% (119) were from San Pablo community. Fifty-four percent of the caregivers were between 21 and 30 years old. The highest education level achieved in Huascar V and San Pablo was secondary school (68.8% (86) and 72.0% (90), respectively). In Huascar V and San Pablo, the majority of the mother were living with a partner (68.0%(85) and 70.4%(88), respectively), and were housewives (82.4%(104) and 78.4%(98), respectively), had houses built of brick 68.0% (85) and cement 68.8% (86), had a bare floor 70.4%(88) and earth floor 69.6%(87) respectively, did not have drinking water (88.0%(110) and 88.8%(111), respectively), no gas stove (96.8%(121) and 96.0%(120), respectively), refrigerator (48.8%(61) and 51.2% (64), respectively), radio and TV set (79.2%(99) and 84.8%(106), respectively), and no microwave oven (82.4%(103) and 84.8%(106), respectively) see Table 2.
Table 2. Description of sociodemographic characteristics of the mothers or caregivers in the areas of Huáscar V and San Pablo, in San Juan de Lurigancho, obtained from survey results.

| Characteristics                          | Huascar (n=125) | San Pablo (n=125) | Total (n=250) |
|------------------------------------------|-----------------|-------------------|---------------|
|                                         | n(%)            | n(%)              | n(%)          |
| Caregiver                               |                 |                   |               |
| Mother                                  | 114(91,2)       | 119(95,2)         | 233(93,2)     |
| Grandmother                             | 8(6,4)          | 5(4,0)            | 13(5,2)       |
| Others                                  | 3(2,4)          | 1(0,8)            | 4(1,6)        |
| Caregiver's age (years)                 |                 |                   |               |
| 17 to 20                                 | 14 (11,2)       | 20(16,0)          | 34(13,6)      |
| 21 to 30                                 | 71(56,8)        | 64(51,2)          | 135(54)       |
| 31 to 40                                 | 36(28,8)        | 37(29,6)          | 73(29,8)      |
| 41 or older                             | 4(3,2)          | 4(3,2)            | 8(3,2)        |
| Education level                         |                 |                   |               |
| No formal education, incomplete or complete primary | 27(21,6)       | 23(18,4)          | 50(20,0)      |
| Complete or incomplete secondary         | 86(68,8)        | 90(72,0)          | 176(70,4)     |
| Higher education                        | 12(9,6)         | 12(9,6)           | 24(9,6)       |
| Marital status                          |                 |                   |               |
| Married                                 | 13(10,4)        | 11(8,8)           | 24(9,6)       |
| Not married but living together          | 85(68,0)        | 88(70,4)          | 173(69,2)     |
| Divorced                                | 27(21,6)        | 26(20,8)          | 53(21,2)      |
| Occupation                              |                 |                   |               |
| Housewife                               | 103(82,4)       | 98(78,4)          | 201(80,4)     |
| Other                                   | 22(17,6)        | 27(21,6)          | 49(19,6)      |
| House building material                  |                 |                   |               |
| Owner/cement and brick                   | 24(19,2)        | 24(19,2)          | 48(19,2)      |
| Owner, other material                    | 85(68,0)        | 86(68,8)          | 171(68,4)     |
| Rented                                  | 16(12,8)        | 15(12,0)          | 31(12,4)      |
| Floor material                           |                 |                   |               |
| Cement                                  | 37(29,6)        | 38(30,4)          | 75(30,0)      |
| Dirt/Earth                              | 88(70,4)        | 87(69,6)          | 175(70,0)     |
| Drinking water (on tap)                 |                 |                   |               |
| Yes                                     | 15(12,0)        | 14(11,2)          | 29(11,6)      |
| No                                      | 110(88,0)       | 111(88,8)         | 221(88,4)     |
| Gas stove                               |                 |                   |               |
| Yes                                     | 4(3,2)          | 5(4,0)            | 9(3,6)        |
| No                                      | 121(96,8)       | 120(96,0)         | 241(96,8)     |
| Refrigerator                            |                 |                   |               |
| Yes                                     | 61(48,8)        | 64(51,2)          | 125(50,0)     |
| No                                      | 64(51,2)        | 61(48,8)          | 125(50,0)     |
| Radio and TV set                        |                 |                   |               |
| Yes                                     | 99(79,2)        | 106(84,8)         | 205(82,0)     |
| No                                      | 26(20,8)        | 19(15,2)          | 45(18,0)      |
| Microwave oven                          |                 |                   |               |
| Yes                                     | 22(17,6)        | 19(15,2)          | 41(16,4)      |
| No                                      | 103(82,4)       | 106(84,8)         | 209(83,6)     |
Table 3 shows the percentage of questionnaire answers about knowledge of kitchen hygiene in Huáscar and San Pablo, where the mothers or caregivers were surveyed.

The caregivers from Huáscar responded affirmatively to the questions related to knowledge about cleanliness and storage in the kitchen (5, 6, 7, and 8) in a higher proportion than the caregivers in San Pablo.

Ninety-five percent of mothers agree that sponges used to wash utensils may be contaminated, and 90.8% state that cloths used to clean surfaces have bacteria and microorganisms. 93.2% consider that the garbage bag can be open as long as the utensils are protected or covered. 99.6% of chopping boards can cause contamination to other products. 74% consider that glass is of high quality for storage; 87.6% consider that utensils would be clean with dishwashing detergent; 84.4% state that food consumption can cause illness in children; 60% consider that if the table where the child consumes food is contaminated, it will also contaminate the food; 62% of mothers or caregivers consider that diarrhea and discomfort in children can have their origin in the food.

In Table 4, we can see that the bivariate regression analysis did not identify any predictive capacity of any evaluated sociodemographic characteristic on the level of knowledge of kitchen hygiene.

However, we can observe that in the age group older than 30, there was a higher proportion of caregivers with good knowledge of kitchen hygiene compared to the group aged 30 years or younger.

| Characteristics                                                                 | Huáscar | San Pablo | Total |
|---------------------------------------------------------------------------------|---------|-----------|-------|
| Chopping boards may have bacteria that can cause contamination of other products. | no      | 6(4,8)    | 5(4,0) | 11(4,4) |
| Sponges that are used to wash surfaces and utensils can harbour bacteria and microorganisms. | yes     | 119(95,2) | 120(96,0) | 239(95,6) |
| Wipes that are used to wash utensils and clean surfaces have bacteria and microorganisms. | no      | 8(6,4)    | 15(12,0) | 23(9,2) |
| The table where children eat can contaminate the food they are going to eat.     | yes     | 117(93,6) | 110(88,0) | 227(90,8) |
| Garbage can be uncovered, or the garbage bag can be open, as long as food and utensils are protected or covered. | no      | 5(4,0)    | 12(9,6) | 17(6,8) |
| Chopping boards may have bacteria that cause contamination of other products.    | no      | 0(0)      | 1(0,8) | 1(0,4) |
| Garbage can be uncovered, or the garbage bag can be open, as long as food and utensils are protected or covered. | no      | 17(13,6) | 48(38,4) | 65(26,00) |
| Glass is of high quality for food storage.                                      | yes     | 108(86,4) | 77(61,6) | 185(74,00) |
| Cooking kills all the bacteria that may be in the food. Utensils will be clean when using dishwasher detergent. | no      | 8(6,4)    | 23(18,4) | 31(12,4) |
| Chopping boards may have bacteria that can cause contamination of other products. | yes     | 117(93,6) | 102(81,6) | 219(87,6) |
| Food consumption can cause diseases in children.                                | no      | 3(2,4)    | 36(28,8) | 39(15,6) |
| Garbage can be uncovered, or the garbage bag can be open, as long as food and utensils are protected or covered. | no      | 34(27,2)  | 66(52,8) | 100(40,0) |
| Glass is of high quality for food storage.                                      | yes     | 91(72,8)  | 59(47,2) | 150(60) |
| Cooking kills all the bacteria that may be in the food. Utensils will be clean when using dishwasher detergent. | no      | 99(79,2)  | 83(66,4) | 182(72,8) |
| Food consumption can cause diseases in children.                                | yes     | 26(20,8)  | 42(33,6) | 68(27,2) |
|                                                                                   | no      | 47(37,6)  | 47(37,6) | 94(37,6) |
|                                                                                   | yes     | 78(62,4)  | 78(62,4) | 156(62,4) |
Table 4. Socio-demographic profile according to knowledge of kitchen hygiene among caregivers in the areas of Huáscar V and San Pablo, San Juan de Lurigancho (n = 250).

| Characteristics                  | Not so good knowledge of hygiene n=92 (36.8%) | Good knowledge of hygiene n=158 (63.2%) | P value | OR (CI 95%) |
|----------------------------------|-----------------------------------------------|------------------------------------------|---------|-------------|
| **Age group**                    |                                               |                                          |         |             |
| 17 to 20                         | 14(15.2)                                      | 19(12.0)                                 | Ref     | 0.896       |
| 21 to 30                         | 56(60.9)                                      | 80(50.6)                                 | Ref     | 0.950 (0.4398, 2.0522) |
| 31 to 40                         | 22(23.9)                                      | 51(32.3)                                 | 0.218   | 0.585 (0.2496, 1.3729) |
| 41 and over                      | 0(0)                                          | 8(5.1)                                   | NA      | 1           |
| **Type of relation**             |                                               |                                          |         |             |
| Mother                           | 82(89.1)                                      | 151(95.6)                                | 0.059   | 2.631 (0.9652, 7.1695) |
| Grandmother or other             | 10(10.9)                                      | 7(4.4)                                   |         |             |
| **Level of education of the mother** |                                             |                                          |         |             |
| Primary                          | 21(22.8)                                      | 29(18.4)                                 | Ref     | Ref         |
| Secondary                        | 62(67.4)                                      | 114(72.2)                                | 0.381   | 0.751 (0.3956, 1.4260) |
| Higher                           | 9(9.8)                                        | 15(9.5)                                  | 0.712   | 0.829 (0.3051, 2.2504) |
| **Marital status**               |                                               |                                          |         |             |
| Married                          | 9(9.8)                                        | 15(9.5)                                  | Ref     | Ref         |
| Free union                       | 65(70.7)                                      | 108(68.4)                                | 0.052   | 0.527 (0.2756, 1.0068) |
| Divorced                         | 18(19.6)                                      | 35(22.2)                                 | 0.763   | 0.857 (0.3144, 2.3371) |
| **Occupation**                   |                                               |                                          |         |             |
| Housewife                        | 72(78.3)                                      | 129(81.6)                                | 0.516   | 1.236 (0.6525, 2.3398) |
| Other                            | 20(21.7)                                      | 29(18.4)                                 |         |             |
| **House building material**      |                                               |                                          |         |             |
| Own home made of brick and cement| 24(26.1)                                      | 24(15.2)                                 | Ref     | Ref         |
| Own home made of other material  | 59(64.1)                                      | 112(70.9)                                | 0.052   | 0.527 (0.2756, 1.0068) |
| Rented                           | 9(9.8)                                        | 22(13.9)                                 | 0.068   | 0.409 (0.1566, 1.0684) |
| **Floor material**               |                                               |                                          |         |             |
| Cement                           | 27(29.3)                                      | 48(30.4)                                 | 0.864   | 1.051 (0.5986, 1.8436) |
| Dirt                             | 65(70.7)                                      | 110(69.6)                                |         |             |
| **Drinking water**               |                                               |                                          |         |             |
| Yes                              | 10(10.9)                                      | 19(12.0)                                 | 0.783   | 0.892 (0.3957, 2.0113) |
| No                               | 82(89.1)                                      | 139(88)                                  |         |             |
| **Gas stove**                    |                                               |                                          |         |             |
| Yes                              | 5(5.4)                                        | 4(2.5)                                   | 0.246   | 2.213 (0.5789, 8.4570) |
| No                               | 87(94.6)                                      | 154(97.5)                                |         |             |
| **Refrigerator**                 |                                               |                                          |         |             |
| Yes                              | 49(53.3)                                      | 76(48.1)                                 | 0.432   | 1.230 (0.7347, 2.0575) |
| No                               | 43(46.7)                                      | 82(51.9)                                 |         |             |
| **Radio and TV set**             |                                               |                                          |         |             |
| Yes                              | 74(80.4)                                      | 131(82.9)                                | 0.623   | 0.847 (0.4375, 1.6411) |
| No                               | 18(19.6)                                      | 27(17.1)                                 |         |             |
| **Microwave oven**               |                                               |                                          |         |             |
| Yes                              | 19(20.7)                                      | 22(13.9)                                 | 0.168   | 1.609 (0.8180, 3.1648) |
| No                               | 73(79.3)                                      | 136(86.1)                                |         |             |
In addition, when the caregiver's role was filled by the grandmother or another person, most of them did not have a good level of knowledge of kitchen hygiene.

Furthermore, when the caregiver had reached a secondary level of education, most of them showed a good level of knowledge about kitchen hygiene in contrast to the group with primary or higher education.

**Discussion**

In the investigated areas of SJL (San Pablo and Huáscar V), more than half are between 21 and 30 years of age. Their marital status is not married but living together in the majority. The surveyed mothers were mainly housewives and had a secondary education level. The vast majority of households lacked water and sewage services.

Although no significant associations were identified between the variables studied and the level of knowledge of kitchen hygiene, the mothers’ education and age in other studies were associated with knowledge of safe food handling and consumption in the home.21 In this regard, studies in Africa have shown that caregivers, especially the younger ones, drop out of education or even abandon it, thus affecting their future.22 Another study developed in communities in Peru showed an intervention for handwashing in child feeding, where 12% of children were identified and this was increased to 32%.23

Years of school attendance could improve hygiene knowledge, as well as generating a larger social network in which mothers or caregivers interact. Likewise, having a radio in a large percentage of households can be a channel to increase mothers’ knowledge and good practices and to obtain appropriate cooking behaviours, through hygiene educational programs. In other studies, mothers’ occupations (homemaker or work outside the home) was shown to be associated with more satisfactory hygienic practices in relation to food poisoning prevention.19,24

The WHO and the Food and Agriculture Organization of the United Nations mention that unsafe food affects the most vulnerable groups, and to promote the improvement of food safety. They should be kept informed, foodborne disease can be prevented with optimal handling, some of the measures that we have assessed here in this study, are related to the cleanliness where food is prepared, including avoiding mixing raw and cooked food, the cooking of food should be complete, use of safe raw materials and use potable water.25

Mother with lower socioeconomic status have been found more likely to experience food products with a high microbial count.26 Our study presented the limitation of not including the microbial count. Studies such as Gil et al., 2014, have shown that this measure has been an accurate indicator to determine families’ household cleaning condition.27

Likewise, demographic and socioeconomic factors may have contributed to unsafe food handling behaviours and microbial contamination risks during preparation.28 Poor food handling has been evidenced among low-income consumers.29

Hygiene education, improved treatment, storage and water connections are necessary.30

This study was conducted in a peri-urban area of Lima; some of our limitations may be due to the fact that the entire study population had the same socioeconomic status. Through an evaluation that includes heterogeneous populations, we could obtain complementary results regarding the influence of other variables not examined in the present study, that could improve our understanding of kitchen hygiene knowledge. It is important to highlight that data collection through interviews and surveys is prone to the possibility that the information revealed by the participants may be incomplete or not entirely truthful, which could directly impact the validity of the results.

**Conclusions**

We could not identify a predictive capacity in regard to the level of knowledge of kitchen hygiene in the evaluated sociodemographic characteristics in this sample. Caregivers in these communities should receive more education on treatment, food storage and achieve better health outcomes. Governments are called upon to join the efforts to accelerate efforts to lead education campaigns.

**Data availability**

**Underlying data**

Figshare: Knowledge about kitchen hygiene and associated factors, https://doi.org/10.6084/m9.figshare.16960207.v1.31
This project contains the following underlying data:

- DB Depurada 07Oct21 ENG.xls (coded questionnaire responses and dictionary)

Extended data

Figsshare: Kitchen hygiene questionnaire, https://doi.org/10.6084/m9.figshare.17868758.v1.32

This project contains the following extended data:

- Cuestionario ETA.docx (questionnaire in English)

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

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Hygiene and food safety play a key role in the prevention of foodborne illnesses. In this context comes this article to assess knowledge about kitchen hygiene and associated factors in caregivers in a peri-urban area. The results of this study will encourage officials to provide these inhabitants with the necessary means to improve their living conditions.

Comments:

Abstract:

- **Background:**
  
  It is better to start with a general statement before indicating the objective of this study.

- **Conclusions:**
  
  You said in conclusion that: “it is necessary to improve mothers' knowledge about the handling and consumption of spoiled food and their effect on children's health”. I think that you must add in result section that the limit level of mothers' knowledge about the handling and consumption of spoiled food.

Introduction:

- Good

Methods:

- **Administration of the questionnaire:**
  
  I want to know if the questionnaire is developed or adapted from a questionnaire already established.
I want to know if you study the reliability (by Cronbach's $\alpha$ for example) and the reproducibility (by Intraclass for example) of the questionnaire with a small sample before the distribution of the questionnaire to the global sample.

It is preferable to indicate the number of item in each dimensions.

**Results:**
- More descriptions on the results presented in Table 3 are needed in the manuscript.

**Discussion:**
- The discussion is quite limited. I think more details are needed.

**Conclusion:**
- The conclusion is also quite limited. A paragraph about preventive and corrective actions is needed.

**Is the work clearly and accurately presented and does it cite the current literature?**
Yes

**Is the study design appropriate and is the work technically sound?**
Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**
Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**
Partly

**Are all the source data underlying the results available to ensure full reproducibility?**
Yes

**Are the conclusions drawn adequately supported by the results?**
No

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Food safety

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.
We thank the reviewer for his suggestions for improvement.

**Abstract:**

**Background:**

It is better to start with a general statement before indicating the objective of this study.

**Answer:** Food and kitchen hygiene are necessary conditions for safe food and prevent foodborne illnesses.

**Conclusions:**

You said in conclusion that: “it is necessary to improve mothers' knowledge about the handling and consumption of spoiled food and their effect on children's health”. I think that you must add in result section that the limit level of mothers' knowledge about the handling and consumption of spoiled food.

**Answer:**

Table 3 shows the results obtained for each of the questions in the questionnaire, according to the Huascar and San Pablo zones. Boundaries for Good knowledge of food hygiene: If the mother interviewed had more than seven answers out of 10 questions it was considered as good knowledge about food hygiene in the household.

Not so good knowledge of food hygiene: If the mother interviewed had less than or equal to seven answers out of 10 questions it was considered as not so good knowledge about food hygiene in the household. This classification is found at the end of Table 1.

**Methods:**

**Administration of the questionnaire:**

I want to know if the questionnaire is developed or adapted from a questionnaire already established.

**Answer:**

We apply the same questionnaire of a publication.

I want to know if you study the reliability (by Cronbach's $\alpha$ for example) and the reproducibility (by Intraclass for example) of the questionnaire with a small sample before the distribution of the questionnaire to the global sample.

**Answer:**

The item Cleaning practices had a KR-20=0.722 storage practices and food contamination 0.518 and 0.5 respectively. Internal consistency. Test validity had a KMO=0.549 and a Barlet's test 591.678 , gl=136.
It is preferable to indicate the number of item in each dimensions.

**Answer:**
Cleanliness has 4 statements
Storage has 4 statements
Contamination of the child: 2 statements.
This answer can be found in table 1

**Results:**
More descriptions on the results presented in Table 3 are needed in the manuscript 5.

**Answer:**
Ninety-five percent of mothers agree that sponges used to wash utensils may be contaminated, and 90.8% state that cloths used to clean surfaces may also contain bacteria and microorganisms. 93.2% consider that the garbage bag can be open as long as the utensils are protected or covered. 99.6% of chopping boards can cause contamination to other products. 74% consider that glass is of high quality for storage; 87.6% consider that utensils would be clean with dishwashing detergent; 84.4% state that food consumption can cause illness in children; 60% consider that if the table where the child consumes food is contaminated, it will also contaminate the food; 62% of mothers or caregivers consider that diarrhea and discomfort in children can have their origin in the food.

**Discussion:**
The discussion is quite limited. I think more details are needed.

**Answer:**
In the investigated areas of SJL (San Pablo and Huáscar V), More than half are between 21 and 30 years of age. Their marital status is free union in the majority. The surveyed mothers were mainly housewives and had a secondary education level. The vast majority of households lacked water and sewage services.

Although no significant associations were identified between the variables studied and the level of knowledge of kitchen hygiene, the mothers’ education and age in other studies were associated with knowledge of safe food handling and consumption in the home.21 In this regard, studies in Africa have shown that caregivers, especially the younger ones, drop out of education or even abandon it, thus affecting their future.22 Another study developed in communities in Peru showed an intervention for handwashing in child feeding, where 12% of children were identified and this was increased to 32% 23.

Years of school attendance could improve hygiene knowledge, as well as generating a larger social network in which mothers or caregivers interact. Likewise, having a radio in a large percentage of households can be a channel to increase mothers’ knowledge and good practices and to obtain appropriate cooking behaviours, through hygiene educational programs. In other studies, mothers’ occupations (homemaker or work
outside the home) was shown to be associated with more satisfactory hygienic practices in relation to food poisoning prevention.\textsuperscript{19,24}
The WHO and the Food and Agriculture Organization of the United Nations mention that unsafe food affects the most vulnerable groups, and to promote the improvement of food safety, they should be kept informed, foodborne diseases can be prevented with optimal handling, some of the measures that we have assessed here in this study, are related to the cleanliness where food is prepared, including avoiding mixing raw and cooked food, the cooking of food should be complete, use of safe raw materials and use of potable water.\textsuperscript{25}
Mother with lower socioeconomic status have been found more likely to experience food products with a high microbial count.\textsuperscript{26} Our study presented the limitation of not including the microbial count. Studies such as Gil \textit{et al.}, 2014, have shown that this measure has been an accurate indicator to determine families’ household cleaning condition.\textsuperscript{27}
Likewise, demographic and socioeconomic factors may have contributed to unsafe food handling behaviours and microbial contamination risks during preparation.\textsuperscript{28}
Poor food handling has been evidenced among low-income consumers.\textsuperscript{29} Hygiene education, improved treatment, storage and water connections are necessary.\textsuperscript{30}
This study was conducted in a peri-urban area of Lima; some of our limitations may be due to the fact that the entire study population had the same socioeconomic status. Through an evaluation that includes heterogeneous populations, we could obtain complementary results regarding the influence of other variables not examined in the present study, that could improve our understanding of kitchen hygiene knowledge. It is important to highlight that data collection through interviews and surveys is prone to the possibility that the information revealed by the participants may be incomplete or not entirely truthful, which could directly impact the validity of the results.

**Conclusion:**
The conclusion is also quite limited. A paragraph about preventive and corrective actions is needed.

**Answer:**
We could not identify a predictive capacity in regard to the level of knowledge of kitchen hygiene in the evaluated sociodemographic characteristics in this sample. Caregivers in these communities should receive more education on treatment, food storage and achieve better health outcomes. Governments are called upon to join the efforts to accelerate efforts to lead education campaigns.

We thank the reviewer for his suggestions for improvement.

**Competing Interests:** No competing interests were disclosed.
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