

Evaluation of Hygiene Practices in Collective Catering in Relation to International Standard Requirements: Case of the Prison Environment

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Abstract **Introduction:** Several million people are exposed to foodborne illnesses every year. These diseases are therefore recognized as one of the most common problems worldwide. **Aim:** Our objective in this study is to assess the level of compliance of the state of hygiene in two prisons with the international's standards requirements relating to food safety. **Methodology:** In this study we adopted a qualitative, case-study approach based on the collected data from two penitentiary sites. Data were collected using a hygiene audit grid to assess the physical characteristics and hygienic condition of the two sites studied in relation to the technical requirements of international standards requirements relating to food safety. **Results:** The Overall compliance rates for the sites studied were 51.60% and 53.19% respectively at establishment n° 1 and n° 2. These results showed that certain hygiene dimensions were satisfactory. However, we recorded higher rates of non-compliance for other hygiene activities. **Conclusion:** This study has shown that the non-conformities observed in certain dimensions of hygiene in the two establishments studied, require the planning and implementation of corrective and preventive actions in order to eliminate the discrepancies raised and improve

general hygiene conditions in line with the technical recommendations of international norms and standards.

Keywords Hygiene, Food-borne Illnesses, Safety, Standard, Compliance, Diseases

1. Introduction

Hygiene and food safety standards are fundamental and vital for ensuring consumers health against foodborne diseases. This significantly contributes to the increase in morbidity and mortality around the world [1]. According to the World Health Organization, 600 million people are affected by foodborne diseases, resulting in approximately 420,000 deaths each year and a loss of 33 million healthy life years [2]. In Morocco, 11% of poisoning incidents are attributed to collective food poisoning, with bacteria responsible for 90% of these cases [3]. Based on national data, the Moroccan Poison Control and Pharmacovigilance Center (CAPM) reported a total of 77133 poisoning cases from 1980 to 2007 (excluding scorpion stings and

envenomation), resulting in a lethality rate of 15.34% [4]. Indeed, collective catering establishments are often mentioned as one of the main sources of foodborne infections, whether sporadic or epidemic [5]-[10], because it is required to prepare a large number of meals for communities.

The prison population is a community that is recognized as vulnerable and socially excluded [11]. Incarceration rates are high in many countries, with around 11 million prisoners worldwide [12], leading to overcrowding and an increased prevalence of health problems. This population is exposed to a number of risk factors that are likely to lead to disease, particularly food-borne illnesses (see Figure 1), which should make prison health a priority [13]. In the same case, Sub-Saharan African detainees are the most exposed to foodborne diseases and are characterized by limited access to healthcare [14], [15].

In this context, prison food services must serve healthy and safe food in a clean environment [16], [17]. However, the existence of some non-conformities in the workplace, including lack of hygiene training, the absence or inadequacy of certain essential infrastructures, the use of

unsanitary equipment, and inadequate working environment conditions is the risk factors for the emergence of foodborne illnesses [18], [19]. Furthermore, inadequate hygiene practices during food handling and preparation can create an environment conducive to the growth, multiplication, and transmission of bacteria as well as other infectious agents [20], [21], [22].

Conscious of the essential importance of food security for the health of inmates, and in accordance with the strategic objectives of the General Delegation for Prison Administration and Reintegration (DGAPR) of Morocco, which aims to humanize detention conditions, the aim of our study (carried out for the first time in the catering departments of two establishments (PE1 and PE2)) is to assess and verify the level of compliance of hygiene conditions with the technical requirements of food safety standards and guidelines. The results of this assessment will enable us to highlight non-compliance and real anomalies, and subsequently determine the corrective actions to be implemented to improve the existing situation, particularly in terms of cleanliness and hygiene, which will be a roadmap for rolling it out to all prisons.

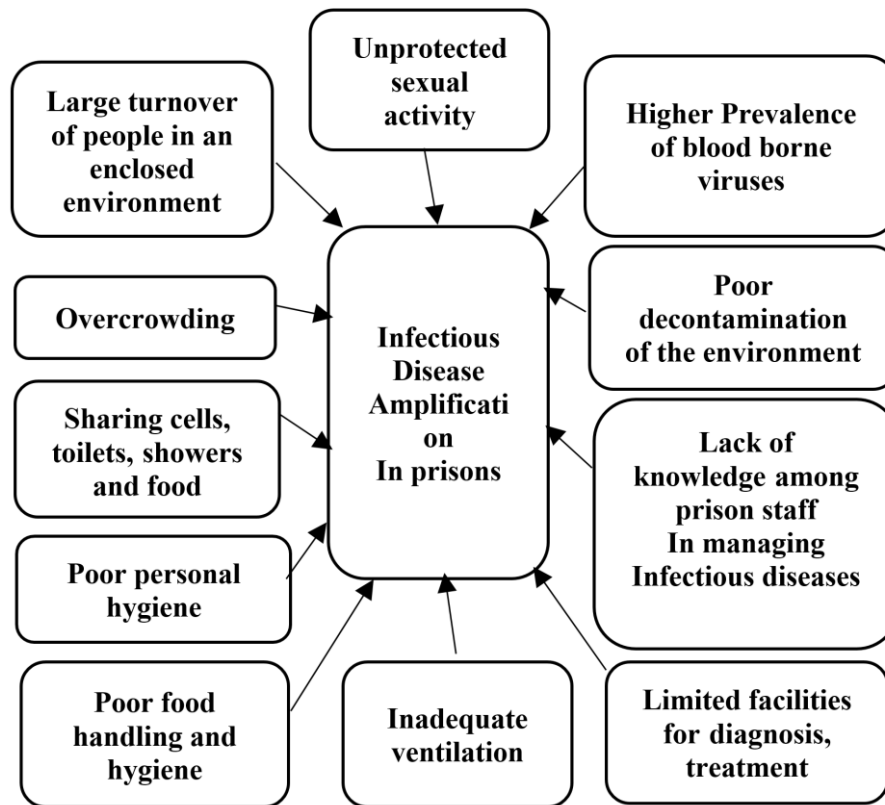


Figure 1. Factors in prisons contributing to a risk of amplification of infectious diseases (Health Protection Agency and Department of Health, 2011).

1.1. Regulatory Basis

The establishment of a self-monitoring system is an absolute obligation for healthy and safe food production, which would ensure the safety of consumers [23]. Certainly, the implementation of this system in collective catering in prisons requires the application of international norms and standards and other national regulations relating to food safety, in particular by way of:

1.1.1. International Standards and Norms

- ISO 22000 version 2018;
- BRC standard;
- Codex Alimentarius;

1.1.2. European Regulations

- Regulation 178/2002 and the Hygiene Package adopted since January 1, 2006... etc.
- Regulation (EC) No 853/2004 of the European Parliament and of the Council of 29 April 2004 on the Hygiene of Foodstuffs.
- The French regulatory decree of May 9, 1995.
- Order of 29 September 1997 laying down the hygiene conditions applicable in social catering establishments....

1.1.3. National Regulations

- Law No. 28-07 on Food Safety, promulgated by Dahir No. 1-10-08 of 26 Safar 1431 (11 February 2010).
- Decree No. 2-10-473 of 7 Chaoual 1432 (6 September 2011) adopted for the application of certain provisions of Law No. 28-07 on the safety of food products... etc.
- Food Establishment Inspection Guide, developed by the Moroccan Ministry of health with the support of the World Health Organization (WHO), 2009.
- Other decrees and orders relating to food product safety.

1.2. Dimensions Assessed

We assessed 12 Dimensions of Hygiene (see table 2) at the restaurant level of two penitentiary sites regarding the application of good hygiene practices and we gave the following dimensions as examples, namely:

1.2.1. Restaurant Staff

Staff training should be provided in prison restorations to ensure that everyone has the knowledge and skills needed to produce safe food.

A staff training plan for food hygiene must be developed annually at the level of each food establishment [24].

The Staff should be aware of the importance of enforcing the rules of the establishment's quality management and health safety system, as well as the negative impact of any failure on the health of consumers [25]. Employee health status is a key component of food safety [26], as the most common source of contamination is human-borne. Anyone suffering from a disease that can be transmitted through

food, or suffering from infected wounds, skin infections or lesions or diarrhea should not be allowed to handle food [27], [28].

1.2.2. Construction of the Premises

The premises must be arranged in such a way as to allow a continuous and rational progression in space or time (respect for the principle of forward movement) of the various elementary operations leading to the production of the finished products [29]. Indeed, foodstuffs move from the dirty to the clean circuit without going backwards or intersecting or overlapping the circuits of circulation of food, waste and personnel [30]. The premises must be constructed of watertight, non-absorbent materials, easy to wash and disinfect in order to limit the risk of contamination [31]. The permanent control of these parameters will prevent the multiplication of microorganisms (mould and bacteria) and fight against vectors and pests.

1.2.3. Equipment & Maintenance

As with the hygiene of the premises, the design and installation of the equipment must allow for physical and hygienic maintenance. A preventative maintenance schedule should be developed and implemented by qualified and trained managers. The general imperative of equipment maintenance is to prevent cross-contamination during food handling.

2. Methodology

2.1. Study Sites

This study was carried out in the restaurants of two prisons in the Rabat-Salé-Kenitra region: Establishment n° 1 and Establishment n° 2. The visits were carried out between April and July 2023.

2.2. Analysis and Data Collection Method Used

In this study, we adopted a qualitative, case-study approach as our research strategy, focusing on the collection of data relating to the evaluation of good hygiene practices in mass catering (the case of the prison environment), regarding to the technical requirements of national and international food safety standards and benchmarks.

In our research we used data collection tools such as: observations, interviews and consultation of traceability documents [32]-[34].

2.2.1. Observation

According to Schneider [35] observation is an essential tool for in-depth studies. We used the following types of observation:

Participatory observation: it involves being part of the context in which an individual's behavior is being studied. It is possible to interact with the person(s) being observed to ask questions.

Structured observation: it involves clearly defined and formulated rules for conducting the observation.

Unstructured observation: it enables precise observation of an individual's behavior. Through this observation technique, the interviewer gathers as much information as possible, and produces a narrative report of the behavior observed.

In our case study, we combined three types of observation: structured observation based on an evaluation grid that we drew up before visiting the study sites (see the evaluation grid model); participant observation, in which we took part in monitoring cold room temperatures and the process of receiving foodstuffs (meat, fish, chicken, etc.); and unstructured observation, which gave us an overview of the situation.

2.2.2. Interviewing

The interview is a technique for collecting informative data [34], [36]. It consists of a questioning session addressed to one or several randomly chosen individuals with the aim of collecting information to confirm or refute research hypotheses [37]. In our case, we used the non-directive (free) interview:

Non-directive (free) interviewing: this type of non-standardized, unstructured or free interviewing allows deeper levels of opinions and attitudes to be reached, as the technique leaves maximum freedom to the interviewee.

The interviews were conducted with those responsible for managing the catering service (managers, supervisors) and the staff responsible for preparing the meals for the service provider (chefs, assistant cooks, inmates doing chores).

2.2.3. Traceability Documents

We consulted registers and control sheets justifying the traceability of catering operations.

2.3. Diagnosis of Good Hygiene Practices (GHP) and Scoring Methodology

GHP diagnosis at the two sites studied n^o1 and n^o2 was carried out using an evaluation grid based on international and national standards and benchmarks relating to the sanitary and hygienic design, equipment and operating conditions that must be met by places where foodstuffs are handled, processed and stored.

This grid is made up of 188 evaluation criteria adapted to the specificities of prison catering, divided into Twelve (12) hygiene dimensions: Premises and facilities (30 criteria); Equipment and materials (21 criteria); Work clothes (7 criteria); Staff hygiene (11 criteria); Medical follow-up (04 criteria); Pest control (6 criteria); Waste and sanitation (19 criteria); Transport and storage (34 criteria); Raw materials reception (14 criteria); Cleaning and disinfection (12 criteria); Meal preparation (22 criteria); Meal distribution (08 criteria). The table below shows the evaluation grid used in our study (**Table 1**).

The results of the Good Hygiene Practices evaluation grid for the prisons studied enabled us to verify the degree of compliance with the evaluation criteria to better interpret the results of our diagnosis.

We converted the information reported in the good hygiene practices evaluation grid into numeral data.

Ratings are assigned on the basis of the estimated health risk associated with premise, equipment, method or hygiene practice [37],[38].

The formulas for calculating the compliance and non-compliance rates are as follows:

Compliance rate:

$$\% C = \frac{(\text{Number of criteria scored with } C)}{(\text{Total number of criteria})} * 100$$

Table 1. Model of the evaluation grid for good hygiene practices

Dimensions	Evaluation Criteria	Current Situation	Corrective Actions	Evaluation		
				C*	PC**	NC***
<i>Hygiene of Premises and Facilities</i>	Premises shall be designed and laid out on a forward basis, including protection against cross-contamination during and between operations.					
	Floors should be constructed of waterproof, non-absorbent, smooth, durable, non-slip, easy to clean and disinfect materials. They should be in good condition and free of cracks. They should be constructed in such a way as to allow for proper drainage and cleaning.					
	Windows should be easy to clean, constructed to minimize dirt build-up and, if necessary, fitted with well-fitting insect screens.					
	Perfect body cleanliness (short and clean nails, clean and restrained hair, etc.).					
<i>Staff Hygiene</i>	Hands should be washed effectively and frequently, especially: - When returning to work - At the exit of the toilet - After handling soiled operations (garbage, waste, chemicals, etc.). - After sneezing or coughing into your hands or blowing your nose.					
	Jewellery is not permitted.					
<i>Hygiene of equipment and materials</i>	Hygienic maintenance: accessibility of fixed equipment to cleaning and disinfection operations and ease of cleaning and disinfection.					
	Physical maintenance: this is maintenance in good working order, replacement of defective or broken parts.					
	Compliance with the cleaning and disinfection program for kitchen equipment.					

The Partial Compliance Rate:

$$\% PC = \frac{(\text{Number of criteria scored with } PC)}{(\text{Total number of criteria})} * 100$$

The non-compliance rate:

$$\% NC = 100 - (\% C + \% PC)$$

Explain: The higher the penitentiary establishment's compliance rate (% C) the better it adheres to food safety standards.

3. Results**3.1. Diagnosis of Good Hygiene Practices for Establishment n° 1**

The results of compliance with good hygiene practices in penitentiary establishment n°1 in relation to the grid's assessment criteria have been reported in Table 2.

Table 2. Results of the diagnosis of good hygiene practices for establishment n° 1 practices

<i>Hygiene dimensions</i>	<i>Number of criteria With compliance</i>	<i>% compliance</i>	<i>Number of criteria with partial compliance</i>	<i>% partial compliance</i>	<i>Number of criteria not compliant</i>	<i>% of non- compliance</i>	<i>Total number of criteria /Dimension</i>
<i>1- Premises and installations</i>	8	26.67	5	16.67	17	56.67	30
<i>2- Equipment and materials</i>	12	57.14	7	33.33	2	9.52	21
<i>3- Work clothing</i>	3	42.86	1	14.29	3	42.86	7
<i>4- Staff hygiene</i>	5	45.45	5	45.45	1	9.09	11
<i>5- Medical care</i>	4	100	0	0.00	0	0.00	4
<i>6- Pest control</i>	2	33.33	1	16.67	3	50.00	6
<i>7- Waste and sanitation</i>	5	26.32	5	26.32	9	47.37	19
<i>8- Transport and storage</i>	28	82.35	0	0.00	6	17.65	34
<i>9- Raw materials reception</i>	12	85.71	1	7.14	1	7.14	14
<i>10- Cleaning and disinfection</i>	4	33.33	3	25.00	5	41.67	12
<i>11- Meal preparation</i>	11	50	6	27.27	5	22.73	22
<i>12- Meal distribution</i>	3	37.50	2	25.00	3	37.50	8
<i>Total</i>	97	51.60	36	19,15	55	29,26	188

3.1.1. Assessment results by hygiene Dimensions and by Establishment

The results in table 2, presented in figure 2 were categorized by hygiene dimension, while figure 3 represented the total compliance rate for establishment n° 1 diagnosed.

Comment of Figure 2:

In order to determine the hygienic and technical conditions in the establishment's catering services (**establishment n°1**), we evaluated different dimensions of hygiene using a hygiene audit checklist. The results obtained are shown in Figure 2. From this figure, it can be seen that hygiene rules relating to the transport and storage of foodstuffs (82.35%), the reception of raw materials

(85.71%) and medical follow-up of staff (100%) represent compliance rates of more than 82%. However, we recorded the highest rates of non-compliance for activities relating to the hygiene of premises and facilities (56.67%), pest control (50%) and waste and sanitation (47.37%), while the hygiene rules related to the work clothes of the staff, cleaning and disinfection operations, and the distribution of meals have non-compliance rates of around 40%.

Comment of Figure 3:

The analysis of the overall situation of the hygiene status of the **establishment n° 1** according to the data mentioned in Figure 3 showed that the average compliance rate is 51.60%, and 19.14% for the partial compliance rate, and a value of 29.26% for the non-compliance rate.

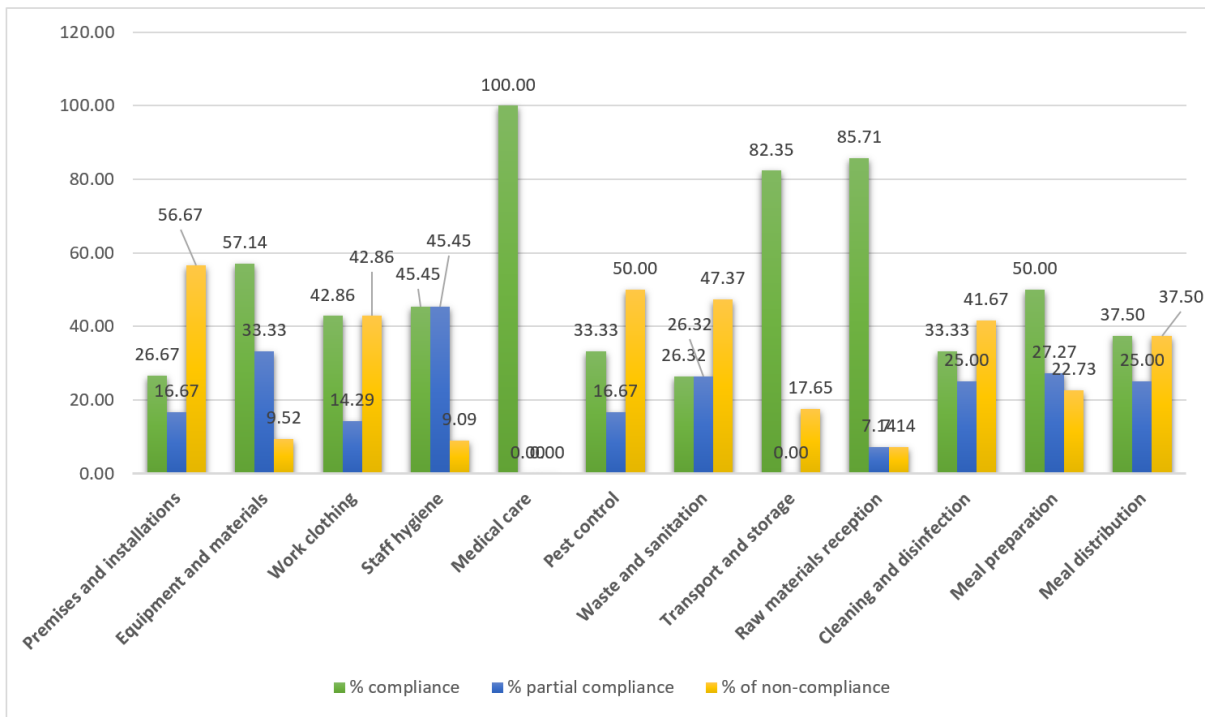


Figure 2. Evaluation of the state of hygiene by Dimensions of the establishment n° 1

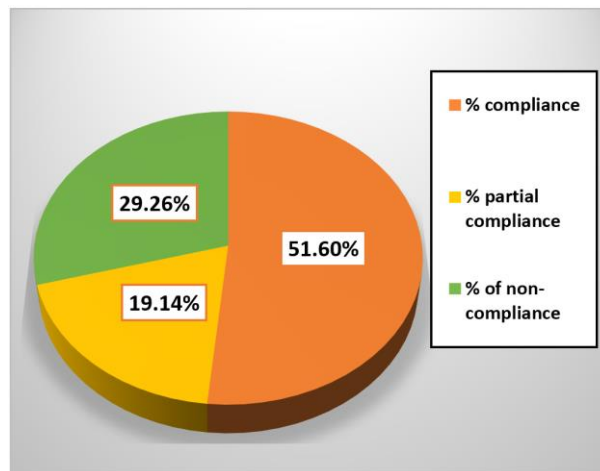


Figure 3. Evaluation of hygiene status of the establishment n° 1

Table 3. Results of the diagnosis of good hygiene practices for establishment n° 2

<i>Hygiene dimensions</i>	<i>Number of criteria compliant</i>	<i>% compliance</i>	<i>Number of criteria compliance partial</i>	<i>% partial compliance</i>	<i>Number of criteria not compliant</i>	<i>% of non-compliance</i>	<i>Total number of criteria /Dimension</i>
<i>1- Premises and installations</i>	12	40.00	6	20.00	12	40.00	30
<i>2- Equipment and materials</i>	12	57.14	7	33.33	2	9.52	21
<i>3- Work clothing</i>	3	42.86	0	0.00	4	57.14	7
<i>4- Staff hygiene</i>	5	45.45	5	45.45	1	9.09	11
<i>5- Medical care</i>	4	100.00	0	0.00	0	0.00	4
<i>6- Pest control</i>	3	50.00	0	0.00	3	50.00	6
<i>7- Waste and sanitation</i>	6	31.58	5	26.32	8	42.11	19
<i>8- Transport and storage</i>	27	79.41	0	0.00	7	20.59	34
<i>9- Raw materials reception</i>	11	78.57	1	7.14	2	14.29	14
<i>10- Cleaning and disinfection</i>	3	25.00	3	25.00	6	50.00	12
<i>11- Meal preparation</i>	11	50.00	5	22.73	6	27.27	22
<i>12- Meal distribution</i>	3	37.50	2	25.00	3	37.50	8
<i>Total</i>	100	53.19	34	18,09	54	28,73	188

3.2. Diagnosis of Good Hygiene Practices for Establishment n° 2

The results of compliance with good hygiene practices in penitentiary establishment n° 2 in relation to the grid's assessment criteria have been reported in Table 3.

3.2.1. Assessment Results by Hygiene Dimensions and by Establishment

The results in table 3, presented in figure 4 were categorized by hygiene dimension, while figure 5 represented the total compliance rate for establishment n° 2 diagnosed.

Comment of Figure 4:

According to the analysis of the above-mentioned data in Figure 4 for the second establishment (**establishment n° 2**), the results of the hygiene assessment are identical to those of the establishment n° 1. However, there is a slight

variation in compliance and non-compliance rates, including:

The compliance rates for hygiene standards are above 78%, with 79.41% for the transport and storage of foodstuffs, 78.57% for the reception of raw materials, and a full 100% for the medical monitoring of staff. However, we recorded the highest non-compliance rates for activities relating to the hygiene of work clothing (57.14%), pest control (50%), and cleaning and disinfection operations (50%). While the hygiene rules relating to premises and facilities, waste and sanitation, and meal distribution have non-compliance rates of around 40%.

Comment of Figure 5:

According to the analysis of the results mentioned in Figure 5, it has been found that the values are relatively the same, in fact the average compliance rate is around 53.19%. The partial compliance rate is 18.09% and a value of 28.73% for the non-compliance rate.

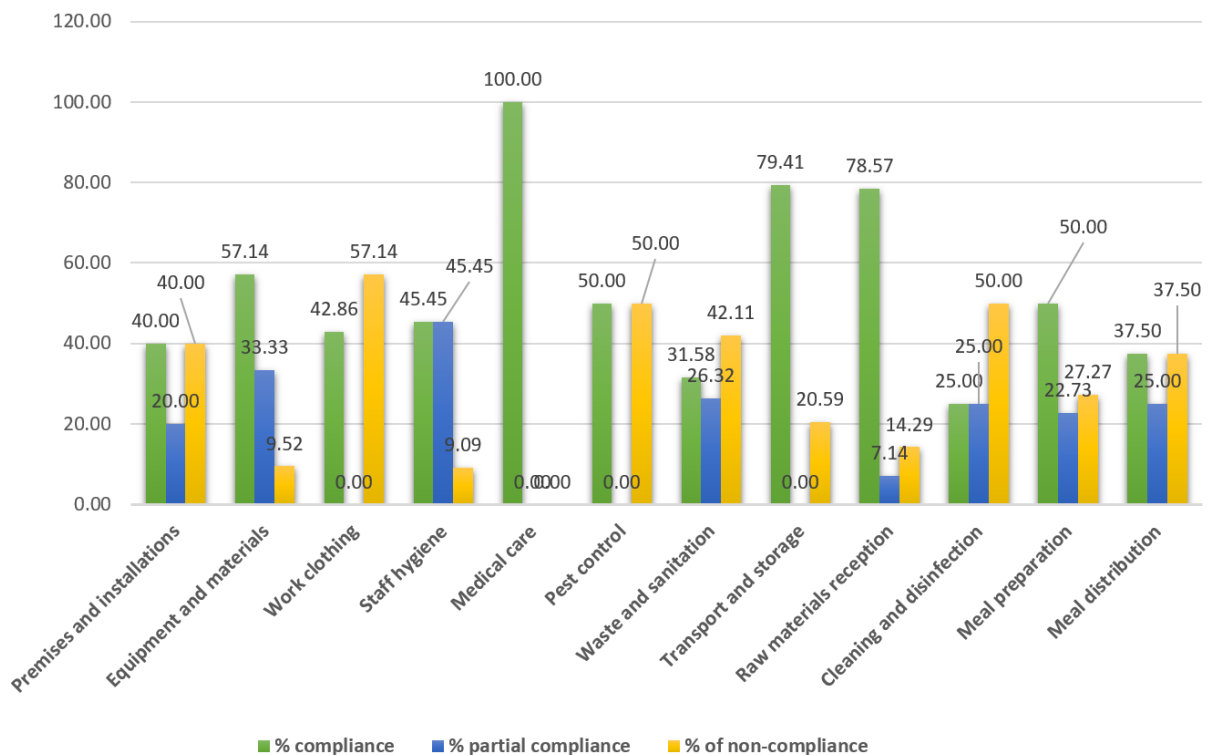


Figure 4. Evaluation of the state of hygiene by Dimensions of the establishment n° 2

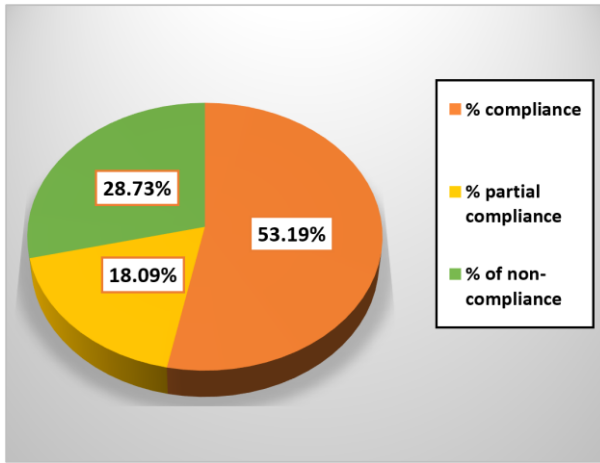


Figure 5. Evaluation of hygiene status of the establishment n°2

4. Discussion

In prisons around the world, inmates suffer from a wide range of health problems, including physical and mental disorders, and this makes prison health a priority on the public health agenda (Oscar O. Simooya, 2010). Many factors in prisons can lead to a risk of infection, and if appropriate control measures are not implemented, this can result in an increased spread of infectious diseases. Therefore there is an obligation to set up a control system based on the application of good hygiene practices (GHP) of food establishments [28], [39], [40]. This system is the set of general hygiene measures or procedures that make it possible to control operational conditions at the level of all communities, including prison catering, and consequently to reduce the incidence of foodborne illness.

Our objective of the study is to evaluate the general hygiene conditions in the catering restaurants of two penitentiary sites and to control all the stages through which the raw material passes, from reception, storage and preparation to their distribution. The staff and the kitchen environment were also controlled. The assessment was carried out against the technical requirements of international food safety standards.

4.1. Analysis in Relation to General Hygiene Conditions by Establishment

The Analysis of Figures 3 and 5 showed that the general hygiene conditions in the two establishments studied were practically the same and that the rate of non-compliance was not significantly high at either site (29.26% for EP1 and 28.73% for EP2). In fact, these results showed that the kitchen staff and the professionals responsible for monitoring the collective catering of the detainees put a lot of effort and participate actively in the implementation of good hygiene practices in order to guarantee the safety and wholesomeness of the food. This involvement is very noticeable in certain dimensions of hygiene, as shown in

Figures 2 and 4.

4.2. Analysis in Relation to General Hygiene Conditions by Dimensions of Hygiene

The results of the analysis of figures 2 and 4 showed that the hygiene conditions in the two establishments studied are satisfactory and comply with the technical requirements of the norms and standards concerning the dimensions of hygiene related to the Reception, Transport and Storage of Raw Materials, Medical Follow-up of Personnel (the compliance rate is between 78 and 100%). In fact, the kitchen staff have applied good hygiene practices relating to the dimensions mentioned above, in particular: compliance with the technical specifications of the foodstuffs during reception, compliance with the required conditions of transport and storage, updating staff medical records. However, the highest rates of non-compliance (between 40 and 60%) were recorded in other hygiene dimensions in terms of:

- Establishment n° 1: premises and facilities (56.67%), pest control (50%) and waste and sanitation (47.37%). While the hygiene rules related to the work clothes of the staff cleaning, cleaning and disinfection operations, and the distribution of meals have non-compliance rates of around 40%.
- Establishment n° 2: hygiene of work clothing (57.14%), pest control (50%), and cleaning and disinfection operations (50%). While the hygiene rules relating to premises and facilities, waste and sanitation, and meal distribution have non-compliance rates of around 40%.

The non-conformities recorded in terms of the dimensions mentioned above are mainly due to the failure to comply with the application of hygiene rules in accordance with the regulatory requirements required by the personnel responsible for the preparation and distribution of meals at the two sites studied (Establishment n°1 and Establishment n°2), which necessitates raising the awareness of food handlers with regard to hygiene and food safety at certain workstations. These findings are consistent with the results of the study presented by S. El Ghaza [41]. Kibret M and Abera B [19] showed that lack of basic infrastructure, lack of hygiene training, use of unhygienic equipment, inadequate environments for food operations can contribute to foodborne illness outbreaks. In addition, inadequate hygiene practices during food handling and preparation can create an environment conducive to the growth, multiplication, and transmission of bacteria as well as other infectious agents [20], [21], [42], [43]. In addition, the significant amounts of meals prepared each day, especially in prison catering, frequently result in overlooked hygiene practices. This negligence can affect diners' health, leading to problems such as food poisoning or other health issues.

In the context of continuous improvement, and the

efforts made by the decision-makers and those responsible for managing the prison canteens, and in order to deal with the non-conformities noted in certain dimensions of hygiene, an intervention plan must be drawn up at the level of the two establishments studied, including the actions to be undertaken, as well as the corrective and preventive measures. The implementation of this plan would make it possible to correct the discrepancies raised and consequently to improve the general hygiene conditions throughout the chain of meal preparation, from the reception of the raw material to the distribution of meals to the prisoners.

Based on the results of the diagnosis of good - Draw up an internal guide to good hygiene practices, which is simplified and comprehensible to all operators. Its aim is to help professionals control food safety and meet their regulatory obligations [23].

- Set up a written preventive maintenance program that lists all equipment and utensils, and indicates the preventive maintenance required.
- Respect the forward motion (do not cross the dirty circuit with the clean circuit).
- Separate soiled and clean areas.
- Foodstuffs must be handled and prepared in compliance with strict hygiene measures.
- The preparation of healthy and sanitary meals requires adherence to good hygiene practices at several levels of the preparation chain: receiving raw materials, preparation environment (premises, equipment, storage, and personnel).
- Train catering staff in hygiene rules.

5. Conclusions

This audit revealed that the general hygiene conditions at the two sites studied were partially satisfactory and complied with the requirements of international standards and norms relating to food safety, especially for certain dimensions of hygiene, in particular activities relating to the reception and storage of raw materials, as well as staff medical monitoring procedures. However, the discrepancies raised could be related to material and technical, behavioral, organizational problems and a lack of training and information on food hygiene.

As part of the continuous improvement of the hygiene situation in the two establishments studied, it is compulsory to adjust and implement good practices and general hygiene procedures to control operational conditions in the food preparation chain.

The objective of this system is, on the one hand, to guarantee the safety and quality of the meals served to prisoners and consequently to reduce the incidence of foodborne diseases, and on the other hand, it will be a basis for helping professionals in collective catering in prisons, as well as inmates, to use new health education programs

aimed at the application of hygiene and food safety rules through the adoption of healthy lifestyle behaviors.

Finally, catering staff must be trained in food hygiene including training in good hygiene practices and the different types of hazards that contaminate food. In addition, management skills can be reinforced through the programming of continuing education and specialized training for catering professionals on quality and food safety standards, and they need to collaborate with organizations and institutes in the field.

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