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Evaluation and improvement of compliance of hygiene dimensions at the level of school canteens compared to internationals standards

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Abstract

Hygiene in school canteens is a major concern aimed at guaranteeing food safety and the health of students. Assessing and improving compliance with good hygiene practice standards is a necessity to meet health standards relating to the handling and storage of food and the distribution of meals. The objective of our study is to carry out an evaluation of the hygiene system in the canteens of three schools in order to improve the conditions and environment for preparing and distributing meals to students. This study touched on the important dimensions resulting from a bibliographic review in order to measure the rate of conformity with the standards and therefore implement improvement actions to correct and deal with the anomalies observed.
The most noted results relate to the dimensions: i) staff hygiene with a compliance rate of 39,34%, ii) cleaning and disinfection activities with a compliance rate of 31,34%, iii) a compliance rate of 31,00% for the transport and storage dimension. An improvement action plan has been established and implemented by those responsible. Improvements and corrections were very noticeable to achieve a compliance rate of 80,67% for the "personnel hygiene" dimension, 60,67% compliance for cleaning and disinfection activities, the compliance rate was recorded at 61,67% for transport and storage", improvements were noted for the "waste management" and "student hygiene" dimensions.

Keywords: Canteen, hygiene, safety, improvement, risk.

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1. Introduction

The premises of collective catering kitchens, in particular school canteens, the materials they contain and the activities carried out expose agents and consumers, more particularly students, to specific risks both in terms of hygiene (microbiological risks) as well as in terms of safety (physical, chemical risks, etc.), as well as other multiple nuisances (cold, heat, humidity, noise, odor, etc.). TIAC generally results from two consecutive mechanisms: contamination by bacteria of a product intended for consumption, and the proliferation of these bacteria leading to the development of a toxin or the creation of an infectious inoculum. These two events are made possible thanks to hygiene errors committed throughout the food chain [1]. A retrospective case study of collective food poisoning was carried out in the province of Kenitra during the period 2001-2018 to collect data relating to the number and characteristics of people poisoned in the study area, the severity of the cases (hospitalization, death), the foods and germs involved as well as the factors favoring such an epidemic. The results show that, between 2001 and 2018, 43 outbreaks of TIAC were notified in the province of Kenitra, involving 367 patients (69 hospitalized and 2 deaths) [2]. The majority of TIACs are associated with family meals followed by those occurring in canteens. This finding is consistent with previous reports that TIACs occurred in the family home [3]. Current regulations and safety and hygiene standards require that no primary product, food product or animal feed constitute a danger to human or animal life or health; they must be produced, handled, treated, transformed, packaged, packaged, transported, stored, distributed and offered for sale or exported, under hygienic and healthy conditions suitable to preserve their quality and guarantee their health safety [4].

The objective of our study is to evaluate the degree of compliance of hygiene conditions in the canteens of three educational establishments and to improve the working

environment by implementing recommendations for improvement in relation to the dimensions relating to hygiene requirements. The implementation of corrective actions has made it possible to significantly improve the procedures and the rate of compliance with the requirements and normative criteria specific to the hygiene system at the level of collective restaurants.

1.1) Regulations relating to hygiene standards in school canteens

Regulations exist for hygiene in school restaurants. School canteens are thus subject to control and surveillance by the veterinary services of the Ministry of Agriculture and Fisheries and the General Directorate of Food, also reinforced by the law on modernization of the 'Agriculture of July 2010 [5]. Very regularly, inspectors from veterinary services, or from the former DDASS (now regional health agencies) are responsible for this nutritional control. The controllers ensure in particular that hygiene rules are applied in the preparation, transport and distribution of meals. Furthermore, inspections are carried out unannounced in the presence of the chef and the manager of the establishment and the checks concern the safety of meals but also the safety implemented for children. Finally, after each visit, an inspection report is sent to the manager of the establishment. Furthermore, Law 12-06 relating to standardization, certification and accreditation, these rules establish the practical modalities for awarding the certificate of conformity of restaurants to Good Manufacturing Practices defined in the certification framework "Establishments of catering: Good Manufacturing Practices (GMP)" in force on the date of publication of these rules [6].

1.2) Some references and standards describing hygiene requirements in school catering

1.2.1) The prerequisite program of the HACCP system

Hazard Analysis Critical Control Points (HACCP) is a management tool developed in the late 1960s to ensure the safety of food intended for space flight. It was subsequently recognized as an effective alternative to conventional endpoint testing by the World Health Organization (WHO) and the Food and Agriculture Organization (FAO), among others, and its use has been recommended in commercial food production [7]. Hazard Analysis and Critical Control Points (HACCP) is recognized as a key element of food safety management practices in the global food industry and can be applied at any stage of the supply chain eating. The use of HACCP techniques for improving systems and practices is explored and the benefits and opportunities of HACCP-based SMSDA are discussed [8].

1.2.2) The BRC standard: British Retail Consortium

The B.R.C is a reference framework which defines the safety, quality and production criteria which must be implemented in an organization which manufactures and prepares foodstuffs, to satisfy obligations in terms of compliance with legislation and consumer protection. [9]. The establishment of a hygiene system requires the application of the norms and standards in force. The quality culture developed among consumers has had a predominant role in the development of the concept of food safety [10].

1.2.3) The ISO 22000 version 2006 standard

The ISO 22000 standard specifies the requirements for a food safety management system. The application of this standard in meal preparation processes helps the establishment to give confidence to interested parties (students, teachers, parents' association, etc.). This system was initially developed in the 1960s for the production of healthy and safe food for the US space program [11]. The Hazard Analysis – Critical Control Points (HACCP) system is a tool that companies in the agri-food sector use to guarantee food safety [12].

1.3) Dimensions relating to the hygiene system

1.3.1) Staff hygiene

This involves ensuring perfect personal hygiene for staff, in particular when returning to work, when leaving the toilet, after handling production operations, dirty equipment, trash cans, waste, chemicals, etc. To deal with certain behaviors of staff and visitors, which can cause contamination, staff must be informed and made aware of good hygiene practices relating to staff.

1.3.2) Cleaning and disinfection

Documented cleaning procedures must be implemented and maintained for buildings, facilities, premises and all equipment. Cleaning equipment and products must be suitable for their use and clean at all times. A cleaning and disinfection program for premises and equipment as well as the effectiveness of cleaning and disinfection procedures must be verified and recorded.

1.3.3) Food and meal hygiene

Receipt of food must be carried out by a reception manager to check the characteristics of the food. Foodstuffs must be preserved and stored in storage areas and in cold rooms according to their nature.

Meals must be transported to the restaurant as quickly as possible and hot meals must be consumed within hours of preparation.

1.3.4) Transport and storage

Products of different origins or types must be stored, displayed or transported in different enclosures or in the same enclosure provided that the products are carefully stored and/or protected. The frequency and volume of supplies must be adapted to the volume of the cold chain. Storage areas should not be left inaccessible areas for cleaning.

Temperature and humidity monitoring of storage rooms must be ensured according to storage requirements. Procedures to maintain product safety and quality during storage, loading and transportation should be developed based on a risk assessment and implemented appropriately.

1.3.5) Waste management

Systems must be put in place to avoid the accumulation of waste in preparation areas and prevent the use of unsuitable materials. Outdoor waste containers and indoor waste collection facilities should be managed to minimize risk. The waste management manager must:

- Eliminate cardboard and wooden packaging as quickly as possible and transfer into clean containers and crates.

- Adapt the number and volume of trash cans to the needs of the kitchen.
- Preferably use trash cans with resistant single-use plastic bags.
- Wash your hands effectively and disinfect your hands after handling trash or waste.
- Clean and disinfect kitchen trash cans daily.

1.3.6) Student hygiene

Students' hands must be washed with liquid soap before and after each meal. Hygiene awareness sessions for students must be carried out systematically. Students should not eat meals in class clothing. To avoid the risk of contamination, each student must use their own tools to eat their meals.

2. Materials and methods

2.1) Establishments recommended by the supervisory administration

The identification of the study sites was carried out in consultation with the heads of the delegation of the Ministry of National Education and Vocational Training of the province of Kenitra. There are three sites identified, of different categories. To ensure the principle of confidentiality of data and results, we assigned a code to each canteen as follows:

- The canteen of a college (CC1).
- The canteen of a high school (CL2).
- The canteen of a preparatory high school (CL3).

2.2) Development of hygiene compliance assessment tools

In our study, we carried out a bibliographic review to identify the repositories and standards which specify the requirements relating to the hygiene system. The standards used are applied, at the level of the agri-food industries and in collective catering, in order to evaluate and improve the conformity of working conditions and prevent potential risks and dangers in this type of catering. We developed a questionnaire (evaluation grid) bringing together the main hygiene dimensions, which we adapted to the specificities of the study sites.

- Staff hygiene
- Cleaning and disinfection
- Food and meal hygiene
- Transport and storage
- Waste Management
- Student hygiene

2.3) Development, verification and validation of the audit questionnaire

An evaluation grid was developed in the form of a questionnaire bringing together the identified dimensions, which cover all the main elements relating to hygiene in the canteens of recommended educational establishments. The evaluation criteria were converted into questions, which were evaluated in order to identify and verify the level of compliance of the different dimensions with respect to hygiene requirements and determine avenues for improvement of the system. hygiene.

All of the questions (evaluation criteria) were subject to verification and review by a commission made up of professors from the faculty and officials from the delegation of the Ministry of National Education in order to have approval and consensus on the importance and relevance of the dimensions and evaluation criteria. The established and verified evaluation grid was validated by the commission in order to ensure and guarantee its applicability within school canteens.

2.4) Planning and carrying out the on-site assessment

We planned and organized staff interview meetings to collect evaluation data in accordance with the questionnaire criteria. Part of the questionnaire was administered to managers to deepen our assessment in relation to the hygiene requirements identified. The questionnaire was administered to all staff to collect the maximum results. Note that, during the completion stage of the questionnaire, certain questions required explanations and clarifications, which prompted us to adapt the language of the questioning by profile of the staff interviewed:

- The head of the financial department
- The boarding school master
- The store manager
- The chef
- Cooking women
- Housekeepers

2.5) Determination of findings: strengths and areas for improvement

The evaluation results collected were reviewed and analyzed by dimension in order to identify findings: strong points and areas for improvement. The objective of this analysis is to demonstrate at what level of performance the requirements for good hygiene practices comply and what opportunities are needed to improve the degree of satisfaction with the applied standards.

2.6) Planning and implementation of corrective actions

The treatment of non-conformities was carried out by the development of a detailed action plan, by dimension, specifying the activities to be carried out, those responsible for execution, the deadlines for carrying out the activities as well as tangible proof of the corrections. carried out.

The effectiveness of the planned and carried out actions was assessed through rigorous monitoring to determine the relevance and adequacy of the corrective actions carried out in relation to the pre-established requirements.

2.7) Reassessment of compliance of hygiene dimensions

The conformity reassessment consists of a second verification of the level of conformity after the implementation of corrective actions. The validated questionnaire was redistributed to all staff to assess the value, effectiveness and performance of the improvement actions implemented.

3. Results and Discussions

3.1) Results

3.1.1) Compliance rate relating to the "staff hygiene" dimension

The results demonstrated in the figures **(n°1 and n°2)** represent the compliance rate of the dimension relating to hygiene of the staff working in the canteens of the three

establishments, with an average of before the implementation of corrective actions (improvements). The degree of compliance increased to an average of 80,67%, which signified a great improvement after the implementation and deployment of planned improvement actions.

3.1.2) Compliance rate relating to the "cleaning and disinfection" dimension

The results demonstrated in the figures **(n°3 and n°4)** represent the compliance rate of the dimension relating to cleaning and disinfection activities of the canteen premises of the three establishments, with an average of 31,34% before the implementation of corrective actions (improvements). The degree of compliance increased to an average of 60,67%, which signified a marked improvement after the implementation and deployment of cleaning and disinfection procedures by agents.

3.1.3) Compliance rate relating to the "food and meal hygiene" dimension

The results demonstrated in the figures **(n°5 and n°6)** represent the compliance rate of the dimension relating to food and meal hygiene, with an average of 80,67% before the implementation of corrective actions (improvements). The degree of compliance increased to an average of 85,34%, which signified a clear improvement after the implementation and deployment of corrective actions.

3.1.4) Compliance rate relating to the "Transport and storage" dimension

The results demonstrated in the figures (**n°7 and n°8)** represent the compliance rate of the dimension relating to transport and storage activities, with an average of 31,00% before the implementation of corrective actions (improvements). The degree of compliance increased to an average of 61,67%, which signified a good improvement after the implementation and deployment of corrective measures for the transportation and storage of food.

3.1.5) Compliance rate relating to the "waste management" dimension

The results demonstrated in the figures (**n°9 and n°10)** represent the compliance rate of the dimension relating to waste management activities, with an average of 64,67% before the implementation of corrective actions (improvements). The degree of compliance increased to an average of 74,34%, which signified a clear improvement after the implementation and deployment of corrective measures for good waste management.

3.1.6) Compliance rate relating to the "student hygiene" dimension

The results demonstrated in the figures (**n°11 and n°12)** represent the compliance rate of the dimension relating to student hygiene, with an average of 68,34% before the implementation of corrective actions (improvements). The degree of compliance increased to an average of 75,67%, which signified a good improvement after the implementation and deployment of planned corrective measures.

3.2) Discussions

One of the most important elements in food safety standards is the hygiene that staff must have. Typically, it is people who carry diseases, bacteria and pathogens. Since it is the staff who prepare the food and meals until they are cooked and distributed to the students, the staff must respect the hand hygiene procedure which is one of the most effective measures to prevent infections and cross-transmission of pathogens in collective catering, particularly school canteens. The measures put in place, focused mainly on hand hygiene and staff training on good practices, have made it possible to improve the compliance rate to reach a rate of 80.67%. The importance of hand hygiene has been highlighted by the increasing number of antibiotic-resistant organisms and the repeated emergence of infectious diseases [13]. Institutional hand hygiene behavior is difficult to monitor and improve consistently, particularly over long periods of time [14]. In order to improve food safety in terms of staff hygiene, greater emphasis should be placed on training maintenance staff in food hygiene and equipment design [15]. The cleaning and disinfection dimension were improved by the implementation of procedures and rules of good practice during cleaning and disinfection to increase from a compliance rate of 31.34% to 60.67%. Environmental hygiene requires the implementation of cleaning and disinfection means aimed at limiting the transmission of micro-organisms linked to premises and their surfaces which could be the source of cross-transmissions. Temporarily, disinfection eliminates micro-organisms on surfaces (furniture, sinks, toilets, floors, tiles, etc. [16]. The hygiene of food and meals constitutes a relevant dimension which can directly impact consumers and mainly students. The quality of food and meals necessarily depends on bacteriological and chemical controls of the goods received upon receipt to verify conformity as well as the absence of dunnage, the strengthening of official controls must also be carried out by the delegation of certain food safety inspections, to public or private organizations, in establishments providing direct delivery to the consumer [17]. The recommendations implemented in relation to the transport and storage dimension essentially concern the practices of isolation and labeling of food in the storage store, monitoring of the temperature and conditions of storage and transport (temperature, humidity, ventilation, etc.) and cleaning and disinfection of means of transport to achieve a compliance rate of 61.67%. The evaluation of the "waste management" dimension made it possible to record a compliance rate of 64.67% before the implementation of corrective actions. The improvements implemented are mainly the identification of outdoor waste containers and indoor waste collection facilities through a labeling system, as well as the use of resistant plastic bags for waste collection. These measures made it possible to move to a rate of 74.34%. Law 28-00, relating to waste management and its elimination, aims to prevent and protect human health, fauna, flora, water, air, soil, ecosystems, sites and landscapes and the environment in general against the harmful effects of waste. To this end, it aims to prevent the harmfulness of waste and reduce its production and the organization of the collection, transport, storage, treatment of waste and its elimination in an ecologically rational manner [18], in particular at the level of public collective catering. A compliance rate of 75.67% was recorded for the "student hygiene" dimension following awareness sessions on good hygiene practices and hand washing techniques and on personal and clothing hygiene.

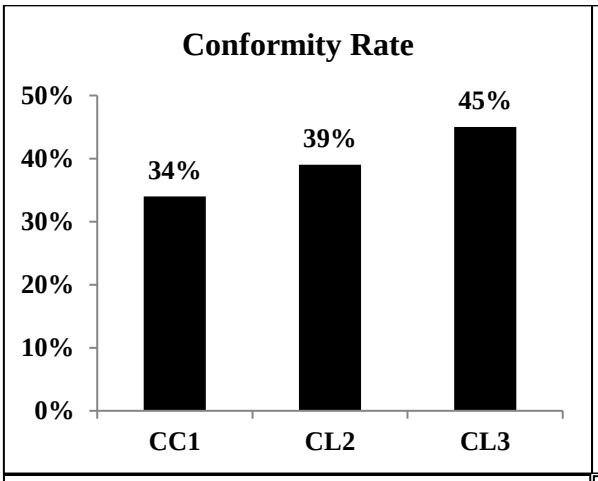

Figure n°1: Staff hygiene compliance rate **BEFORE** improvements

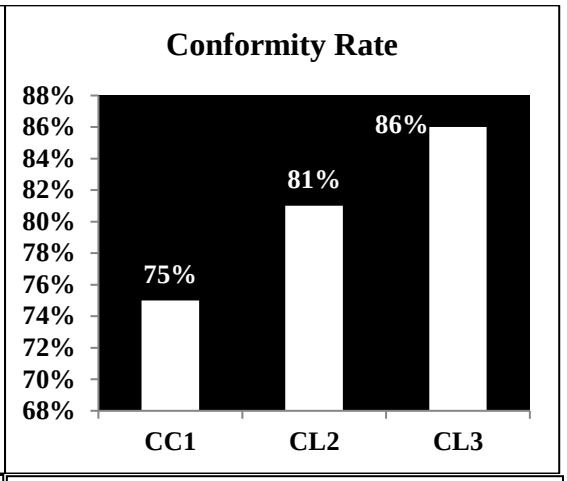

Figure n°2: Staff hygiene compliance rate **AFTER** improvements

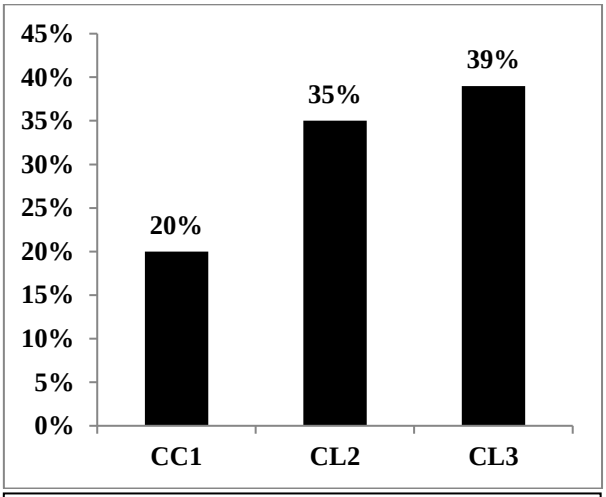

Figure n°3: Compliance rate of cleaning and disinfection **BEFORE** improvements

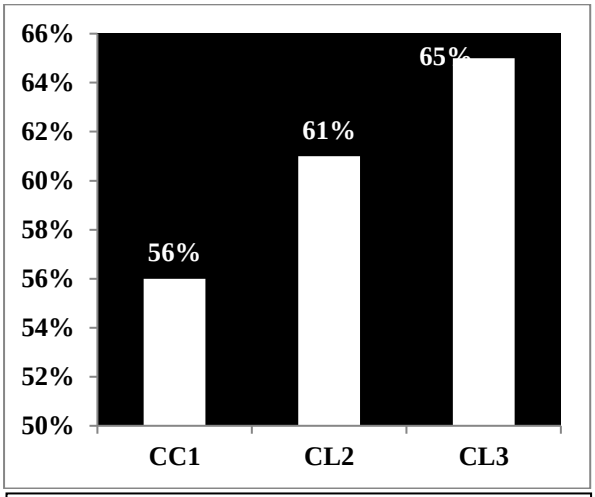

Figure n°4: Compliance rate of cleaning and disinfection **AFTER** improvements

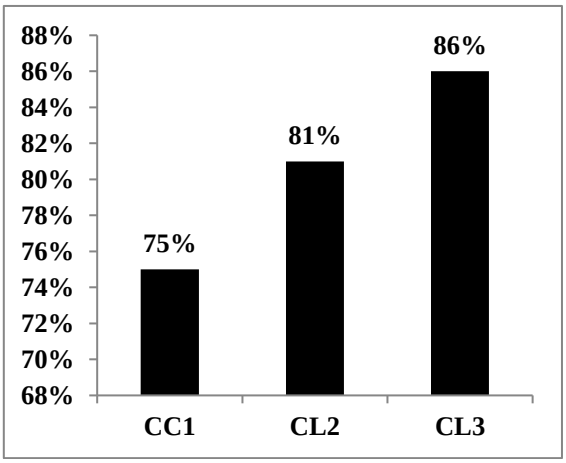

Figure n°5: Food and meal hygiene compliance rate **BEFORE** improvements

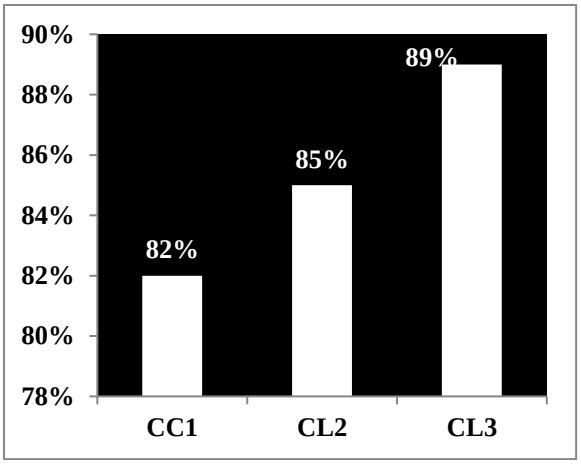

Figure n°6: Food and meal hygiene compliance rate **AFTER** improvements

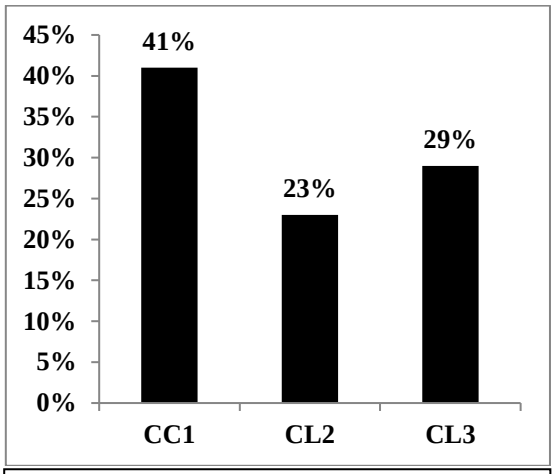

Figure n°7: Transport and storage compliance rate **BEFORE** improvements

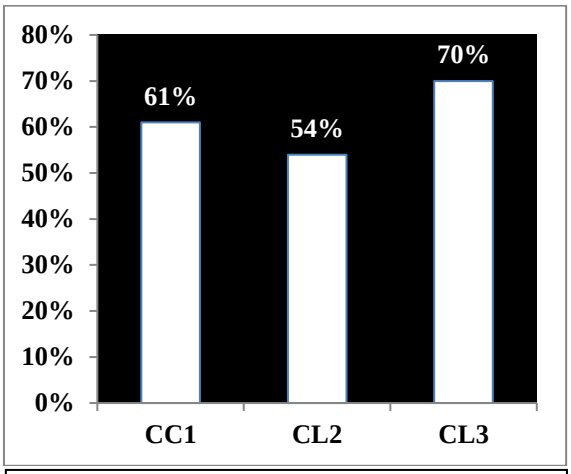

Figure n°8: Transport and storage compliance rate **AFTER** improvements

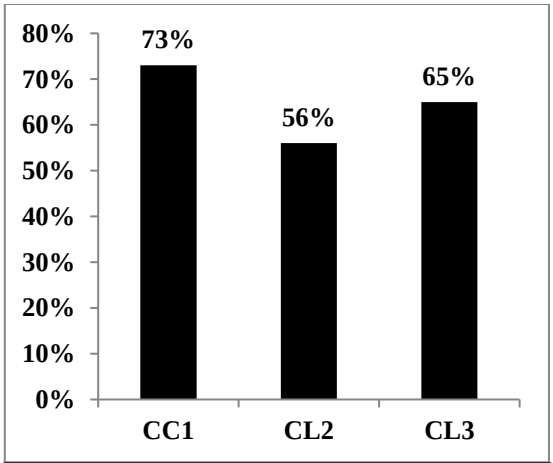

Figure n°9: Waste management compliance rate **BEFORE** improvements

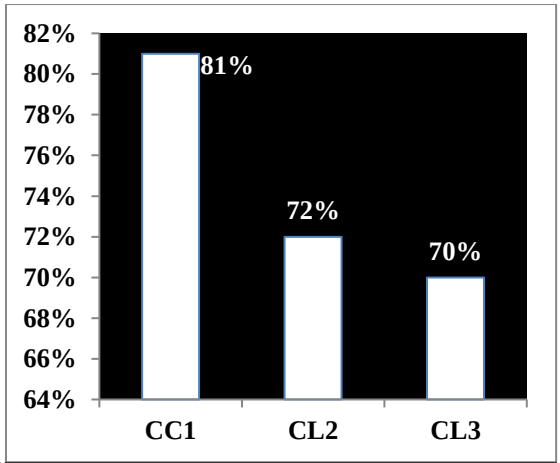

Figure n°10: Waste management compliance rate **AFTER** improvements

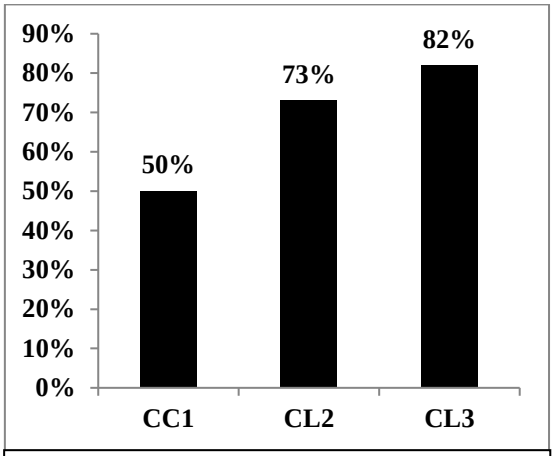

Figure n°11: Student hygiene compliance rate **BEFORE** improvements

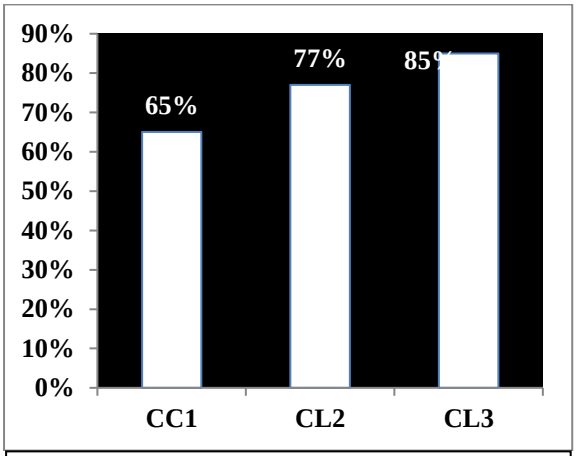

Figure n°12: Student hygiene compliance rate **AFTER** improvements

4. Conclusions

In conclusion, the study highlights the crucial importance of maintaining high standards of hygiene in the canteens of three schools to guarantee food safety and the well-being of students. The assessment revealed different levels of compliance with hygiene standards in different dimensions, highlighting areas for improvement. The dimensions of personnel hygiene, cleaning and disinfection activities, and transportation and storage have been identified as crucial focal points.

Thanks to a comprehensive action plan, implemented and supervised by responsible people, substantial progress has been made. Remarkable improvements have been observed, particularly in staff hygiene, cleaning and disinfection, as well as transport and storage. These improvements demonstrate a commitment to meeting hygiene standards and creating a safer environment for food preparation and distribution.

In addition, attention was also paid to waste management and student hygiene, highlighting a holistic approach to improve overall cleanliness and sanitation in school canteens. Continued dedication to maintaining and improving these hygiene standards is paramount to fostering a healthy and conducive dining environment for students. This study serves as the basis for ongoing efforts to optimize hygiene practices in school canteens, ultimately benefiting the entire school community.

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Conflicts of Interest
None.

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