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ORIGINAL PAPER

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Rating of the effectiveness of cleaning and disinfection procedures in a mass catering establishment

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ABSTRACT

Introduction. An increasing problem in maintaining the proper level of hygiene in food industry plants is microbiological hazards, affecting the quality and safety of produced food, which in consequence may lead to the creation of many negative health effects on consumers.

Aim. Determination of the degree of microbiological contamination of machinery and equipment as well as small production equipment before the commencement of production activities and rating of the effectiveness of the implemented procedures of cleaning and disinfection in a mass catering establishment.

Material and methods. The research material was the surfaces of machinery and equipment as well as small production equipment used in a mass catering establishment located in the Primary School in Przemyśl. Microbiological tests were carried out using the swab method in accordance with the recommendations of the Polish Standard PN-A-82055-19: 2000.

Results. The hygienic condition of the marked surfaces largely differed from the specific hygiene standards described in PN-A-82055-19: 2000. In most cases the degree of microbial contamination was insufficient. It is recommended to follow strictly defined washing and disinfection procedures every time after finishing work and if necessary before proceeding with production.

Conclusion. The obtained results showed that there was secondary microbiological contamination of the determined production areas subjected to cleaning and disinfection. It was found that the procedures of cleaning and disinfection of small production equipment, including parts of machines and devices, were properly developed, while there are discrepancies in their implementation.

Keywords. food safety, production hygiene, washing and disinfection

Introduction

Washing and disinfection play a very important role in maintaining an appropriate level of hygiene, ensuring safety and high quality of the food produced.[1,3]

The main purpose of carrying out cleaning and disinfection procedures is to remove or reduce all physical, chemical and, above all, microbiological contamination that accumulates on production surfaces, which is a major threat to the food being produced. The concept of production hygiene in the food industry includes both cleanliness of production rooms, machinery and equipment, as well as personal hygiene of personnel.[2,4,5]

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Participation of co-authors: A – Author of the concept and objectives of paper; B – collection of data; C – implementation of research; D – elaborate, analysis and interpretation of data; E – statistical analysis; F – preparation of a manuscript; G – working out the literature; H – obtaining funds

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In food production plants, the basis for hygiene is to perform cleaning and disinfection of all tools, machines and equipment as well as production rooms in accordance with the procedures and instructions developed.[6-9] The correct way to carry out cleaning and disinfection procedures with the use of appropriate equipment and devices, as well as the selection of appropriate cleaning agents, allows proper preparation of the rooms and production areas. The use of appropriate washing and disinfection systems should guarantee that the highest hygienic and sanitary standards, as well as health food safety, are met. [10] In food production, a very important stage is the monitoring of washing and disinfection processes, aimed at limiting potential hazards and controlling each stage of the production process, which has a decisive impact on the health quality of food.[11,12] Systematic control of the effectiveness of cleaning and disinfection processes by performing microbiological tests and analyses of both production rooms and all surfaces in contact with the produced food will allow to identify and locate the potential source of hazards, obtaining an actual picture of the hygienic condition of the devices.[13-16]

Material and methods

Research into this work was carried out on the premises of a collective catering facility located at the Primary School in Przemyśl.

The nutrition block located on the ground floor part of the school building has been in operation since 1978. The facility's activity is based on organized nutrition for children and youth as well as school employees. The food segment provides about 150 meals a day in the form of a two-course dinner and a dessert compote and fresh fruit. Meals are served every day from Monday to Friday from 11:00 a.m. to 1:00 p.m.

The preparation of meals takes place in a designated kitchen room, equipped with the necessary equipment as well as machinery and equipment.

After the end of the work, are treatments carried out for cleaning and disinfecting kitchen utensils, all production areas, floors, machinery and equipment and auxiliary equipment in accordance with the developed procedures and instructions.

The research material consisted of machine and equipment surfaces (a vegetable and fruit slicer, meat grinder and electric frying pan), as well as small production equipment (ladle, bowl, lid, a roasting pan, colander) used in a mass catering establishment.

Test samples were taken from the controlled areas for five days a week at 7:00 a.m., prior to the start of production at the plant, then transported to the laboratory for microbiological testing. The transport time did not exceed 60 minutes, the temperature was within 0-5°C.

Microbiological tests in this work were carried out using the swab method in accordance with the recommendations of PN-A-82055-19: 2000, to determine the degree of microbiological contamination of machinery and equipment and small production equipment based on the total number of mesophilic aerobic microorganisms.

Determination of microbiological contamination of machinery and equipment as well as small production equipment, carried out as part of the internal control of the plant, were carried out in the morning before production. Sterile tampons and a jar with 30 milliliters of Ringer's solution were prepared prior to the collection of the swabs. The jar with the sample taken was placed in an isothermal container, and then swabs were taken from the following surfaces, proceeding in the same way as described above.

During the day, four different surfaces were marked. After collecting the swabs from all four surfaces, the jars were put into an isothermal container with ice to keep the temperature between 0 ° C and 5° C, and within one hour of collection, they were transported to the laboratory for microbiological testing.

Before starting the work, the laminar table top was disinfected by rubbing with ethyl alcohol. Sterile tubes with 9 milliliters of Ringer's solution were then prepared and labeled accordingly. Prior to the dilution, a sample of the test material was shaken intensely for about 1 minute. Sterile 1 milliliters of the test sample was removed from the sterile pipette and transferred to a test tube with 9 milliliters of Ringer's solution. The first dilution obtained in this way (10^{-1}) was thoroughly mixed. Worn tips were placed in a beaker with cotton wool and alcohol. All operations were carried out under sterile conditions.

Two sterile Petri dishes were prepared for each dilution and labelled accordingly. Before seeding, the tubes with lavage were mixed thoroughly. The automatic pipette was made of the initial suspension and dilution of 10^{-1} inoculation of 1 milliliter into two parallel plates. Subsequently, 15 milliliters of cooled agar fluid (Nutrient Agar 70148-500G) was poured on each plate within 15 minutes of the culture. After complete solidification of the medium, inverted plates in the incubator were placed. Incubation was carried out at 30 °C for 48 hours.

After 48 hours incubation in the incubator, the number of colonies on the plates of two parallel replicate cultures from the washings (starting suspension) was read, due to the lack of the presence of CFU on the plates with a dilution of 10^{-1}.

The number of microorganisms located on 1 cm^2 limited by the surface template (25 cm^2) was calculated on the basis of PN-A-82055-19: 2000.

Results

After reading the number of colonies grown on Petri dishes, calculations were made to determine the total number of mesophilic aerobic microorganisms and on

Table 1. Summary of results from the microbiological contamination of machines and devices

The total number of microorganisms		Research object: Machines and devices							
		Vegetable and fruit slicer			Meat grinder			Electric frying pan	
		The term of research							
		30.05.	31.05.	01.06.	30.05.	31.05.	01.06.	02.06.	03.06.
The number of colonies on the plates(from the starting suspension)	I plate	63	23	21	35	29	18	34	23
	II plate	67	21	25	39	31	22	36	25
The average number of colonies		65	22	23	37	30	20	35	24
Standard deviation		±2,83	±1,41	±2,83	±2,83	±1,41	±2,83	±1,41	±1,41
The number of microorganisms on 25 cm^2 area [jtk/25cm^2]		$2,0\times10^3$	$6,6\times10^2$	$6,9\times10^2$	$1,1\times10^3$	$9,0\times10^2$	$6,0\times10^2$	$1,1\times10^3$	$7,2\times10^2$

Table 2. Summary of results from the microbiological contamination of small production equipment

The total number of microorganisms		Research object: Machines and devices					
		Roasting pan			Colander		
		The term of research					
		30.05.	31.05.	01.06.	30.05.	31.05.	01.06.
The number of colonies on the plates(from the starting suspension)	I plate	28	18	7	27	13	5
	II plate	24	20	7	29	17	3
The average number of colonies		25	19	7	28	15	4
Standard deviation		±1,41	±1,41	±0,00	±1,41	±2,83	±1,41
The number of microorganisms on 25 cm^2 area [jtk/25cm^2]		$7,5\times10^2$	$5,7\times10^2$	$1,0\times10^2$	$8,4\times10^2$	$1,5\times10^2$	$1,0\times10^2$

Table 3. Summary of results from the microbiological contamination of small production equipment

The total number of microorganisms		Research object: Machines and devices					
		Lid		Bowl		Ladle	
		The term of research					
		02.06.	03.06.	02.06.	03.06.	02.06.	03.06.
The number of colonies on the plates(from the starting suspension)	I plate	23	11	7	3	7	4
	II plate	21	13	5	3	11	6
The average number of colonies		22	12	6	3	9	5
Standard deviation		±1,41	±1,41	±1,41	±0,00	±2,83	±1,41
The number of microorganisms on 25 cm^2 area [jtk/25cm^2]		$6,6\times10^2$	$3,6\times10^2$	$1,0\times10^2$	$9,0\times10$	$2,7\times10^2$	$1,5\times10^2$

its basis to assess the degree of microbial contamination of machinery and equipment as well as small production equipment.

After calculations, the results are presented in two tables divided into machines and devices (table 1) and small production equipment (table 2 and 3).

Discussion

Microbiological hazards are a very serious problem in maintaining the proper level of hygiene in food industry devices. Exposure to biological agents may cause a decrease in the quality of food produced, as well as threaten its safety, which in turn may lead to many negative health effects on consumers.[17-20] Therefore, a prerequisite for maintaining the hygienic condition of the plant and full health comfort for consumers is to conduct systematic inspections, by performing tests and microbiological analyses assessing the degree of microbiological contamination and the effectiveness of the procedures of washing and disinfection implemented. The necessary measure to achieve the abovementioned objective is to develop appropriate standards and guidelines that are widely accepted and allow for correct interpretation of the results obtained.

In contrast to the majority of physical and chemical hazards, there are no universally accepted criteria for the assessment of microbial contamination, as well as acceptable normative values or methodological recommendations. Nevertheless, there are many standards, standards or proposals for limit values that are helpful in

interpreting the obtained test results. They are usually of relative or arbitrary nature.[17-20]

The assessment of microbial contamination of machinery and equipment as well as small production equipment on individual test days was made on the basis of the guidelines of PN-A-82055-19: 2000. Summing up, the obtained results from the entire research period (from 30/05/2016 to 03/06/2016) indicate that the hygienic condition of the marked surfaces to a large extent deviated from the specific hygiene standards described in the standard. In most cases the degree of microbial contamination was insufficient (above 100 cfu/25cm^2). During the whole research period, the surface of machines and devices was much more dirty than small production equipment. This may have been caused by the difficulty in maintaining a high degree of cleanliness requiring the dismantling of machinery and equipment components.

Conclusion

On the basis of conducted microbiological tests and a review of the applied washing and disinfection procedures in a mass catering establishment, the following conclusions and recommendations were formulated:

1. The hygienic condition of the marked surfaces largely differed from the specific hygiene standards described in PN-A-82055-19: 2000. In most cases the degree of microbial contamination was insufficient. It is recommended to follow strictly defined washing and disinfection procedures every time after finishing work and if necessary before proceeding with production.
2. At the beginning of the week, ie. 30/05/2016, during the inspection, the highest microbiological contamination of the tested areas was recorded, from the entire research period. It could be caused by a longer break in carrying out the cleaning and disinfection procedures, ie. from Friday to Monday.
3. During the whole research period, the surface of machines and devices was much more dirty than small production equipment. This may have been caused by the difficulty in maintaining a high degree of cleanliness requiring the dismantling of machinery and equipment components. For this type of surfaces, appropriate methods and techniques of cleaning and disinfection should be applied in accordance with the developed procedures.
4. Due to the lack of generally recognized microbiological purity criteria in the law, it is recommended that the operator of the food sector should develop its own limits of plant purity.
5. After analyzing the obtained test results, it was found that after at least 12 hours after the completion of the cleaning and disinfection procedures, there was a secondary infection of the tested production areas. It was found that there are slight discrepancies in the implementation of cleaning and disinfection procedures. It is recommended to perform initial rinsing of production equipment before starting the production process, in order to reduce the microbiological contamination of production areas and increase the efficiency of the implemented procedures of cleaning and disinfection in a collective catering establishment.

References

1. Trziszka T. *Zarządzanie jakością i bezpieczeństwem Żywności*. Wrocław: Wydawnictwo Uniwersytetu Przyrodniczego we Wrocławiu. 2009:20-132.
2. Poradnik Dobrej Praktyki Higienicznej i Produkcyjnej. Web Site *https://gis.gov.pl/*. Published December. 2017. Accessed February 15,2019.
3. Trafiałek J, Lehrk M, KarlLücke F, Kołożyn-Krajewska D, Janssen J. HACCP-based procedures in Germany and Poland. *Food Control*. 2015;44:66-74.
4. Koziróg A. Higiena i bezpieczeństwo w procesie wytwarzania żywności. *Przemysł Spożywczy*. 2012;66;(2):20-23.
5. Książczyk M, Krzyżewska E, Futoma-Kołoch B, Bugla-Płoskońska G. Disinfectants - bacterial cells interactions in the view of hygiene and public health. *Postępy Hig Med Dośw (online)*. 2015;69:1042-1055.
6. Żakowska Z, Stoińska H. *Mikrobiologia i higiena w przemyśle spożywczym*. Łódź: Wydawnictwo Politechniki Łódzkiej. 2000:320-398.
7. Dzwolak W. HACCP in small food businesses – The Polish experience. *Food Control.* 2014;36(1):132-137.
8. Garayoa R, Leturia M, Bes-Rastrollo M, García-Jalón I, Vitas A. Catering services and HACCP: Temperature assessment and surface hygiene control *before* and *after* audits and a specific training session. *Food Control*. 2014;43:193-198.
9. Tomasevic I, Kuzmanovićb J, Anđelković A, et al. The effects of mandatory HACCP implementation on microbiological indicators of process hygiene in meat processing and retail establishments in Serbia. *Meat Science*. 2016;114:54-57.
10. Godlewska K. Nowoczesne rozwiązania mycia i dezynfekcji. *Przemysł Spożywczy*. 2007; 8: 68-71.
11. Kunicka A. Monitoring higieny w przemyśle spożywczym. *Przemysł Spożywczy*. 2006;3: 31–34.
12. Walaszczyk A. *Wdrażanie standardów zarządzania bezpieczeństwem żywności w teorii i praktyce.* Łódź; Monografia Politechnika Łódzka. 2016;2183:4-11.
13. Jałosińska M. Nowoczesne metody mikrobiologiczne w zapewnieniu i kontroli higieny produkcji żywności. *Przemysł Spożywczy*.2005;2:17–21.
14. Bućko-Płoszczyca E, Szybieniecka Ewa, Krochmal-Marczak B, Wilczek S. Bezpieczeństwo żywności-zagrożenia, organy i systemy jego kontroli. 2018;1;15-35. https://www.researchgate.net/publication/2018 324227193.

15. Godela A, Lewańska M, Olszewska D, Myga-Nowak M. Bezpieczeństwo żywności w Polsce - przegląd najważniejszych zagadnień. Częstochowa, Technika, Informatyka, Inżynieria Bezpieczeństwa. 2016; IV:183–193.
16. Cleaning and Disinfection in Food Processing Operations Web Site. http://www.safefood360.com. Published August, 2012. Updated January, 2017. Accessed February 1, 2019.
17. Górny RL. Biologiczne czynniki szkodliwe: normy, zalecenia i propozycje wartości dopuszczalnych. *Podstawy Metody Oceny Środowiska Pracy*. 2004;3;(41):7–39.
18. Lasik A, SzablewskI T, Cegielska-Radziejewska R, Tomczyk Ł, Zabielsk J. *Zastosowanie mikrobiologii prognostycznej do oceny bezpieczeństwa żywności*. Poznań. Wydział Nauk o żywności i żywieniu. Uniwersytet Przyrodniczy w Poznaniu. 2016;8,37:41-48.
19. Zubeldia B, Jiménez M, Valenzuela C, Mariscal A, Martin-Olmedo P. Effectiveness of the cold chain control procedure in the retail sector in Southern Spain. *Food Control.* 2016; 59:614-618.
20. Jurkiewicz A, Oleszczak-Momot W. Listeria monocytogenes jako problem zdrowia publicznego. *Med Og Nauk Zdr*. 2015;21(1):29–32.