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SURVEYING THE HYGIENIC CONDITIONS OF CANTEENS BY MEANS OF SURFACE MICROBIOLOGICAL ANALYSES

András BITTSÁNSZKY[1], Csaba Bálint ILLÉS[2], Lajos FÜLÖP[1], András J. TÓTH[1,2]
[1]*InDeRe Analytical and Economic Research Institute, Budaörs, Hungary*
[2]*Szent István University, Gödöllő, Hungary*
E-mail: andras.bittsanszky@indere.hu

Summary: There are significant differences in the standard of canteens catering for schoolchildren. Catering providers have to observe a lot of rules and regulations to maintain and guarantee the hygienic quality of food although certain flaws can occur in the processes. In our research we measured all the aerobic microbes on different kitchen surfaces and from there we concluded the differences between the hygienic standard of kitchens. Altogether 10 different surfaces of 11 different canteens were involved in the survey. To determine the number of all microbes MicroTester equipment was used which detects the multiplication of bacteria through redox potential change.

Keywords: microbiology, school catering, kitchen surfaces

1. Introduction

A greater and greater attention is paid to institutional catering and within it, children's catering. More and more people realise that the quality of the food consumed has a great impact on the health condition of the society. Nowadays it is a typical phenomenon that our children have their main meals outside their homes, which is the school canteen in most cases. The basic expectation is that these institutions must provide safe and quality food, which can be assured by quality standards, first of all (Tóth and Bittsánszky, 2014).
Nowadays the widely accepted and supported detection methods in microbiology are time consuming and it can take days to reach a result. At present food is examined from a microbiological aspect when a problem occurs. Unfortunately, after the incident 3-5 days are required till the result is gained, which, of course, is dangerous and a case for concern. However, rapid examination methods must be used at the end of the food supply chain right before consumption. The introduction of rapid microbiological examination methods into the final quality assurance can detect faulty products and even can point out if a unit does not cater for the proper hygienic conditions during its activities. One of the most suitable methods can be a MICROTESTER instrument that detects the multiplication of bacteria though their redox potential change (Reichart et al., 2007).
In order to raise the quality of services it is indispensable to determine the microbiological contamination of kitchen surfaces (working desks, plates, utensils).
To ensure the proper food quality standard in school canteens it is necessary to survey potential microbiological risks. The objective of the present study is to examine and evaluate the hygienic conditions of school canteens and their microbiological quality.

2. Materials and methods

2.1 Sample taking

Our survey was carried out in 11 secondary school canteens where food is transported from outside. Sample was taken from 10 different surfaces by using a sterile tampon.

Surfaces:

1. spoon
2. fork
3. knife
4. soup plate
5. dinner plate
6. dessert plate
7. kitchen desk
8. serving utensils
9. catering tray
10. glass

Samples were taken from 100 cm^2 surface and in the case of spoon, fork and knife measures were added. After sample taking, samples were transported to laboratories where microbiological examinations were started.

2.2 Rapid detection of aerobic colony count (ACC)

In order to determine the total number of germs available on surfaces MICROTESTER was used on the basis of redox potential change (Reichart et al., 2007). The basics of measuring is that as a result of energy producing biological oxidation reactions, when bacteria multiply, the redox potential of the environment decreases, which is well-detected above a certain microbe concentration. Detecting time (TTD) is the period when the absolute value of the speed of redox potential change exceeds a value significantly different from accidental impacts (e.g. $|dE/dt| \geq 0.5$ mV/min). This value is termed as detection criterion (Reichart et al., 2007).
Redox potential change is independent of the shape and size of the measuring cell and also the composition of the substrate so measuring can be done in any liquid substrate with unlimited numbers of samples. In accordance with this, the MICROTESTER instrument makes it possible to use standard media applied in standard microbiological processes. The redox curves of different microbe groups also differ, so this method can identify the multiplying microbes for orientation in addition to detecting multiplication (Erdősi et al., 2012).
Measures were taken by inserting the tampons from different surfaces into a measuring cell containing 9 ml liquid and detection time was determined by MICROTESTER.

2.3 Editing calibration curves

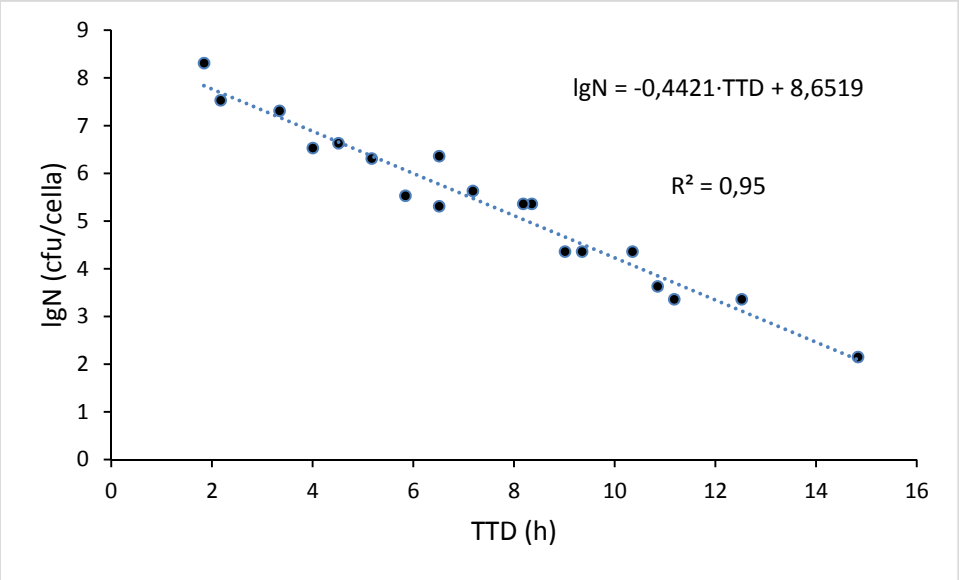
In order to exactly determine the number of germs, calibration curves are necessary to make. To this end, ten-fold diluting series were prepared and the microbial count in each dilution were determined using the standard plating method (in accordance with ISO 4833:2003) together with the TTD value by MICROTESTER. The calibration curves were edited on the basis of lgN values and TTD-s.
The results gained were analysed by using T-test and variance analysis.

3. Results and discussion

3.1 Determining calibration curves

Calibration curves were determined by the diluting rows of microorganisms from different surfaces taken at different times. Detection criterion in all the cases was 0.4 mV/min. Figure 1 presents the calibration curve.

Figure 1: The calibration curves of different surfaces

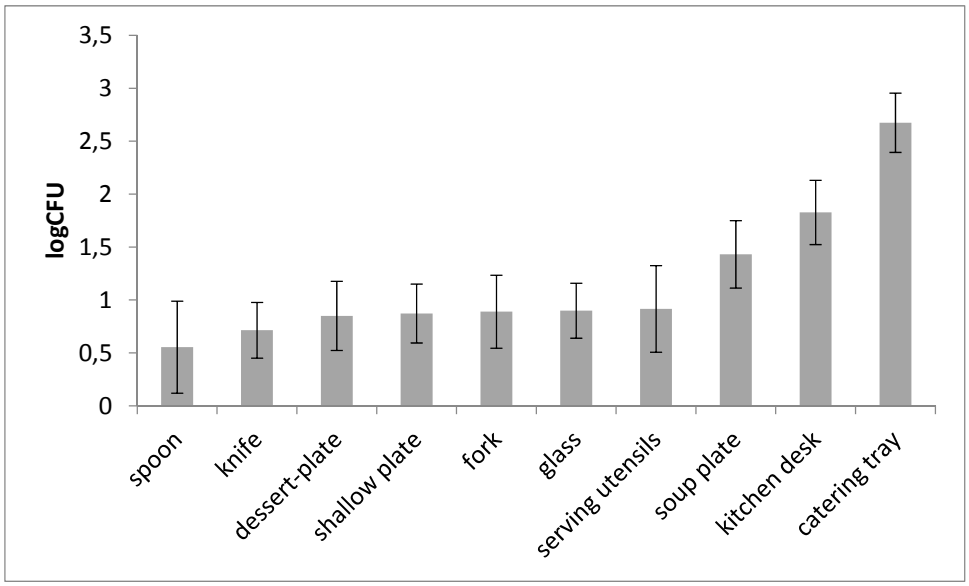


Source: own research results

3.2 The microbiological cleanliness of surfaces

The total microbe number of instruments is presented by Figure 2.

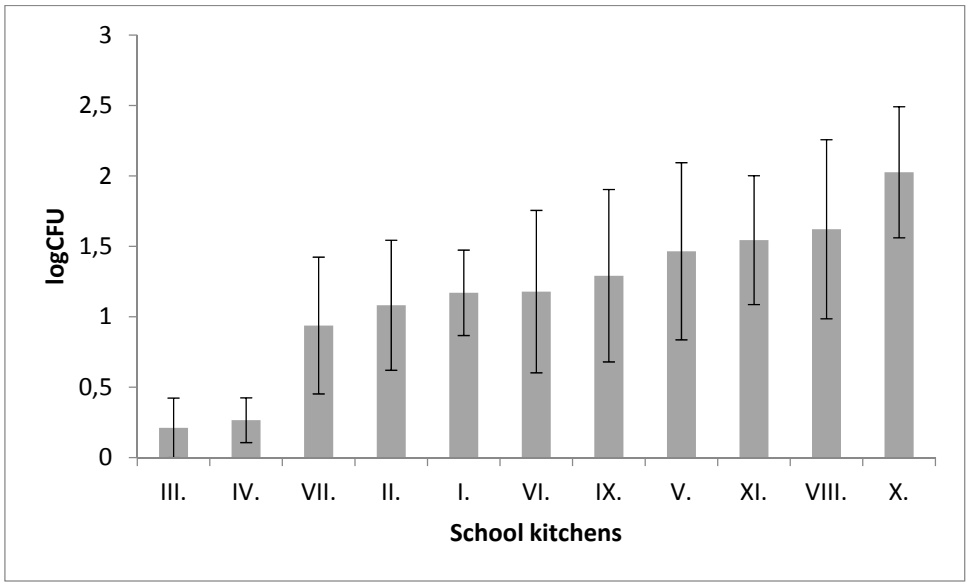
Figure 2: The total number of microbes in school canteens. The unit of surface pollution is cfu/instrument in the case of spoon, knife, fork, serving utensils and glass, in the case of others it cfu/100 cm^2. Mean ± standard error of mean are indicated (n=11).



Source: own research results

Figure 3 illustrates the differences between schools.

Figure 3: The total number of microbes on utensils and surfaces in different school canteens. Mean ± standard error of mean are indicated (n=10).



Source: own research results

According to the regulations of Decree 4/1998. (11 November) of the Ministry of Health Care the pollution of surfaces in direct contact with food must not exceed 100 cm^2 of the surface in direct contact with food while in the case of a smaller surface it can only be 250 cfu per total surface after cleaning and sterilisation.

Kitchens were ranked by microbiological cleanliness on the basis of the results of their surfaces in direct contact with food.
Three groups were classified, which are as follows.

- *Clean*: the logarithm of microbe averages ≤ 2.4 (lg250)
- *Semi-polluted*: the logarithm of microbe averages > 2.4, but ≤ 3.4 (lg2500)
- *Heavily polluted*: the logarithm of microbe averages > 3.4

Based on the results the following kitchens are include in the groups:

Clean	***Semi-polluted***	***Heavily polluted***
I.	XI.	V.
II.		VIII.
III.		IX.
IV.		
VI.		
VII.		

The results of international research have also found great differences between catering units t (Santana et al., 2009; Laranjeiro et al., 2014). However, the reasons for these differences have not been explained so far. The most crucial risk factor in running school canteens is the improper work of colleagues managing food (Tóth & Bittsánszky, 2014).

4. Conclusion

School canteens are the final stations of the food supply chain as from here food is served directly to the consumers, who, in general, consumes it on the spot. In this environment rapid microbiological methods are of vital importance as there is a chance to make the necessary steps immediately if microbiological problems occur.
On the basis of the results of the examination the risk factors of school canteens can be determined that can contribute to the multiplication of bacteria and cross-infections (Yoon et al., 2008). Although the food handlers take part in regular trainings, it can be seen that practice is not proper in many cases. Our research can help highlight the weak points of the currently applied HACCP systems and contribute to raising the present food safety standards in school canteens.

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