

## HAZARD ANALYSIS CRITICAL CONTROL POINT (HACCP) IN PUBLIC CATERING SERVICES: A MODIFIED METHOD, COMBINED TO BACTERIOLOGIC ASSAY

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**Summary.** - During 1990 and 1991 the Veterinary and Public Health Services of USL 35 of Ravenna carried out a research programme aimed at the control of food-borne diseases in the sector of public catering services, in collaboration with the Public Health Laboratory (Presidio Multizonale di Prevenzione). The objectives were: obtaining sure information about health hazards in public catering services; checking structural characteristics and equipment of workrooms in restaurants, hotels and refectories; verifying food preparation and preservation methods; promoting health education to increase employees' awareness of hygiene-related problems. The first objective, evaluation of the level of the control of the workrooms exerted on the food contamination hazard by pathogenic or potentially pathogenic organisms, was carried out by allotting specific scores to several characteristics of laboratories or workers' habits, as suggested by the "Hazard Analysis Critical Control Point" (HACCP) method for butcher's shops and fish markets. Five hundred ninety-eight public catering service units have been inspected in restaurants, hotels, school-refectories, factories, hospitals and social houses; 2 097 bacteriological examinations by agar-contact plates and swabs were carried out; 118 preserved-food temperatures were measured, especially in deep-frozen and cooked food; 70 food specimens were tested to search for *Salmonella* spp. and *Staphylococcus aureus* and measure Total Aerobic Mesophilic Weight. The presence of *Enterobacteriaceae* and *Escherichia coli* was also tested.

KEY WORDS: catering, hygiene, HACCP.

**Riassunto** (Il sistema di analisi dei rischi e dei punti critici di controllo (HACCP), modificato ed associato a monitoraggio microbiologico, nel settore della ristorazione). - Nel corso del 1990 e del 1991 il Servizio Veterinario ed il Servizio Igiene Pubblica della USL 35 di Ravenna hanno realizzato, congiuntamente al Presidio

Multizonale di Prevenzione, un programma di studio volto a quantificare il rischio di malattie a circuito oro-fecale nel settore della ristorazione collettiva. Gli obiettivi del lavoro sono stati: ottenere dati certi sul rischio sanitario di malattie di origine alimentare negli esercizi di ristorazione del territorio ravennate; controllare le caratteristiche strutturali e le attrezzature dei laboratori di preparazione annessi agli esercizi; verificare le modalità di preparazione dei pasti e di conservazione dei cibi; promuovere una specifica azione di educazione sanitaria rivolta agli alimentaristi nei riguardi dei problemi di igiene. Il primo obiettivo, valutare il livello di controllo esercitato sul rischio di contaminazione dei cibi da parte di germi patogeni o potenzialmente tali, è stato realizzato attraverso l'assegnazione di specifici punteggi alla presenza di alcune caratteristiche strutturali o al verificarsi di alcuni comportamenti del personale, così come suggerisce il sistema HACCP per le macellerie e le pescherie. Sono stati ispezionati 598 laboratori annessi a ristoranti, alberghi, mense scolastiche, ospedali e case di riposo; sono stati eseguiti 2 097 controlli microbiologici con piastre di contatto e tamponi ambientali; sono state controllate le temperature di conservazione di 118 campioni di alimenti, soprattutto congelati, surgelati e cibi mantenuti in legume caldo; 70 campioni di alimento sono stati analizzati per la ricerca di *Salmonella* spp. e di *Staphylococcus aureus* e per la determinazione della Carica Batterica Mesofila Aerobica, di *Enterobatteri* e di *Escherichia coli*.

PAROLE CHIAVE: ristorazione, igiene, HACCP.

### Introduction

In recent years concern has increased regarding the health hazard posed by the consumption of contaminated food. An epidemiological research, based on reports of

infectious diseases to the Public Health Services during 1980-89, showed that oro-faecally transmitted infections, such as salmonellosis, have a higher incidence in the territory of the Local Health Unit (Unità Sanitaria Locale USL 35, Ravenna) than on a regional and national basis. Conscious of the distortions which may arise from a research developed within an epidemiological surveillance system based on notifications, the Veterinary and the Public Health Services began in 1990 a research programme aimed at the control of food-borne diseases in the sector of public catering services.

Laboratory supply was provided by the Public Health Laboratory (Presidio Multizonale di Prevenzione, USL 35, RA).

The range choice for the above study was made in consideration of the large number of restaurants, hotels and refectories in the Ravenna district, many of which with seasonal operation, and of the importance which scientific literature ascribes to social and economic development in relation to increasing occurrence of salmonellosis [1].

## Methods

The first objectives were checking structural characteristics and equipment of workrooms, verifying food preparation and preservation methods, promoting an action of health education and obtaining sure information about health hazards in public catering services.

The workgroup (one of the first examples of permanent collaboration between Veterinary and Public Health Services) decided to examine all workrooms in restaurants, hotels and refectories of the USL territory during a 3-year period; the choice of sequence was made at random.

Regular inspections were made and each time a guide-card was filled in, which indicated, *inter alia*, several data regarding workrooms, their equipment, employees and their working habits, ways of preserving food and so on (Appendix 1). Moreover, it was decided to check working surfaces and equipment by swabs and agar-contact plates, to search for pathogenic bacteria and measure Total Aerobic Mesophilic Weight, Enterobacteriaceae and *Escherichia coli*. *Salmonella* spp. and *Staphylococcus aureus*, as frequent causes of food-borne diseases, were sought from among pathogenic or potentially pathogenic organisms. The programme picked out the block, the mincing-machine, the slicing-machine and other kinds of surfaces as critical control points in workrooms; in refectories a further analysis by contact-plates from the hands of an employee at work during the inspection was included. Then, a food specimen containing meat or some other substance of animal origin was taken for bacteriologic tests. Due to the importance for bacterial growth, frozen and cooked food temperatures were measured. Running efficiency of freezers was also checked.

The objective of the inspections was to check structural characteristics and equipment of workrooms and to monitor violations of current laws, whereas filling in the guide-card had the purpose of evaluating the control standard of the laboratories on the contamination hazard by pathogenic organisms, in a specific and quantitative way.

The data from the guide-card have been further elaborated: a score, varying from 0 to 3, was allotted to several characteristics of workrooms or workers' habits, so that "hazard condition" for food-borne diseases were evaluated (Appendix 2). The method of evaluation and the allotment of score follow the "Hazard Analysis Critical Control Point" (HACCP) suggested for butcher's shops and fish markets [2, 3].

A higher, therefore more positive score was allotted to:

- the presence of steel table-tops and surfaces, diversified for kind of food or treatment;
- the correct and hygienic way of preserving food (proper separation, proper packaging, appropriate working temperature of refrigerators, freezers, thermal containers and warm counters);
- the correct behaviour of employees, such as the use of disposable papertowels in the kitchen, instead of cloths or the like;
- a proper disinfection of workrooms and bathrooms;
- cleanliness of kitchens, bathrooms and pantries.

The highest score in every group of data (kitchen - bathroom - pantry - food) shows the presence of all the proper qualifications and correct behaviour in food-borne diseases control. Tested workrooms are divided into 3 groups:

- score higher than 25: working environments with "no hazard" for oro-faecal diseases;
- score from 25 to 19: working environments with "low hazard" for oro-faecal diseases;
- score lower than 19: working environments with "medium hazard".

A score above 25 indicates that conditions are at their best, the risk for food-borne diseases is considered imputable to gross blunders in food preservation or in workmen's behaviour, or to exceptional circumstances. A score between 25 and 19 indicates that structural and behavioural standards are not respected, so that the control of employees to prevent oro-faecal diseases must be necessarily high and steady.

If the score is lower than 19, workrooms are not up to standard; therefore rebuilding or re-equipping the workrooms, plus health education to increase employees' awareness of hygiene-related problems, are needed.

## Results

At the end of 2 years, 598 public catering service units had been inspected, following the above-described method; 528 were in restaurants and hotels, 70 were in schools, hospitals, factories and social houses.

Sometimes, the guide-card compilation could not be completed, or specimens for bacteriologic tests could not be drawn out, so the final results concern 588 workrooms, 519 in restaurants-hotels and 69 in refectories.

Workrooms were grouped by daily production capacity ratings: under 20 meals, 20 to 50 meals, over 50 meals.

Finally, this aggregation shows that 38 workrooms belong to the 1st class, equal to 6.4 per cent, 224 belong to the 2nd class, equal to 38.1 per cent and 326 belong to the 3rd class, equal to 55.5 per cent.

## Production capacity and score

The score-based grouping of the services was as follows:

- 210 "no-hazard" workrooms, equal to 35.7%;
- 285 "low-hazard" workrooms, equal to 48.5%;
- 93 "medium-hazard" workrooms, equal to 15.8%.

The groups of workrooms, classified by daily production capacity and score, are shown in Appendix 3.

Most restaurants, hotels and refectories with a high score belong to the group with greater capacity; this indicates that the random choice of units to be controlled resulted in more inspections of the larger production capacity units.

Few refectory kitchens received a low score (4 in all), but a large number of restaurant and hotel kitchens received it (89).

## Bacteriological assay

Two thousand ninety-seven bacteriologic examinations by agar-contact plates and swabs were carried out, the presence of *Salmonella* spp. was evidenced in 25 of them, equal to 1.2 per cent.

Among these positive tests, 17 concern blocks or work-tops, 7 concern mincing-machines and 1 examination concerns a slicing-machine.

After identification, *Salmonellae* types B and D were found to be more frequent than *Salmonellae* types C1, C2 and E.

Eighty-six per cent of the infected workrooms belonged to the "low-hazard" group. In all of the infected units, *Staphylococcus aureus* was also found. With regard to *S. aureus*, 663 samples from equipment, equal to 31.6 per cent, were infected with this bacterium: 294 samples concern blocks or table-tops, 144 concern slicing-machines, 128 were taken from mincing-machines and 97 samples concern other control points, such as employees' hands.

Generalized equipment contamination was observed in 163 kitchens through 2 or more positive samples, equal to 27.7 per cent; 28 of them were classified as "medium-hazard" workrooms, 85 as "low-hazard" and 50 as "no-hazard".

## Food and equipment

Seventy food specimens taken in refectories were tested with satisfactory results on average; only 7 specimens had a Total Aerobic Mesophilic Weight higher than  $5 \times 10^5$  colonies/g and none of them was over the Health Ministry's critical values for raw meat and meat products (\*).

The Health Ministry set the critical values of *Staphylococcus aureus* contamination at  $5 \times 10^2$  colonies/g. This limit was exceeded by 5 food samples and a high Total Aerobic Mesophilic Weight was also found. The presence of *Salmonella* type B was confirmed in one sample of raw meat.

*E. coli* was seldom found: 3 times only, with 9 colonies/g, 460 colonies/g and 1100 colonies/g contamination ratios.

Temperatures of preserved foods were taken in 118 cases (meat, fish, vegetables and delicatessen): 39 cases, equal to 33 per cent, did not follow the guidelines for the conservation of hot (60-65 °C) and of deep-frozen food (-18 °C).

A significant difference of 5 °C or more from the correct temperature was only found on 17 occasions; all cases concerned hot foods.

Whenever the inspectors found food in doubtful conditions, official samples for bacteriologic tests were taken.

When *Salmonella* spp. from agar-contact plates or swabs were evidenced, managers and employees were instructed to disinfect the workroom and the equipment; a second series of samples taken after the sanitation measures was checked, and showed no evidence of the presence of pathogenic organisms.

## Conclusions

The results of the inspections made in restaurants, hotels and refectories in the USL territory evidenced generally satisfying conditions, but a broad lack in awareness of hygienic behaviour on the part of employees was also found.

Hygiene was worst in bathrooms and in pantries: soap-dispensers and disposable papertowels were often absent, frequently wash-basins had no foot-control levers and so on; in many situations there was a trend to stack many kinds of goods and alien matters in pantries.

Sometimes kitchen employees make use of unwashable objects and equipment they can hardly disinfect, such as wooden knife-handles, wooden working surfaces, wiping cloths and rags.

At times it was deemed necessary to impart instructions regarding garbage disposal.

The habit of separating ready-for-cooking and cooked foods from raw materials and fresh groceries in refrigerators is now widespread, as is the tendency to roll up foods in films or store them in special boxes.

Very often technical information was given to workmen regarding the overloading of freezers and avoiding the introduction of warm foods, so that the temperature of freezers remains steady and correct.

With regard to the bacteriological tests by contact plates or swabs and the scores, the analytical data confirm that proper equipment, good structures and correct behaviour do not always keep workrooms free from pathogenic or potentially pathogenic organisms.

As a matter of fact, high contaminations by *S. aureus* were often found in kitchens which seemed to be clean.

A generalization of this fact would be incorrect of course, but it can be perhaps explained by remembering the survival capacities of bacteria in the environment, and the role of asymptomatic pathogens-spreading carriers.

(\*) Health Ministry's Note, prot. 27512/A1, 24 October 1985.

Workers do not seem to know the substantial difference between "usual cleaning and washing" and "recurrent disinfection" of equipment and workrooms; moreover, way of use and properties of chemicals are often unknown.

Many workers explained that usual cleaning consists in simple washing; many others claimed they often disinfect equipment with sodium hypochloride. Once more, even if they are accustomed to use very effective disinfectants, they are not well-informed about correct behaviour: washing - cleaning - rinsing - disinfecting - rinsing.

Daily contaminations from *S. aureus*-carriers must also be considered; it appears very important to advise employees to refrain from working if ill from skin infections or respiratory diseases, and to use disposable papertowels in the kitchen.

A close connection between *S. aureus* and high Aerobic Mesophilic Weight in food and the presence of the same kind of contamination on workmen's hands was found.

In school-refectories the employees were found to be much more qualified than people of the same profession in private hotels or restaurants; the first group of workrooms had often better and cleaner equipment than the second. With regard to this last point, the hygienic and sanitary training of school-refectory workers a few years before the beginning of the programme is believed to have been fundamental.

As to food temperature, the point of view of the Public Health Services involved in the programme is that one of the most important critical control points is cooked-food preservation at 60-65 °C, and its transport from cooking workrooms to service place; therefore the surveillance staff has to be alerted in checking this kind of food, especially with regard to means of transport, food containers and temperatures.

The adoption of the modified "HACCP" method has requested a great deal of human resources involved in surveillance, but after a period of settlement, it increases the effectiveness of any inspection programme.

An initial wide research is an indispensable condition for planning the control action of Veterinary and Public Health Services and to decide the exact, sufficient and useful number of inspections in restaurants, hotels and refectories.

According to this conclusion, the workgroup believes that one inspection every 2 years and one inspection every year are needed in "no-hazard" and in "low-hazard" workrooms, respectively.

More frequent inspections are supposed to be necessary in "medium-hazard" workrooms; in fact the control standard in food-borne diseases must be increased and specific instructions for health education must be given to workmen.

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#### Appendix 1. - "Guide-card"

USL 35 - Ravenna  
Veterinary Service - Public Health Service

Workroom in \_\_\_\_\_  
Owner \_\_\_\_\_  
Daily production capacity: number \_\_\_\_\_ meals

#### Kitchen

washable walls and floor		yes	no
work surfaces	steel _____ wood _____ others _____		
hygienic condition of equipment:	mincing-machine _____		
	slicing-machine _____		
	work-tops _____		
diversified slicing-machine		yes	no
wooden knife-handles		yes	no
hygienic condition of oven, grill, etc.	_____		
general hygienic condition of the kitchen	_____		
correct way of waste collection		yes	no
anti-fly nets		yes	no
wiping cloths, rags		yes	no
notes	_____		

## Appendix 1. - (continued)

**Food preservation and pantry**

fresh food: good preservation ☐ bad preservation ☐ yes ☐ no ☐  
 proper separation of meat, vegetables, eggs, gastronomy, etc. yes ☐ no ☐  
 proper walls, doors, floor and shelves of cold-store yes ☐ no ☐  
 refrigerated and deep-frozen food: good preservation ☐ bad preservation ☐  
 alien materials yes ☐ no ☐  
 general hygienic condition of the pantry \_\_\_\_\_  
 notes \_\_\_\_\_

**Bathroom**

for workers only yes ☐ no ☐  
 disposable papertowels yes ☐ no ☐  
 soap dispenser yes ☐ no ☐  
 foot control-lever in wash-basin yes ☐ no ☐  
 dressing-room or locker yes ☐ no ☐  
 general hygienic condition of the bathroom \_\_\_\_\_  
 notes \_\_\_\_\_

**Workers' hygiene**

number of workers \_\_\_\_\_  
 regular health-card yes ☐ no ☐  
 proper clothes and hat yes ☐ no ☐  
 correct hygienic behaviour yes ☐ no ☐  
 recurrent disinfection of equipment and structures yes ☐ no ☐  
 chemicals used \_\_\_\_\_  
 notes \_\_\_\_\_

**Food temperature**

food \_\_\_\_\_  
 way of preservation: fresh \_\_\_\_\_  
                                   refrigerated \_\_\_\_\_  
                                   deep-frozen \_\_\_\_\_  
                                   hot \_\_\_\_\_  
 temperature: ☐ °C  
 if present, proper warm counters yes ☐ no ☐  
 average pause between meal preparation  
 and meal consumption \_\_\_\_\_  
 food transport by proper thermal containers yes ☐ no ☐  
 notes \_\_\_\_\_

Inspectors

Date, \_\_\_\_\_



## Appendix 2. - Checklist

<b>Kitchen</b> (highest score = 8)		
work-tops	steel - marble = 2	wood - others = 0
different (specific) work-tops and equipment	yes = 2	no = 0
hygienic condition of equipment	good = 2	bad = 0
hygienic condition of the kitchen	good = 2	bad = 0
<b>Food preservation</b> (highest score = 10)		
preserving condition of fresh food	good = 2	bad = 0
proper separation of different kinds of food	yes = 2	bad = 0
preserving condition of refrigerated and deep-frozen food	good = 2	bad = 0
alien materials in the pantry	yes = 0	no = 2
hygienic condition of the pantry	good = 2	bad = 0
<b>Bathroom</b> (highest score = 8)		
for workers only	yes = 3	no = 0
disposable papertowels, soap dispenser and foot control-lever in wash-basin	yes = 3	no = 0
hygienic condition of the bathroom	good = 2	bad = 0
<b>Workers' hygiene</b> (highest score = 6)		
regular health-card, proper clothes and correct behaviour	yes = 3	no = 0
recurrent disinfection of equipment and structures	yes = 3	no = 0

## Appendix 3. - Groups of workrooms, divided by daily production capacity and score, concerning 519 restaurants (A) and 69 refectories (B)

Daily production: Capacity (meals/day)		Hazard standard		
		Medium hazard	Low hazard	No hazard
A	< 20	24	4	7
	20/50	33	110	51
	> 50	32	152	106
B	< 20	2	1	0
	0/50	1	10	19
	> 50	1	8	27

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