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Application of HACCP System during Preparing Escalope Panee` Sandwich in Fast Food Restaurants

Nadia A. Abd-El Aziz[1]; Moharram[2], Y. G.; Kotit [2], S. M. and Attia, R. S. [2]

ABSTRACT

Implementation of Hazard Analysis Critical Control Point (HACCP) system during preparing the Escalope panee` sandwich in some fast food restaurant branches at Alexandria city, Egypt was carried out using physicochemical and microbiological tests to identify and eliminate the Critical Control Points (CCP_s), which could lead to hazards. The obtained results showed that there were significant differences among the determined parameters, temperatures, pH, and microbiological quality due to restaurant branches, quality of meat slices, sandwich preparing steps and the interaction between such factors. The critical control points of this product were mainly due to the cross contamination from the different ingredients to the end product, workers to product, microbiological growth through abuse of storage holding time and temperature. Because meat slices are the only ingredient that subjects to heat treatment to make it safe, an effective supply assurance program for other sandwich ingredients is also necessary to ensure that their potential hazardous are properly eliminated.

Key words: Critical Control Points, Quality assurance, Escalope Panee` Sandwich, Fast food restaurants.

INTRODUCTION

The rise of the food related diseases cases over the world (WHO, 2000) led to increase from the consumer awareness to perceive unsatisfactory food and also to search about a new systematic approach to apply during food production to ensure food safety (Phillips *et al*., 1994).Hazard Analysis Critical Control Point (HACCP) concept was developed to meet the safety requirement and to protect the public from food borne illness (Poumeyrol *et al*., 2010).

Egyptian Organization for Standardization and Quality Control (2002) published the Egyptian standard No 3778/2002 for HACCP system and the guide lines for its application in Egyptian food production units.

Bolat (2002) suggested the application of HACCP system to manage the production of fast food business. The following information should be available to evaluate and identify the potential hazards in HACCP plan; components of food, outline of food production, microbial load of food ingredients, building design and production of an equipments, sanitation conditions and practices, employees health, hygiene and training, stability of the product till consumption, service conditions, food uses and potential consumers (NACMCF, 1997).

Alexandria city considers the second capital of Egypt. More than 10% of the Egyptian population live in this city. It has more than 30 famous fast food restaurants. Many of such shops had several branches at different locations in the city and offered their home delivery service. In year 2004, food containing meat, poultry and fish implicated in 36.64% of the recorded food poisoning cases in Alexandria poison center, Medical College, Alexandria University. Therefore the major goal of this study was to implement HACCP system during preparing escalope meat panee` sandwich in three branches of one of the big fast food restaurant at Alexandria city, Egypt, to identify the potential hazardous and mention the corrective actions to make the product safe for consumption.

MATERIALS AND METHODS

Materials:

Samples of the cold slices of the frozen Brazilian imported back rip boneless beef, meat dressing mixture forming from minced onions, spices blend (black pepper and cumin), salt and lime juice, meat coating layers

[1]Meat and Fish Technol. Res. Dept., Food Technology Res. Inst. A.R.C., El-Sabahia, Alexandria, Egypt.
[2]Food Science and Technology Department, Faculty of Agriculture, Alexandria University, Egypt.
Corresponding Author, E.mail: dr.ramadan_attia@yahoo.com
Fax: (+203) 5922780
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forming of wheat flour, mixture of milk and liquid egg and ground bread crumb, mayonnaise, tomato slices, sweet pickled cucumber slices, processed cheddar cheese slices, fried meat slices, and bread loaf (72% extraction wheat flour) were collected at the same times from three branches of one of Alexandria food restaurants in sterilized bags. The samples were stored in ice boxes during transporting to the laboratory for analysis. Also swabs from surfaces of tables, equipments, utensils and hands of workers were taken to estimate the efficiency of sanitation program applying in such units.

Technological methods:

Escalope panee` sandwich was prepared by the same method in the three branches of the fast food restaurant. Meat slices are dressed with mixture of minced onions, spices blend (black pepper + cumin), salt and lime juice, kept for 1 - 3hrs at 4°C in a refrigerator, formed into slices with similar size, shape and weight (26 - 28g), coated with thin layer of 72% extraction wheat flour, immersed in a mixture of 3 : 20 w/v whole liquid eggs to sterilized liquid milk, recoated with a thin layer of fine ground bread crumbs, stored at 4°C in a refrigerator at least for 45 min. and not more than 3 hrs before frying in shortening at 170°C for 1 - 1.5min in a deep-fat fryer with a capacity of 23 liter oil (Model Bartlett D11E30, Italy). The obtained fried meat slices are kept hot on tray inside an electrical open heater before sending to sandwich preparation place. The loaf is opened then the following ingredients, mayonnaise, slices of tomato, pickled cucumber, processed cheese, and fried meat, are added respectively. The resulted sandwich is wrapped first in white butter paper then packed in paper bags before giving to the consumer. The selection and working of the employees, establishing of restaurant and its sanitation, cleaning and examination of the sanitation quality of the equipments, utensils, apparatus and packaging materials, specification of handling, transporting and storing of raw materials, ingredients, and the end products were carried out according to the rules of the Egyptian law number 10 of 1966.

Microbiological methods:

Ten grams from each sample were blended with 90 ml of sterilized peptone water for 5 min. in sterilized glass jar of a blender. Appropriate dilution was prepared for enumeration using standard microbiological pour plate technique and the recommended culture media of Oxoid (2002). Plate count agar medium was used for enumerating the standard plate count (SPC) and psychrotrophic count (PPC) bacteria after incubating at 35 - 37°C for 48 hrs and 7°C for 10 days, respectively. Violet red bile agar with methyl umbeliferyl glucuronide (VRB MUG) selective media was used for the isolation of Coliform, gram negative enteric bacteria and rapid detection of *E. coli*. The proper dilution of the food homogenate was inoculated into sterile Petri dishes then medium was poured and plates were incubated at 37°C for 18 - 24 hrs. Colonies of lactose negative *Enterobacteriaceae* are colourless and those of lactose positive are red and often surround by a forbid zone due to precipitation of bile acids. Light blue fluorescent colonies under UV lamp (336 nm.) (Merck, Germany) denote as *E. coli.* The recommended Difico Barid Parker agar medium by ICMSF (l978) was used to detect *Staphylococcus aureus* after incubating the plates at 35 – 37°C for 48hrs. The black shiny colonies with narrow white margin and surrounded by clear zones were counted as a *Staphylcoccus aureus.*

Physicochemical methods:

The temperature of the meat before and after frying was measured using Comark Thremocouple Type Testo 230 – Testo Lenzkirch Germany. Meat and other samples were homogenized with distilled water at ratio of 1: 10 w/v in a blender before determining their pH values using pH meter type Testo, 230, Lenzkirch – Germany, at room temperature (22 ± 3°C) as described in AOAC (1995).

Statistical methods:

A simple complete randomized design as described by Little and Hill (1978) was used to study the effect of the received meat slices from three different meat block batches in three restaurant branches, their preparation into an escalope panee` sandwich and the interaction between these three factors on the quality of the sandwich.

RESULTS AND DISCUSSION

The results in this study were classified into three parts:

A. Preparation of fried meat slices:-

1- Delivery of meat slices:

The following points can be noticed from the results in Table (1):- (a) temperature of the delivered meat slices varied between 2.64 to 4.75°C among the three restaurant batches. The improper cooling, late of storage and extending of the delivery time of meat slices may be behind the variations in the temperature. According to the rules of the food restaurant, the temperature of the delivered meat slices should not be more than 5°C. Results of Jeneja *et al.,* (1997) indicated that at 7°C, no growth was noticed for *Bacillus cereus* spores, *Staphylococcus aureus*, *Salmonella* and *Clostridium* spores in cooked ground beef .(b) pH value of the delivered meat slices resulting from three different meat

block batches in the three restaurant branches varied from 5.91 to 5.96 . According to Devine and Chrystall (1992), the pH of fresh meat ranged from 5.9 to 6.2. (c) SPC load fluctuated among the delivered meat slices in the three studied restaurant branches. This load differed from $1.9\times I0^4$ to $1.6\times l0^5$ CFU/g. Pierson and Stern (1986) stated that meat having less than 10^5 CFU/g SPC had an acceptable quality. (d) psychrotrophic bacteria load was lower in slices resulting from meat block batch I than those of the other two batches. Also the count of these bacteria was relatively higher in the examined slices of the restaurant C than the other two restaurant branches. (e) load of *Enterobacteriaceae* was higher in the prepared slices from meat block batch III than those of the other two batches. It was also relatively higher in meat slices of restaurant branch C than the other two restaurant branches. Generally, this load varied from 4.9×10^3 to 5.2×10^4 CFU/g among the examined meat slices in the three restaurant branches. According to Capita *et al.,* (2004) the enumeration of both total aerobic and *Enterobacteriaceae* counts gives information about the hygienic performance of meat handling, storing and processing. (f) *E. coli* count ranged from $3.1\times l0^2$ to $4.6\times I0^2$ CFU/g in the meat slices of the three different meat batches in the three different restaurant branches. Generally, the presence of this type of bacteria indicates the poor hygienic practices followed during transporting, handling and storing of the meat slices. (g) *Staphylococcus aureus* was detected in low load in some received meat slices. The count of the latter bacteria was higher in slices resulting from meat block batch I than the other two meat batches. In addition, these bacteria were detected in low number in meat slices obtained from the three restaurant branches.

Results of the microbial examination of the swabs of the surface of the containers used to transport and store meat slices indicated: (i) presence of SPC (3.1×10^2 – 3.8×10^3 CFU/cm^2) and *Enterobacteriaceae* (3×10^2 – 3.7×10^3 CFU/cm^2) in the containers used for transporting and storing meat slices. This means that the cleaning practices of such containers should be revised

Table 1. Temperature, pH and microbiological quality of delivered meat slices

Parameter	Meat batch	Restaurant branch		
		A	B	C
Temperature °C	I	2.66	2.62	2.64
	II	4.53	4.70	4.63
	III	3.93	3.75	4.71
pH	I	5.91	5.92	5.93
	II	5.92	5.94	5.93
	III	5.96	5.96	5.95
Microbiological count CFU/g (SPC)	I	4.1×10^4	3.1×10^4	1.9×10^4
	II	5.2×10^4	9.8×10^4	1.6×10^5
	III	3.0×10^4	5.4×10^4	7.7×10^4
Psychrotophic	I	N. D	3.0×10^2	5.9×10^2
	II	3.5×10^3	4.9×10^3	9.8×10^3
	III	4.1×10^3	4.2×10^3	5.1×10^3
Enterobacteriaceae	I	7.7×10^3	7.6×10^3	7.7×10^3
	II	4.9×10^3	5.4×10^3	5.4×10^3
	III	4.0×10^4	3.5×10^4	5.2×10^4
E. coli	I	4.0×10^2	4.4×10^2	3.6×10^2
	II	4.3×10^2	4.6×10^2	3.7×10^2
	III	4.6×10^2	4.5×10^2	3.1×10^2
Staphylococcus aureus	I	85	88	90
	II	N.D	54	56
	III	N.D	N.D	N.D

N.D = Not detected.

LSD values at 0.05 levels for different parameters:-

Variance	Temp.	pH	SPC	*Enterobacteriaceae*	*E. coli*	*Staphylococcus aureus*
1- Batch	0.4125	0.0076	0.1343	0.1182	0.4289	0.01643
2- Branch	0.4125	0.0076	0.1343	0.1182	0.4289	0.01643
3Interaction(Batch×Branc)	0.7146	0.0132	0.2327	0.2048	0.07429	0.0284

and controlled. (ii) detection of low count of 30 colonies of *Staphylococcus aureus* in the containers used for transporting meat slices of meat batch I and II to the restaurant branch C. According to Bolat (2000), one of CCP_s of food service operations is utilizing equipments and/or utensils without intervening cleaning in keeping and preparing uncooked or reheated foods.

2- Dressing of meat slices:

The following can be concluded from the data in Table (2):- (i) temperature of meat slices increased from nearly 4°C to about 9.3 to 11.7°C after dressing at room temperature, 22 + 3°C. As seen from Table(3), temperature of the dressing mixture varied from 10.7 to 15.0°C within and among the different restaurant branches instead of 5°C as mentioned in working manual of these units. (ii) dropping in pH of meat slices after dressing from approximately 5.95 to about 5.68-5.78 due to the low pH of lime juice in this dressing mixture. Results in Table (3) showed that pH of the dressing mixture ranged from 4.32 to 4.72 within and among the different restaurant branches, and(iii) an increase in the load of SPC, absence of Psychrotrophic, and *Staphylococcus aureus*, slight changes in count of both *Enterobacteriaceae* and *E. coli* were observed in meat slices after dressing operation. Results in Table (3) showed that the load of SPC, *Enterobacteriaceae* and *E. coli* of the dressing mixture ranged from 3.1 to 7.6×10^4, 3.7 to 8.0×10^3 and N.D to 3.5×10^2 CFU/g, respectively. Spices and onion may be the sources of these microorganisms in the dressing mixture. Tainter (1992) attributed the high content of microorganisms in spices to the poor sanitary conditions followed during their production. On the other side, spices have antimicrobial activity and may influence the keeping quality of foods, which they have been, added (Liewen 1992). Kamm (1992) isolated and identified a number of antimicrobial compounds from raw onions, such as sulphur compounds. Such compounds are broadly effective against yeasts, moulds and bacterial growth. The data of swabbing analysis of the dressing containers and hands of workers revealed the absence of *E. coil*, Coliform and *Staphylococcus aureus* and the presence of SPC (3 - 4×10^2 CFU/Cm^2) and *Enterobacteriaceae* (3.1– 6.1×10^2 CFU/cm^2).

According to the above results, dressing of meat slices was considered as one from the CCP_s point. Temperature, pH and immersion duration can be suggested as rapid procedures to control the application of this step instead of time-consuming microbiological tests.

Table 2. Temperature, pH and microbiological quality of meat slices after dressing

Parameter	Meat batch	Restaurant branch		
		A	B	C
Temperature °C	I	9.70	10.40	9.40
	II	9.30	11.50	7.80
	III	9.50	11.70	9.60
pH	I	5.68	5.72	5.69
	II	5.76	5.74	5.78
	III	5.77	5.77	5.75
Microbiological count CFU/g (SPC)	I	4.4×10^5	5.1×10^5	2.8×10^5
	II	2.2×10^5	4.4×10^5	7.8×10^5
	III	7.3×10^5	2.8×10^5	5.2×10^5
Enterobacteriaceae	I	9.8×10^3	9.7×10^3	8.3×10^3
	II	8.4×10^3	9.4×10^3	9.3×10^3
	III	2.0×10^4	5.5×10^4	2.3×10^4
E. coli	I	3.9×10^2	4.1×10^2	3.0×10^2
	II	3.7×10^2	3.4×10^2	3.2×10^2
	III	3.6×10^2	3.9×10^2	3.2×10^2

LSD values at 0.05 levels for different parameters:-

Variance	Temp.	pH	SPC	*Enterobacteriaceae*	*E. coli*
1- Batch	0.4125	0.0076	0.1343	0.1182	0.4289
2- Branch	0.4125	0.0076	0.1343	0.1182	0.4289
3- Interaction (Batch×Branch)	0.7146	0.0132	0.2327	0.2048	0.07429

Table 3. Temperature, pH and microbiological quality of meat dressing mixture

Parameter	Meat batch	Restaurant branch		
		A	B	C
Temperature °C	I	13.5	15.0	14.9
	II	14.9	12.5	15.0
	III	10.7	13.1	13.0
pH	I	4.72	4.53	4.56
	II	5.76	4.66	4.32
	III	4.32	4.51	4.55
Microbiological count CFU/g (SPC)	I	4.7×10^4	3.1×10^4	5.6×10^4
	II	5.4×10^4	4.0×10^4	7.6×10^4
	III	4.3×10^4	3.9×10^4	3.3×10^4
Enterobacteriaceae	I	6.4×10^3	6.4×10^3	4.0×10^3
	II	4.7×10^3	8.0×10^3	4.6×10^3
	III	4.0×10^3	7.3×10^3	3.7×10^3
E. coli	I	3.1×10^2	3.4×10^2	3.5×10^2
	II	N.D	3.0×10^2	N.D
	III	3.3×10^2	3.1×10^2	3.1×10^2

N.D = Not detected.

3- Breading of meat slices:

Data in Table (4) showed that:- (a) temperature of meat slices ranged from 9.2 to 12.4°C. Table(5) illustrated that the temperature of the dressing mixture varied from 2.6 to 10.1°C among and within the restaurant branches. (b) immersion in milk and eggs mixture led to raise the pH of meat slices to 6.0 - 6.27. This rise was due to the rise of pH of the dressing mixture (6.71 - 6.86) as seen in Table (5). (c) reduction in count of both SPC and *Enterobacteriaceae* and absence of Psychrotrophic, *E. coli*, Coliform and *Staphylococcus aureus* of meat slices were noticed after dressing in milk-egg mixture. In addition, milk-egg mixture was free from *E. coli*, Coilform, *Staphylococcus aureus* and had low load of SPC and *Enterobacteriaceae*, Table (5). The antimicrobial components in egg white such as lysozyme, avidin, ovomucoid and canalbumin may prevent the growth of such bacteria (Mclandsborough 2005). Also low temperature of this dressing mixture may increase the influence of such antimicrobial components against microorganisms. The results of swabs analysis of containers and hands of workers indicated the presence of low count (3×10^2 CFU/cm^2) of SPC bacteria only in some containers of the restaurant branch(B) and detection of low count of SPC, *Enterobacteriaceae* and Coliform only in hands of workers of some restaurant branches. The containers of the three restaurant branches were free from the other determined microorganisms.

Results in Table (6) showed an increase in temperature, pH, load of SPC, *Enterobacteriaceae*, *E. coli* and absence of Psychrophilic, and *Staphylococcus aureus* in meat slices after breading. The rate of the changes in these parameters differed among and within the restaurant branches. It was found that the utensils in which breading step was done and hands of workers contaminated with SPC (3×10^2 – 7.1×10^3 CFU/cm^2) and *Enterobacteriaceae* (3 – 5.6×10^2 CFU/cm^2). The load of these microorganisms varied among restaurant branches. Poumeyrol *et al.*, (2010), showed that the CCP_s of food service operation may result from; (i) using unapproved water and ice sources, (ii) workers who do not wash their hands after handling raw material (meat, poultry, egg shells or fish) and (iii) utilizing equipments and/or utensils without intervening cleaning in preparing uncooked or reheated foods.

4- Frying of meat slices:

As seen from Table(7), the temperature of meat slices increased to 89.30 - 92.0°C after frying process. This process also caused a slight change in pH of meat slices (6.12-6.29), acomplete absence of *Enterobacteriaceae*, *E. coli*, Coliform, *Staphylococcus aureus* and a great reduction in SPC. Santos *et al.*, (2003) stated that unsterilized spices, which added to meat during cooking, might contain as many as 10^6 CFU/g. microorganisms most of this count presents in spore form. During meat cooking only vegetative cells will die. Gibbons *et al.*, (2005) announced the important usage of an adequate heat treatment to reduce the risk of the contamination of meat especially with pathogen microorganisms. Data of swabbing analysis of the hands of workers and the used containers for keeping fried meat slices indicated the absence of *Enterobacteriaceae*, *E. coli*, Coliform and *Staphylococcus aureus.* Only SPC bacteria was detected in containers of the B and C restaurant branches(3 – 5.3×10^2 CFU/cm^2) and in the

hands of workers (3×10^2 CFU/cm^2) working in food restaurant branch C.Capita *et al.,* (2004) showed that the evaluation of the hygienic performance of meat production is based on the enumeration of total aerobic count and *Enterobacteriaceae* at the end of the process. According to Tompkin(1990) the time and temperature of roasting process considered one of the CCPs during production of roasted beef. After frying process, the fried meat slices were held on the tray inside an electrical open heater at 69°C before adding to the sandwich.

The determination of the changes in temperature, pH and microbiological quality of these slices during holding for 2.5 hrs were estimated in one of the food restaurant branches and the obtained results revealed that the temperature of the fried meat slices was gradually dropped from approximately 90 to 51°C after 2.5 hrs of holding in an electrical open heater. Also through this holding period, the pH(6.09) and SPC count(3.3×10^2 CFU/g) of fried meat slices were nearly stable. In addition, a complete absence of the other determined bacteria was noticed.

Table 4. Temperature, pH and microbiological quality of meat slices after coating with flour and dressing with milk-egg mixture

Parameter	Meat batch	Restaurant branch		
		A	B	C
Temperature °C	I	10.20	9.70	11.60
	II	9.20	10.00	10.90
	III	11.40	10.50	12.40
pH	I	6.20	6.27	6.26
	II	6.00	6.14	6.12
	III	6.10	6.18	6.11
Microbiological count CFU/g (SPC)	I	5.2×10^4	6.3×10^4	5.5×10^4
	II	3.1×10^4	4.4×10^4	3.9×10^4
	III	4.1×10^4	3.8×10^4	4.8×10^4
Enterobacteriaceae	I	3.9×10^3	3.6×10^3	3.2×10^3
	II	3.0×10^3	3.4×10^3	5.5×10^3
	III	3.5×10^3	3.3×10^3	5.3×10^4

LSD values at 0.05 levels for different parameters:-

Variance	Temp.	pH	SPC	*Enterobacteriaceae*
1- Batch	0.4125	0.0076	0.1343	0.1182
2- Branch	0.4125	0.0076	0.1343	0.1182
3- Interaction (Batch×Branch)	0.7146	0.0132	0.2327	0.2048

Table 5. Temperature, pH and microbiological quality of milk-egg dressing mixture

Parameter	Meat batch	Restaurant branch		
		A	B	C
Temperature °C	I	6.7	3.0	8.7
	II	2.6	4.3	7.1
	III	5.3	6.6	10.1
pH	I	6.86	6.77	6.81
	II	6.71	6.77	6.83
	III	6.81	6.74	6.73
Microbiological count CFU/g (SPC)	I	3.0×10^2	3.0×10^2	3.2×10^2
	II	3.0×10^2	3.0×10^2	3.0×10^2
	III	3.0×10^2	3.0×10^2	3.3×10^2
Enterobacteriaceae	I	3.1×10^2	3.4×10^2	3.0×10^2
	II	3.0×10^2	3.0×10^2	3.0×10^2
	III	N.D	N.D	3.0×10^2

N.D = Not detected.

Table 6. Temperature, pH and microbiological quality of meat slices after breading

Parameter	Meat batch	Restaurant branch		
		A	B	C
Temperature °C	I	16.0	19.4	15.0
	II	15.0	14.2	15.0
	III	12.7	15.3	13.0
pH	I	6.28	6.26	6.29
	II	6.04	6.16	6.18
	III	6.20	6.20	6.18
Microbiological count CFU/g (SPC)	I	8.4×10^4	8.8×10^5	5.8×10^5
	II	3.8×10^4	1.5×10^5	3.6×10^5
	III	6.1×10^4	7.4×10^4	6.4×10^4
Enterobacteriaceae	I	6.6×10^3	8.5×10^4	1.5×10^4
	II	5.8×10^3	1.9×10^4	4.4×10^3
	III	5.7×10^3	3.1×10^3	3.0×10^3
E. coli	I	3.1×10^2	N.D	3.3×10^2
	II	4.0×10^2	3.0×10^2	3.5×10^2
	III	4.7×10^2	3.0×10^2	3.1×10^2

N.D = Not detected.

LSD values at 0.05 levels for different parameters:-

Variance	Temp.	pH	SPC	*Enterobacteriaceae*	*E. coli*
1- Batch	0.4125	0.0076	0.1343	0.1182	0.4289
2- Branch	0.4125	0.0076	0.1343	0.1182	0.4289
3- Interaction (Batch×Branch)	0.7146	0.0132	0.2327	0.2048	0.07429

Table 7. Temperature, pH and microbiological quality of fried meat slices

Parameter	Meat batch	Restaurant branch		
		A	B	C
Temperature °C	I	90.00	89.70	91.30
	II	92.00	91.80	90.10
	III	89.30	89.50	89.10
pH	I	6.61	6.17	6.13
	II	6.15	6.29	6.23
	III	6.12	6.23	6.19
Microbiological Count CFU/g (SPC)	I	3.1×10^2	3.4×10^2	4.8×10^2
	II	3.0×10^2	3.1×10^2	4.2×10^2
	III	3.0×10^2	3.0×10^2	3.0×10^2

LSD values at 0.05 levels for different parameters:-

Variance	Temp.	pH	SPC
1- Batch	0.4125	0.0076	0.1343
2- Branch	0.4125	0.0076	0.1343
3- Interaction (Batch×Branch)	0.7146	0.0132	0.2327

According to Bolat (2002), holding temperature of cooked meat is one of CCP_s during preparing hamburger product in fast food restaurants.

B- Preparation of sandwich ingredients other than fried meat slices:-

These ingredients were prepared and kept at 4°C in a refrigerator until taken for further steps. The examination of these ingredients, just before adding to the sandwich, utensils and hands of workers responsible of such operations were conducted. The results were as follows:-

1- **Tomato slices**:

Results in Table (8) showed that temperature of tomato slices ranged from 3.26 to 7.36°C among and within the three studied restaurant branches. According to the processing manual of restaurant, temperature of tomato slices should not exceed 10°C. The pH of tomato sliced ranged from 4.40 to 4.53, Table (8). This

pH helps in reducing the growth of microorganisms. Only SPC and *Enterobacteriaceae* were detected in tomato slices, Table (8). According to Rushing *et al.*, (1996) three main CCP_s were detected during tomato handling (**a**) cleaning of the wooden bins used for transporting tomato from field to packing house, (**b**) water used in the packing house dump tank and (**c**) hand sorting process of individual tomato on the packing line. Generally, in each of the three restaurants, tomato fruits were subjected for storing at law temperature, washing, sorting, coring and trimming, cutting into slices and keeping the cut slices at refrigerated temperature. Results of swabbing analysis showed low count of SPC (3 - 5×10^2 CFU/cm^2), *Enteracteriaceae* (3×10^2 - 3×10^3 CFU/cm^2) and Coliform (3×10^2 CFU/cm^2) in cutting board and knives used in preparing tomato slices in the restaurant branches. The hands of workers were free from the other studied microorganisms. Fujisawa and Mori (1992) isolated (10^2 - 10^4 CFU/g.) Coliform bacteria from whole and cut raw tomatoes.

2- Pickled cucumber slices:

The temperature and pH of pickled cucumber slices varied from 3.8 to 6.7°C and from 4.0 to 4.09, respectively among and within the restaurant branches, Table (8). Microbial analysis showed the absence of *E. coli*, Coliform and *Staphylococcus aureus*, presence of low count of SPC and *Enterobacteriaceae* in the pickled cucumber slices, Table (8). Low counts of SPC (3.4×10^2 CFU/cm^2) and *Enterobacteriaceae* (3×10^2 - 3×10^3 CFU/cm^2) were only detected in pickled cucumber containers and hands of workers in restaurant branches, A and B.

3- Processed cheese:

The temperature and pH of processed cheese slices ranged from 4.3 to 9.03°C and from 5.5 to 5.8, respectively among the restaurant branches and within the processed cheese batches, Table (8). The cheese slices contained only low load of SPC (3 - 6.2×10^2 CFU/g.) and free from other's determined bacteria. This may be due to the combined effect of acid and salt in addition to low moisture content of processed cheese. It was found that cheese containers and hands of workers in restaurant branches, B and C contaminated with low level of SPC (3×10^2 CFU/cm^2) and *Enterobacteriaceae* (3 - 3.7×10^2 CFU/cm^2).

Table 8. Temperature, pH and microbiological quality of sandwich ingredients other than fried meat slices

Parameter	Ingredient batch	Restaurant branch A: Tomato slices	A: Pickled cucumber slices	A: Processed cheese slices	A: mayonnaise	B: Tomato slices	B: Pickled cucumber slices	B: Processed cheese slices	B: mayonnaise	C: Tomato slices	C: Pickled cucumber slices	C: Processed cheese slices	C: mayonnaise
Temperature °C	I	6.10	6.10	9.03	8.03	3.26	5.30	4.80	4.00	5.83	3.80	7.66	6.70
	II	5.70	4.16	6.73	7.36	3.83	5.03	6.23	6.26	3.60	6.70	5.53	7.53
	III	5.23	3.90	6.10	7.73	4.66	6.03	4.30	7.03	7.36	4.23	5.16	6.13
pH	I	4.49	4.04	5.60	4.22	4.53	4.06	5.50	4.26	4.42	4.06	5.80	4.20
	II	4.48	4.01	5.80	4.24	4.49	4.09	5.60	4.23	4.45	4.04	5.50	4.28
	III	4.51	4.07	5.80	4.27	4.40	4.08	5.7	4.28	4.46	4.05	5.07	4.21
SPC	I	4.2×10^4	6.1×10^2	3.1×10^2	N.D	4.1×10^3	7.8×10^2	5.3×10^2	3.5×10^2	6.5×10^4	4.2×10^2	6.2×10^2	3.0×10^2
	II	4.7×10^4	5.2×10^2	3.0×10^2	3.0×10^2	5.6×10^3	3.2×10^2	4.8×10^2	3.0×10^2	1.8×10^4	5.7×10^2	3.0×10^2	3.0×10^2
	III	6.8×10^3	3.6×10^2	3.0×10^3	3.0×10^2	4.8×10^3	3.2×10^2	3.6×10^2	3.0×10^2	2.1×10^4	4.1×10^2	3.0×10^2	3.0×10^2
Enterobacteriaceae	I	6.5×10^2	N.D	N.D	N.D	4.2×10^2	7.7×10^2	N.D	N.D	2.1×10^4	3.0×10^2	N.D	N.D
	II	3.9×10^2	5.2×10^2	N.D	N.D	3.2×10^2	3.0×10^2	N.D	N.D	3.8×10^2	3.0×10^2	N.D	N.D
	III	4.4×10^3	3.0×10^2	N.D	N.D	4.9×10^2	3.0×10^2	N.D	N.D	3.5×10^3	3.0×10^2	N.D	N.D

N.D = Not detected.

4- Mayonnaise:

Temperature and pH of mayonnaise ranged from 4 to 8.03°C and from 4.2 to 4.28, respectively among and within the restaurant branches, Table (8). In addition, all examined bacteria did not detect except very low count of SPC, Table(8). Lock and Board (1995) attributed the non-growth of pathogens in mayonnaise to its low pH, water activity, storage temperature and the presence of lysozymes in whole egg. Swabbing analysis of the mayonnaise containers and hands of workers showed the presence of low load of only SPC (3×10^2 CFU/cm^2) and *Enterobacteriaceae* (3×10^2 CFU/cm^2) in some of the restaurant branches.

C- End sandwich preparation:

The sandwich containing all ingredients except fried meat slices is usually prepared and left for a period extending to 0.5 hr at room temperature (22±2 °C) to cover the requisite orders of the product at rush hrs. Samples of this free meat sandwich in one of the restaurant branches were withdrawn after and before 0.5 hr and subjected for temperature, pH and microbiological analysis. The results in Table (9) indicated slight changes in temperature, pH, and counts of SPC, *Enterobacteriaceae* and Coliform bacteria after leaving the free meat sandwich for 0.5 hr at room temperature.

Also the examination of the collected samples of end Escalope panee` sandwich from the three restaurant branches at different times revealed that: - (I) the pH of the sandwich ranged from 5.49 to 5.94, Table (10). The presence of mayonnaise, pickled cucumber and tomato slices were responsible of this pH and (ii) presence of low count of SPC, *Enterobacteriaceae,* and absence of *E. coli*, Coliform and *Staphylococcus aureus*, Table (10). According to Hinton *et al.,* (1998), the good quality food has an aerobic plate counts under 10^5 CFU/g and Coliform count under 10^3 at 25°C.

The results of swabs of sandwich preparing tables, hands of workers and packaging materials showed that:- (i) Among the studied bacteria, only SPC ($3.2 - 3.8\times10^2$ CFU/cm^2) and *Enterobactriaceae* (3×10^2 CFU/cm^2) were detected in low load in sandwich preparing table in some restaurant branches. (ii) low count of SPC bacteria ($3 - 4.1\times10^2$ CFU/cm^2) was detected only in the hands of workers responsible of stuffing and wrapping the sandwich in some restaurant branches and (iii) wrapping white butter paper and paper bags were free from the studied bacteria in the three examined restaurant branches.

Table 9. Temperature, pH and microbiological quality of free meat Escalope Panee` sandwich

Parameter	Zero time	After 30 min
Temperature °C	26.3	26.7
pH	5.01	5.13
Microbiological Count CFU/g (SPC)	3.2×10^3	6.5×10^3
Enterobacteriaceae	4.1×10^3	4.1×10^4
Coliform	3.0×10^3	3.2×10^3

Table 10. pH and microbiological quality of meat Escalope panee` sandwich

Parameter	Meat batch	Restaurant branch		
		A	B	C
pH	I	5.56	5.49	5.82
	II	5.94	5.62	5.54
	III	5.79	5.72	5.73
Microbiological Count CFU/g (SPC)	I	4.7×10^4	8.9×10^4	4.2×10^4
	II	3.9×10^4	3.4×10^4	3.2×10^4
	III	5.2×10^4	6.9×10^4	4.2×10^4
Enterobacteriaceae	I	8.7×10^2	6.3×10^2	7.3×10^2
	II	6.1×10^2	7.4×10^2	9.5×10^2
	III	7.3×10^2	9.3×10^2	4.1×10^2

CONCLUSION

Application of HACCP system to restaurant operations may be difficult due to the many steps of product handling which can lead to a great opportunity for cross contamination. The common contributory reasons for food risks associated in food restaurant are:- Improper cooling, long duration between preparation and consumption, infected people handling food, inadequate reheating, improper hot holding, contaminated ingredients, food from unsafe sources and improper cleaning of equipments and utensils. Prevention of cross-contamination of bacteria or foreign matter, inhibition of microbiological growth through abuse of storage holding times and temperature, and an adequate frying of meat slices to destroy any pathogenic organisms are important to control the main CPPs during preparing escalope panee` sandwich.

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الملخص العربي

تطبيق نظام الهاسب خلال إعداد سندوتش قطع اللحم المحمرة في مطاعم الأغذية السريعة

نادية أحمد عبد العزيز ، يحيى جمال الدين محرم، سعد محمد قطيط، رمضان شحاتة عطية

تم تنفيذ نظام تحليل المخاطروتحديد نقاط التحكم الحرجة (الهاسب)أثناء إعداد سندوتش قطع اللحم المحمرة في ثلاثة أفرع من مطاعم إحدى الشركات الكبرى العاملة في مجال الأغذية سريعة الإعداد بالإسكندرية– مصر– مستخدمين الأختبارات الفيزوكيماوية والميكروبيولوجية لتحديد وتجنب النقاط الحرجة والتي قد تؤدي إلى الضرر عند إستهلاكه. وأظهرت النتائج التي تم الحصول عليها عن وجود إختلافات معنوية للأختبارات المقدرة (درجة الحرارة، الأس الهيدروجيني والجودة الميكروبيولوجية) بين الأفرع الثلاثة،شرائح اللحم، خطوات إعداد السندوتش والتداخل بينهم.

ووجد أن نقاط التحكم الحرجة لهذا المنتج ترجع أساساً إلى التلوث العرضي بين المكونات المختلفة المستخدمة في إعداد السندوتش، والعاملين القائمين بإعداده، والحمل الميكروبي بالأضافة إلى سوء التخزين وعدم أستخدام درجات الحرارة المناسبة. ونظراً لأن شرائح اللحم هي المكون الوحيد للسندوتش التي تعرضت للمعاملة الحرارية لجعلها آمنة. لذلك يجب توفير برنامج فعال لمكونات السندوتش الأخرى وطريقة الأعداد للقضاء على أحتمال تواجد ضرر من أستهلاكه.

الكلمات الدالة: نقاط التحكم الحرجة، توكيد الجودة، سندوتش قطع اللحم المحمرة، مطاعم الأغذية السريعة.