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Accessories of Food Handlers and Restaurant Staff as a Source for Food Contamination

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Abstract

With the popularity of the culinary society and the new role of the cooks as media icons, some of the good practices of correct hygiene for items such as the working uniform are being underestimated. This study demonstrates the bacterial load of some accessories (rings, tattoos, watches, etc.) as sources of cross-contamination for foods. The purpose of this article is to reinforce one of the basics of food safety such removal of personal accessories as a means of; the good practices of hygiene in food handlers.

In line with this purpose, samples from gastronomy sciences students were collected as representative of a culinary work environment. Sampling process was done through a swab collection method from accessories such as piercings, rings, bracelets, earrings, necklaces, (and recently done tattoos) unremoved while developing culinary skills in risk of food cross-contamination, either cooking or waiting tables. After the maintenance of 10^{-1} and 10^{-2} sample dilutions for 48 hours in culture conditions, the results showed a clear count of *Enterobacteriaceae*, and *Staphylococcus* in these accessories and even, some colonies of *Escherichia Coli* were detected in some of these handler samples as an indicator of fecal contamination.

In the light of these results, it is shown the importance of maintaining hygienic dress code in those professional practices that involve any kind of food contact in a culinary environment.

Keywords: Food handler; Food contamination; *E.coli*; *Staphylococcus*; Chef; Culinary; Accessories

Introduction

Nowadays, in some areas of the culinary environment correct hygiene is being compromised due to chefs wearing accessories such as rings, bracelets, earrings, necklaces, and also recent tattoos uncovered when cooking is becoming normal. The latest image of the "new chef" wearing all kind accessories when performing their professional tasks is frequently shown in show-cookings, reality TV programs, interviews and all the media involved in the culinary and gastronomy. Nowadays they are generally not portraying an example proper hygienic cooking practices. The problem is that these new kitchen icons, far from being rejected by clients due to the lack of good hygiene practices in their appearance, usually entail a trendy effect that increases the view ratings.

Permission of wedding rings in handlers is worth to mention. Other kinds are not allowed as they are an equal mean of transport for bacteria and thus, a risk for food contamination. The influence of these accessories on the bacterial load of hands and the effectiveness of disinfection of hands with rings has been investigated [1]. Also, the fact that wearing rings increases the bacterial presence of hands, and what is more, disinfection with alcohol seems to be inefficient in reducing contamination from ringed hands [2].

The importance of contaminated surfaces in spreading pathogenic microorganisms to foods is already well studied and prevented in food processing, catering and domestic environment [3,4]. In addition to this, It is known that Food handlers are a major source of contamination in food processes when their work is developed without taking care of the hygienic standards required [5,6] as it has been proven in several foodborne outbreaks during the years [7], being *Staphylococcus* and *E. coli* the bacteria most frequently found when sampling [8,9]. *Staphylococcus aureus* [Staph] is a common ubiquitous bacterium of skin and noses microbiota of up to 25% of healthy people and animals. It usually does not cause illness in these healthy people unless it is transmitted to food products [10]. Once in food, a toxin production process takes place at the same time the bacterial growth. These *Staphylococcal* toxins are resistant to heat so they could not be destroyed by cooking, constituting a risk for food poisoning. Foods that present the highest risk of producing *Staphylococcus aureus* toxins are those made by hand without cooking requirement. The prevalence of the *S. aureus* presence in foods due to contamination sources such as skin lesions, sneezing or coughing or by sneezing or coughing have been already proven, [11] and also presence of *E. coli* as a Fecal pollution indicator in chefs and food handlers hands [12,13]. According to these evidences, the willing of this study is to establish the presence of this microorganism in food handler accessories as indicators of a risk for food contamination. That is why, in order to preserve food safety, every possible source of bacterial transmission should be removed before manipulating food. There is a need to communicate and control bacterial contamination from the use of personal accessories since there is increased popularity for trendy chefs.

Materials and Methods

Sampling

An amount of 35 samples were collected from students of culinary from the Basque Culinary Centre (BCC). This institution is a gastronomic science and culinary arts faculty, where different subjects related with the culinary and hostelry are taught, giving this study a close approach to what a real cuisine environment. In this context, samples were collected without prior advice to volunteer students who were wearing some of the accessories described during their lessons. Sampling method was determined to be done by a peptone water moistened swab through the surface of tattooed skin and the skin below earrings, piercings and watches [14] counting one sample per accessory and student. From the students who volunteered, those who were chosen represented a wide range of variety, either in gender or nationality, with the purpose to recreate the widest range of cook profiles possible.

Sampling process was done three different times, for three different kinds of lessons. First one was done at the end of a first course theoretical class where a number of 11 samples were collected. Second sampling was performed to twelve second course students during a practical cooking lesson in one of the main kitchens. Finally, the third one was done to the students attending a table service, lesson when the 11 left samples were collected.

Procedure

All of the samplings were collected in a proper hygienic way using sterile gloves and materials. Firstly, swabs were moistened with buffered peptone water (Panreac-AppliChem, Spain) and were slipped over the surfaces commented above. Then, they introduced in a 4 ml peptone water tube to dilute sample collected by slipping in a buffer solution and be carried to analysis. Analysis were performed immediately upon arrival to the laboratory, dilutions of 10^{-1} and 10^{-2} were made by addition of 1 ml of the initial solution in 4 ml of peptone water, and 1 ml of the 10^{-1} in another 4 ml of buffer. Then, 1 ml of each dilution used to cultivate in petri dishes.

Culture condition

Culture media used to study bacterial growth were; A.P.H.A [Standard Method Agar] (Panreac AppliChem, Spain) for aerobic bacteria, E.M.B [Eosin-Methylene Blue Agar] ; APHA [Standard Method Agar] (Panreac AppliChem, Spain) for *Enterobacteriaceae* especially selected to observe *E.coli* colonies and Baird-Parker [Baird-Parker Agar Base] (Cultimed laboratories, Spain) as a selective medium for isolation and enumeration of *Staphylococcus aureus*. [14, 15]

Cultures of APHA y and EMB media were set in PETRI dishes of 50 mm. of diameter. Each solution, both 10^{-1} and 10^{-2} cultivated in the two culture media types, counting four plates for each sample, one plate for the 10^{-1} solution and another for the 10^{-2} in APHA media, and the same for the EMB. On the other hand, Baird-Parker media PETRI dishes measured 90 mm. of diameter and only one culture for the 10^{-1} dilution of each sample was made.

Incubation and criteria

All plates are incubated at 37°C [98.6°F] as the relevant temperature in infectious disease for 48 hours [16]. The growing count method used is visual, counting colonies as they appear on the agar media considered as a direct evidence of bacteria growth. Criteria used to evaluate results obtained from EMB and APHA agar were obtained from [17], following Table 1.

	CORRECT	INCORRECT	INCONCLUSIVE
Total count of aerobic bacteria expressed in CFU/25 cm^2. (Colony forming units in cm^2)	X<80	X>200	80< X >200
Total count of *Enterobacteriaceae* expressed in CFU/25 cm^2. (Colony forming units in cm^2)	X=0	X >3	0< X >3

Table 1: Total counts of aerobic bacteria and *Enteriobacteriaceae* considered as patron for the safety assessment of the bacterial growth obtained from the samples collected.

Accordingly, It is considered as unacceptable in food handlers a count of aerobic bacteria above 200 CFU, inconclusive between 80-200 CFU, being acceptable values below 80 CFU. On the other hand, the evaluation of *Staphylococcus aureus*, was done according to a qualitative criteria either presence or absence of bacteria growth in Baird Parker culture media [18].

Results

Quantitative

After analyzing the results of the quantitative count of APHA Agar, according to (Figure 1), it is shown that there is a bacterial growth in all kind of accessories. That is why, despite of the fact that growing means show different bacteria counts for each kind of accessory, none of them provide a significant result to associate a major growth with a specific kind of accessory. On the other hand, as it is shown in the growing count of the Baird-Parker agar culture media, most of the microorganism growth detected in the accessories belong to *Staphylococcus aureus* (Figure 2).

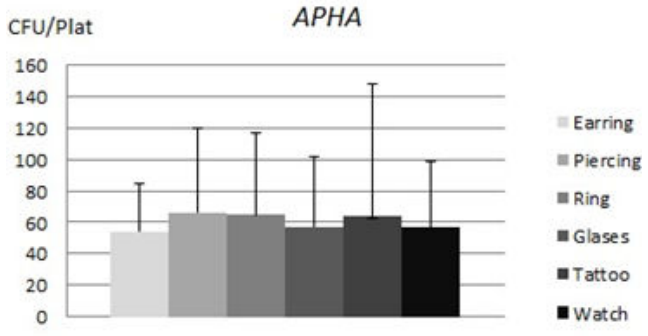

Figure 1: Comparison of Means and Standard Deviations of the total plate count obtained in APHA media at sampling of different kinds of accessories. Data are means ±SD and are analyzed by Student's t test ($p<0.05$), n=35.

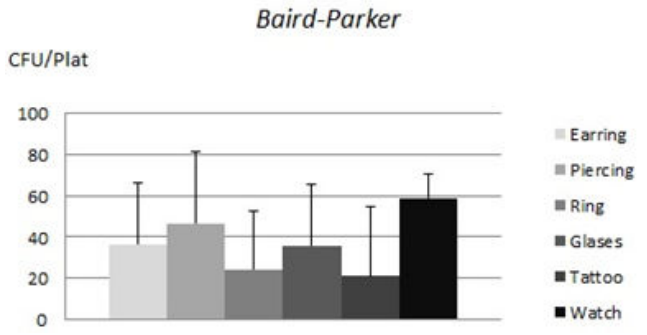

Figure 2: Comparison of Means and Standard Deviations of the total plate count obtained in Baird-Parker media at sampling of different kinds of accessories. Data are means ±SD and are analyzed by Student's t test ($p<0.05$), n=35

EMB culture media, revealed an *Escherichia coli* growth in two of the samples collected. One of them belonged to a ring and the other to an earring. *E. coli* is an indicator of fecal contamination, therefore, as Table 1 indicates, any kind of sample related to food or manipulation should not show any *E. coli* growth [Table 2].

E. coli **[EMB]**	**nº.Samples**	**Count**
Earrings	9	1
Piercings	8	1
Rings	9	0
Glasses	7	0
Tattoo	5	0
Watch	2	0

Table 2: Total count of *Escherichia coli* detected in accessories samples cultured in EMB agar

Chi- square test indicates that there is no direct relation between the frequency in which exceeded the presence Legal Limit established between *Staphylococcus* and Total Aerobic, except from the watches. The rest of the accessories values are <0.5, but for watches, their chi-square value is 0.4795, indicating relation between the CFU of APHA and Baird-Parker (Figure 3). This is explained due to the great amount of death skin, rest of material and so on that remains in the watches since they are items that are not usually washed thoroughly although they are worn by the individual the whole day. Anyway, Samples collected from watches are not enough so as to determinate result as conclusive, but it is as an indicator.

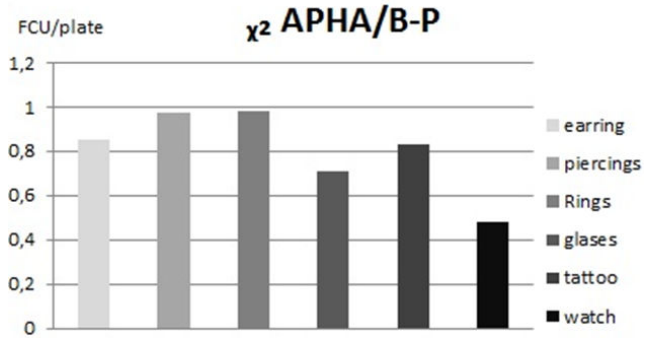

Figure 3: Comparison between Chi Square tests executed in both APHA and Baird-Parker Agar Medias for the different kinds of accessories. n=35

Qualitative

As for the Chi Square test results, practically there is no difference between APHA and Baird-Parker culture media, being both quite elevated for each accessorize (Figure 4 and Figure 5).

Regarding to EMB agar, as has been demonstrated before and according to Table 1, both piercing and earrings showed an unacceptable growing of *E. coli* [UFC>0] (Figure 6).

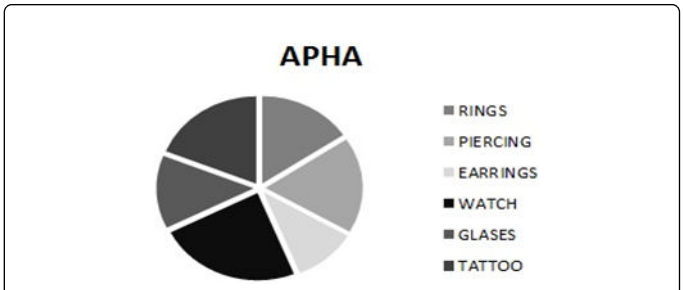

Figure 4: Total count for aerobic bacteria in APHA media from the samples collected for each kind of accessory.

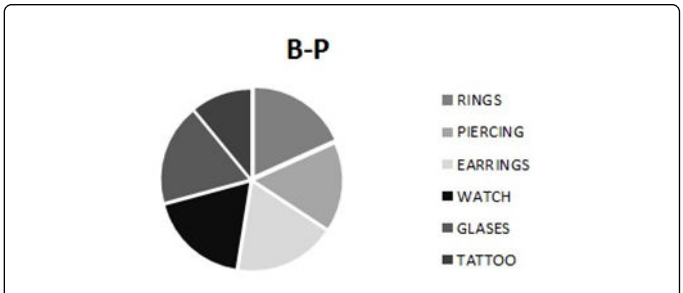

Figure 5: Total count for *Staphylococcus aureus* in Baird-Parker media from the samples collected for each kind of accessory.

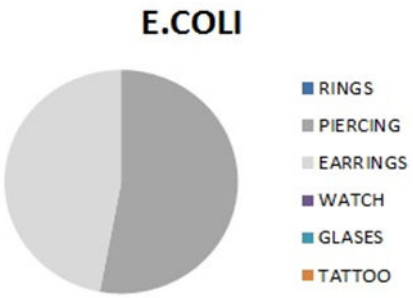

Figure 6: Total count of *Enterobacteriaceae* especially *Escherichia coli* from the samples collected for each kind of accessory.

Discussion

It is a common belief for people that they are unlikely to get a foodborne illness

Actually, only the most important cases, usually the ones that appear as outbreaks, are publicly spread by media, projecting the wrong idea to consumers of being an unlikely event.

However, it is more likely than expected to suffer from a foodborne illness

Actually, data collected from 2014, [19] identified in U.S.A, 19,542 cases of infection, 4,445 hospitalizations, and 71 deaths [Table]. Following the incidence: Salmonella (7,452), Campylobacter (6,486) Shigella (2,801), Cryptosporidium (1,175) STEC non-O157 (690), STEC O157 (445), Vibrio (216), Yersinia (133 [0.28]), Listeria (118 [0.24]), and Cyclospora (26 [0.05]). Being the percentage of infections linked to outbreaks as follows: STEC O157 (16%), Listeria (11%), STEC non-O157 (7%), Shigella (7%), Salmonella (6%) [20].

Instead of the prevalence, people sometimes are not conscious of it because of its variety of symptoms or their prolonged time of incubation, making it difficult to relate symptoms with a food origin. Usually, they are considered as a simple stomachache or postprandial discomfort without realizing their truly etiology.

Accordingly, it is important to be concerned about the prevalence of foodborne disease in society so as to prevent them at any area of possible contamination. That is why accessories in kitchens as a source of food contamination should be also taken into account in order to improve the hygienic environment when cooking.

The bacterial load that rings and other chef accessories can transport has been demonstrated in studies performed to sanitary subjects such as nurses and other sanitary staff [2].

There have been some studies related to the rings bacterial charge in nurses or sanitary staff and materials [2]. However, none of them has been focused on a culinary environment.

In this study it is also highlighted that the bacterial persistence is not influenced by the ring shape, being equal either for regular rings or wedding rings, what leads to question the permissiveness in some culinary environments about this lack of hygiene.

It is worth to quote from these, the demonstration of the bacterial persistence in wedding rings in the same way than any other kind of rings, and even the survival to alcohol disinfection.

On the other hand, presence of *Staphylococcus* or *E. coli* in hands has been demonstrated widely, but again, in different areas and without taking into account the possibility of accessories as a possible source of food contamination [9,21]. This study demonstrates the microbiological risk that these accessories can carry, being some of them such a *Staphylococcus*, potentially pathogenic for humans in contaminated food consumption or indicators of fecal contamination as presence of *E. coli* does [22].

In the light of the above the importance of these elements in different environments are shown as a sample to extrapolate the matter of this article, in the kitchens where food handler appearance is important for business.

Conclusion

The present study demonstrates that food handlers accessories such as piercings, rings, bracelets, earrings, necklaces and also recent tattoos hold a significant bacterial load [Aerobic bacteria, *S. aureus* and also *E. coli*] what means that these objects are a potential source for the contamination of foods if they are not removed when working at a restaurant (canteen, catering or so) either cooking or serving tables.

According to the above, it would be convenient to restrict the use of accessories in cooks, waiters, and restaurant staff in general, recommending at the same time the removal of wedding rings, indifferently from any other kind of ring.

Due to the demonstrated bacterial load that these items can have, professionals or media chefs should be aware of the example that they represent for their colleagues and domestic users, maintaining the proper habits when dressing and acting professionally as a main part of the good hygiene practices.

On the other hand, clients, consumers and domestic users, should also be aware of the importance of maintaining the proper hygienic habits to prevent health public risks derived from this lack of food safety that can lead to the various foodborne diseases.

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