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Determination of Outbreaks of Collective Food Poisoning (TIAC) on University Campuses in Senegal: A Necessity for Their Prevention and the Improvement of Food Safety

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Abstract In Senegal, university canteens, places of high production of meals for students, are real sources of collective food poisoning (TIAC). In these campuses, the origin of these TIACs remains difficult to locate and remains a real problem for prevention, risk control and food safety. The objective of this study is to identify TIAC outbreaks, their levels of attendance, hygiene control, and contamination of surfaces and food to which students are exposed. To do this, a questionnaire was developed and a team of investigators was formed. From 2012 to 2017, a retrospective survey was conducted. The choice of targets focused on students, restaurateurs, food vendors, residence chefs and medical workers. A system has been set up for the collection and analysis of food samples (processed fish, hot meals, unpasteurized juices and sandwiches) and surfaces (trays and hands of divers and waitresses) at the UCAD CENTRAL restaurant under aseptic conditions. Data processing was carried out using an Excel spreadsheet and XLStat software. The results of the study reveal four TIAC outbreaks with varying levels of attendance and hygiene control: university restaurants, university residences, fast food restaurants and outdoor restaurants. These results show that university restaurants, controlled at 43%, are frequented at 60%, unlike outdoor restaurants which are the least controlled (24%) and the least frequented by students (4%). Given these results, we can say that the collective food poisoning that shakes campuses has several highly frequented origins but is not rigorously controlled and this poses a real threat to food and consumer safety. This study allowed the authorities in charge of social works, to focus on preventive measures at the level of the real sources of TIAC in these campuses to control food and consumer safety.

Keywords: *risk, hygiene, food poisoning, food safety*

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1. Introduction

In Senegal, university catering is frequently hit by collective foodborne infections (TIAC) especially in 2013; 2015 and 2017 [1]. In these university campuses, the number of students admitted far exceeds the capacity of reception, particularly in the field of restoration, which is under the responsibility of the centre of university works of Dakar (COUD) for UCAD and the Regional Centres of University Works (CROUS) for UGB, UIT, UADB and UASZ.

This massification of campuses has led to an uncontrolled proliferation of meal manufacturing sites by food vendors who are unaware of the risks of foodborne illnesses such as collective foodborne illness (TIAC) and their prevention [2,3,4]. In these campuses, there are so many places where meals are produced that the origin of a TIAC remains difficult to locate and this constitutes a real problem for the prevention, risk control and safety of food intended for consumers [5,6,7]. So, to solve these TIACs, it is important to determine their origins in these campuses for better prevention. This study aims to identify the sources of TIAC in these campuses and specifically their levels of attendance, hygiene control,

and contamination of surfaces and meals to which students are exposed.

2. Material and Methods

2.1. Material

Survey material for the identification of different meal production sites on these university campuses; estimation of their level of attendance and hygiene control.

The survey material used in this study consists of Sheets (physical format) of the questionnaire consisting of six (6) parts, each of which has several headings relating to variable parameters; A team of trained investigators made up of students; An Excel spreadsheet and XLstat software for data processing and exploitation;

Bacteriological analysis equipment for contamination in and outside the restaurant

Bacteriological analyses were carried out at the restaurant level on surfaces, processed fish and meals and outside the restaurant on unpasteurized fruit juices and sandwiches. Technical equipment consisting of a device for taking, preserving and transporting samples. Thus, the samples to be analyzed were:

- Surfaces of the trays;
- Surfaces of divers' hands;
- Surfaces of waitresses' hands;
- Raw products (processed fish);
- Cooked products (hot meals);
- Five categories of unpasteurized fruit juice sold around the CENTRAL restaurant (Bouye, Bissap, Ginger, Ditakh and Tamarind);
- Five categories of sandwiches sold around the CENTRAL restaurant (Meat, cowpea, peas, Fatayas and Hamburgers);

2.2. Methods

Survey methods for the identification of different meal production sites on these university campuses; estimation of their levels of attendance and hygiene control.

The survey is a retrospective survey from 2012 to 2017 targeting students, restaurateurs, food vendors, residence chefs and medical staff in the five (5) social campuses of the universities of UGB, UCAD, UIT, UADB and UASZ represented by red stars on the geographical map of Senegal in Figure 1. The application of the sampling method from the sample size estimation table (95% confidence level ± 5%) of Krejcie and Morgan [8] made it possible to find the sample size which is 384 people to be surveyed in these five (5) universities. The distribution was made on a pro-rata basis in the universities according to the target given for each. Thus the samples are established in Table 1 below. This part of the survey aims to identify TIAC outbreaks, their levels of attendance and hygiene control.

Figure 1. Map of Senegal: the red stars designate from top to bottom: UGB, UCAD, ITU, UADB and UASZ

Table 1. Sampling method from the Krejcie and Morgan sample size estimation table (95% confidence level ± 5%)

	TARGETS	UGB	UCAD	UIT	UADB	UASZ	TOTAL
POPULATION	Number of students	11.441	75.111	4.173	3.500	3.525	97.750
	Number of residences	15	47	10	9	5	86
	Number of restaurants	2	8	4	5	1	20
	Number of canteens	22	46	7	7	6	88
	Number of doctors	1	15	1	1	1	19
	Total in absolute value	11.481	75.227	4.195	3.522	3.538	97.963
	Total in relative value (%)	11,72	76,79	4,28	3,60	3,61	100
	TOTAL SHEETS	45	295	16	14	14	384
SAMPLES	SAMPLES	UGB	UCAD	UIT	UADB	UASZ	TOTAL
	Number of students	23	211	5	3	3	245
	Number of mansions	8	21	3	3	3	38
	Number of restaurants	4	28	3	3	3	41
	Number of canteens	8	20	3	3	3	37
	Number of doctors	2	15	2	2	2	23
	TOTAL SHEETS	45	295	16	14	14	384

Methods for bacteriological analysis of contamination at the restaurant level (surfaces, processed fish and meals) and outside the restaurant (unpasteurized juices and sandwiches).

For these bacteriological analyses, only one restaurant located on the large campus is chosen at UCAD; This is the CENTRAL restaurant During the five (05) series of official analyses, four (4) germs on the surface (*Total Aerobic Mesophilic Flora, Staphylococcus aureus, thermotolerant or faecal coliforms and Escherichia coli*) and five (5) germs in food products (*Total Aerobic Mesophilic Flora, Staphylococcus aureus, Thermotolerent or faecal coliforms, Sulfito-reducing Anaerobes and Salmonella*) were sought. The total number of samples analyzed was obtained according to the nature of the medium or the type of product; Thus: For surfaces:

- trays: 3 samples per series which give 15 samples per restaurant or 15 samples;
- divers: 3 samples per series which give 15 samples per restaurant or 15 samples;
- waitresses: 3 samples per series which give 15 samples per restaurant or 15 samples;

For food products located at the restaurant level:

- processed fish: 1 sample per series, which gives 5 samples per restaurant or 5 samples;
- hot meals: 3 samples per series (the first at the beginning of the service, the second in the middle of the service and the third towards the end of the service) which gives 15 samples per restaurant or 15 samples;

For the food products sold around this restaurant, two were chosen: On the one hand sandwiches:

- 5 categories of sandwiches sold in these campuses: (meat, cowpea, peas, Fataya and hamburger) among which two categories are concerned by this part of the study: meat sandwich and cowpea;
- 2 samples per series which give 10 samples per restaurant area or 10 samples;

On the one hand, unpasteurized fruit juices:

- 5 categories of fruit juices are sold in these campuses: (Bouye, Bissap, Ginger, Ditah and Tamarind) among which two categories are concerned by this part of the study: bouye and bissap juice;
- 2 samples per series which give 10 samples per restaurant area or 10 samples;

The normative references, growing conditions and horizontal methods of two- or three-class enumeration from Table 2 were used.

Table 2. Standards, culture media and incubation temperature used for the analysis of different microbiological flora

Flores Wanted on surfaces, food, meals and fruit juices	Références Normatives						
	Standards used	Environments of culture	Temperatures (°C), incubation times (h) and atmosphere	Criteria: (m) (Number of standard germs / g of food or surfaces tested)			
				Surfaces used	Fish costs elaborate	Meals and Sandwiches	Fruit juice
Total Aerobic Mesophilic Flora at 30°C	NF EN ISO 4833	Standard agar (PCA: Plate Count Agar)	30°C for 24h in aerobiosis	10^2	10^5	3. 10^5	3. 10^3
Staphylococcus aureus	NF V08-057-1	(BP): Heart broth rabbit plasma brain)	37°C for 48 hours in aerobic	10	10^2	10^2	< 10^2
Coliforms thermotolerant or "faecal" 44°C	NF V08-060	Esculin sodium azide (BEA) agar	44°C for 48 hours in aerobic	10	10	10	< 10^2
Anaerobic Sulfo-Reducing (ASR) at 37°C	XP V 08-61	Cycloserine Tryptose-Sulfile Agar (TSC) Thioglycolate Liquid	37°C for 24 hours in anaerobic conditions	30	10	30	30
Escherichia coli	ISO 16649-2	TBX Agar	44°C for 24 hours in anaerobic conditions	10	10	10	10^2
Salmonella	NF V08-6579	Rappaport Vassiliadis (RV) Selenite-cystine broth (BSC) Glossy green agar (GVB)	37°C for 24 to 48 hours in aerobic	Absence /25g	Absence /25g	Absence /25g	Absence /25g

3. Results and Discussions

Survey results on the identification of different meal production sites on these university campuses.

The results of the study on the identification of different meal production sites on these university campuses are reported in Table 3 below.

Table 3. Different meal production sites on university campuses

Number	Number Order	Meal production sites on university campuses in Senegal
4	1	University restaurants
	2	Fast-Foods
	3	University residences
	4	Outdoor restaurants

These results show that on these university campuses, there are four sources of TIAC: university restaurants, fast food outlets, university residences and outdoor restaurants. This result is different from that found by Bonhôte and al. (2011) [9] which found two sources close to that of Vaissière and al. (2016) [10] which is established at three sources. This high number of TIAC sources is due to a lack of rigorous control on these university campuses.

Survey results on the estimation of the level of attendance at the various meal production sites on these university campuses.

The results of the study on the estimation of the level of attendance at the various meal production sites on these university campuses are shown in Figure 2 below.

The results of the study reveal that the sources of TIAC are frequented differently at 43%, 25%, 24% and 8% respectively for university restaurants, fast foods, residences and outdoor restaurants. The results are similar to those of ESSOMBA (2000) [11] and confirm the effect of exceeding the capacity of restaurants which makes students look for other points to have the meal. This rush of students to these eating points other than university restaurants encourages their abundance on campuses.

Survey results on the estimation of the level of hygiene control in these different meal production sites on these university campuses.

The results of the study on the estimation of the level of hygiene control in these different meal production sites on these university campuses are shown in Figure 3 below.

Figure 2. Level of attendance of the different TIAC centers

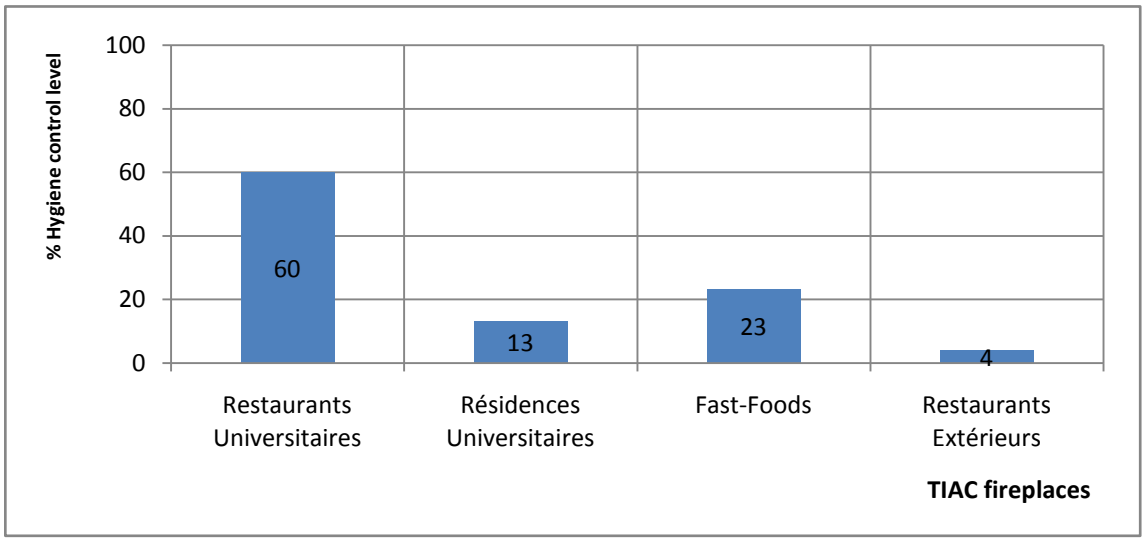

Figure 3. Hygiene control level of the different TIAC homes

The results of the study show that on these campuses, the hygiene of TIAC sources is controlled differently at 60%, 13%, 23% and 4% respectively for university restaurants, residences, fast food and outdoor restaurants. The results, identical to those of ESSOMBA (2000) [11], indicate the need to strengthen hygiene control in the face of the proliferation of food outlets on university campuses.

Bacteriological results of contamination at the university cafeteria level (surfaces, processed fish and meals) and outside the restaurant (unpasteurized juices and sandwiches).

Bacteriological results of contamination at the university cafeteria (surfaces, processed fish and meals).

The results of the study on surface contamination in this university cafeteria are shown in Figure 4 below.

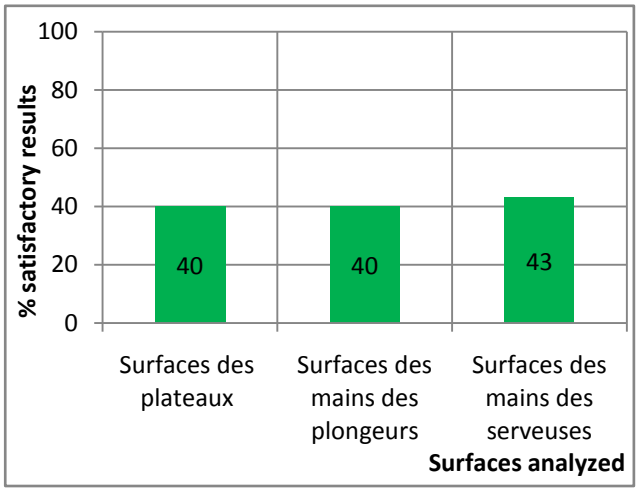

Figure 4. Level of contamination of material and biological surfaces of the CENTRAL restaurant of the large social campus of UCAD

The results of the study reveal non-compliance with the hygiene rules of cleaning and disinfection of surfaces which are satisfactory to 40%, 40% and 43% respectively for trays, divers and waitresses. These results on the bacteriological survey of the surfaces of the materials and biological of this restaurant of the large campus are less satisfactory by far than those found by NJUEYA and al. (2006) [12] which are between 60 and 80% satisfaction. The results of the food contamination study in this university cafeteria are shown in Figure 5 below.

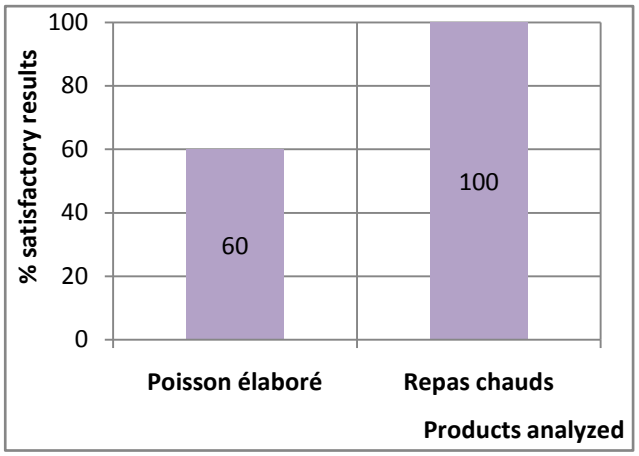

Figure 5. Level of contamination of prepared fish and hot meals in the CENTRAL restaurant of the large social campus of UCAD

As for the fish elaborated, the results of the study reveal a non-compliance with the rules of conservation in the cold room with a satisfaction rate of 60%. This 60% satisfaction rate found on the elaborate fish is different from that found by Seydi and al. (1992) [13] which is 31.3%. Regarding the meal served hot, the result is close to that of GOUSSAULT and al. (1983) [14] which is 97.8% satisfaction.

Bacteriological results of contamination outside the CENTRAL restaurant (unpasteurized juices and sandwiches).

The results of the study on the contamination of unpasteurized juices and sandwiches sold outside the CENTRAL restaurant are shown in Figure 6 below.

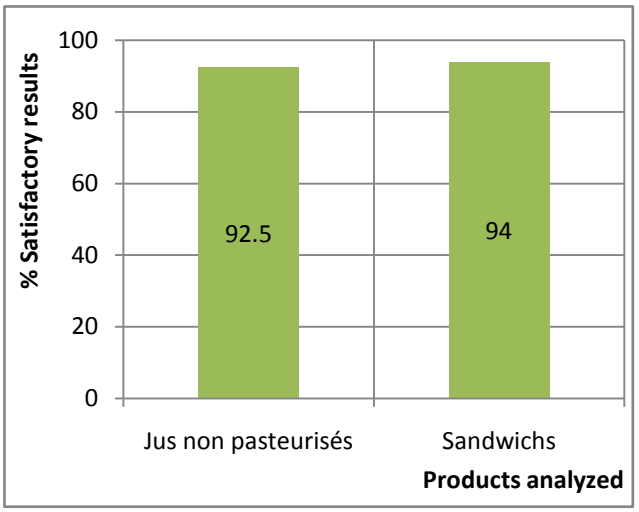

Figure 6. Level of contamination of pasteurized npn juices and sandwiches sold around the CENTRAL restaurant of the large social campus of UCAD

The analysis of the bacteriological results obtained on the samples of unpasteurized fruit juice sold around the CENTRAL university restaurant on the large UCAD campus shows that they are 94% satisfactory. These bacteriological results revealed a total absence of pathogenic bacteria; this finding is identical to that of Ndiaye and al. (2015) [15] contrary to the finding of OUATTARA and al. (2018) [16] which notes the presence of pathogens in homemade juices. Regarding the samples of sandwiches sold around this university restaurant on the large UCAD campus, the analysis of the results shows that they are 94% satisfactory. The values found by Ndione and al. (2000) [17] of 70% satisfactory and acceptable at 30% are far below the study values.

4. Conclusion

The results of the study show that campus TIACs have several origins that are not rigorously controlled and this poses a real threat to food and consumer safety. The results made it possible to identify the real sources of TACs on these campuses and the risks whose prevention will make it possible to better control food safety and guarantee the health of consumers. This study made it easier for the authorities in charge of social work to focus on preventive measures at the level of the real sources of TIAC in these campuses and to control food safety.

Abbreviations

UGB- Gaston Berger University of Saint Louis; UCAD- University Cheikh Anta DIOP; UADB- Alioune Diop University of Bambey; UASZ- Assane Seck University of Ziguinchor; UIT- University Institute of Technology

References

[1] HAMZA R. Collective food-borne illness (CBIT): from epidemiology to prevention. 128 pp. 2001.

[2] CHAHED MK, Hassairi M, Daghsen M, Zouari B, Nacef T. Foodborne diseases are an emerging global phenomenon. *Microb Hyg Ali*: 13 (38). 2001.

[3] HAMZA R. Management of a collective foodborne illness. 174 pp. 2012.

[4] TACKER S. R., Berkelman R. L. Public health surveillance in the United States Epidemiologic review. 10:164-190. 1988.

[5] MORDELLES A. The training of people in collective catering. *Nutrition and Dietetics Notebooks*, No. 3, p. 237. 1987.

[6] OFFICIAL JOURNAL of the FRENCH REPUBLIC. - Circular of 6 March 1968 on the preventive measures to be taken in the field of food hygiene in public university and school establishments. *Paris*, 5 May 1968

[7] OFFICIAL JOURNAL of the FRENCH REPUBLIC. - Order of 26 June 1974 on the regulation of hygiene conditions relating to the preparation, conservation, distribution and sale of dishes cooked in advance. *Paris*, 16 July 1974.

[8] Turcotte D. and Jocelyn L. Social intervention with groups, Boucherville, *Gaëtan Morin editor*, 410 p. 2000.

[9] BONHOTE P. Raising the level of hygiene in catering. *Master in Advanced Studies Food Safety Services*. 67p. 2011.

[10] VAISSIERE E. Epidemiological investigation of suspected waterborne TIAC. HWB: Health watch bulletin; February n°1: 11-13. 2016.

[11] ESSOMBA J. A. Study of the hygiene of collective catering in Cameroon: Case of the centre of university works of Yaoundé I and surrounding eateries. *Thesis: Med. Vet. Dakar*. No. 18. 2000.

[12] NJUEYA M. L. M. F. Study of surface contamination in university catering: a case of the centre of university works of Dakar: *COUD. Thesis: Med. Vet. Dakar*. No. 19. 2006.

[13] SEYDI Mg; PANGUI L. and AZIBE M. Hygienic quality of frozen fish fillets produced in Senegal. *Microb and Hyg. Ali*. 9 (4):12-17. 1992.

[14] GOUSSSAULT, B. Importance and role of microbiological control in collective catering in social and commercial catering. *Paris: I.S.T.V.:* 277-280. 1983.

[15] NDIAYE N. A., DIENG M., KANE A., CISSE M., MONTET D., TOURE N. C. Diagnosis and microbiological characterization of artisanal processes for the manufacture of *Hibiscus sabdariffa* L beverages and concentrates in Senegal. *Africa SCIENCE* 11(3). 197-210. 2015.

[16] OUATTARA Y., TRAORE L. B., ADAMOU M. Microbiological quality control of artisanal beverages in commune V of the district of Bamako. *Malian Symposium on Applied Sciences* (MSAS). 2018.

[17] DIONE A. Contribution to the study of the bacteriological quality of some foodstuffs of animal origin marketed on the Dakar market. *Med Vet thesis n°3*. 2000.

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