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Microbiological quality of meals in collective catering in Ouagadougou: Essential hygiene practices and public health challenges

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Abstract

Collective catering plays a crucial role, but meal inspections are often insufficient, posing a significant health risk. These meals can be contaminated by pathogenic microorganisms, such as *Escherichia coli*, *Salmonella* spp., *Staphylococcus aureus*, and *Shigella* sp., which are responsible for many foodborne illnesses. This study aims to assess compliance with good hygiene practices and the microbiological quality of meals in collective restaurants in Ouagadougou, Burkina Faso. Field investigations were conducted to observe hygiene practices and collect samples for analysis. A total of 85 samples of meals and utensils were taken at various points along the service chain and immediately transported to the laboratory at 4°C. These samples were analysed using standard microbiological methods to detect the presence of the mentioned pathogens. The results revealed widespread non-compliance with good hygiene practices. Microbiological analyses revealed that nearly all samples were contaminated, with 97.5% containing at least one pathogen. The primary contaminants were 31/85 (36.47%) for *Escherichia coli*, 7/85 (8.23%) for *Salmonella* spp., 8/85 (9.41%) for *Shigella* sp., and 29/85 (34.11%) for *Staphylococcus aureus*. Of the 85 samples, 75 showed contamination or co-contamination, representing 88.23%. These findings highlight a high health risk for consumers and emphasise the need to intensify hygiene measures. It is essential to raise awareness and train catering professionals to reduce the prevalence of pathogens and ensure food safety.

Keywords: Collective catering; Hygiene practices; Microbiological quality; Public health; Ouagadougou/Burkina Faso

1. Introduction

The collective catering sector, particularly street food, has established itself as a key activity in meeting the nutritional needs of the working population. These establishments provide over 80% of city dwellers with access to quick and affordable meals [1, 2]. However, the lack of rigorous health controls and inadequate hygiene practices increases the risk for consumers of contracting foodborne illnesses [3]. Consuming food contaminated with pathogens such as *Escherichia coli* (*E. coli*), *Salmonella* spp., *Shigella* sp., or *Staphylococcus aureus* (*S. aureus*) can lead to mild disturbances or more serious illnesses [4-6].

In Burkina Faso, the sector of collective catering has experienced significant growth, providing a large number of meals daily in Ouagadougou. Although its socio-economic importance is vital, hygiene remains a significant concern. Several studies show that sanitary rules are often neglected due to the high volume of meals prepared, the low level of staff

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training, and an unsanitary environment [7-10]. These shortcomings facilitate the multiplication and spread of microorganisms.

In this context, this study was conducted to document good hygiene practices and to assess the microbiological quality of meals in collective catering in Ouagadougou. It aims to understand the health risks in this sector better and provides key data for the implementation of preventive measures.

2. Materials and methods

2.1. Framework and type of study

This prospective and cross-sectional study was conducted in Ouagadougou, the capital of Burkina Faso, from June to November 2024. It involved six sites of collective catering: Dassasgho, Zone 1, Kossodo, Wemtengha, Zogona, and Patte d'oie. The aim was to assess the hygienic and microbiological quality of the meals served at these locations. The populations studied included restaurant staff and consumers.

2.2. Data collection and surveys

Hygiene practices were assessed using surveys that employed the 5M method of Ishikawa (Manpower, Material, Method, Equipment, Environment). A structured questionnaire was used to observe the manufacturing process, equipment handling, utensil cleaning, food storage, as well as the overall condition of the environment, the cleanliness of clothing, and waste management. In total, 70 consumers were also surveyed via an evaluation form to gather their perceptions of hygiene, using a scoring grid (Poor, Good, Very Good, Excellent). The questionnaires were administered to both staff and consumers, with an oral explanation provided for those who were not literate.

2.3. Microbiological analyses

2.3.1. Preparation of samples and decimal dilutions

To prepare the samples, 25 g were weighed using a balance and then placed into a bottle containing 225 mL of Buffered Peptone Water (BPW). This mixture was shaken for 3 to 5 minutes to release the microorganisms. Subsequently, serial dilutions were performed using sterile pipettes: 1 mL of the previous solution was transferred into 9 mL of BPW to obtain a 10^{-1} dilution.

2.3.2. Research and identification of microorganisms

The analyses involved identifying and quantifying several pathogenic germs. Regarding the search for *Salmonella* and *Shigella*, their isolation and identification were carried out according to the ISO 6579-1:2017 standard. The procedure included a non-selective pre-enrichment step in the EPT (incubation at 37 °C for 18-24 hours), followed by selective enrichments in Müller-Kauffmann tetrathionate and novobiocin (MKTTn) broth, as well as modified Rappaport-Vassiliadis (RVS) broth. Isolation was performed on Xylose Lysine Deoxycholate (XLD) and *Salmonella-Shigella* (SS) agar plates. Suspected colonies were selected, purified, and then identified using a basic biochemical gallery (urease, indole, oxidation, and Kligler-Hajna tests) before being confirmed with the API 20E gallery. The isolated strains were stored at -20 °C in brain-heart infusion (BHI) broth with 20% glycerol.

E. coli detection: The search for *E. coli* was carried out by inoculating 0.1 mL of the dilutions onto Eosin and Methylene Blue (EMB) agar, followed by incubation at 42 °C for 24 hours. Suspect colonies (green with a metallic sheen) were subjected to a minimal biochemical panel for identification (urease test, indole, and Kligler-Hajna tests) and then to the API 20E panel. The strains were preserved in the same manner as those of *Salmonella and Shigella*.

Search for *Staphylococcus aureus*: Isolation was carried out by spreading 0.1 mL of the mother solution onto a Baird-Parker (BP) agar plate and incubating it at 37 °C for 24 to 48 hours. Suspect colonies (black, shiny, with a clear halo) were purified on a Muller-Hinton medium. A coagulase test was then performed to confirm the identification of the *Staphylococcus aureus* species, in accordance with the AFNOR XP V 08-057-1 standard.

2.4. Interpretation criteria

The analysis of the results was carried out in accordance with the criteria of the French Standardisation Association (AFNOR). For *Salmonella* spp. and *Shigella* sp., any detection in 25 g of sample indicates that the meal is unfit for consumption, according to standard NF V 08-052. Concerning *Staphylococcus aureus*, the meal is deemed non-compliant

if the number of colonies reaches or exceeds 10^2, in accordance with standard NF V 08-057-1. The detection of *E. coli* serves as an indicator of faecal contamination.

2.5. Statistical analysis

The data collected was entered and analysed using Microsoft Excel and SPSS software.

3. Results

3.1. Observations on the environment and hygiene of establishments

The inspection of catering sites revealed numerous non-compliances with good hygiene practices. The survey results show a mixed perception among consumers: 60% consider the cleanliness of the premises to be 'acceptable', but only 28.57% find it 'very clean'. Similarly, 57.14% of utensils and dishes are deemed 'acceptable' in terms of cleanliness, compared to only 15.71% that are 'well clean'. Furthermore, 65.71% of participants observed no significant improvement in sanitary conditions (Table 1).

Table 1 Study of the environment of catering sites

Variables	Terms	Frequency	Percentage (%)
Cleanliness of premises	Very clean	0	0
	Acceptable	2	25
	Not very clean	5	62.5
	Not clean	1	12.5
Total			100
Cleanliness of kitchen utensils and dishes	Very clean	0	0
	Acceptable	3	37.5
	Not very clean	3	37.5
	Not clean	2	25
Total			10
Raw material	Clean property	0	0
	Acceptable	2	25
	Not very clean	4	50
	Not clean	2	25
Total			10

The methods of food storage are inadequate: half of the raw materials are left exposed to the air. An inappropriate mixture of vegetables, meats, and fish has been observed in the refrigerators. Wastewater management is deficient, with the same water sometimes used for all dishwashing operations (Figure 1). These practices significantly increase the risk of cross-contamination and bacterial growth.

Figure 1 Dishwashing operation in the visited restaurants

3.2. Characteristics of staff and consumers

3.2.1. Staff practices

The staff observation revealed a deficiency in personal protective equipment, including lab coats, closed-toe shoes, and hairnets. The lack of soap for frequent hand washing directly exposes the food to contamination risks. It was also observed that 100% of the female staff wear a headscarf, a practice that does not replace a hairnet to ensure protection. The lack of professionalism in food handling and manual task execution increases health risks.

3.2.2. Knowledge and habits of consumers

The survey reveals that the majority of the population is male (60%, n = 42), with a predominantly undergraduate level of education (45.71%) or a master's degree (34.29%). It is positive to note that 92.86% of consumers have access to information on good hygiene practices, mainly through training (51.43%). Regarding habits, 85.71% of participants occasionally consume these meals, and 67.14% eat them on-site. The use of sachets as containers is widespread (74.29 %), which poses a hygiene risk. The majority prefer hot meals (94.29 %).

3.2.3. Consumer satisfaction and characteristics of the samples

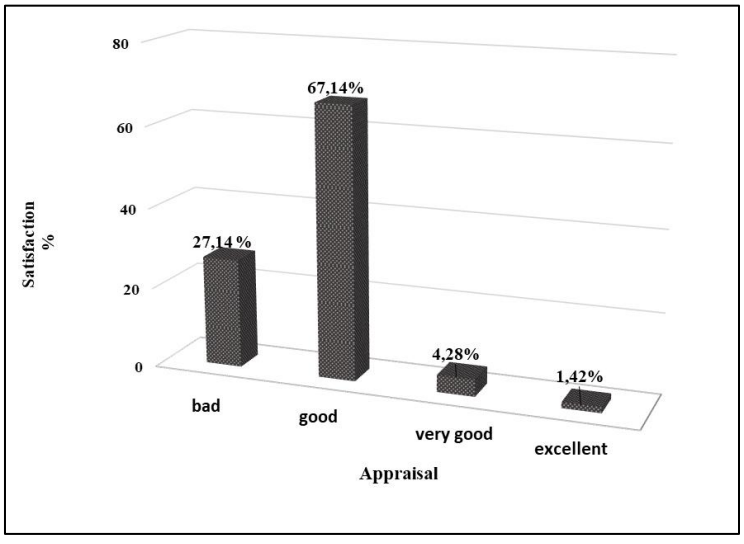

Figure 2 Consumer satisfaction level regarding the served meals

Regarding satisfaction, 67.14% of consumers find it 'good', while a notable percentage (27.14%) perceive it as 'bad'. Only 4.28% rate it as 'very good' and 1.42% as 'excellent' (Figure 2), which suggests there is room for improvement.

3.3. The different meals served in collective catering sites

The study analysed a total of 85 samples, including 77 meals and eight utensils. The tested dishes represented a wide variety of traditional meals (beans, rice, various sauces, etc.). The temperature of the meals at the time of purchase varied significantly, ranging from 7 °C to 80 °C. Table 2 presents the list and number of different foods collected, along with the temperature at the time of purchase.

Table 2 Sampled different dishes

Food/meals/materials	Temperature °C/Sample	Number of samples collected by restaurant type
Beans	55 - 62.2	4
Rice with peanut sauce	57 - 74	5
Porridge	57.1	1
Fatty rice	44.8 - 80	3
Yoghurt	22 - 26	3
Degué small millet	21 - 32	5
Degué couscous	7 - 30	3
Cakes	35 - 37	3
Salad	36.6 - 37	6
Atieké	32 - 50.3	7
Degué	24 - 26	7
Macaroni + raw vegetables	37 - 36.6	2
Alloco	38	1
Babenda	63	1
Chilli	-	1
Couscous beans	48.8 - 66	3
Rice with tomato sauce	58 - 55	2
Fish sandwich	37	1
Wheat flour cakes	66	1
Powdered milk	-	2
Bean soup	37.3	1
Spaghetti with soumbala	36	1
Rice with vegetable sauce	65 - 62	2
Spaghetti/shell pasta	62.2	1
Plates	-	3
Spoons	-	2
Bowl of degué	36	1
Tray	36	1
Sauce bowl	-	1
Potato stew	40	1
Beans and rice	40	1

Bean sauce	40	1
Spaghetti	38	1
Raw vegetables	32	1
Couscous	40	1
Fish	37	1
Atiéké sauce	32	1
Total		85

3.4. Microbiological quality of food and utensils

Microbiological analyses revealed a high level of contamination in the samples. Out of 85 samples, 75 cases, or 88.23%, showed contamination. *E. coli* was the most frequently isolated germ, with a prevalence of 36.47%, followed by *Staphylococcus aureus* (34.11%), *Shigella* sp. (9.41%), and *Salmonella* spp. (8.23%) (Table 3). This high presence of *E. coli* is a clear indicator of faecal contamination and a widespread lack of adherence to good hygiene practices.

Table 3 Distribution of germs isolated in the sample dishes

Germs sought	**Number (n=85)**	**Frequency %**
E. coli	31	36.47
Staphylococcus aureus	29	34. 11
Shigella sp.	8	9, 41
Salmonella spp.	7	8.23
Total contamination and co-contamination	75	88.23

3.4.1. Distribution of germs by sample type

The study revealed varied contamination levels depending on the categories of food and utensils analysed.

Utensils

Among the eight utensils analyzed, 5 showed contamination, with the most common germ being *Staphylococcus aureus*, at a prevalence of 62.5%. One case of *Salmonella* spp. and another of *Shigella* sp. were also isolated (Table 4). These results highlight the role of utensils as vectors of cross-contamination.

Table 4 Distribution of germs isolated from restaurant utensils

Utensils	**Number**	**Pathogens tested for**			
		E. coli	*Salmonella* spp.	*Staphylococcus aureus*	*Shigella* sp.
Plates	3	-	01	01	01
Spoons	2	-	-	01	-
Sick bowl	1	-	-	01	-
Plateau	1	-	-	01	--
Sauce bowl	1	-	-	01	-
Total	08	-	01	05	01

Meal based on cereals and starchy foods

Among the 23 samples analyzed, *E. coli* was the most common, at 39.13%, followed by Staphylococcus aureus at 26.08% and *Shigella* sp. at 17.39%. A case of *Salmonella* spp. was also identified (Table 5).

Table 5 Distribution of germs isolated in cereal and starchy food meals

Food/meals	**Number**	**Pathogens sought**			
		E. coli	*Salmonella* spp.	*Staphylococcus aureus*	*Shigella* sp.
Peanut sauce Riz	5	01	01	-	01
Fat rice	3	01	-	-	-
Atieké	7	02	-	02	01
Atiéké sauce	1	01	-	01	-
Macaroni + raw vegetables	2	01	-	-	-
Rice with vegetable sauce	2	01	-	01	01
Spaghetti or coquillette	1	-	-	-	-
Spaghetti	1	01	-	01	01
Couscous	1	01	-	01	-
Total	23	09	01	06	04

Meal based on legumes

Among the 10 legume samples, significant contamination was identified: 50% by *Staphylococcus aureus*, 40% by *E. coli*, and 10% by *Salmonella* spp..

Table 6 Distribution of germs isolated from leguminous meals

Food/meals	**Number**	**Pathogens tested for**			
		E. coli	*Salmonella* spp.	*Staphylococcus aureus*	*Shigella* sp.
Beans	4	02	-	01	-
Couscous beans	3	01	01	01	-
Beans and rice	1	-	-	01	-
Bean soup	1	-	-	01	-
Bean sauce	1	01	-	01	-
Total	10	04	01	05	-

Meal based on dairy products

Contamination was identified in 21 samples. *Staphylococcus aureus* was present in 28.57% of cases, followed by *E. coli* (19.04%) and *Shigella* sp. (4.76%) (Table 7).

Table 7 Distribution of germs isolated from dairy-based meals

Foods/meals	Number	Pathogens tested for			
		E. coli	*Salmonella* spp.	*Staphylococcus aureus*	*Shigella* sp.
Yoghurt	3	-	-	-	-
Degué small millet	5	01			01
Degué couscous	3	01	-	-	-
Degué	8	02	-	03	-
Powdered milk	2	-	-	03	-
Total	21	04	-	06	01

Meal based on fruits and vegetables

Seven samples of fruits and vegetables, particularly in salads and raw vegetables, were collected. The identified pathogens include *E. coli* in 4 cases (57.14%), *Salmonella* spp. in 2 cases (28.57%), and *Staphylococcus aureus* in 2 cases (28.57%).

Meal based on meat and mixed products

Contamination has been detected in all meat product samples (by *E. coli* and *Staphylococcus aureus*). Mixed meals showed the presence of various pathogens, highlighting the risk associated with the complexity of the dishes.

4. Discussion

Field inspections have uncovered apparent non-compliance with Good Hygiene Practices (GHP) in collective restaurants in Ouagadougou. The staff have limited appropriate protective gear, such as aprons or hairnets. The premises are poorly maintained, infested with pests, and the food storage methods are inadequate. More than half of the raw materials are stored outdoors, and the cold chain is frequently broken. These findings support several studies, notably those by some authors, which highlight that poor environmental hygiene contributes to food contamination [11, 12].

Microbiological analysis reveals a direct link between poor practices and health risks. The most prevalent pathogen is *E. coli* (36.47%), indicating faecal contamination and inadequate personal and environmental hygiene. The presence of *Staphylococcus aureus* (34.11%) is also concerning, as it is often associated with human contamination by food handlers through their hands, hair, and nasal passages. This supports our observations regarding the lack of protective equipment and poor handwashing practices. Our findings align with similar studies in Algeria, such as those by [13-16], which all reported a high occurrence of these germs in meals.

Although most served meals are hot, often exceeding 50°C, pathogenic bacteria such as *Salmonella* spp. and *Shigella* sp. have been found in 8.23% and 9.41% of samples, respectively. This result, which differs from [17], who detected none of these bacteria, is likely due to post-cooking contamination. According to the United Nations Food and Agriculture Organization and World Health Organization, temperatures above 70°C are sufficient to kill most bacteria, indicating that their presence likely results from improper handling or cross-contamination after cooking [2]. This aligns with [18], who showed that cooked foods are at high risk when handled without proper sanitary precautions.

The detection of germs indicating faecal contamination and pathogens in the majority of analysed meals indicates a significant public health problem in Ouagadougou.

Previous research in Burkina Faso has already indicated that legumes are among the high-risk products, which is confirmed by our results [19]. Furthermore, our observations support those of [20], who demonstrated that poorly washed vegetables can be sources of contamination. These findings emphasise the urgent need to raise awareness and train catering staff in good hygiene practices, in order to significantly reduce the presence of pathogenic agents and ensure the food safety of consumers.

5. Conclusion

This study highlights that meals served in collective catering establishments in Ouagadougou pose significant public health risks. On-site investigations revealed frequent violations of good hygiene practices (GHP), including the lack of proper uniforms, improper food storage, and inadequate environmental management. These hygiene issues are confirmed by microbiological analyses, which show high contamination levels in meals and utensils. Pathogens such as *E. coli, Salmonella* spp., *Shigella* sp., and *Staphylococcus aureus* were identified, confirming the risk of food poisoning. Based on these results, it is crucial to take immediate corrective actions. Continuous staff training and enhanced health surveillance are necessary. These steps will significantly reduce contamination risks and enhance food safety for consumers in Ouagadougou/Burkina Faso.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflicts of interest regarding the conduct of this study and the publication of this manuscript.

References

[1] Hoffmann S, Devleesschauwer B, Aspinall W, Cooke R, Corrigan T, Havelaar A, et al. Attribution of global foodborne diseases to specific foods: results from a structured expert elicitation by the World Health Organization. PLoS ONE. 2017 ;12: e0183641. https://doi.org/10.1371/journal.pone.0183641

[2] FAO & WHO. Measures for controlling Campylobacter spp. in chicken meat: meeting report. Microbiological Risk Assessment Series No. 46. 2024.https://www.who.int/publications/i/item/9789240088085.

[3] Havelaar AH, Kirk MD, Torgerson PR, Gibb HJ, Hald T, Lake RJ, et al. World Health Organization global estimates and regional comparisons of the burden of foodborne disease in 2010. PLOS Med. 2015;12(12):e1001923.https://doi.org/10.1371/journal.pmed.1001923

[4] Hald T, Aspinall W, Devleesschauwer B, Cooke R, Corrigan T, Havelaar AH, et al. Estimation of the World Health Organization on the relative contributions of foods to the burden of diseases caused by certain foodborne hazards: a structured expert solicitation. PLoS ONE. 2016;11: e0145839.https://doi.org/10.1371/journal.pone.0145839

[5] Beshearse E, Nane GF, Havelaar AH. Use of the classical model for source attribution of diseases caused by pathogens. In: Expert Judgement in Risk and Decision Analysis. International Series in Operations Research and Management Science. Ed. Hanea AM, Nane GF, Bedford T, French S. Cham: Springer International Publishing; 2021. p. 373-385.https://doi.org/10.3201/eid2701.200316

[6] Havelaar AH, Sapp AC, Amaya MP, Nane GF, Morgan KM, Devleesschauwer B, et al. Burden of foodborne disease due to bacterial hazards associated with beef, dairy, poultry meat, and vegetables in Ethiopia and Burkina Faso, 2017. Front Sustain Food Syst. 2022;6:1024560.https://doi.org/10.1371/journal.pmed.1001923.

[7] Dione MM, Diarra S, Ilboudou G, Konkobo-Yamego C, Lallogo VR, Roesel K, et al. Value chain assessment of animal-source foods and vegetables in Ouagadougou, Burkina Faso, considering food safety, quality, and hygiene perceptions and practices (ILRI Research Report 87). International Livestock Research Institute; 2021.https://cgspace.cgiar.org/handle/10568/117352

[8] Nikiema MEM, Gandara MP, Compaore KAM, Ba AK, Soro KD, Nikiema PA, et al. Contamination of street food with multidrug-resistant Salmonella in Ouagadougou, Burkina Faso. PLOS ONE. 2021;16(10):e0258242.https://doi.org/10.1371/journal.pone.0258242.

[9] Botha E, Appiah-Nkansah ND, Asiamah-Tandoh AO, Fofie JY, Ahene RO. Public Health Concerns Regarding Food Contamination in Ghana. PLoS ONE. 2023;18(8).https://doi.org/10.1371/journal.pone.

[10] Chaibou Yaou, Mahamadou Aboubacar Ali, Mamadou Lewamy, Hassimi Sadou. Microbiological quality control of street food sold in schools in Niamey (Niger). Int Rev Biol Chem Sci. 2024;18(3):938–949.https://doi.org/10.4314/ijbcs.v18i3.17.

[11] Kone A, Sika A, Adingra A, Zamble BA, Toule AC, Koffi-Nevry R. Microbiological contamination of cooked dishes in collective and commercial catering at public universities in Abidjan, Côte d'Ivoire. Rev Int Sci Bio Chim. 2022;16(1).https://doi.org/10.23880/fsnt-16000189

[12] [Michel Dione, Guy Ilboudo, Claudia Ganser, Adama Paré, Laurencia T. Songré-Ouattara, Michelle D. Danyluk, et al.] Washing chicken carcasses with water proves unreliable as a means of reducing bacterial contamination under unhygienic market conditions in Burkina Faso. J Food Prot. 2025;88:100598.https://doi.org/10.1016/j.jfp.2025.100598.

[13] Mayoré A, Tidjani A, Bessimbaye N, Asséta K, Kuan A, René D. Characteristics of the street food sector in N'djamena, Chad. Food Sci Nutr Technol. 2017;2(3):1–7. https://doi.org/10.23880/fsnt-16000189

[14] Naibe Maimangyang S. Assessment of food quality in school environments in N'Djamena, Chad [Master's thesis]. University of Montreal, 2019.https://doi.org/1866/22404

[15] Nassarawa SS, Luo Z, Lu Y. Conventional and emerging techniques for detecting foodborne pathogens in horticultural crops: a leap towards food safety. Food Bioprocess Technol. 2022;15(6):1248–1267.https://doi.org/10.1007/s11947-021-02730-y.

[16] Scott TA, Baker KS, Trotter C, et al. Shigella Sonnei: Epidemiology, evolution, pathogenesis, resistance, and host interactions. Nat Rev Microbiol. 2025;23(5):303-17.https://doi.org/10.1038/s41579-024-01126-x.

[17] Raschid-Sally L, Jayakody P. Factors and characteristics of agriculture using wastewater in developing countries: results of a global assessment. Adv J Com. 2009;12(1).https://hdl.handle.net/10568/39914

[18] N'Guessan BE, Kouakou AL, Kouamé KA, Kouakou BH. Distribution circuit of fresh and frozen fish in Abidjan: hygiene and microbiological assessment. Rev Maroc Sci Agron Vét. 2018;6(1):110–117.https://doi.org/10.34624/amis.v6i1.543

[19] Nonato IL, de Almeida MO, Grazieli BP, Daurea AD. Nutritional issues concerning street foods. J Clin Nutr Diet. 2016 ;2(1):1–7.http://dx.doi.org/10.4172/2472-1921.100014

[20] Randriambanona H, Randriamalala JR, Carrière SM. Regeneration of indigenous forest and vegetation dynamics in non-native Pinus patula plantations in Madagascar. 2019; p46.agascar. 2019; p46. https://www.documentation.ird.fr/hor/fdi:010076176