Original Research Article

Factors contributing to unsafe Food Processing and Preservation among Food Handlersin Port Harcourt, Nigeria

Abstract

Background: Unsafe food processing and preservation among food handlers has been one of the common causes of food and waterborne diseases. This study aimed to identify factors contributing tounsafe food processing and preservation practices among food handlers in Obio-Akpor LGA of Rivers state.

Materials and Methods: The study was a descriptive cross-sectional study whichassessed 365 food handlers in Obio/Akpor Local Government Area of Port Harcourt, Nigeria. A semi-structured questionnaire was used to collect relevant data. Quantitative datawas presented as frequencies and percentages. All statistical tests were set at a significance level of $p< 0.05$.**Results**:Findings show that out of the 365 food handlers who participated in the study,only 43.0% had a set of standard practice guidelines. 47.4% of the food handlers practiced unsafe food processing and preservation methods.Duration of practice for more than 5 years (63.6% vs. 36.4%; p=0.04) and scale of business (large/small) (turnover>NGN50,000.00) ((58.4%, vs. 10.4%, p=0.05) were significantly associated with unsafe food processing and preservation practicesas handlers who have been in the food business longer and those with larger scale food outlets tended to have better standards.

Conclusion: Unsafe food processing practices exist among food handlers with nearly half of the food handlers studied having poor practices. Inadequate working experience and the presence of more small and medium scale businesses was found to be the factors affecting unsafe food processing and preservation practices in our locality.

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Keywords: food safety, Food service, food borne diseases, good practices

Introduction

Food is the most essential of the three basic physiological needs of all human beings according to the Maslow's hierarchy of needs(1). Food is a necessary requirement for the sustenance of life.Six principles guide the food system (plant or animal) from production to consumption. These arethat the food is safe, authentic and nutritive. Othersare that the food should be produced by sustainable systems,the highest ethical standards are employed and need to have respect and consideration to ourphysical, biological and the social environment(2).In order to achieve all that have been outlined in the principles, wholesome food processing and preservation are central to these objectives.

According to Food and Agricultural Organization(FAO)(3), the most basic level of food processing is preservation.In prehistoric ages, when the ancient man realized food was essential for his sustenance and survival, his earliest action was harnessing nature to preserve his food such that in temperate climate, the froze seal meaton the ice while those in the tropics dried food in the sun (4). He later worked out other basic methods such as fermenting, preserving with salt,roasting, smoking, steaming, and sand oven baking.Saltpreservation was particularly common for foods that constituted diets that warriors and sailors depended on since they were usually apart from the society for long stretches of time. (5)

Primary food processing is aimedat making raw materials edible, such as milling wheat into flour, while secondary food processing turns the ingredients into familiar foods, such as wheat flour into bread, cake. Tertiary food processing is the commercial production of what is commonly called convenience or processed food. These are ready-to-eat or heat-and-serve foods, such as pasta, candy, soft drinks, canned products like soups and meat. (6)

Food processing hasenormous benefits which include; preservation, removal of non- edible part, making marketing and distribution easier. In addition, processing increases yearly availability of many fooditems, enables transportation of delicate perishable foods across long distances and makes many kinds of foods safe to eat by delaying spoilage and de-activating pathogenic micro-organisms (7).

Any deviation from ethical practices during processing and preservation could produce unwholesome foodswhich pose serious concerns over the health andsafety of the practitioners and consumers (8).

Unsafe food processing and preservation among food handlers has been one of the basic causes of food borne diseases and infections(9). These unsafe activities have been noted to transverse the whole supply chain of food industry from agricultural raw materials (plant and animal) to retailed street foods (10). Thesafety of food is an integral part of food safety and is the protection of food from microbial, chemical and physical hazards that may occur during all stages of food production.

Food safetythusgives the “assurance that food will not cause harm to the consumer when it is prepared oreatenand should meet the initial intention” (11).

Factors like globalization, rapid urbanizationand population growth, increase in theworking-class population, especially among women, have led to a significant increase in the growth of food service outlets and street foods. In order to meet up with demand, what is often noted is a resort to poor food handling, poor storage, unsanitary environment, poor personal hygiene practices, lack of good water supply and improper waste disposal.These are some of the identified factors associated with unwholesome food processing and preservation. (12,13)

According to some reports, unsafe food causes 600million cases of food borne disease and 420,000 deaths worldwide, resulting in the loss of 33 million healthy life years (DALYS) with the number said to be likely an under estimation. In Nigeria, Ezirigweand colleaguesreported that more than 200,000 persons die of food related illness leaving the cost of food borne disease in Nigeria at 3.6 billion dollars per annum. Hygiene of

food handlers, food processing methods, improper preservation practices are possible sources for food borne diseases. (14)

Obio/Akpor is not only the second richest local government in Nigeria but a very fast developing urban area, hence urbanization and its accompanying increase in demand for street foods will lead to an increase in unwholesome food processing and resultant food borne disease outbreaks. Against this background, it is imperative to identify factors affecting unsafe food processing and preservation practices among food handlers in Obio/Akpor LGA of Rivers state.

Materials and methods

Study design

A descriptive cross sectional study was employed for this study.

Study Area

The study was carried out in Obio/Akpor local Government Area of Rivers state. ThisLGA isin the metropolis of Port Harcourt, one of the major centers for economic activity in Nigeria. Obio/Akpor is one of the 8 local government areas that form the Rivers East senatorial district. It consists of 17 electoral wards administered by the Obio/Akpor Local Government Council. The indigenesareIkwere's, but due to its urban

status, it also comprisesof people from various tribes of Nigeria and other nationalities.

Study population

The study population comprised 365 food handlers in Obio/Akpor LGA of Rivers state.

Sample size determination

The sample size was determined using the formula for descriptive studies (15)

$$n = \frac{Z^2_{1-\alpha/2} P(1-P)}{d^2}$$

P=the prevalence of poor food safety practices in a study conducted in South-western Nigeria (9).A minimum sample size of 365 was calculated.

Sampling procedure

Multistage sampling method was used in the selection of the wards for the study in the local government. A total of 4 wards were selected and two (2) communities were randomly selected from each of the 4 wards, making a total number of eight (8) communities selected for the study. Systematic sampling procedure was adopted in the recruitment of all food handlers from the nearest point till the minimum sample size of 46 was reached for each community.

Method of data collection

Quantitative study

A semi-structured questionnaire and an observational checklist were used to capture socio-demographic data, Food Processing/Preservation practices, methods used by respondents in compliance to the standards of serving food and other variables related to the study objectives.

Prevalence of Unsafe Food Processing and preservation practice score

In measuring prevalence of unsafe food processing and preservation practices, twenty-six (26) responses on the questionnaire were scored, with (1) havingsafe food processing and preservation practices and (0) having unsafe food processing and preservation. The scores were summed for the 365 respondents. Participants having safe food processing and preservation practices were scored (14-26) and those with unsafe food processing and preservation practices were scored (0-13).

Data Analysis

Data from the questionnaires were extracted, coded and entered into Microsoft excel version 2010 and imported into the Statistical Package for social sciences (SPSS) version 22 for data analysis. Categorical data was presented in frequencies and percentages, while continuous data was presented in means and standard deviations. Inferential Statisticswasdone using Chi-square (X^2) test. A p-value ≤ 0.05 was considered statistically significant.

Results

The age group 30-39 had the highest number of food handlers (150/365). Also, there were more females (74.5%). Christianity was the dominant religion of the handlers (92.0%). More food handlers were married individuals (59.4%). Also, most of the food handlers were secondary school leavers (46.0%). Most of the food handlers (79.2%) had been in thefood handling business for less than 10 years. Small and medium scale businesses were practiced by themajority of the food handlers(25.7%and 61.4% respectively) whereas only about12.9% had a large-scale business.

Table 1: Socio-demographic Characteristics of the respondents

Variables	**Frequency (n=365)**	**Percentage (%)**
Age		
20-29	120	32.9
30-39	150	41.1
40-49	77	21.1
50-59	18	4.9
Mean		***34.6 ± 8.14 years***
Sex		
Male	93	25.5
Female	272	74.5
Tribe		
Igbo	108	29.6

Ikwerre	72	19.7
Yoruba	54	14.8
Hausa	14	3.8
Others	117	32.1
Marital Status		
Married	217	59.4
Single	138	37.8
Widowed	5	1.4
Divorced	5	1.4
Educational Level		
None	17	4.7
Primary	32	8.8
Secondary	168	46.0
Tertiary	148	40.5
Religion		
Christianity	336	92.0
Islam	28	7.7
Others	1	0.3
Total		
Duration of workas a food handler (years)		
1-3	131	35.9
4-6	90	24.7
7-9	68	18.6
≥10	76	20.8
Mean		***6.12 ± 4.40***
Types of food handled (n=1548)		
(Multiple response)		
Grains	330	21.3
Fried foods	323	20.9
Fruits & Vegetables	317	20.5
Meat/Fish	297	19.2
Beverages	281	18.1
Type of business		

Small Scale	94	25.7
Medium Scale	224	61.4
Large Scale	47	12.9
Estimated daily turn over		
≤10000	93	25.5
11000-20000	91	24.9
21000-30000	41	11.2
31000-40000	77	21.1
41000-50000	27	7.4
>50000	36	9.9
Mean	***34,731.51 ± 46,281.20***	

Table 2 below shows that majority of the food handlers undergo food safety training (72.6%), whereas only 43.0% has a set standard of practice guidelines. Thawing of foods below the room temperature was practiced always by 20.0% of the respondents. 68.2% wash their hands before handling food whereas only 45.2% always cook food as quickly as possible once it is taken out from the refrigerator. About 40.3% of food handlers prepare salad on request, 64.4% practices the reuse of cooking oil while 21.4% use dark coloured oil(always 11.0% and sometimes 10.4%). The majority of the handlers use additives to make cooking faster and avoid spoilage during food processing (always 11.0% and sometimes 49.9%). Prevalence of Unwholesome Food Processing and preservation practices score revealed that 47.4 % of food handlers were associated with unsafe food processing practices.

Table 2: Food Processing/Preservation practices of the respondents

Variables	Frequency (n=365)	Percentage (%)
Have a set standard of practice guide		
Yes	157	43.0
Undergo regular food hygiene safety training		
Yes	265	72.6
How often do you buy food ingredients		
Daily	112	30.7
Weekly	227	62.2
Monthly	26	7.1
What you look out for during food purchase (n=845) (*Multiple response*)		
Wholeness	330	39.0
Freshness	315	37.3
Quantity	200	23.7
Thaw frozen food to a temperature below the room temperature		
Always	73	20.0
Sometimes	189	51.8
Never	103	28.2
Re use of cooking oil		
Always	87	23.8
Sometimes	148	40.6
Never	130	35.6
Use of dark coloured oil		
Always	40	11.0
Sometimes	38	10.4
Never	287	78.6

Use food additives to make food cook faster, avoid spoilage during processing		
Always	40	10.9
Sometimes	182	49.9
Never	143	39.2
Use of chemicals to hasten food fermentation/cooking		
Always	5	1.4
Sometimes	143	39.2
Never	217	59.4
Washing of hands in a bowel containing water		
Always	95	26.0
Sometimes	56	15.3
Never	214	58.6
Clean and sanitized work area, cutting boards, knives and utensils		
Always	284	77.8
Sometimes	77	21.1
Never	4	1.1
Wash your hands before handling food		
Always	249	68.2
Sometimes	116	31.8
Cook food as quickly as possible once it is taken out from the refrigerator		
Always	165	45.2
Sometimes	184	50.4
Never	16	4.4

Cook food within the required time

and at the recommended temperature		
Always	124	34.0
Sometimes	234	64.1
Never	7	1.9
Covering of already prepared food		
Always	281	77.0
Sometimes	69	18.9
Never	15	4.1
Presence of toilet facilities		
Available	205	57.8
Unavailable	150	42.2
Use of non-portable water		
Always	2	0.6
Sometimes	53	14.5
Never	310	84.9
Prevalence of Unsafe Food Processing and preservation practices score		
Present (0-13)	173	47.4
Absent (14-26)	192	52.6

Table 3 revealed that more than half (63.6%) of the respondents always reheat aswellas serve food at the right temperature. Less than half (38.9%) sometimes usekitchen utensil for tastingwhile 23.0% alwaysminimizes bare hand contact with already cooked food.Majority (69.0%) of respondents practice good personal hygiene (bathing before going to work, keep fingers short and clean). More than half of the food handlers (57.5) do not use scoop and tongs for food service. About 63% of food handlers never minimizes bare hand contact with cooked foods.

Table 3: Adherence to the standards of serving food

Variables	F(n=365)	Percentage (%)
Serving food at the right temperature (Reheating)		
Always	232	63.6
Sometimes	129	35.3
Never	4	1.1
Change to clothing knownto food service		
Always	161	44.1
Sometimes	183	50.1
Never	21	5.8
Use of kitchen utensil for tasting		
Always	101	27.7
Sometimes	142	38.9
Never	122	33.4
Minimizing bare hand contact with already cooked food.		
Always	84	23.0
Sometimes	51	14.0
Never	230	63.0
Use of scoops and tongs		
Always	101	27.7
Sometimes	54	14.8
Never	210	57.5
Practicing good personal hygiene. Bathing before going to work, fingers kept short and clean		
Always	252	69.0

Sometimes	38	10.4
Never	75	20.6

Table 4showed the food storage practicesofthe respondents.Only 19.5% of the respondents always take food out of the original package and store in tightly covered containers which is protective and easy to clean. About 17.3% always keep chemicals away from food items while 30.9% of the food handlers allow food thaw on table tops. The majority use insecticides (33.4%) to get rid of pests as wellasother methods whereas cleaning up was the least method mentioned for getting rid of pests (2.1%).

Table 4: Food Storage technique practiced by the respondents

Variables	**Frequency (n=365)**	**Percentage (%)**
Take food out of the original package store in tightly covered containers which is protective and easy to clean		
Always	71	19.5
Sometimes	178	48.9
Never	115	31.6
Store chemical products away from food items		
Always	63	17.3
Sometimes	60	16.4
Never	242	66.3
Store foods at the right temperature.		
Always	257	70.4
Sometimes	88	24.1

Never	20	5.5
How you thaw foods brought out of the freezer (n=920) **(*Multiple response*)**		
Running water	289	31.4
Left on the surface to defrost	285	30.9
In the refrigerator	191	20.8
Microwave	155	16.9
Where prepared food is kept (n=600) **(*Multiple response*)**		
Food warmer	232	38.7
In a plastic container	152	25.3
In the freezer	108	18.0
Left in the pot	108	18.0
Method used to get rid of pest (n=434) **(*Multiple response*)**		
Chemical spray	16	3.7
Cleaning up	9	2.1
Camphor	29	6.7
Fumigation	17	3.9
Insecticides	145	33.4
Pest Control/Pesticides	85	19.6
Rat gum/Poison	65	14.9
Sniper	68	15.7

Table 5 shows that no statistically significant association was observed between age, sex, marital status, educational status, income of the respondents and unwholesome food processing and preservation practices($p>0.05$). Statistically significant association was observed between the duration of work as a food handler and unwholesome food processing and preservation practices, as respondents with 5 years or

less work experience had a statistically significantly higher proportion for having unwholesome food processing and preservation practices than those that have worked for greater than 5 years (63.6% vs. 36.4%; p=0.04). Similar observation was also recorded between scale of business and unwholesome food processing and preservation practices, as respondents who have either small or medium scale businesses had a statistically significantly higher proportion for having unwholesome food processing and preservation practices than those with large scale businesses (58.4% smallscale, 31.2%medium and 10.4%large).

Table 5: Association between Socio-demographic characteristics, and Unsafe Food Processing and preservation practices

Variables	**Unwholesome Food Processing and preservation practices**		**Total**	***Df***	***χ^2 (p-value)***
	Present	**Absent**	**Total**	***Df***	***χ^2(p-value)***
Variables	**F (%)n=173**	**F (%)n=192**	**Total**	***Df***	***χ^2(p-value)***
Age					
>30	99 (57.2)	127 (66.2)	226 (61.9)	1	2.70 (0.100)
≤30	74 (42.8)	65 (33.8)	139 (38.1)		
Sex					
Male	45 (26.0)	48 (25.0)	93 (25.5)	1	0.01 (0.919)
Female	128 (74.0)	144 (75.0)	272		

			(74.5)		
Marital Status					
Married (in union)	99 (57.2)	118 (61.5)	217 (59.5)	1	0.512 (0.474)
Single (not in union)	74 (42.8)	74 (38.5)	148 (40.5)		
Educational Status					
≤Secondary	110 (63.6)	107 (55.7)	217 (59.5)	1	2.01 (0.156)
Tertiary	63 (36.4)	85 (44.3)	148 (40.5)		
Daily turnover (₦)					
≤30000	109 (63.0)	116 (60.4)	225 (61.6)	1	0.16 (0.612)
>30000	64 (37.0)	76 (39.6)	140 (38.4)		
Duration of work as a food handler (years)					
≤5	110 (63.6)	101 (52.6)	211 (57.8)	1	4.05 (*0.04*)*
> 5	63 (36.4)	91 (47.4)	154 (42.2)		
Scale of business					
Small Scale	54 (31.2)	40 (20.8)	94 (25.7)	1	5.85 *(0.05)**
Medium Scale	101 (58.4)	123 (64.1)	224 (61.4)		
Large Scale	18 (10.4)	29 (15.1)	47 (12.9)		

Discussion

The socio-demographic characteristics, showedthat majority of the food handlers were within the age 40years and below,signifying that food handling is essentially a business ran majorly by the youth. Females were the predominant food handlers in food handling business in the study areawhich is in accordance with the prevailing standards and trend that cooking is a feminine business. These compareswell with a study by Ituma et *al*. (16) on the food hygiene knowledge, practice and safety training intervention among food handlers in AbakilikiNigeria, where76.5% of the food handlers were female, but disagreed with Kasturwar and Shafee(17) who reported that 62.7% of food handlers in a study at aprivate medical college were males. Thisdifference might be due to different cultural settings where males work more than females.The majority of the food handlers practiced small and medium scale businesses with only about less than ten percent earning a daily turnover of fifty thousand naira (NGN50,000) and above. This is consistent with the study carried out among food handlers in Ijebu Ode, South-West Nigeria by Adebukola*et al*. (9)in their report, 84.50% of the food handlers had turnover below thirty thousand naira (NGN30,000).

Food handling practices

Unwholesomefood handling practices have been identified as the leading cause of food borne diseases with food handlers as the culprit (18). In this present study, nearly half of the food handlers had unwholesome food processing practice. This study is similarto the report ofAzanaw*et al*.(19)Galgamuwa*et al*. (20), Adebukola*et al*. (9) Anuradha &Dandekar (21) who reported about 49.0%, 40.5%, 31.5%, and 43.8% respectively for poor food safety practices.Likewise,Otu and colleagues (22) recorded a prevalence of 23.0%. On the contrary,Fasoro et al. (23), Legesse et al.(24) and Dersо*et al*.(25) noted a good food handling prevalence of 80.60%, 67.4% and 67.6% respectively in their own studies. These variations in prevalence rates might be due to differences in study locations, vision and mission of outlets and scaleof food business. The prevalence level from the current study suggests that more efforts still need to be put in place to ensure better practices among food handlers. In the current study, despite a majority of food handlers undergoing regular food safety training, only less than half had a set standard of practice guideline.This simply means that knowledge does not necessarily translate into adequate good food handling practice (9,26,27,28).Findings from the study showed that only few foodhandlers thaw their food at a temperature below the room temperature whereas a majority leave foods to thaw on the surface. Studies had shown incorrect food thawing practices demonstrated by both consumers and food

handlers (28,29,30). Over reuse of cooking oil exposes unsaturated fattyacids in the oil to thermal oxidation andthese leads to an increase in the amount of trans fatty acids in the oil (31,32) which has been shown to bedetrimental to the health of the consumers. Findings in this studyreported that more than half of food handlers reuse cooking oil, with some using the oil even when it is dark in color. More than half of the respondents made use of chemical as food additives that included potash, drugs, sodas and detergent, sugar to cook food faster, avoid spoilage during processing andimprove palatability. Some of these additives pose a major risk to the consumers as a study conducted in Abakiliki, Nigeria by Ibiam*et al*.(33) showed a reduction in the nutritional quality of eggs cooked with additives and thus should be discouraged, while a study by Iweka(34), revealed that potash altered the liver function as well as physical activity of the Wister Rats. Thus its consumption should be restricted and better sources of potassium like Banana should be consumed. Inetianbor*et al*., (35) advocatedconsumption of foods in their fresh natural state to avoid health consequencesof food additives. From this study, it was observed that nearly half of the food outlets studied had open doors and windows. These encourage the activities of vectors and rodents - birds, flies, cockroaches, rats/mice and ants. They carry micro-organismsand deposit on food. Control of Pests, disease vectors and rodentsare crucial anywhere food is handled (36). Nearly half of the food outlets studied

had no portable water and as such relied on water vendors or use of buckets and gallons to fetch and store water. The absence of portable running waterexplains reason why a good number of the food handlers in our study practice hand washing in bowls. Lack of toilet facilities is said to be one of the obstacles to food safety in Nigeria (37). From the current study, nearly half of the food handling outlets had no toilet facility for customers, thus leading to passage of waste around the surroundings which in turn attracts presence of insects and rodents. The study recorded a high percentage of food handlers keeping chemical substances with food that can result in cross-contamination againstinstructions by FAO/WHO food handlers guide (36), likewise, it was reported that some of the handlers used chemicals to quicken food ripening, prevent pestson stored food products anduse to hasten food fermentation and cooking. Studies had revealed that these chemicals can be detrimental to health as it causes various health hazards like headache, dizziness, mood disturbances, mental confusion, seizuresand even cancer(38,39,40).

Factors affecting unsafe food processing and preservation practices

The study showed no statistically significant association between socio-demographic characteristics and unwholesome food processing and preservation ($p>0.05$). The result of the study was related to the study by Okojie(41) and Ncube*et al*.(42)which recorded no statistical association between sex, educational status and hygiene practices, among food

handlers (p=0.624 and p=0.362 respectively). Ituma*et al*. (16) alsorecorded no significantdifference in the food safety practices of food handlers based on the level of education. These findings showed that unsafe food processing practices was not determined by the sex, age, or educational status of the food handlers. Whereas a study by Adebukola*et al*. (9) in another part of Nigeria, showed a significant relationship between educational qualification and the practices of food handlers (p=0.0011).Likewise, Faremiet *al*.(30), attributed the high level of good practice of food handlers to theirhigh educational attainment.

Afoloranmi*et al*. (43) found theage of vendors to be related to their food safetyand hygiene practices. There was a significant association between the duration of work as a food handler and unsafe food processing practice as practitioners that have worked for more than five years tended to have better practices. This finding was in tandem with the saying that “practice makes perfect”. These findings corroboratethe findings by Nee and Sani(44), they reported a statistically significant relationship between food handlers’ food safety practices and their duration of work experience.On the contrary, Ncube*et al*.(42) and Abdul-Mutalib*et al*.(29) reported a non-significant correlation (p>0.05) between food handling work experience and all other variables relating to food handling.The presence of a low level of working experience as food handlers may increase the risk of food contamination as well aswrong food handling practices.The current study also showed a

statistically significance association between scaleof business and unsafe food processing and preservation practices, as

small and medium scale businesshad a statisticallysignificant association with unsafe preservation practices. They were associated with unsafe food practices. This can be attributed to the possibility of larger food outlets (large scale businesses) having more resources capabilities and knowledge to provide morestandard operation and training for their employees. The current study tallies with a study byMamoun*et al*. (45), which showed thehighest food handling practices were among large scale businesses. On the contrary Adebukola*et al*.(9), recorded nosignificantrelationship between thescale of business and food safety practices (p=0.654).Azanaw*et al*. (19), reported food safety training, marital status, supervision by healthprofessionals and knowledge as statistically associated variables with food safety practices. Their study agrees with the current study as themajority of the food handlers in their study had regular food safety training, but still exhibit other some practices. This may be attributed to irregular supervision by health professionals found in the present study. Regular supervisionby health professionals can awaken safety consciousness among food handlers, as no one would want to be caught unawares.

Conclusion

Unsafe food processing practices exist among food handlers with nearly half of the food handlers studied having poor practices. Inadequate working experience and the presence of more small and medium scale businesses was found to be the factors affecting unsafe food processing and preservation practices in Obio-Akpor.There is need therefore for continuous training of food handlers on standard practices. Regulatory units should also increase the monitoring, supervisoryand enforcement activities.

Ethical Approval And Consent

Written ethical clearance was obtained from the University of Port Harcourt Research Ethics Committee (UNIPORT REC) with an approval number (UPH/CEREMAD/REC/MM68/022). Written informed consent was obtained from all participants after informing them of the purpose of the research.

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