Assessments of Nutritional Profile and Shelflife of Cuisines Sold in Selected Restaurants for Family Consumption in Urban-Ibadan, Nigeria

Abstract

Family sustainability necessitates adequate consumption of nutritious foods; however, in recent times, most families are preoccupied with various activities as a result of westernization, which introduced the work-family system, leaving them with insufficient time to cook at home, prompting them to visit Quick Service Restaurants (QSRs) for their meals. As a result, this study assessed the nutritional composition of some QSR cuisines consumed by families in Ibadan. Five out of teneateries in located in Challenge and Awololowo Avenue area both located in urban-Ibadan Oyo State were selected. The sample foods for the study were collected in take-away packs as consumed in the eateries, including Amala with ewedu, Chicken and offals were subjected to proximate analysis [Crude fibre (CF) and protein] and evaluation of the microbial load [Total Bacterial Count (TBC)] to determine their nutritional composition (NC) and shelf life respectively as described by the Association of Official Analytical Chemists (2010).Offals had the least content of CF at 0.30%, while chicken (10.0%) had the highest. Meats (51.25 and 41.5%, chicken and offal, respectively) had the highest percentage of protein, while Amala (10.0%) had the least. There was no trace of TBC on the zero-day except Amala with <1 unit, but it continued growing and multiplying till day3 with more than 4units.This study sheds light on the nutritional value of popular Nigerian cuisines, thereby promoting balanced and diverse dietary options for families in Ibadan, Nigeria. The findings emphasize the importance of considering both NC and shelflife for a holistic understanding of the nutritional value of cuisines from QSR. The findings also highlight the need for public health efforts to promote safe and balanced use of QSR meals in family diets.

Keyword: Work-Family, Adequate consumption, Nutritional Composition, Nigerian Cuisines, Quick Service Restaurants

1. INTRODUCTION

A family is a group of people who are related by blood, adoption, or marriage and who hold similar values and views (Bokek-Cohen, 2020). The spouses and children could all be considered family members. They spend a lot of time together cooking, cleaning, washing, and doing other home tasks, but in modern times, the stresses of civilization and job have disrupted some family ties. Therefore, most families resort to quick fixes by visiting fast food production joints.

A fast food restaurant (FFR), commonly referred to as a quick service restaurant (QSR) in the business, is a particular kind of eatery that is distinguished by its quick cooking and lack of table service. Even though seats may be available, the food served in fast food restaurants is typically prepared in large

quantities ahead of time, kept hotz, completed, and packaged to order. (Nyamogosa, &Obonyo, 2022; Bowman, 2014; Sand, 2007).

Fast food business is now a multibillion naira industry that has expanded quickly into the twenty-first century in several nations due to the growing popularity of eating at fast food outlets worldwide. People find it quite pleasant because fast food restaurants frequently offer takeout or takeaway in addition to sit-down service, providing an alternative to meals prepared at home (Mendocilla, Miravitlles, &Matute, 2021). In the developed countries where fast food consumption is habitual, a lot of research efforts have identified some factors that may lead to excessive weight gain such as massive serving size, high energy density, palatability (appealing to primordial taste preferences for fats, sugar and salt), high content of saturated and trans fatty acids and low content of fiber (Ebeling, 2012; Bowman, 2014; Sand, Jansen, Carol, Henry, Sanbir and Ashwine, 2007). Nutrient and safety analyses of food prepared by eateries in Nigeria is necessary due to the ingredients used, preparation methodsand methods ofhandling. Nigerian fast food may differ from those in developed nations, making it impossible to estimate the contribution of fast food to Nigerians' nutrient intake from food composition tables calculated for food prepared in other countries.

2. MATERIALS AND METHODS

2.1 Study Area

Ibadan is an ancient city in Southwestern Nigeria, Ibadan is the capital of Oyo state, Nigeria. The city houses eleven (11) local governments, comprising five urban (Ibadan North, Ibadan Northeast, Ibadan Northwest, Ibadan Southeast andIbadan Southwest local government area and six semi-urban (Akinyele, Egbeda,Ido, Lagelu, Oluyole, and Ona aralocal government area).

Challenge (Ibadan Southwest local government area) and Awolowo Avenue (Ibadan Northlocal government area) were purposively selected due to rampantness of the fast food restaurants located in the vicinity.

2.2 Materials

The food samples (Jollof rice, fried rice, Amala (yam flour paste with ewedu (vegetable), Semovita with eforiro (vegetable), offal, chicken, meat pie and Ice cream) were purchased and packaged in take away packs as consumed infast food restaurants.

2.3 Preparation of the samples

All the main products from quick service restaurants were purchased and used as samples for experimental examination and shown in table 1

Table 1: Preparation of the samples as stated by the producers

Samples	Description and Method of Preparation	Preparation for Analysis
Conventional		
Fried rice	Rice cooked (or baked) with ground tomatoes, peppers, garnished with diced meat and other spices	Thoroughly marched together until blended
Jollof rice	Rice cooked in vegetable oils, liver chop, meat, carrot, green beans and spices are added to taste	Thoroughly marched together until blended
Ethnic		
Amala/ewedu	Prepared by mixing dried yam flour powder in boiled water into a thick paste, served with vegetable soup (Ewedu) and pepper stew	Thoroughly marched together until blended
Semo/efo	Prepared by mixing dried packaged semolina powder in boiled water into a thick paste, served with vegetable soup (Efo) and pepper stew	Thoroughly marched together until blended
Meat		
Chicken	Dressed, boiled in seasoning and chicken then fried	Oven dried and grinded
Offal	Seasoning boiled and Fried inner part of cattle	Oven dried and grinded
Snacks		
Pie	Prepared by mixing flour, sugar, pinch of Salt, butter and adding water to mold, garnish with seasoned meat, carrot, potato (irish	Thoroughly marched together until blended
Dessert		
Ice cream	Mixed commel with water	

2.4 Experiment analysis of food samples

All the analyses were prepared in triplicate

- **Proximate Composition**

Jollof rice, fried rice, Amala (yam flour paste with ewedu (vegetable), Semovita with eforiro (vegetable), offal, chicken, meat pie and Ice cream were analyzed for moisture, ash, crude fibre, protein, crude fat and the carbohydrate according to the method described by AOAC, 2017

- **Determination of Minerals content**

Atomic absorption spectrophotometer was used to determine Calcium, Magnesium, Potassium, and Sodium through dry ash extracts as described by AOAC, 2017

- **Microbiological Properties determination**

Microbiological Properties; total viable count, bacterial count, fungi; (mould count), and coliform count were determined using the methods described by Merck, 2010

3. RESULTS AND DISCUSSION

3.1 Proximate composition of foods served in Ibadan Fast food Restaurants

The proximate analysis of selected foods served in fast-food outlets, as presented in Table 2, revealed a comprehensive overview of the moisture, ash, fiber, fat, protein, and carbohydrate (CHO) content of conventional, ethnic, meat, snacks, and dessert categories of food. Under the conventional food category, Fried rice and Jollof rice show significant differences ($p<0.05$) in their nutritional profiles. Fried rice has a higher fat content (16.21±0.01%) compared to Jollof rice (10.55±0.01%), which may be due to the cooking process and ingredients used. Conversely, Jollof rice has a higher protein content (16.11±0.01%) than fried rice (10.65±0.01%), making it a more protein-rich option for consumers (Thangaraj, 2016). In terms of ash content, the Jollof rice is significantly higher ($p<0.05$) than Fried rice with (5.20% and 3.70%) respectively which is an indication of the amount of minerals present in a matter (Ashraf and Hamidi-Esfahani, 2011).

Amala/ewedu and Semo/efo being traditional Nigerian dishes and ethnical food as categorized in table 2. It was notable that Semo exhibit lower fat contents compared to the Amala, with values of 10.00±1.41% and 5.00±1.41%, respectively. This could be due to the use of indigenous ingredients and cooking methods that prioritize healthful preparation(Thangaraj, 2016). Notably, Semo/efo has remarkably high fiber content (9.00±1.41%) than Amala, which is beneficial for digestive health and which reduces serum cholesterol level, hypertension, and diabetes (Food and Agriculture Organization (FAO), 2024; Babalola & Alabi, 2015).

For meat category, Chicken has the highest protein content (51.25±0.01%) among the foods analyzed. This aligns with the global understanding of chicken as a lean protein source. Offal, on the other hand, has a higher ash content (7.90±0.14%), indicating a rich mineral profile, which is essential for various

bodily functions (Thangaraj, 2016). Notably, the carbohydrate content of offal is significantly higher ($p<0.05$) than that of chicken.

Pie, categorized under snacks, has moderate protein content (22.80±0.14%) and relatively low carbohydrate content (46.90±0.14%), suggesting it could be a more balanced snack option in terms of macronutrient distribution. Ice cream, as a dessert, has the highest moisture content (51.34±0.01%) and a moderate carbohydrate content (24.16±0.01%), reflecting its nature as a sweet, water-rich treat (FAO, 2024).

In line with previous studies, the findings from this study are consistent with the known proximate compositions of similar foods as revealed. For instance, the high fiber content in ethnic foods like Semo/efo is supported by studies highlighting the nutritional benefits of traditional Nigerian vegetable soups (Lawal *et al.,* 2018). Similarly, the protein content in chicken is in line with its recognized status as a primary source of animal protein (Thangaraj, 2016). Also the moisture content of the ice cream that is higher make is susceptible to microbiological deterioration or microbial spoilage whereas the dried samples which are characterized by lower moisture content will keep longer. And the ash contents notable in offal shows an indication for the presence of minerals (Ashraf and Hamidi-Esfahani, 2011; Thangaraj, 2016), and the higher fat content present in fried rice which may be due to the presence of the oil used as an ingredient in the preparation.

Table 2: Proximate composition of foods served in Ibadan Fast food Restaurants

Samples	Moisture	Ash	Fibre	Fat	Protein	CHO
Conventional						
Fried rice	19.50±0.71^{de}	3.70±0.14^{c}	1.05±0.01^{bc}	16.21±0.01^{a}	10.65±0.01^{g}	47.30±0.14^{b}
Jollof rice	19.00±1.41^{e}	5.20±0.14^{b}	0.90±0.14^{bc}	10.55±0.01^{b}	16.11±0.01^{d}	48.24±0.01^{a}
Ethnic						
Amala/ewedu	34.00±1.41^{b}	1.30±0.14^{f}	0.40±0.14^{c}	10.00±1.41^{b}	10.00±1.41^{g}	44.30±.14^{d}
Semo/efo	31.20±0.14^{c}	1.50±0.14^{ef}	9.00±1.41^{a}	5.00±1.41^{e}	12.50±0.14^{f}	40.80±0.14^{e}
Meat						
Chicken	19.25±0.01^{e}	2.73±0.01^{d}	10.00±1.41^{a}	8.90±0.14^{bc}	51.25±0.01^{a}	7.87±0.01^{h}
Offal	14.01±0.01^{f}	7.90±0.14^{a}	0.30±0.14^{c}	8.10±0.14^{cd}	41.65±0.01^{b}	28.04±0.01^{f}
Snacks						
Pie	21.10±0.14^{d}	1.70±0.14^{e}	0.80±0.14^{bc}	6.70±0.14^{d}	22.80±0.14^{c}	46.90±0.14^{c}
Dessert						
Ice cream	51.34±0.01^{a}	2.90±0.14^{d}	2.20±.14^{b}	4.70±0.14^{e}	14.70±0.14^{e}	24.16±0.01^{g}

Values are mean ± SD (Standard Deviation), (n = 3). Values with the different superscripts along the rows are significantly different.

3.2 Mineral content of foods served in Ibadan Fast food Restaurants

Table 3 revealed the mineral contents of the selected foods served in fast foods outlets in Ibadan, Nigeria. The table indicates the levels of calcium, magnesium, potassium, and sodium in various food categories typically found in fast food restaurants in Ibadan. Calcium is a vital mineral for bone health and metabolic functions. The findings revealed that 'Pie' contains the highest calcium content (250.00±1.41 mg), which is consistent with the literature indicating that baked goods can be an excellent source of dietary calcium, particularly when fortified (Amith *et al.,* 2021). In contrast, 'Fried rice' has the lowest calcium content (74.00±1.41 mg), this suggests that rice-based dishes may not be the best option for meeting daily calcium requirements.

Magnesium plays a crucial role in numerous physiological processes, including energy production and muscle function. 'Offal' exhibits the highest magnesium level (394.00±1.41 mg), aligning with studies that have highlighted organ meats as rich in various minerals (Chinaza *et al.,* 2019). Conversely, 'Jollof rice' has the lowest magnesium content (63.00±1.41 mg), which may reflect the limited presence of magnesium-rich ingredients in its preparation.

Potassium is essential for cardiovascular health and fluid balance. The table shows 'Offal' as having the highest potassium content (779.00±1.41 mg), which is in agreement with research indicating that meat products, especially organ meats, are high in potassium (Chinaza *et al.,* 2019). 'Ice cream', on the other hand, has the lowest potassium content (105.00±1.41 mg), which could be due to the higher water and sugar content relative to its mineral content.

Sodium is necessary for maintaining fluid balance but is often consumed in excess in fast food diets. 'Chicken' contains the highest sodium content (500.00±1.41 mg), which is a well-documented characteristic of fast food meat products, often due to added salts during processing as stated by (Musaiger*et al.,* 2008). 'Offal' has the lowest sodium content (189.00±1.41 mg), suggesting that it may be a better option for those looking to reduce sodium intake and this depicts that it can be recommended for cardiovascular disease patients.

Table 3: Mineral content of selected foods served in fast foods

Samples	Calcium	Magnesium	Potassium	Sodium
Conventional				
Fried rice	74.00±1.41^{h}	85.00±1.41^{f}	130.00±0.00^{g}	255.50±0.71^{d}
Jollof rice	108.00±1.41^{e}	63.00±1.41^{g}	202.00±1.41^{e}	255.00±1.41^{d}
Ethnic				
Amala/ewedu	84.00±1.41^{g}	95.00±1.41^{e}	489.50±0.71^{c}	350.00±1.41^{b}
Semo/efo	132.50±0.71^{d}	141.00±1.41^{c}	617.50±0.71^{b}	238.00±1.41^{e}
Meat				
Chicken	142.00±1.41^{c}	218.00±1.41^{b}	395.00±1.41^{d}	500.00±1.41^{a}
Offal	98.00±1.41^{f}	394.00±1.41^{a}	779.00±1.41^{a}	189.00±1.41^{g}
Snacks				
Pie	250.00±1.41^{a}	138.00±1.41^{c}	157.00±1.41^{f}	302.00±1.41^{c}
Dessert				
Ice cream	180.00±1.41^{b}	127.00±1.41^{d}	105.00±1.41^{h}	220.00±1.41^{f}

Values are mean ± SD (Standard Deviation), (n = 3). Values with the different superscripts along the rows are significantly different

3.3 Microbiological analysis

The microbiological analysis presented in Table 4 indicates a progressive increase in the Total Viable Count (TVC) of various food samples over a period of four days. This trend suggests microbial proliferation, which is a critical factor affecting food quality and safety (Chauhan & Jindal, 2020). The initial TVC values for conventional foods such as Fried Rice and Jollof Rice were relatively low,

indicating acceptable levels of microbial presence at Day 0. However, by Day 3, the TVC values increased significantly, reaching 8.45 and 6.35 respectively, which may suggest a decline in the microbiological quality of the food over time.

Amala/Ewedu and Semo/Efo, showed a similar pattern, with initial TVC values of 0.70 and 0.04, respectively, escalating to 6.65 and 6.85 by Day 3. This increase could be attributed to the nature of the ingredients used and the conditions under which these foods were stored. Also, Chicken and Offal, maintained low TVC values until Day 2 but experienced a noticeable increase by Day 3. This rise in microbial count, particularly in Chicken, from 0.23 to 3.85, raises concerns about the potential for foodborne illnesses if consumed without proper cooking or handling (Chauhan & Jindal, 2020). Furthermore, Pie and Ice cream, showed the most significant increase in TVC, with Pie reaching a count of 10.10 by Day 3.

This dramatic rise could be due to the high nutrient content that supports microbial growth, emphasizing the need for stringent quality control measures during preparation and storage (Chauhan & Jindal, 2020). Comparing these findings with previous research, it is evident that the rate of microbial growth in food products is influenced by various factors, including the type of food, storage conditions, and the presence of preservatives (Chauhan & Jindal, 2020). The observed pattern of results is consistent with the literature, which suggests that microbial contamination critically affects food quality and can lead to foodborne illnesses (Chauhan & Jindal, 2020).

Table 4: Total viable count

TVC **10^{-5}CFU**	**Samples**	**Day 0**	**Day 1**	**Day 2**	**Day 3**
	Conventional				
	Fried Rice	0.30	1.65	8.20	8.45
	Jollof Rice	0.10	0.80	2.40	6.35
	Ethnic				
	Amala/Ewedu	0.70	6.65	8.55	6.65
	Semo/Efo	0.04	3.55	8.20	6.85
	Meat				
	Chicken	0.10	0.10	0.23	3.85
	Offal	0.10	0.10	0.10	1.50
	Snacks				
	Pie	0.00	0.22	9.90	10.10
	Dessert				
	Ice cream	0.00	0.00	6.15	8.05

Key: TVC = Total Viable Count

This study evaluate the microbial quality of various food samples from day 0 to 4 as showed in table 5. On Day 0, both Fried and Jollof Rice showed no bacterial growth, indicating proper cooking methods that eliminate bacteria. However, by Day 3, the TBC increased to 0.65 and 0.31, respectively. This gradual increase suggests a decline in the microbial quality, likely due to improper storage conditions, which is consistent with findings from previous research indicating that rice dishes can harbor bacteria if not stored correctly (Chauhan&Jindal, 2020). Amala/Ewedu and Semo/Efo showed initial bacterial presence on Day 0, which drastically increased by Day 3. The high TBC in Amala/Ewedu (4.15) on Day 3 is particularly concerning and suggests that these foods are highly perishable or were contaminated during preparation. This aligns with studies that have identified high microbial loads in ethnic foods due to the use of raw ingredients that are not thoroughly cooked (Chauhan&Jindal, 2020). Chicken and Offal had similar TBCs on Days 0 to 2. However, a significant spike in TBC was observed in Chicken on Day 3 (4.95), indicating potential post-cooking contamination or growth of bacteria during storage. This is supported by research indicating that poultry is susceptible to bacterial contamination if not handled properly (Kramer & Gilbert, 1978). The Pie showed no bacteria on Day 0 but had a high TBC by Day 3 (8.30), which could be due to the incorporation of ingredients prone to bacterial growth or cross-contamination. Ice Cream also showed an increase in TBC, which could be attributed to the melting and refreezing process that allows bacteria to proliferate (Biyani *et al.*, 2018). To sum up, the pie has increasing number of bacterial counts as the days progress, followed by amala/ewedu and ice cream.

Table 5: Total bacteria count

TBC **10^{-5}CFU**	**Samples**	**Day 0**	**Day 1**	**Day 2**	**Day 3**
	Conventional				
	Fried Rice	0.00	0.15	0.39	0.65
	Jollof Rice	0.00	0.00	0.11	0.31
	Ethnic				
	Amala/Ewedu	0.10	0.23	3.85	4.15
	Semo/Efo	0.10	0.10	1.50	1.52
	Meat				
	Chicken	0.10	0.10	0.15	4.95
	Offal	0.10	0.10	0.10	1.2
	Snacks				
	Pie	0.00	5.10	5.80	8.30
	Dessert				
	Ice cream	0.00	0.00	1.65	3.85

Key: TBC = Total Bacteria Count

Table 6 presented the total fungi count (TFC) of the samples over the period of four days. It was observed that the TFC in the food samples increased over time, with the most significant growth observed in the ice cream, which showed a significant increase from 0.00 to 4.15 CFU by Day 3. This suggests that desserts, particularly those with high sugar content, may provide a conducive environment for fungal growth. The conventional food samples, fried and jollof rice, also showed an increase in TFC, albeit to a lesser extent. This pattern of fungal growth is consistent with previous research indicating that fungi can thrive in a variety of food products, particularly those with high moisture and nutrient availability (Aladhadh, 2023). The findings of this study align with the study carried out by He *et al.* (2022), who reported that fungal contamination in food can lead to an increase in volatile organic compounds, affecting food safety. Similarly, the increase in TFC in meat products, although minimal, is in line with the understanding that fungi can be present in a variety of food matrices, as discussed in the review by Aladhadh (2023). Therefore, the findings' implications shows its significance for food safety and storage. And this also shows that the rapid increase in TFC, especially in ice cream shows the need for stringent storage conditions to prevent fungal growth.

Table 6: Total fungi count

TFC 10^{-5}CFU	Samples	Day 0	Day 1	Day 2	Day 3
	Conventional				
	Fried Rice	0.00	0.00	0.30	1.65
	Jollof Rice	0.00	0.00	0.10	0.80
	Ethnic				
	Amala/Ewedu	0.00	0.00	0.00	0.15
	Semo/Efo	0.00	0.00	0.00	0.11
	Meat				
	Chicken	0.10	0.10	0.10	0.23
	Offal	0.10	0.10	0.10	0.10
	Snacks				
	Pie	0.10	0.10	0.10	1.50
	Dessert				
	Ice cream	0.00	0.45	1.65	4.15

Key: TFC = Total Fungi Count

Table 7 presents the data on the total coliform count of varieties of food from fast foods outlet in Ibadan, Nigeria from day 0 to day 3. The result from the findings an increase in the total coliform count (TCC)

in ice cream from 0.02 to 1.01 CFU over three days and this suggests a potential for coliform bacteria to multiply in dairy-based desserts. This is consistent with the understanding that coliforms, as indicators of sanitary quality, can proliferate in environments with high nutrient content (Chauhan&Jindal, 2020).The increase in TCC observed in the result findings aligns with the findings by Martin *et al.* (2016), who discussed coliforms as indicators of unhygienic processing conditions in dairy foods. Therefore, the study highlighted that coliforms are not exclusively fecal in origin but can also be environmental contaminants, which may explain their presence in ice cream as a post-pasteurization product.The observed rise in TCC, particularly in ice cream shows the importance of maintaining strict hygienic conditions during processing and storage to prevent coliform proliferation. This has direct implications for food safety regulations and consumer health, as coliform presence can indicate potential contamination and the risk of foodborne illnesses (Chauhan&Jindal, 2020; Feng *et al.*, 2020).

Table 7: Total coliform count

TCC **10^{-5}CFU**	**Samples**	**Day 0**	**Day 1**	**Day 2**	**Day 3**
	Conventional				
	Fried Rice	XXX	XXX	XXX	XXX
	Jollof Rice	XXX	XXX	XXX	XXX
	Ethnic				
	Amala/Ewedu	XXX	XXX	XXX	XXX
	Semo/Efo	XXX	XXX	XXX	XXX
	Meat				
	Chicken	XXX	XXX	XXX	XXX
	Offal	XXX	XXX	XXX	XXX
	Snacks				
	Pie	XXX	XXX	XXX	XXX
	Dessert				
	Ice cream	0.02	0.18	0.74	1.01

Key: TCC = Total Coliform Count

XXX = not visible

Conclusion

In conclusion, this study sheds valuable light on the nutritional composition of famous Quick Service Restaurant (QSR) cuisines consumed by families in Ibadan, Nigeria. The findings reveal significant variations in key nutritional parameters, such as crude fibre and protein content, among the sampled foods, namely Amala with ewedu, chicken, and offals. Notably, meats exhibited high protein content, while Amala had the least, highlighting the importance of understanding the nutritional profiles of commonly consumed dishes.

Furthermore, the assessment of microbial load, notably Total Bacterial Count (TBC), underscores the importance of considering shelf life alongside nutritional composition. The observed increase in TBC over time emphasizes the need for vigilance regarding food safety practices, especially in QSRs where food turnover is high.

These findings have important implications for promoting family sustainability through healthy eating habits. As families increasingly rely on QSRs due to time constraints imposed by modern lifestyles, understanding the nutritional value of restaurant meals becomes paramount. By providing insights into the nutritional content of popular Nigerian cuisines, this study empowers families to make informed dietary choices, fostering balanced and diverse eating habits.

Recommendations

The stakeholders in the food industry, including QSRs and policymakers, prioritize efforts to enhance the nutritional quality of restaurant offerings while maintaining stringent food safety standards. Food initiatives such as menu labelling could increase transparency about the nutritional content of dishes and education campaigns to promote healthy eating habits among consumers.

Moreover, further research is warranted to explore additional factors influencing food choices and consumption patterns among families in Ibadan and beyond. The investigation could be on the impact of socio-economic factors, cultural preferences, and accessibility to nutritious food options on dietary behaviours.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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