Access to and Nature of Drinking Water: A case Study of Kafin Hausa Town, Jigawa State, Nigeria

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Abstract
There is global concern on the status and nature of drinking water in both developed and developing nations. About 25% of the African populations are experiencing water stress, sanitation, accessibility and availability. This study assessed the sources and nature of drinking water as well as spatial distribution of hand pumps and overhead tanks as the major source of domestic water in the study area. The primary data consist of hand pumps and overhead tanks coordinates collected using GPS using their number and addresses to create spatial database of facilities in Microsoft excel environment. The data were analyzed using spatial overlay and query operations, where the spatial database of water facilities was imported into ArcGIS. However, structured questionnaire were administered to assess the perceptions on the state of drinking water in the area as well as its nature, sources and associated diseases in relation to drinking water. The study revealed that hand pump constitutes 54% as the major supplier of domestic water in the area, followed by tap water 21% connected to the overhead tanks. However, 49% of the respondents attested that water is good for drinking. About 73% of the respondents relate typhoid fever with nature of the drinking water.

Keywords: *Water Availability, Water Sources, Nature, Potability, Kafin Hausa*

1. Introduction

The problem of water scarcity is expected to increase significantly in the coming years, unless a sustainable awareness of resources management emerges (Ayenew, 2007). Water resource is not only a basic need, but is also a centre-piece of sustainable development and a crucial part of poverty alleviation (Förch and Thiemann, 2004). The Dublin principles and the Earth Summit's Agenda 21, also emphasize the need for integrated water management, recognizing water as one of a number of natural resource elements that needs to be managed in a sustainable manner (Figuaeres et al., 2003). Many parts of the world, markedly the Middle East and the Sub-Saharan Africa (SSA) are experiencing intense competition over water management failures. Providing safe drinking water for the more than 1 billion people who currently lack it is one of the greatest public health challenges facing national governments today. In many developing countries, safe water, free of pathogens and other contaminants, is unavailable too much of the population, and water contamination remains a concern even for developed countries with good water supplies and advanced treatment systems. Freshwater accounts for only some 6 percent of the world's water supply, but is essential for human uses such as drinking, agriculture, manufacturing, and sanitation, two-thirds of global freshwater is found underground. Drinking water in most rural communities of developing countries comes from sources such as rivers, streams, lakes, boreholes and wells; and they are likely to be polluted with domestic, agricultural or industrial wastes posing as potential health consumer (Yakubu e t al . , 2010). Groundwater contamination is the result of polluted water infiltrating through the soil and rock and eventually reaching the groundwater reservoir (Njinga et al, 2018).

This process might take many years and might take place at varying distances from various wells where such contaminations are found. Once the groundwater is contaminated, it is very difficult to remediate (Garba et al, 2016; Pritchard et al., 2008). "The water requirement for Kafin Hausa townis met from groundwater supplies, as the area has a good groundwater potential. As it has been found in many in many cities and towns in Nigeria, due to the population increase the demand for potable water has also increased, as a result, a certain proportion of the population is force to rely on borehole water for drinking source as the alternative to the inconsistent flow of pipe borne water supply, which could have been more

reliable source of safe water for the growing population. Groundwater supply schemes in the area consist typically of a large number of hand pumped boreholes, providing untreated, unmonitored and often unconnected supplies. Poor quality of water threatens human health, thereby adversely affecting economic development and social prosperity. It is therefore crucial to establish the current status of nature and sources of potable water and thus its appropriateness for the use in drinking" (Garba et al, 2016).

2. Materials and Method

Kafin Hausa is a local government area of Jigawa state, Nigeria. Its headquarters are in the town of Kafin Hausa. It has an area of 1,380 km^2 and a population of 271,058 as at the 2006 census (NPC, 2006). The area falls under AW climate with two distinct seasons: dry and wet seasons. Temperature reaches up to 40^0 around months of April- June, the temperature falls as low as 20^0 around the Months of December-January. The area is generally characterized by sandy soil, therefore, the major crop produced are cereals. The topography of the area is undulating comprises sand dunes of several kilometers and the presence of river Kafin Hausa which also permit vegetable production in dry season.

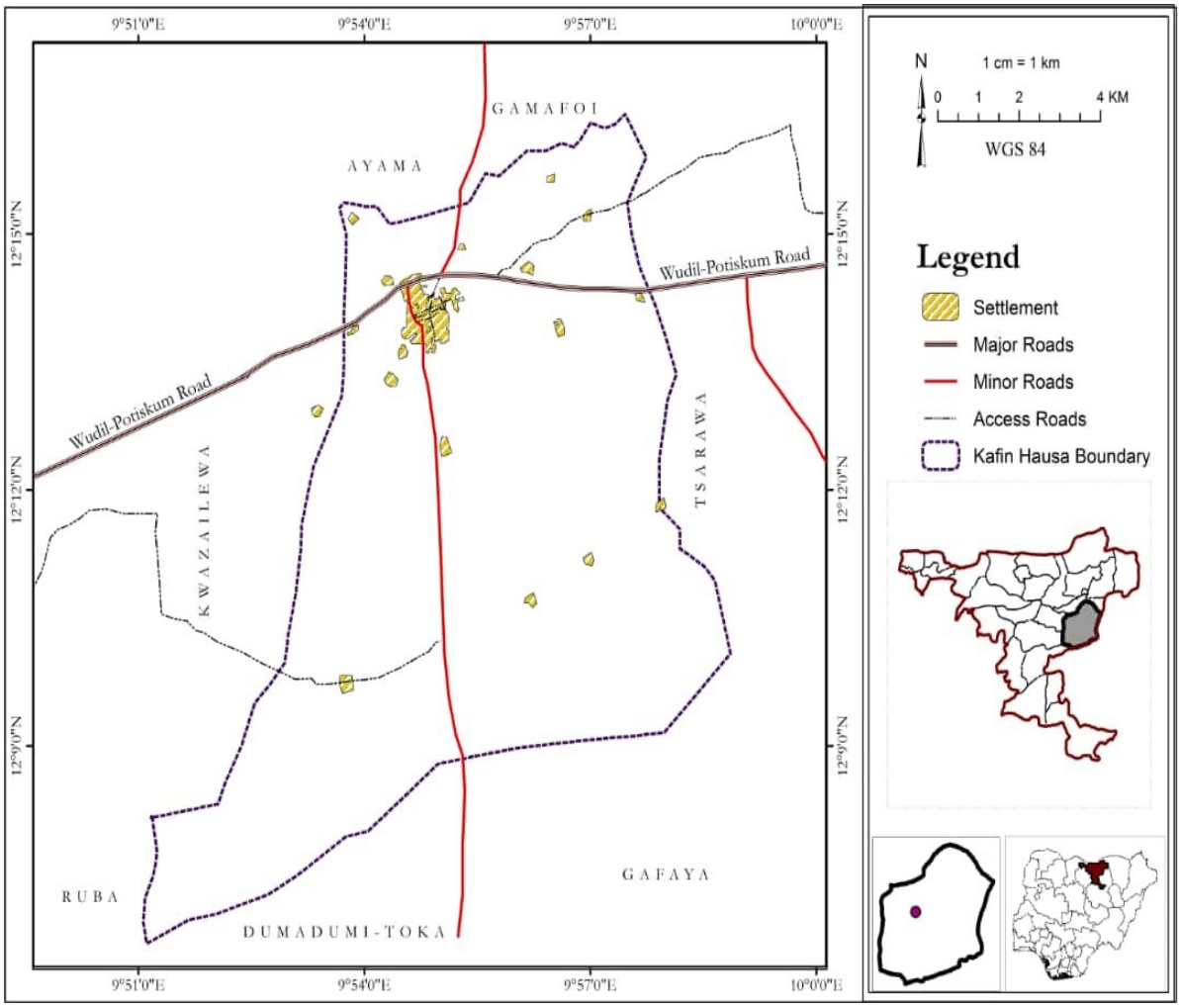


Figure: 1 Administrative Map of Kafin Hausa Town
Source: Adapted and Modified from administrative map of Jigawa State, 2019

The primary source of data for this study consist of coordinates of hand pumps and overhead tanks collected using Global Position System (GPS) and information about their number and addresses. All are used to create a spatial database of the facilities in MS excel

environment. Obtained from Kano State Ministry of Land and Physical Planning (KMOLPP) center of GIS were: the topographic and the administrative maps of Jigawa State. Both were scanned and imported in to ArcGIS for processing. With the aid of the State's boundary extent and the control points extracted from Google earth satellite imagery and integrated into ArcGIS, the maps were geo-referenced and projected using Universal Transverse Mercator (UTM) with World Geodetic System (WGS) 84, 32N. Clip analysis was then computed to obtain the area of interest (AOI) and digitization was subsequently performed to acquire shapefiles of road network types (line), built up area and the boundary (polygon) of the study area. The base-map produced was validated and adjusted based on the imagery's control points and GPS observation carried out.

The technique of data analysis employed in this study is mainly "Spatial Overlay and Query Operations" where, the spatial database of the water facilities was imported into the ArcGIS. The shapefiles holding the digitized data were then spatially overlaid and a composite map of line and polygon feature classes was ultimately made. Thus, the coordinates of all the facilities spontaneously displayed their absolute locations on the base-map. This aided to visually appreciate and examine the distribution of the facilities in space. Additionally, with Structured Query Language (SQL), particularly using selection by attribute, the database was queried, where maps showing the Overhead Tanks and Hand pumps were derived respectively and examined visually.

3. Results and Discussions

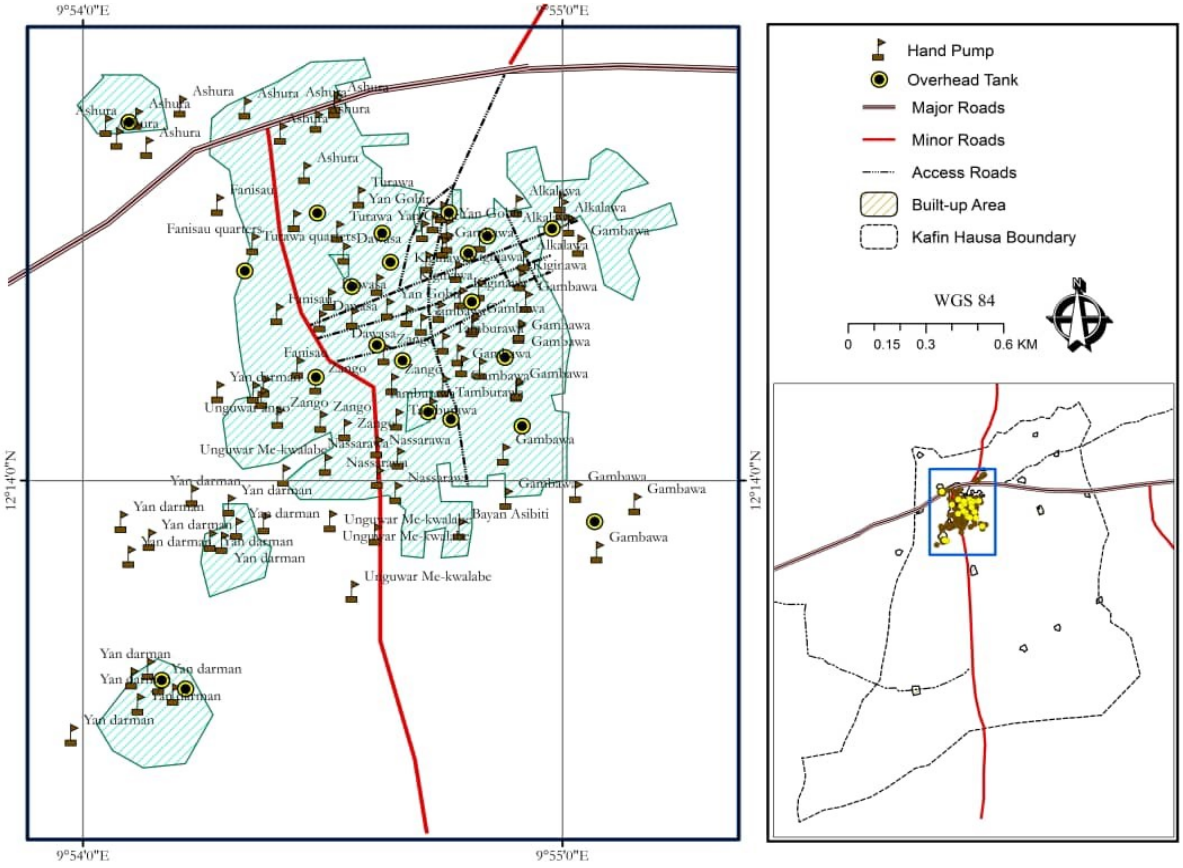
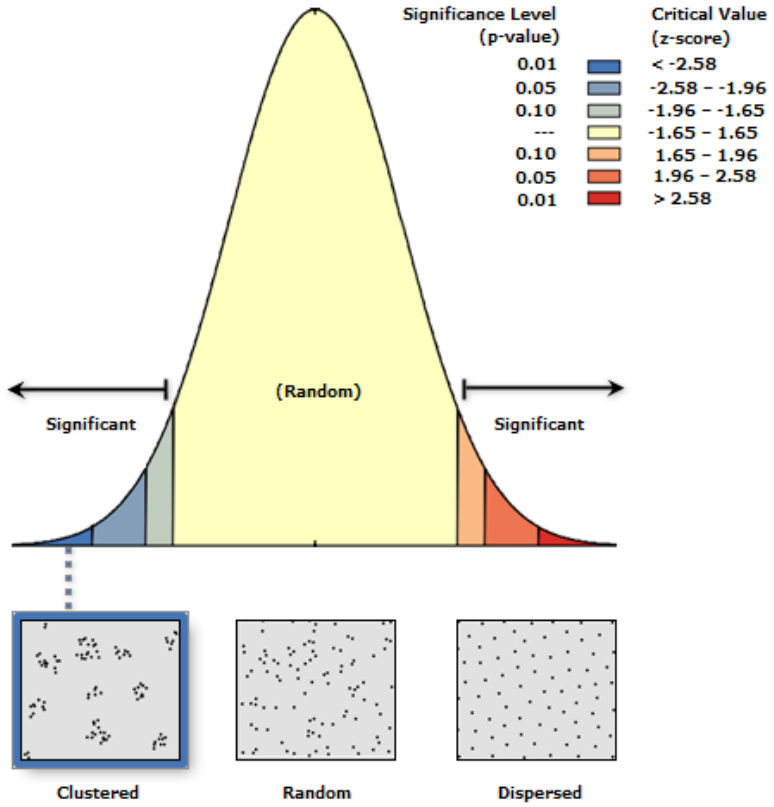


Figure: 2 spatial distributions of hand pumps and overhead tanks in Kafin Hausa town
Source: Authors' GIS analysis, 2019



Given the z-score of -6.59622335891, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Average Nearest Neighbor Summary	
Observed Mean Distance:	0.0007 Meters
Expected Mean Distance:	0.0010 Meters
Nearest Neighbor Ratio:	0.696422
z-score:	-6.596223
p-value:	0.000010

Figure: 3 **Average Nearest**

Dataset Information	
Input Feature Class:	Water Facilities
Distance Method:	EUCLIDEAN
Study Area:	0.000559
Selection Set:	False

Neighbor Summary

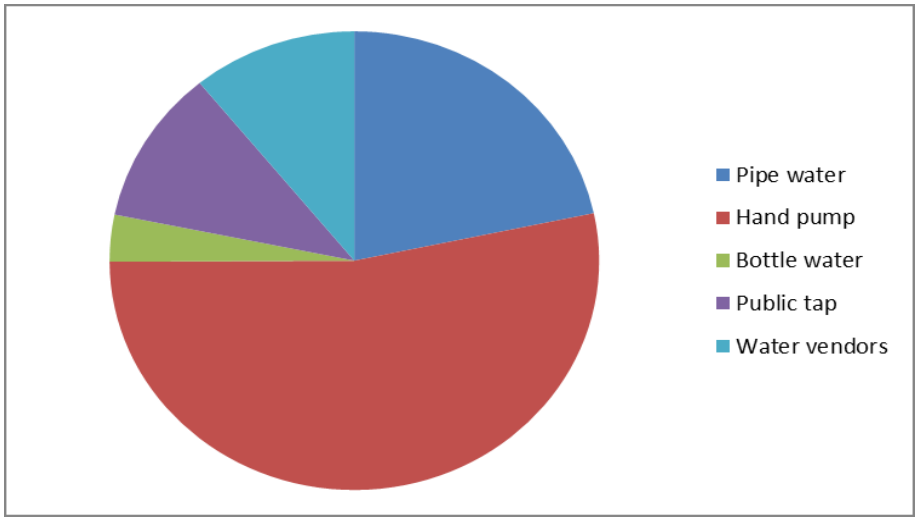


Figure: 4 Sources of Drinking Water
Source: Field Survey, 2019

The study revealed that the major source of drinking water in the area is hand pump which account for about 54% for all the sources of drinking water, followed by pipe water into dwelling which account for about 21%, pubic tap and water vendors each account for 10.9%, while bottle water remain the least source of drinking water in the area with 3.3%. looking at the spatial distributions of hand pumps in the area signifies that hand pumps remain soley the major source of drinking water in the area.

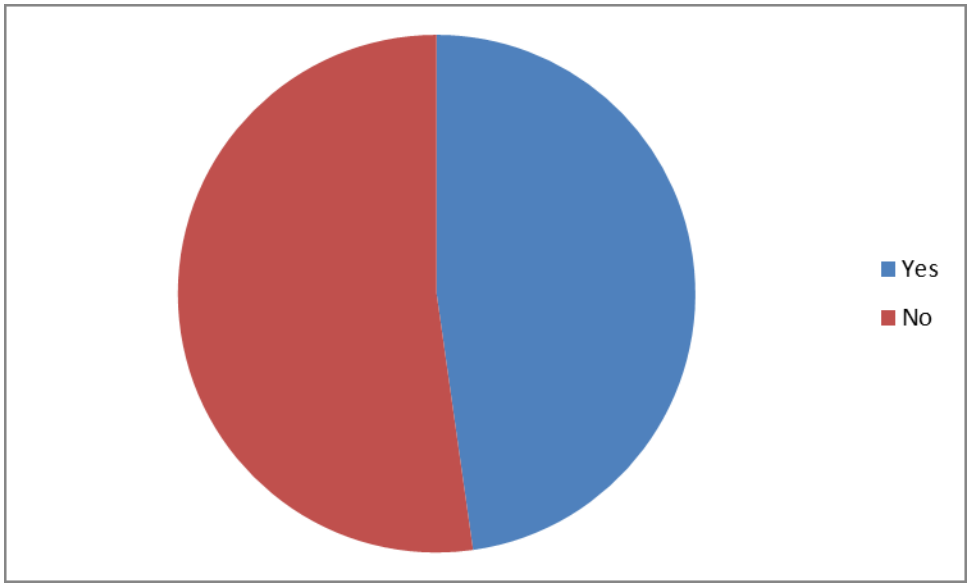


Figure: 5. Water Treatment Before Drinking
Source: Field Survey, 2019

There is almost equal proportion in terms of water treatment. 47% of the respondents attested that they treat water before drinking while 51.1% attested that they don't treat water before drinking. For those that treat water have various means of water treatment. Boiling of water before drinking account for 39.1%, straining water through cloth account for 5.4%, use of water filters account for 6.5%, solar disinfection account for 5.4% and let the water settle itself account for 28.3% of the responses in terms of water treatment.

Good water is an indication of good water quality health, therefore, 49% of the repondents attested that the water is good for drinking, while 24% answered that the water taste is acceptable not that bad for drinking, however, 19.6% believed that the water is excellent for

drinking and 6.5% attested that the water is unfit, undesirable and unacceptable for human drinking.

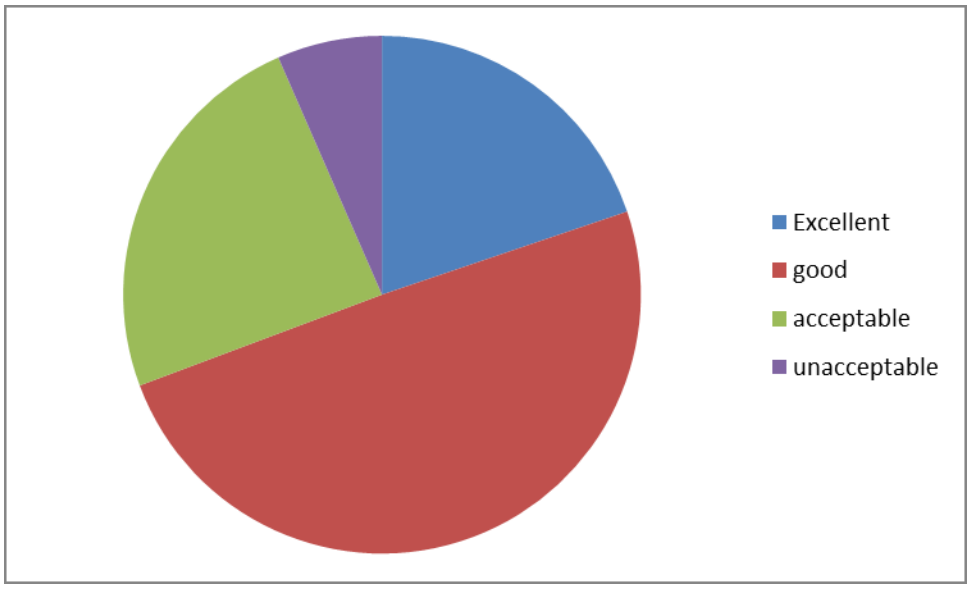


Figure: 5 Perceived water taste
Source: Field Survey, 2019

Perceived associated diseases with drinking water

The respondents attested that there are some certain diseases that are associated with drinking water in the area, notebly among them is cholera which account for 22.8%, typhoid fever account for 72.8% and desentry 2.3%. these are perceived diseases caused or associated with drinking water in the area.

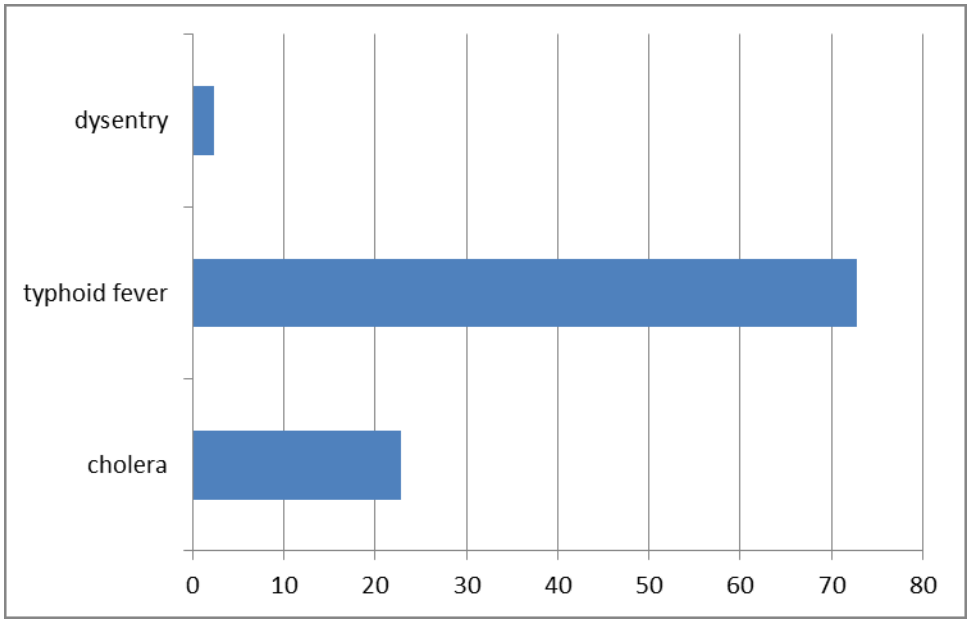


Figure: Perceived associated diseases with drinking water
Source: Field Survey, 2019

4. **Conclusion**

The findings of the study revealed that hand pump is the major source of water in the area with overhead tank that supply tap water **to** various houses. Most of the overhead tanks are not functional therefore people rely on hand pumps for water which is mainly used for domestic purposes.

5. Recommendations

1. Establishment of modern water supply facilities at various locations within the study area so as to meet the water demand of the population.
2. The community concern should be able to fixed the existing water supply facilities and employ operators and overseers to monitors the water pumping stations as well to collect monthly revenue for facilities maintenance
3. Community sensitization on the need of water treatment before drinking. This can be achieved through community organization to enlighten the public on the need of good and well treated drinking water

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