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PREVALENCE AND SOCIO-DEMOGRAPHIC FACTORS ASSOCIATED WITH URINARY SCHISTOSOMIASIS IN SELECTED COMMUNITIES OF KADUNA NORTH LOCAL GOVERNMENT, KADUNA STATE

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ABSTRACT
Digenetic trematode flatworms (flukes) of the genus *Schistosoma* are the cause of schistosomiasis. These water-borne parasitic diseases are extremely debilitating and chronic, causing serious health problems as well as financial burden. After malaria, schistosomiasis is thought to be the most prevalent tropical parasitic disease. Cercariae that pierce the skin while bathing, washing, playing in rivers, streams, lakes, fishing, working in agriculture, or engaging in any other activity involving contact with infested water are the means by which *S. haematobium* is spread. Therefore, this research aims to study the prevalence and socio-demographic factors associated with urinary schistosomiasis in selected communities of Kaduna North L.G.A. A total of 300 samples were collected from three communities: Rafin Guza, Badarawa and Ungwan Dosa. The samples were examined microscopically, then subjected to sedimentation technique and microscopy. The overall prevalence of urinary schistosomiasis found in this study was 19%. There was a statistically significant difference (P=0.002) in the occurrence of the infection across the three communities: the highest was 24% in Rafin Guza, followed by Badarawa (17%) and the least was at Ungwan Dosa (16%). The age group 11 to 15 had prevalence infection rate of 12.66 % contributing to the total prevalence infection rate of 19 % across all three communities. One of the major suspects of this parasitic infection is due to their association with water. The positive cases were further confirmed by ELISA. There is a need for community-based health education and awareness campaign which will help to reduce the burden of the disease.

Keywords: *Schistosoma haematobium*, Rafin Guza, ELISA, Prevalence, Community.

INTRODUCTION
Digenean parasites of the genus *Schistosoma* are the root cause of the neglected tropical disease (NTD) schistosomiasis, often known as bilharziasis. The genus Schistosoma comprises five species that infect humans: *Schistosoma mekongi, Schistosoma japonicum, Schistosoma haematobium, Schistosoma intercalatum* and *Schistosoma mansoni* (Alemu *et al*., 2018; Mohammad *et al*., 2018; Wei *et al*., 2018 and Deribe *et al*., 2022). These metazoan parasites are members of the Class Trematoda and the Phylum Platyhelminthes (Colley *et al.,* 2014).

In third-world nations where access to basic services like pipe-borne water is problematic, schistosomiasis is more common (CDC, 2011). These nations suffer from bad sanitation, civil unrest, and wars that force people to flee. The development of irrigation schemes and dams for hydroelectric power and flood control has greatly increased the prevalence of *S. haematobium* infection in these countries (Hotez, 2012).
The spread of the parasite has also increased as a result of refugee influx. On the other hand, cercariae that pierce the skin while bathing, washing clothing, playing in rivers, streams, or lakes, fishing, working in agriculture, or engaging in any other activity involving contact with polluted water are the means by which *S. haematobium* is spread. A higher percentage of adolescents and teens contract and re-infect infections in most endemic locations (Kouado, 2023).

School-age children are known to have poor hygiene and to play in the water, which increases their risk of contracting the infection, they provide an excellent target population for research on urinary schistosomiasis in endemic regions. Examining the frequency and risk factors of the disease in a few rural areas in the area, this study will provide a current road map for developing appropriate preventive and control methods.

MATERIALS AND METHODS

Study area and population
The study was conducted in three communities within Kaduna North Local Government Area Kaduna state, namely: Rafin guza, Badarawa and Ungwan dosa. Children in the communities often play and swim in the streams and water bodies in the areas. Three hundred (300) urine samples were collected from the children between the ages 1-15 years with the consent of their parents. Ethical clearance for this study was obtained from the Kaduna State Ministry of Health.

Collection of samples and administration of questionnaire
Each participant was given a sterile dry plastic universal container with a screw lid, in which they were asked to provide terminal urine sample between 10:00am and 2:00pm, when the ova load is maximal (Aryeetey *et al.,* 2013). Each container was labelled with the sex, age and number of the participant as were provided in the questionnaire form. Fresh urine samples collected were examined macroscopically for presence of blood (visible haematuria). The samples were then preserved by adding 5 mL of dilute (0.3%) carbol-fuchsin solution to each 10 mL of urine (Safaa, 2017), and transported to the laboratory in an ice-pack.
Questionnaires were administered to participants to obtain information on age, sex, education, occupation, level of awareness

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of the disease, clinical symptoms and associated risk factors. Each completed questionnaire was given an identification number corresponding to the subject's assigned urine sample number.

Processing of Samples

Microscopy (Sedimentation Technique)
Microscopic examination of the urine samples for urinary schistosomiasis detection was based on detection of terminal-spine eggs of *S. haematobium* using a sedimentation concentration technique (Charan *et al.,* 2013). Ten millilitres of each urine sample were collected from each sample container into a centrifuge tube and spun for 5 minutes at 3000 revolutions per minute to concentrate the eggs. Thereafter, the supernatant fluid was discarded into a Petri dish. A drop of the sediments was transferred to a clean and grease-free glass slide, covered with a coverslip and examined microscopically using 100^x and 40^x objectives for the light compound microscope for eggs of *S. haematobium* and recorded.

Enzyme Linked Immunosorbent Assay (ELISA)
All reagents and samples were brought to room temperature (18°C-25°C) naturally for 30min before starting assay procedures. Hot water baths were not used to thaw samples or reagents. If necessary, doing a low speed centrifugation for one or two seconds to concentrate the positive/negative controls to the bottom of the vials. The plates were detachable, unused strips were detached from the plate frame and returned to the foil pouch with the desiccant pack, and resealed for preventing damps. Positive control wells, negative control wells and sample wells were set. Then 50µl of urine sample was added to positive control well, 50µl was added to negative control well. Also, 50µl of corresponding urine sample was added to each Sample wells. Note: This kit is designed to be used with undiluted samples. Thereafter,100µl of HRP-conjugate reagent was added to Positive Control wells, Negative Control wells and Sample wells, and covered with an adhesive strip and incubated at 37°C for 60 minutes. The plate was washed 4 times. Chromogen Solution A (50µl) and Chromogen Solution B (50µl) was added to each well successively. The preparation was gently mixed and then protected from light, and incubated at 37°C for 15 minutes. Stop solution (50µl) was added to each well. The colour in the wells changed from blue to yellow. The optical density (0.D) was read at 450 nm using an ELISA reader within 15 minutes after adding stop solution.

Statistical Analysis
Cronbach's alpha was used to verify the reliability of the data obtained in this study. The prevalence values were calculated by finding the percentage of the factors. Associations between demographic characteristics (age, sex, and occupation) and the prevalence of infection were analysed using Pearson's Chi-square test and odds ratio (OR) analysis using IBM SPSS version 23 at 95% confidence interval. Final results were simplified in tables and charts.

RESULTS

Prevalence of urinary schistosomiasis in some selected communities of Kaduna North Local Government Area
The overall prevalence of urinary schistosomiasis in this study was 19% (Figure 1). Table 1A shows the prevalence of urinary Schistosomiasis in Badarawa. The table shows that there was no significant difference in the isolates (*Schistosoma haematobium*) from male and female with a p-value of 0.053. The odds of this are 1.482 within a 95% confidence level of 0.441 to 4.986. The overall prevalence for male was 13% and that of female 4%. Table 1B shows the prevalence of urinary Schistosomiasis in Ungwan Dosa. The table showed that there is no significant difference in the isolates (*Schistosoma haematobium*) across different age group of both male and female with a p-value of 0.079. The odds of this are 0.241 within a 95% confidence level of 0.635 to 9.124. The overall prevalence for male is 13% and that of female is 3% in Ungwan Dosa. As for Table 1C, it showed the prevalence of urinary Schistosomiasis in Rafin Guza. The table shows that there was no significant difference in the isolates (*Schistosoma haematobium*) across different age group of both male and female with a p-value of 0.053. The odds of this are 1.976 within a 95% confidence level of 0.662 to 5.896. The overall prevalence for male was 11% and that of female 3% in Rafin Guza.

Table 1A: The Occurrence of urinary *Schistosomiasis* in Badarawa

	Male		Female		Statistical Analysis			
Age Group (Years)	NE	NI	NE	NI	P-value	OR	LCL	UCL
1 - 5	5	0	2	0	0.053	1.482	0.441	4.986
6 - 10	31	3	11	1				
11 - 15	34	10	17	3				
TOTAL	70	13	30	4				

Key: Where: NE = Number Examined, NI = Number Infected, P-Value = Probability Value,
OR = Odd Ratio, LCL = Lower Confidence Level, UCL = Upper Confidence Level.

Table 1B: The Occurrence of urinary *Schistosomiasis* in Ungwan Dosa

	Male		Female		Statistical Analysis			
Age Group (Years)	NE	NI	NE	NI	P-value	OR	LCL	UCL
1 - 5	7	1	4	0	0.079	0.241	0.635	9.124
6 – 10	29	4	17	0				
11 – 15	31	8	12	3				
TOTAL	67	13	33	3				

Key: Where: NE = Number Examined, NI = Number Infected, P-Value = Probability Value,
OR = Odd Ratio, LCL = Lower Confidence Level, UCL = Upper Confidence Level

Table 1C: The Occurrence of urinary *Schistosomiasis* in Rafin Guza

	Male		Female		Statistical Analysis			
Age Group (Years)	NE	NI	NE	NI	P-value	OR	LCL	UCL
1 – 5	3	1	1	1	0.053	1.976	0.662	5.896
6 – 10	26	7	9	1				
11 – 15	40	11	21	3				
TOTAL	69	19	31	5				

Key: Where: NE = Number Examined, NI = Number Infected, P-Value = Probability Value,
OR = Odd Ratio, LCL = Lower Confidence Level, UCL = Upper Confidence Level

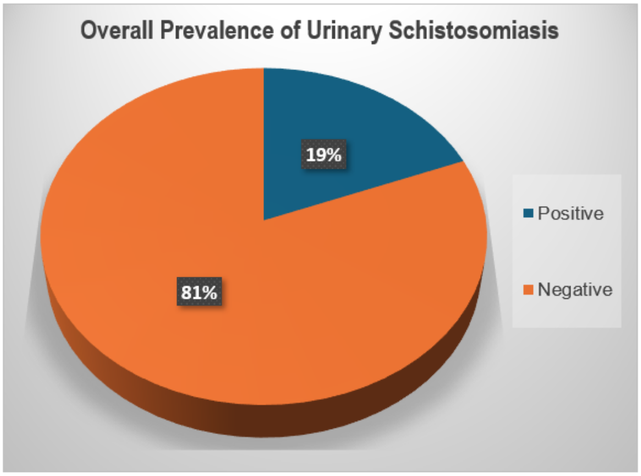

Figure 1: Overall Prevalence of Urinary Schistosomiasis in the Selected Communities of Kaduna North L.G.A

Clinical Signs and Associated Risk Factors of Urinary Schistosomiasis in Selected Communities of Kaduna North Local Government Area

The symptoms presented in Table 2 are responses of the respondents in respect to symptoms they have experienced in the past six (6) months to the period of administration of the questionnaire. The result revealed that there was a significant difference in the isolated parasite in respect to the following symptoms; painful urination, fever, abdominal pain and frequent urination with p-value of 0.007, 0.009, 0.008 and 0.005 respectively. The p-value for cloudy urine and blood in urine showed that there was no significance difference of those symptoms in respect to the isolated parasite with p-value greater than 0.05. Furthermore, Table 4 showed how frequent the respondents experience these symptoms in Table 2. More of Schistosoma haematobium parasite was isolated from those who experienced the symptoms daily with prevalence of 12.33% out of the total prevalence of 19.0%. The odd ratio for this was 0.156 within 95% confidence level of 0.09 to 0.258.

Table 2: Symptoms of urinary schistosomiasis among children in selected communities in the past Six (6) months

	NE	NWS (%)	NI (%)	P-VALUE	OR	LCL	UCL
Painful urination	300	147 (49.0)	57 (38.77)	0.007	0.37	0.23	0.575
Cloudy urine	300	95 (31.67)	57 (60.00)	0.253	0.156	0.09	0.258
Blood in urine	300	73 (24.33)	57 (78.08)	0.383	0.066	0.035	0.123
Fever	300	259 (86.33)	57 (22.01)	0.009	0.831	0.551	1.255
Abdominal pain	300	232 (77.33)	57 (24.57)	0.008	0.72	0.475	1.091
Frequent urination	300	134 (44.67)	57 (42.54)	0.005	0.317	0.203	0.496

Key: Where: NE = Number Examined, NWS = Number with Symptoms, NI = Number Infected, P-Value = Probability Value, OR = Odd Ratio, LCL = Lower Confidence Level, UCL = Upper Confidence Level

Table 3: Frequency of symptoms Occurrence

	NE	NWS	NI	P-VALUE	OR	LCL	UCL
Rarely	300	112	1	0.007	0.37	0.23	0.575
Daily	300	73	37	0.253	0.156	0.09	0.258
Weekly	300	58	16	0.383	0.066	0.035	0.123
Monthly	300	57	3	0.009	0.831	0.551	1.255

Key: Where: NE = Number Examined, NWS = Number with Symptoms, NI = Number Infected,
P-Value = Probability Value, OR = Odd Ratio, LCL = Lower Confidence Level,
UCL = Upper Confidence Level

Table 4, Table 5 and Table 6 showed the relationship or association between frequency of swimming, major sources of water and possibly history of being infected with *Schistosoma haematobium* within few months (6 months) to the respondent's participation to this research. The odd ratio of swimming being associated with the isolation of *Schistosoma haematobium* within the sample site is 7.891 within a 95% confidence level of 3.991 to 15.6. This is much higher compared with their major source of water (Table 5) such as Borehole, Well and Stream. The odd ratio of River being a major source of water to the isolation of *Schistosoma haematobium* was very high (28.5) within 95% confidence level of 8.969 to 90.564. Table 6 showed that there is no significant difference (p-value = 0.152; > 0.05) in the isolation of *Schistosoma haematobium* from those that were diagnosed before and those that were not.

Table 4: Association between Swimming and *Schistosoma haematobium*

	NE	NWS	NI	P-VALUE	OR	LCL	UCL
Yes	300	96	45	0.333	7.891	3.991	15.6
No	300	202	12				

Table 5: Association Between Major Water Sources and *Schistosoma haematobium*

	NE	NI	P-VALUE	OR	LCL	UCL
Borehole	67	7	0.303	0.406	0.177	0.929
Well	139	19	0.363	0.182	0.107	0.313
Pond	23	8	0.482	6.423	2.465	16.737
Stream	57	11	0.381	1.019	0.497	2.091
River	15	9	0.507	28.5	8.969	90.564

Table 6: Previously diagnosed with schistosomiasis

	NE	NWS	NI	P-VALUE	OR	LCL	UCL
Yes	44	24	20	0.152	3.145	1.673	5.911
No	256	219	37				

The Impact of Urinary Schistosomiasis in Selected Communities of Kaduna North Local Government Area.

In respect to the impact of schistosomiasis in selected communities, Table 7 and Table 8 showed the data in that regards. In Table 7, it showed that there was no significant difference in the infection stopping them from going to school in the three communities. From Table 8, it showed that most of those that were being infected had not being experienced social stigma or discrimination due to schistosomiasis. Regardless, some of those infected with the parasite (26.32 %) were not facing or experiencing any form of social stigmatization.

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Table 7: Impact of schistosomiasis on schooling

	NE	NWS	NI	P-VALUE	OR	LCL	UCL
Yes	44	24	20	0.152	3.145	1.673	5.911
No	256	219	37				

Table 8: Social stigma/ discrimination due to schistosomiasis

	Badarawa	Ungwan Dosa	Rafin Guza	P-Value
Yes	5 (29.41%)	2 (12.50%)	8 (33.33%)	0.027
No	12 (70.59%)	14 (87.50%)	16 (66.67%)	

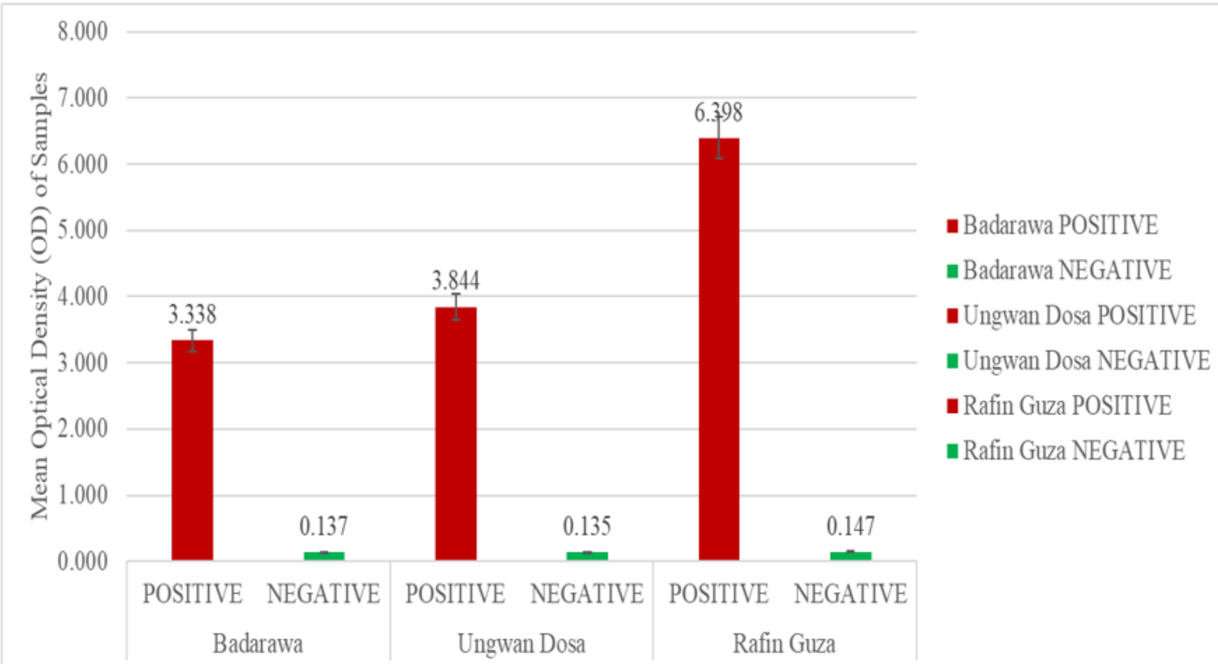

Figure 2: ELISA analysis for positive and negative samples in selected communities of Kaduna North Local Government Area

DISCUSSION

The current study examined the prevalence and socio-demographic factors associated with urinary schistosomiasis among children in selected communities of Kaduna North Local Government Area. The community's specific prevalence was observed that Rafin Guza had the highest case of urinary schistosomiasis (24 % of the population that volunteered; 100), followed by Badarawa (17 %) and then Ungwan Dosa (16 %) and there is a significant difference (P-Value of 0.0020) in their prevalence. According to the research, which reports an overall prevalence of 19%. Urinary schistosomiasis is endemic in the three communities. Recent studies on the prevalence of urinary schistosomiasis in Giwa and Makarfi Local Government Areas of Kaduna State indicate a significant burden of the disease in these regions. The overall prevalence was reported at 9.5%, with Giwa showing a slightly higher rate (10.0%) compared to Makarfi (9.0%) (Markus and Bishop, 2024). Analogous investigations carried out on children in Zambia's Kalabo, Serenje, and Lusaka districts revealed prevalence rates of 1.4% (1/69), 3% (3/100), 13.1% (34/260), and 20.72% (328/1583), in that order (Kalungwana *et al.,* 2012; Agnew-Blais *et al.,* 2010; Shawa *et al.,* 2024). The present study's findings, which fall between the three previously published prevalence, demonstrate that the illness is prevalent in Kaduna North Local Government Area of Kaduna State. A much lower incidence of 6.8% (192/2829) was reported by another investigation on the prevalence of *S. haematobium* in Siavonga. Nonetheless, adult populations were the subject of the aforementioned study (Halwindi *et al*., 2017).

However, the focus of this current study is primarily on the disease's prevalence among children, which is particularly concerning to the public. These findings suggest that the present initiatives to prevent and control the illness in youngsters are not entirely successful. This is due to the possibility of reinfection even after praziquantel treatment is effective, as humans may resume their regular activities involving contact with water contaminated with the snail intermediate hosts. Consequently, in order to maintain the parasite at low transmission levels, frequent routine dosages along with epidemiological monitoring are needed. The results of the current investigation, which found that some participants who had previously received successful treatment with praziquantel had schistosomiasis infection, are consistent with the observations regarding reinfection following praziquantel treatment. Comparable results from research on children were documented in African countries (Angora *et al*., 2019; Joof *et al*., 2021), where prevalence rates of 10.2%, 12.9%, and 14% were found in the Gambia, Sudan, and Cote d'Ivoire, respectively.

Males are more likely than females to contract schistosomiasis, according to a number of earlier research (Hajissa *et al*., 2018; Joof *et al*., 2021). In a similar vein, male children had greater overall and gender-specific prevalence than female children. Male children are more likely than female children to engage in water-related activities on a regular basis, such as playing, swimming, and fishing in freshwater bodies, which may explain the high incidence in men. Male children are more prone to the infection during watering of

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livestock (Joof *et al*., 2021; Hajissa *et al*., 2018) Conversely, findings from this current study are at odds with those of research carried out in Nigeria, where females were found to have a higher prevalence of schistosomiasis than males (Sam-Wobo *et al*., 2011; Noriode *et al*., 2018;Lawiye *et al*., 2020). This was explained by the fact that women were more likely than men to participate in household tasks like dishwashing and gathering water from streams, snail farming especially in places like Lagos, and river areas of Nigeria especially the eastern part of Nigeria which put them in greater contact with water. Boys and girls were found to be equally infected with *S. haematobium* in other studies carried out in Sudan and Cote d'Ivoire (Hajissa *et al*., 2018). This was explained by the fact that both sexes were equally involved in daily tasks like collecting water.

The age group between 11 and 15 years old had the highest overall prevalence of urinary schistosomiasis, according to the study's findings. This result is in line with earlier research from studies, which showed that the age categories of 7–15 and 10–15 years old had the largest disease burdens. The results obtained in the present study also support numerous findings from prior studies conducted in various parts of Africa (Amuta *et al*., 2014; Senghor *et al*., 2014; Hessler, *et al*., 2017; Hajissa *et al*., 2018; Lawiye *et al*., 2020; Joof *et al*., 2021). The high burden of disease in this age range is because children in this age group are typically very active and have the highest contact levels with water which expose them to Schistosoma infections. The majority of children infected with this infection do not show any symptoms at first, but as the adult worms and eggs move through the body, problems like haematuria, dysuria, anemia, and bladder lesions that raise the risk of urinary bladder cancer may develop (Lawiye, *et al*., 2020).

A number of studies have discovered a strong correlation between schistosomiasis infection and activities including swimming, fishing, playing, bathing, and water fetching in rivers and other bodies of water (Umar *et al*., 2017; Atalabi *et al*., 2018). A history of urogenital schistosomiasis, poor sanitation, closeness to water bodies, and awareness of the snail host are other factors that have been linked positively to schistosomiasis infection (Umar *et al*., 2017; Atalabi *et al*., 2018). The findings in these studies are comparable to the current results where a positive link between characteristics such as prior infection, distance to water bodies, fishing, swimming, inadequate sanitation and knowledge about the disease and schistosomiasis was seen. These observations confirm findings from a study carried out by Umar *et al*. (2017), where the odds ratios among children who swam, fetched water, and played/bathed showed that the more often the children visited the water bodies infested with cercariae, the higher the likelihood of infection compared to those who did not.

Conclusion

The study on the prevalence and socio-demographic factors associated with urinary schistosomiasis in selected communities of Kaduna North Local Government Area, Kaduna State, has provided valuable insights into the burden of this neglected tropical disease. The study showed a prevalence of 19% in all the communities examined.

Clinical signs highly observed from the infected children were haematuria and cloudy urine. Statistically, cloudy urine, haematuria and frequent urination is significantly associated with urinary schistosomiasis.

The study revealed that infected children frequently missed school due to discomfort from hematuria (blood in urine), dysuria (painful urination).

The role of gender as a factor in the isolation of urinary schistosomiasis in this study revealed that the males are more prone to infection than females.

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