

Potential of Silver Nano Particles Synthesized from *Ficus sycomorus* Linn Against Multidrug Resistant *Shigella* species Isolated from Clinical Specimens

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Abstract: *Ficus sycomorus* Plant was known traditionally for its medicinal properties, *Shigella* species as a bacterial was also known for their resistance to orthodox medicine. Hence the synthesis of silver nanoparticles from *Ficus sycomorus*. This study was carried out to investigate the anti-shigellosis potential of silver nanoparticles synthesized from *Ficus sycomorus* Linn stem bark aqueous extract against Multi-drug Resistant (MDR) *Shigella* species isolated from clinical specimen collected from patients attending Yobe State Specialist Hospital Damaturu, Nigeria. A total of 400 diarrhoeagenic stools were screened for isolation of *Shigella* species and determined their antibiotic susceptibility pattern using standard methods. Phytochemical constituents of *Ficus sycomorus* extract were used to synthesize silver nanoparticles using green synthesis approach. The nanoparticles was analyzed for transmittance, functional groups, sizes and shapes using Uv-vis, FTIR and Scanning Electron Microscopy (SEM), and was tested for antibacterial activities on MDR *Shigella* isolates. There is no significant difference in *Shigella* recovery relation to patients gender ($P < 0.05$). The age group, 0 - 10 years were more susceptible, 40% (36), followed by >30 years (21). *Shigella* were also found to be sensitive to Ciprofloxacin (92%), Augmentin (87%), Cefuroxime (85%), Streptomycin (83.5%) while the most frequent resistance was showcased against Nalidixic Acid (48%), and Tetracycline (27%). Phytochemicals detected include saponins, flavonoids, alkaloids, cardiac glycoside and tannin. Uv-vis showed broad peaks around 460nm, the FTIR showed C-H stretch of hydroxyl group of alkanes and the SEM showed nanoparticles with wide range of shapes and sizes. Anti-*Shigella* activities of silver nanoparticles is higher at zones of inhibition between 10mm and 30mm higher compared to the activities of crude aqueous extract and AgNO_3 solution against the MDR *Shigella* species which showed an enhanced activities. The high prevalence of shigellosis among children in this study, indicated that improved hygiene is needed for children in the area and detailed examination is required for the treatment of diarrhoea in adults. Ciprofloxacin and Amoxicillin Clavulanate, Nalidixic acid could be used only where culture and sensitivity results prevailed. Enhanced traditional medicine should be given priority because of its potentials. This study have demonstrated feasibility of the green synthesis of *F. sycomorus* as a potent anti-shigellosis to combat the global burden of the disease. This is the first study On Stem bark aqueous extracts of *F. sycomorus* against *shigella* species in the area.

Keywords: Nanoparticles, Shigellosis, Diarrhoeagenic, Damaturu, *Ficus sycomorus*, MDR

1. Introduction

Shigellosis is a major public health problems responsible for high morbidity and mortality rate among children aged

less than 5 years in tropical countries. It is an acute diarrhoea disease caused by *Shigella* species, a gram negative bacterium belonging to the family *enterobacteriaceae* with four species; *Shigella dysenteriae* (serogroup A), *Shigella*

flexneri (serogroup B), *Shigella sonnei* (Serogroup C) and *Shigella boydii* (serogroup D) [1].

Shigella infection appears to be more frequent among adult populations, via direct faeco-oral transmission either through accidental ingestion of stool contaminated food or through direct oral-anal contact [2]. It has relatively no animal reservoir making *in-vivo* studies and vaccine development difficult. In developed countries, it is a paediatric diseases but it is widespread between children and adult population in developing countries. The disease may be widespread in war time and natural disaster [3]. Global distribution associated with over-crowding and poor hygienic condition. It can be spread by flies, finger, food, and faeces, part of gay bowel syndrome. *Shigella sonnei* – North of USA, *Shigella flexneri* – South, in India, *Shigella flexneri* have been predominant species followed by *dysenteriae* and *sonnei* in temperate region [4]. Predisposing factors increasing the risk of Shigellosis in Nigeria and other developing countries include; feeding habit, literacy, occupation and hygiene among others [5].

The high cost of antibiotics, presence of counterfeit drugs readily hawked in the city, expiration and improper storage of drugs have contributed to improper usage of drugs leading to multiple drug resistance. Antibiotic treatment is mostly recommended for younger or older patients, mal-nourished children, patients infected with HIV, food handlers, health care workers and children in day care centres. The resistance mechanisms therefore depend on which specific pathways are inhibited by the drugs and the alternative ways available for those pathways that the organisms can modify to get a way around in order to survive [6]. Despite the need to combat antibiotic resistant strains, relatively few shigella-infecting bacteriophages have been described thereby posing therapeutic challenges [7].

The medicinal plants have great positive impacts on the treatment of gastroenteritis and other infectious diseases caused by bacteria [8]. Nowadays, they are widely used in conventional as well as alternative medical practices not only in developing countries like Nigeria but also in the Developed countries as a complementary medicine [9]. *Ficus sycomorus* Linn (Moraceae), Farin Baure in Hausa, Ibibi in Fulfulde, Sycamore Fig in English is a large, semi-deciduous spreading savanna tree, up to 21 (max. 46) m, occasionally buttressed. Its bark is slash pale pink with heavy latex flow. Leaves broadly ovate, obtuse with rough surface [10]. In-vitro antimicrobial screening of methanolic stem bark extract of *F. sycomorus* revealed that the extract inhibited varying activity against *enterococcus faecalis*, *E. coli*, *S. typhi*, *Shigella dysenteriae* and *Candida albicans* [11].

Silver and its compounds have been used since ancient time for treatment of bacteria and wound infections especially in patients with severe burns [12]. Silver nanoparticles are particles of silver between 1nm and 100nm in size. Nano-particles are mostly synthesized from silver but diamond, octagon and thin sheets are also popular [13]. Biosynthesis of nano-particles is an important area in the field of nanotechnology which is economic and eco-friendly.

It is promising as antibacterial agent for both Gram's positive and Gram's negative bacteria [14]. Silver nanoparticles have attracted interest due to its corresponding small size, unusual physical, chemical and biological properties [15]. It has potent antimicrobial and antioxidant activities and potential biomedical and industrial applications [16]. It has been reported that they have advantages as drug carriers [17]. In the antimicrobial activities, initially Silver nano-particles attach to the surface of the bacteria membrane and then penetrate into bacteria. After penetration, they inactivate enzymes of the microbes, generating H_2O_2 causing bacteria death. The green synthesis of Silver Nanoparticles suggests their usage in medical devices as an antimicrobial coater [18]. Antimicrobial activity of AgNPs may also, be due to either (i.) formation of pores on the cell membrane which ultimately lead to leakage of cellular content, or (ii.) the silver ion penetrate through the ion channels does not damage the cell membrane; rather, denatures the ribosome and exhibit the expression of enzymes and thiol containing protein essential for the production of ATP and thus result to cell death as argued by [19]. AgNPs synthesized from various plants including *Ficus sycomorus* shown efficient antimicrobial activity against pathogenic bacteria [20].

Damaturu is the Capital of Yobe state, North-Eastern Nigeria affected by insurgency, we have many internally displaced camps across the city and the specialist hospital has been the hospital of choice for both IDPs and Residents because of the state governments free drugs initiate, subsidy on every other services rendered by the hospital and Victim Support Funds. The health facility have been overwhelmed with diarrhoea, dysentery and other diseases associated with poverty, war, internal displacement, poor sanitation, personal hygiene, and shortage of water supplies. This necessitated prospective study to determine the prevalence and antimicrobial profiles of *Shigella species* isolated from the diarrhoeal stool of patients presented for care at Yobe State specialist Hospital Damaturu and the potential of using silver nanoparticle enhanced *Ficus sycomorus* to combat the multiple drugs resistant strains isolated between April, 2019 and October, 2019. This should provide Information for use in designing treatment guideline for treatment of Shigellosis that will be appropriate in the area. In addition, the study would add to existing literature on epidemiological information on the resistance patterns of *Shigella* isolates of public health importance and feasibility of using and enhancing natural products against shigellosis in the area.

2. Methodology

2.1. Study Area and Population

The study was carried out in Yobe State Specialist Hospital, Damaturu, North-East Nigeria. It is Located at 12000'N, 11030'E with 45, 502 km² and estimated population of 2, 757,000.

2.2. Specimen Collection

A total of 400 faecal specimens was collected as non-invasive method from diarrhoea/dysentery patients of all ages and sexes in the study area. Sterilized sample containers were given for collection of stool sample.

2.3. Isolation, Identification and Characterization of *Shigella* species.

The samples were processed the same day for the isolation of *Shigella* species. Faecal specimens were processed according published methods [21]. One loopful of faecal sample was streaked on MacConkey-Lactose Agar (MLA) and Lactose-Lysine Deoxycholate Agar (XLD) and incubated at 37°C for 24 hours. The MLA plates that showed the presence of convex, colourless colonies and XLD plates showing presence of translucent or red colonies were considered for further identification. Suspected colonies were re-streaked on other selective media i.e Hektoen Enteric Agar (HEA), *Salmonella-Shigella* Agar (SSA) and Deoxycholate Citrate Agar (DCA) as described by [22]. The culture plates were examined for typical morphological characteristics of *Shigella* species.

2.4. Biochemical Characterization of *Shigella* species

Colonies showing characteristic appearance on selective media were sub-cultured on Kligler iron agar (KIA) and Triple sugar iron agar (TSI). Oxidase, Urease, Indole, Citrate and Motility tests were conducted for further identification as described by [22].

2.5. Antibiotics Susceptibility Testing

The susceptibility of all strains was performed using the single disc diffusion technique [23]. This was achieved by using Commercial Antibiotic discs (Optu disc) for Gram's negative bacterial disc consisting of Ofloxacin (25mcg), Cefuroxime (30mcg), Ciprofloxacin (25mcg), Augmentin (30mcg), Streptomycin (25mcg), Cephalosporin (5mcg), Gentamycin (10mcg), NA - Nalidixic Acid (25mcg), Cotrimoxazole (5mcg), Ampicillin (30mcg) at appropriate concentrations were placed on the *Shigella* species isolates streaked plates and incubated at 37°C overnight. The diameter of inhibition zones measured in millimeter using a caliper. Zones of inhibition was used to determine resistant and sensitive organisms using standard of [24].

2.6. Green Synthesis and Characterization of Nano-scale Silver Particles from Stem Bark Extracts of *F. sycomorus*

Biosynthesis of Nano-Scale Silver Particles using aqueous Stem Bark Extracts of *F. sycomorus* as reducing agent [25]. With constant stirring, 50ml of AgNO₃ solution (1mM) were added drop-wise to the aqueous extract of *F. sycomorus* stem bark at 50-60°C for the reduction of Ag²⁺. This solution was

incubated in the dark at 37°C until use. A control solution (without extract) was incubated under the same condition. [26].

2.7. UV-vis Spectra Analysis

This was carried out for the nanoparticles of stem bark extract of *F. sycomorus*, by measuring the Optical Density (OD) using UV-2401, India. Measurement was performed between 200-800nm with a resolution of 1nm and Scanning speed of 300nm/min. The reduction of Ag²⁺ was monitored by measuring the UV-vis spectrum of 1ml aliquot sample and 2ml de-ionized water in quartz cell. Silver nitrate (1mM) was used to adjust the baseline as a blank [14].

2.8. Fourier Transmission Infra-Red Analysis (FT-IR)

This analysis was carried out using IRAffinity-1S Spectrometer (Buck Scientific – 530) and Perkin-Elmer spectrophotometer on the powder sample of AgNPs. The AgNP solution was centrifuged at 10,000 rpm for 20 minutes. The solid residue obtained was then dried at room temperature, and the powder obtained was used for FTIR measurement.

2.9. Scanning Electron Microscopy

Scanning Electron Microscopy (SEM) was performed with Phenom Pro-X 800-07334 operated at 25 kv. Scanning Electron Microscope (SEM) images were taken by coating a drop of silver nanoparticles of *F. sycomorus* onto a carbon-coated copper grid and allowed to evaporate, while held with the aid of sample holder before scanning [27].

2.10. Test for Antibacterial Efficacy of the Extracts

This test was performed using disc diffusion methods [24]. McFarland 0.5 standard inoculum was prepared [28]. The test was carried out by using filter paper discs (Whatman No. 1) of 6mm prepared and sterilized. The discs was impregnated with 100µl of AgNP from dilution (100mg/ml) and reconstituted in minimum amount of solvent was then applied over each of the culture plates previously seeded with the 10⁶ cfu/ml culture of *Shigella* and incubated at 37°C for 18hours. The same was repeated for crude extract and AgNO₃ [29]. After incubation period, the zone of inhibition was then measured as an indicator for antibacterial activity compared to stem bark crude extract, its AgNPs, and AgNO₃.

3. Results and Discussion

3.1. Characteristics of *Shigella* Isolates from Stool Samples

The age distribution data revealed that *Shigella* species were isolated from 85 cases, where highest frequency 40% (34) was recorded in the age group 0 – 10, followed by 22.2% (19) in age group 11 – 20, 14%. Most of the isolates 52% (44) were from male patients.

Table 1. Distribution of *Shigella* species isolates according to Demographic characteristics of the patients.

Demographic Characteristics	No. of Specimen collected (n=400)	No. of Positive Isolates (n=85)	% of positive Isolates
Age (Years)			
0 – 10	143	34	40.0
11 – 20	91	19	22.4
21 – 30	66	11	12.9
31 – 40	39	06	7.1
41 – 50	25	08	9.4
51 – 60	15	02	2.4
>60	21	05	5.9
Sex			
Male	221	44	51.8
Female	179	41	48.2

The frequency of *Shigella* isolated in this study (22.4%) is related to a work 19.72% reported in Iran, but slightly higher compared to 13.5% reported in Lagos, Nigeria [30, 31]. 11.6% isolates frequency in diarrhoea patients from Bangladesh, 8.56% from Addis Ababa, Ethiopia and 8.0% in Maiduguri, Nigeria as reported by other studies [32, 33, 34]. The value obtained in this study also observed lower when compared with report in Kano, Nigeria [35]. High prevalence *shigella* in the present study indicated low hygiene level among the patients. It is found to be more prevalent among children categories <11 years of age, contrary to reported cases by Andualem in Addis Ababa, Ethiopia with highest prevalence rate between 15 – 35 years age group and claim that *Shigella* is more common among MSM (Men Sleeping with Men) in California [2]. There is a slight difference between number of males and females but statistically insignificant at ($P < 0.05 = 0.026$) suggesting that there is no statistical difference between the recovery rate of *Shigella* in both male and female respondents.

3.2. Antibiotics Susceptibility Pattern of *Shigella* species Isolated from Stool Samples

Although, Shigellosis can be self-limiting with oral rehydration and care but there is need to use antibiotics as the only way to reduce severity of the infection, illness duration and shedding of the etiologic agent. Choice of antimicrobial in developing countries is determined by the availability of

the drugs, cost, and pattern of resistance in the area. Overall resistance recorded in this study is with Nalidixic acid (48.2%) followed by Tetracycline (27.1%), Ampicillin (24.7%). Ciprofloxacin (90.6%) on the other hand leads the sensitivity of the isolates, followed by Amoxycillin Clavulanate (Augmentin) (87.1%), Cefuroxime 84.7%.

There is no total resistance, with limited total sensitivity to the antibiotics used in this study. This is contrary to reports in some previous studies with overall resistant to ampicillin 100% total sensitivity to ciprofloxacin and Ofloxacin but rather worrisome that resistant to two or more antibiotic is at very high rate as findings revealed that 95.1% of *Shigella* spp. isolated from patients showed a MDR phenotype [33, 34, 30].

Resistance to Ampicillin, a common antibiotic previously used for bloody diarrhoea in this area, was low at 24.7% as reported in a study [34]. But high resistance to Ampicillin (78.0%) was reported by National Antimicrobial Resistance Monitoring System in United States and other studies [20]. The high resistance to Nalidixic acid (48.2%), in this study slightly agreed with the value (31%) reported in Iran [30]. Worldwide, in the last decade, there has been an increased proportion of isolates resistance to drugs that were known to be effective against *Shigella* isolates such as Ampicillin, Chloramphenicol, Cotrimoxazole, and Tetracycline. Therefore, these antibiotics should no longer be considered as appropriate empirical therapy without culture and sensitivity [30].

Table 2. Distribution of *Shigella* Isolates from Diarrhoeagenic patients according to antibiotics susceptibility pattern.

Antibiotics (µg)	No. (%) of <i>Shigella</i> isolates (n=85) and susceptibility pattern			
	Sensitive		Resistant	
Ofloxacin (25)	68	(80.0)	19	(20.0)
Cefuroxime (30)	72	(84.7)	13	(15.3)
Ciprofloxacin (25)	77	(90.6)	08	(9.4)
Augmentin (30)	74	(87.1)	11	(12.9)
Streptomycin (25)	71	(83.5)	14	(16.5)
Cotrimoxazole (5)	68	(80.0)	17	(20.0)
Gentamycin (10)	68	(80.0)	17	(20.0)
Nalidixic Acid (25)	44	(51.8)	41	(48.2)
Tetracycline (25)	62	(72.9)	23	(27.1)
Ampicillin (10)	64	(75.3)	21	(24.7)

3.3. Phytochemical Constituents of *F. sycomorus* Stem Bark Extracts

Phytochemical constituents identified in the methanol and

aqueous stem bark extracts (Table 3); include: carbohydrates, saponins, cardiac glycosides, flavonoids, tannins and Anthraquinones. Steroids is absent in both extracts.

Table 3. Phytochemical screening of *F. sycomorus* stem bark.

Phytochemicals	<i>Ficus sycomorus</i> extracts and test Inference	
	Water	Methanol
Cardiac Glycosides	-	+
Saponins	+	+
Flavonoids	+	+
Tannins	+	+
Steroids	-	-
Anthraquinones	-	+
Carbohydrate	+	+

Key: (+) Present, (-) Absent.

This agreed with previous findings [36-39]. In another study using root bark extract of the same plant, reducing sugar was also found [40]. The phytochemical analysis of *Ficus sycomorus* revealed the presence of alkaloids, tannins, saponins, flavonoids and steroids in both the aqueous extracts of the leaves and the fruits [41].

These classes of compounds are known to be biologically active and are associated with the antimicrobial activities of *Ficus sycomorus* [42, 43]. Alkaloids have been associated with medicinal applications in plants, among which is their toxicity against cells of foreign organisms.

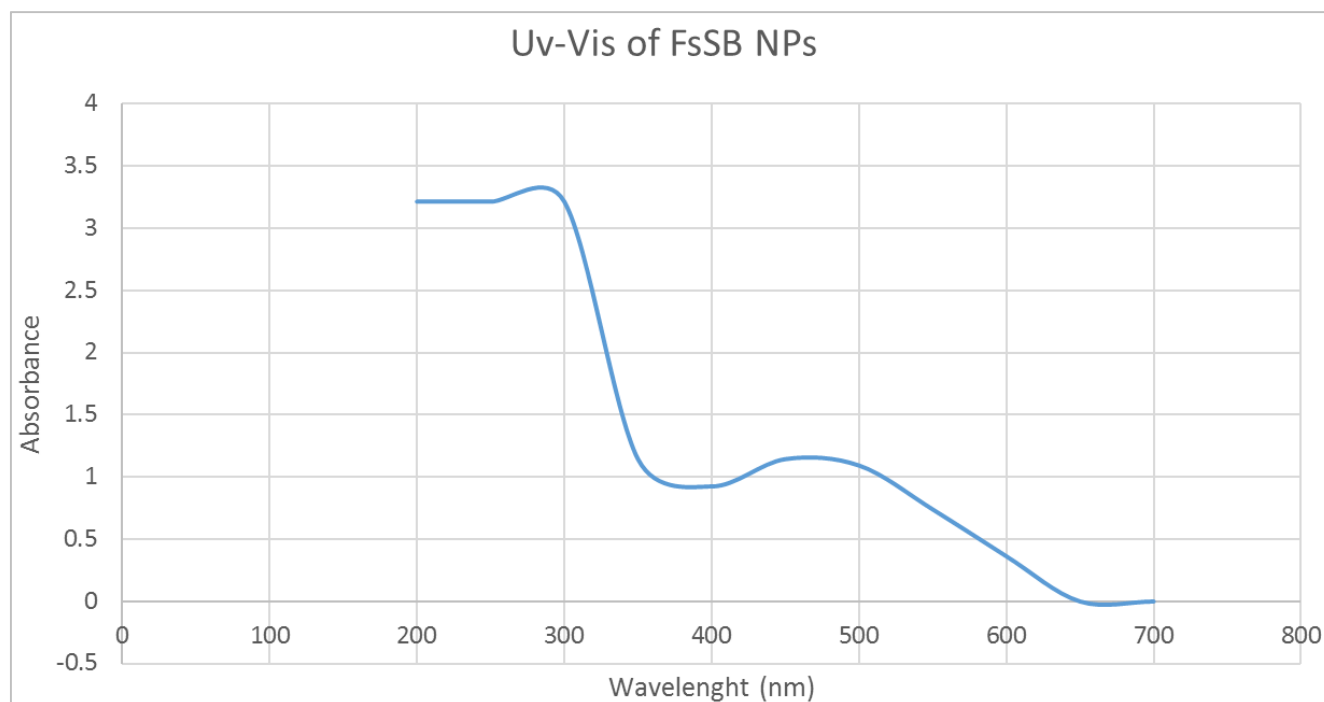


Figure 1. UV-vis absorbance characteristics displayed by AgNPs of *F. sycomorus* stem bark extract as the function of their surface Plasmon resonance peak broad around 460nm.

3.4. Synthesis and Characteristics of Silver Nanoparticle

The clear colourless solution of silver nitrate changed to clear deep brown immediately and remained deep brown over a period of time. The change in colour to deep brown with time is due to excitation in surface Plasmon resonance and the collective oscillation of conduction electrons within metal nanoparticles. The surface Plasmon resonance, enables scattering and absorption of light at a particular frequency, giving them the colour [44]. UV-vis absorbance characteristics displayed by AgNPs of *F. sycomorus* aqueous stem bark extract as the function of their surface Plasmon resonance peak broad around 460nm (Figure 1). The highest peak in this study falls within close range as those observed by previous scholars at 450, 451, 457 and 460 [45, 27, 46, 47].

3.5. FT-IR Characteristics of Silver Nano Particle Synthesized

The AgNPs obtained from the stem bark extract of *Ficus*

sycomorus mimic prominent bands suggesting absorbance around 3379.4505, 2941.7374 and 1633.6242 neglecting the fingerprint region (Figure 2). The bands denote stretching vibration bands as a result of presence of compounds like Flavonoids and other phyto-compounds present in the crude extract [23].

The Broad, medium absorbance around 3379.4505 resembles N-H stretch of Amine, which can be specific to the frequency of extending vibration of primary amine [48]. Weak C-H stretching of aldehyde or hydroxyl group of alkane around 2941.6949 was observed, and FTIR spectrogram observed around 1633.6242 indicate C=C stretching, 1631-1633 stretch indicate C=C stretch of alkenes or C=O stretch of Amides found in alkaloids falling within the range reported [46]. A similar kind of IR bands was observed for Ag nanoparticles of the same plant with minor shift in the absorption bands. The minor shift may be due to the interaction of leaf extract with AgNPs which changed the original transmittance level of the extract. It can be concluded that the water soluble compounds in the crude

extract are responsible for capping and efficient stabilization of the Nanoparticles.

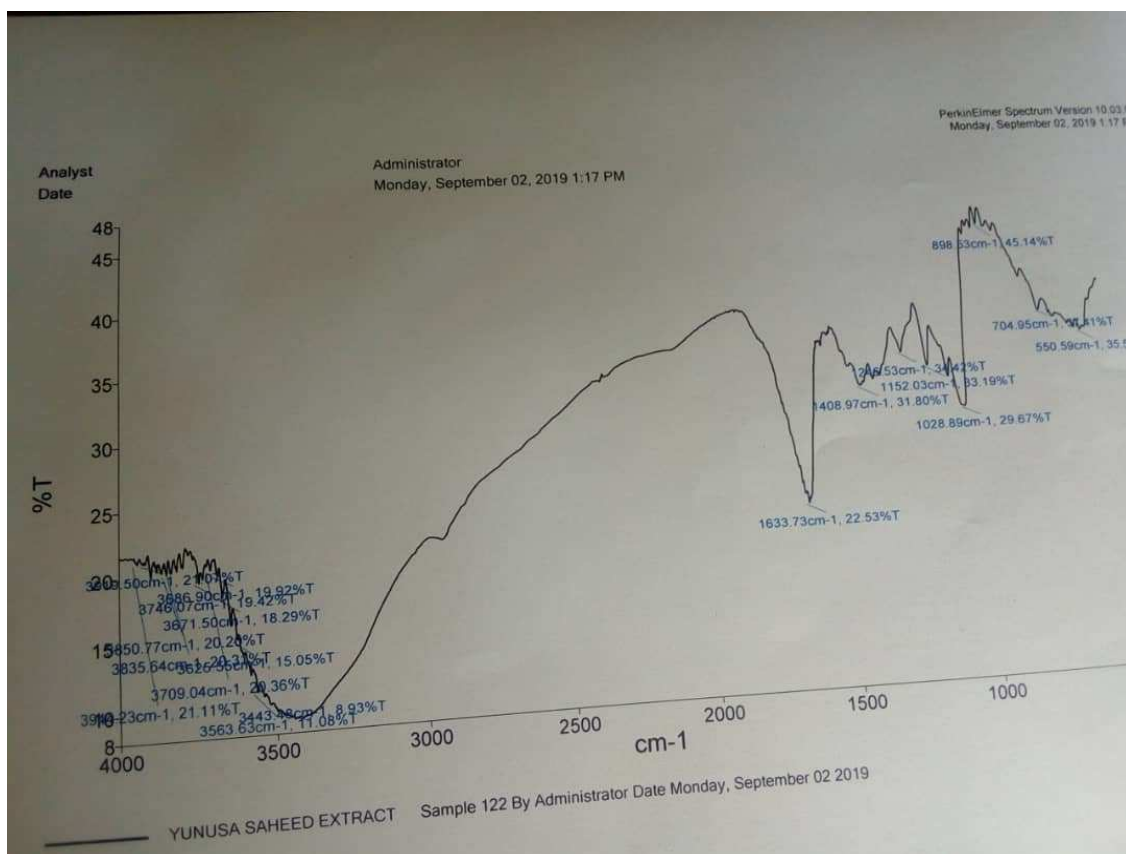


Figure 2. FT-IR Spectrogram of *Ficus sycomorus* aqueous Extract.

3.6. Electron Microscopy

The morphology of the synthesized AgNPs was determined by SEM (Phenom Pro-X 800-07334) which showed different morphologies. The resulting nanoparticles showed uniform spherical particles in the size range of 30-75

nm. SEM images also showed the presence of Nano triangles and other morphologies in the same sample. Other nanoparticles of equal range in size and shapes have been reported, using aqueous extracts from *Buchholzia coreacea*, *Sargassum insisifolium* and various plants species, [47-49].

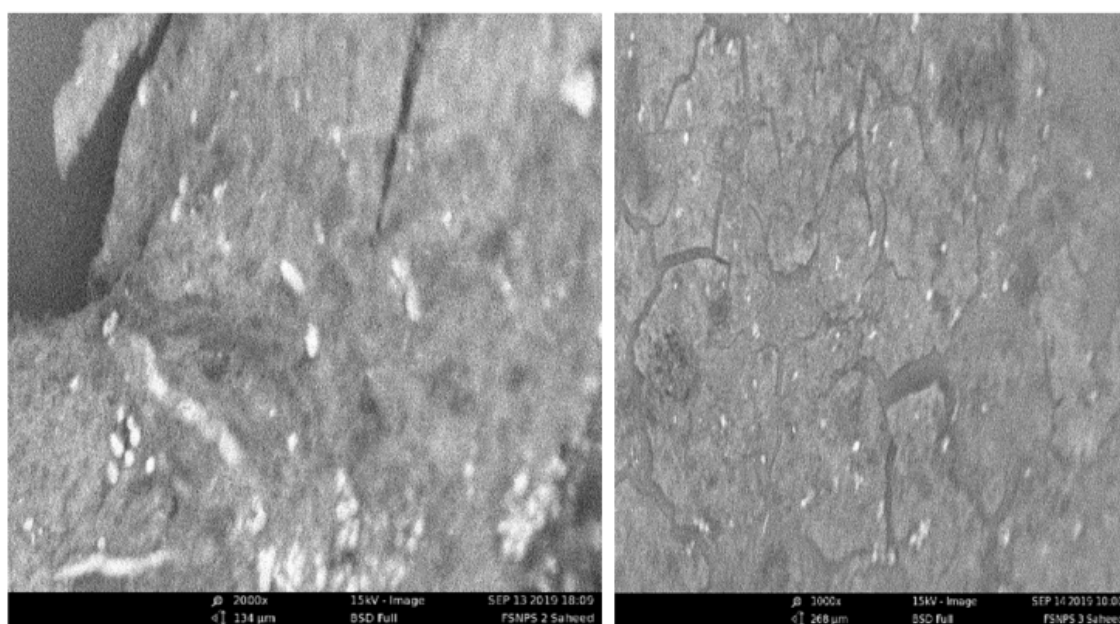


Figure 3. Scanning Electron Microscope images of Silver Nanoparticles of *F. sycomorus*.

Ficus sycomorus leaves and latex extract Nanoparticles have been explored [14] and characterized as Ellipsoidal, spherical and irregular in shapes using TEM, EDX.

3.7. Antishigella Activities of AgNPs

This studies showed that the *F. sycomorus* stem bark extract synthesized silver nanoparticle exhibited enhanced potency with massive zones of inhibition between 10mm and 30mm compared to the activities of both crude stem bark extract and AgNO₃. The bacterial isolates were multidrug-resistant strains of *Shigella* species showing resistance to two or more commercially available antibiotics. The activities due to zones of inhibitions produced range between less than 10mm and 24mm inhibition zones for *F. sycomorus* crude extract with highest percentage (77.6%) inhibition less than 10mm, less than 10mm – 29mm inhibition zones for Silver Nitrate with highest percentage inhibition (60.3%) produced 10mm – 14mm and greater than 10mm – greater than 29mm zones of inhibition for the silver nanoparticles synthesized from the stem bark extract of *Ficus sycomorus* with highest inhibition (46%) found between 15mm and 19mm, though inhibition zone of as high as 30mm was also observed.

Table 4. Antishigella activities of crude extract, AgNO₃ and AgNPs on *Shigella* isolates.

Number (%) of Isolates positive per test			
Zones of inhibition (mm)	FsSBE	AgNO ₃	FsAgNPs
<10	45 (77.6)	19 (32.8)	00 (00)
10 – 14	09 (15.5)	35 (60.3)	15 (25.9)
15 – 19	03 (5.2)	03 (5.2)	27 (46.6)
20 – 24	01 (1.7)	00 (00)	10 (17.2)
25 – 29	00 (00)	01 (1.7)	05 (8.6)
>29	00 (00)	00 (00)	01 (1.7)

Keys: FsSBE – *F. sycomorus* Stem Bark Extract, FsAgNPs – *F. sycomorus* Silver Nanoparticle.

These results falls within same range as reported by previous studies [43, 47, 50, 51, 46, 14, 52]. Zones of inhibition of *F. sycomorus* fruits and leaves extract between 15mm and 17mm on *E. coli.*, zones of inhibition of 7-19 mm for biosynthesized AgNPs using leaf and latex of *Ficus sycomorus* against some bacterial strains and 32mm inhibition zone against *Shigella sonnei* and *Salmonella typhi* using NPs synthesized from *Bacillus* spp. have been reported [43, 14, 48]. NPs synthesized from colanut exhibited Zone of Inhibition between 12mm and 15mm [47, 46]. Ciprofloxacin and Streptomycin resistant bacteria have been reported to be sensitive to silver nanoparticle synthesized from Kapparrillaka leaves 16mm – 21mm [53]. *Ficus sycomorus* leaves 12mm - 24mm and *Nelumbor nucifera* leaves around 16mm [29, 51]. However, the present study has shown more potent activities of AgNPs against multidrug-resistant *Shigella*, thereby demonstrating the efficacy of the particles, which can be applied for biomedical applications to combat drug-resistant bacterial infections in this era of emerging and re-emerging infectious diseases.

4. Conclusion

It was found that the frequency of isolation of *Shigella* is common among children (40%), slightly more among male (52%) compared to female but statically insignificant at 95% confidence level. The *Shigella* species isolated showed considerable resistance to Nalidixic acid and sensitive to Augmentin and Ciprofloxacin which suggest the continued use of these drugs in the treatment of shigellosis due to low resistance. Nalidixic acid can be excluded from empirical drugs used in treatment of shigellosis in this area, due of its high rate of resistance. Silver nanoparticles produced showed maximum absorption bands around 460nm, and the FT-IR showed N – H stretch of amine, weak C – H stretch of aldehyde or hydroxyl group of alkanes and C – C stretch of alkenes or C=O stretching of amides while the SEM showed various characteristics. Anti-*Shigella* activities of the silver nanoparticles produced from stem bark extract of *F. sycomorus* showed commendable zones of inhibition against the MDR *Shigella* species, compared to its crude extracts and silver nitrate solutions. Biosynthesized AgNPs a is very promising as an anti-shigellosis suggesting possibility of enhancing local herbs using nano-biotechnology models which is not only environmental friendly but also, economical.

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