

## Physiochemical Parameters of the Soil from Selected Dumpsites in Lapai Town

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**ABSTRACT:** Parasite infection has remained a public health problem in Lapai. This study was carried out in Lapai local government Areas of Niger state to determine the values of physiochemical parameters of soil from selected dumpsites in Lapai town. The study utilized a simple randomized design approach. A total of six different locations of dumpsite were selected for the study. The physico-chemical properties of the soil at the dumpsites investigated namely; pH, Conductivity, Moisture and Temperature showed slight significant variation from January to September 2020 ( $p < 0.05$ ), but the pH and Conductivity of the soil examined at 5cm depth and Moisture of the soil examined at the surface showed no significant difference between the months ( $p > 0.05$ ). In general, at the surface, a weak acidic to weak alkaline pH range of 6.86 to 7.53 was observed across the months, Conductivity ranged from 0.00 to 1.69, Moisture ranged from 6.21 to 33.03, while Temperature ranged from 23.00°C to 32.33°C. It is therefore recommended that policies on the waste disposals and management should be enacted and strictly enforced by government to avoid the spread of preventable parasitic diseases.

**Key words:** Physiochemical, dumpsites, soil

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### INTRODUCTION

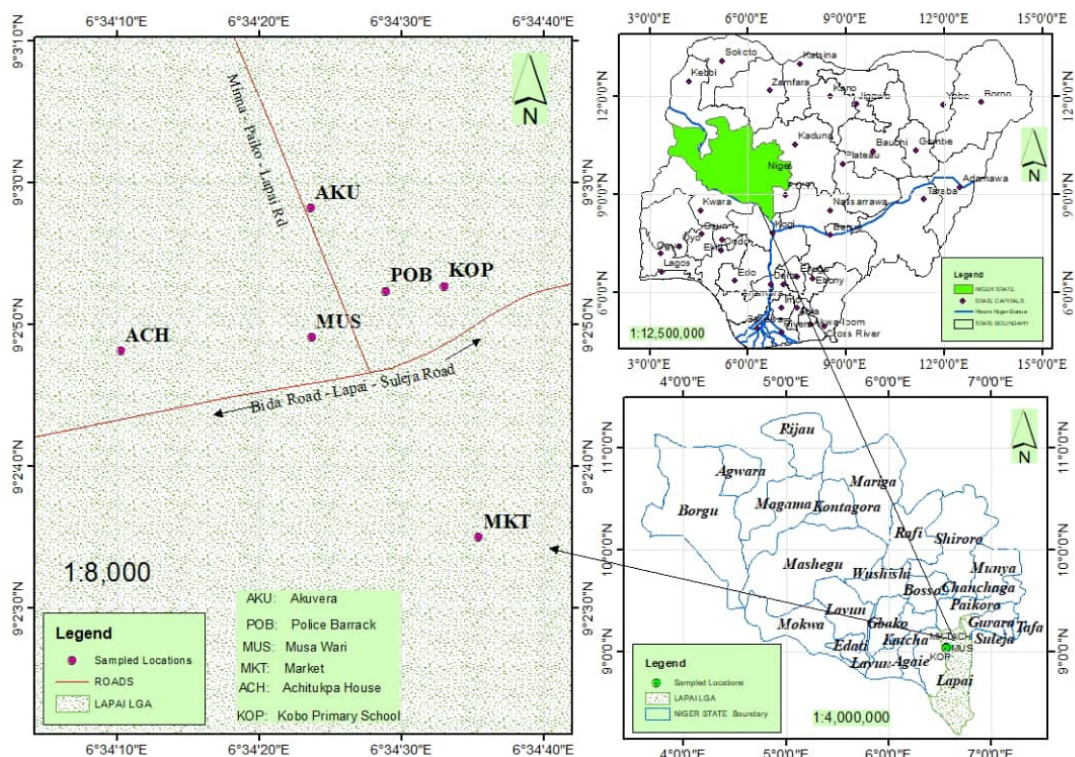
Problems caused by improper waste disposal and management has gotten to a scaring dimension with its effect on the environment, health and well-being of the populace thus approaching it holistically is a non-negotiable alternative for a healthy and sustainable living (Ahmad *et al.*, 2013). Urbanization and population growth had led to increase in waste generation due to anthropogenic activities of human (Verge and Rowe, 2013). The pollution of soil through waste discharges is a global issue and carries various metals which can be transferred to plants through different ways (Akinbile and Yusoff, 2012). This pollution of soil by heavy metals from dumpsites can cause adverse effects on the soil productivity, human and animal health (Voutsas *et al.*, 1996). Open dumpsites are common practice in Lapai town as a result of low budget for waste disposal.

A good amount of the waste in Lapai town is dumped in a low lying areas which can cause threat to soil and water (Akinbile, 2012). Studies had shown several evidences of hazards caused by open waste dumping, importantly is irreversible erosion (Phil-Eze, 2010). Physiochemical quality of soil is ultimately affected by solid waste pollutants, therefore this study was conducted to determine the physiochemical parameters of soil from selected dumpsite in Lapai town.

### MATERIALS AND METHODS

#### Description of the study area

This study was carried out in Lapai metropolis. Lapai is the Local Government headquarter of Lapai Local



**Figure 1:** Lapai Map showing the study Area. Source: Field photograph, 2020

Government Area, Niger State, Nigeria, adjoining the Federal Capital Territory at 9° 03' 00"N 6°34'00 "E. It has an area of 3, 051 km and a population of 110,127 at the 2006 census (Figure 1). Lapai is located east of Agaie on the road to Abuja. Revolv (2020).The area has a tropical climate with a mean annual temperature, relative humidity and rainfall of 30.20°C, 61.00% and 1334.00mm, respectively. The climate presents two distinct seasons: a rainy season (May- October) and dry season (November – April). The vegetation in the area is typically grass dominated savannah with scattered trees. (Niger State Agricultural Developmental Project (NSADP), 2020). The study area consists of six different location of refuse dumpsite which was randomly selected for this study. The dumpsites are located at Lapai Market, Police Barack, Achitukpa, Musawari, Kobo primary School, Akuvera in Lapai town Niger State (Figure 1).

**Sample collection**

Samples were gotten and classified into six(6) categories, this include; samples from Akuvera (sample A), Musawari (sample B), Police Barrack (sample C), Kobo Primary School (sample D), Lapai Market (sample E) and

Achitukpa (sample F). At each location, samples were gotten from different parts, giving a specific interval of 25-30cm from the initial point of collection. Each point of collection is being marked as the same, dumpsite is revisited for another collection of sample. For each Location, sample collected include; surface of the earth and at a depth of 5 cm using the method of (Cletus, 2015). Samples were collected monthly from the month of January 2020 to the month of September 2020. Physicochemical properties of soil from the dumpsites was measured in- situ with the aid of a multipara meter by HANNA. Temperature, Conductivity, and pH with an exception to moisture content which was analyzed in ex – situ. Soil sample (60g) was collected from each sampling sites in the morning hours between 7; 30 am and 10; 30 am. A total of 864 soil samples were collected from six refuse dumpsite in the study areas. Each of the dumpsites was visited twice in a month for sample collection.

**Statistical analysis of data**

Data obtained are presented in percentiles, summarized into respective means and accompanied with standard

**Table 1:** Summary of Physicochemical Parameters of the soil at the Dumpsites (Surface and 5cm Depth) at Lapai, from January to September 2020.

Month	PH		Conductivity		Moisture		Temperature	
	Surface	5cm depth	Surface	5cm depth	Surface	5cm depth	Surface	5cm depth
January	7.53±0.12 <sup>a</sup>	7.71±0.14 <sup>a</sup>	0.63±0.07 <sup>b</sup>	0.21±0.02 <sup>a</sup>	16.24±0.79 <sup>a</sup>	18.58±0.76 <sup>b</sup>	31.00±0.55 <sup>b</sup>	28.50±0.48 <sup>a</sup>
February	7.25±0.05 <sup>b</sup>	7.22±0.06 <sup>a</sup>	0.61±0.07 <sup>b</sup>	0.21±0.02 <sup>a</sup>	10.45±0.34 <sup>a</sup>	12.68±0.61 <sup>b</sup>	30.67±0.54 <sup>b</sup>	28.83±0.61 <sup>a</sup>
March	7.25±0.05 <sup>b</sup>	7.22±0.06 <sup>a</sup>	1.69±0.35 <sup>a</sup>	1.46±0.34 <sup>a</sup>	7.10±0.42 <sup>a</sup>	8.00±0.43 <sup>b</sup>	32.25±0.73 <sup>a</sup>	31.50±0.78 <sup>a</sup>
April	7.06±0.04 <sup>a</sup>	7.06±0.03 <sup>a</sup>	0.00±0.00 <sup>a</sup>	0.00±0.00 <sup>a</sup>	6.57±0.38 <sup>a</sup>	7.40±0.69 <sup>b</sup>	32.33±0.67 <sup>a</sup>	32.33±0.67 <sup>a</sup>
May	7.02±0.01 <sup>a</sup>	7.04±0.01 <sup>a</sup>	0.38±0.02 <sup>a</sup>	0.34±0.01 <sup>a</sup>	6.21±0.30 <sup>a</sup>	6.93±0.56 <sup>a</sup>	26.58±0.29 <sup>a</sup>	28.13±0.20 <sup>b</sup>
June	6.90±0.06 <sup>b</sup>	6.78±0.05 <sup>a</sup>	0.13±0.03 <sup>a</sup>	0.11±0.01 <sup>a</sup>	13.23±0.92 <sup>a</sup>	15.04±0.83 <sup>b</sup>	25.50±0.40 <sup>a</sup>	26.92±0.47 <sup>a</sup>
July	6.86±0.06 <sup>a</sup>	6.88±0.05 <sup>a</sup>	0.21±0.02 <sup>a</sup>	0.19±0.02 <sup>a</sup>	15.27±0.92 <sup>a</sup>	17.55±0.87 <sup>b</sup>	26.83±0.78 <sup>a</sup>	28.50±0.92 <sup>a</sup>
August	7.01±0.04 <sup>a</sup>	7.05±0.03 <sup>a</sup>	0.02±0.00 <sup>a</sup>	0.02±0.00 <sup>a</sup>	16.50±0.62 <sup>a</sup>	24.90±1.21 <sup>b</sup>	23.88±0.55 <sup>a</sup>	24.58±0.50 <sup>a</sup>
September	6.99±0.01 <sup>a</sup>	7.00±0.00 <sup>a</sup>	0.02±0.00 <sup>a</sup>	0.02±0.00 <sup>a</sup>	33.03±1.18 <sup>a</sup>	38.22±1.38 <sup>b</sup>	23.00±0.58 <sup>a</sup>	23.00±0.58 <sup>a</sup>

Values with the same superscript along the same row, for each physicochemical parameters are not significantly different at  $p>0.05$  from paired sample T-test. Values are presented in Mean  $\pm$  Standard error of their replicates

errors. Analysis of Variance (ANOVA) one-way and Post-Hock test was used to determine the significance between means of the various dumpsites selected for evaluation. The means difference between parasite prevalence with respect to season was established using paired sample T-test. All analysis was assumed significance at  $p<0.05$ . Analysis was done using Microsoft excel and statistical packages for social sciences.

## RESULTS AND DISCUSSIONS

### Physicochemical parameters of the Soil from Dumpsites

A summary of some physico-chemical properties of the study stations of the soil at both surface and 5cm depth of the dumpsites at Lapai, Niger State from January to September 2020 is given in (Table 1). The physico-chemical properties of the soil at the dumpsites investigated namely; pH, Conductivity, Moisture and Temperature showed slight significant variation from January to

September 2020 ( $p<0.05$ ), but the pH and Conductivity of the soil examined at 5cm depth and Moisture of the soil examined at the surface showed no significant difference between the months ( $p>0.05$ ). In general, at the surface, a weak acidic to weak alkaline pH range of 6.86 to 7.53 was observed across the months, Conductivity ranged from 0.00 to 1.69, Moisture ranged from 6.21 to 33.03, while Temperature ranged from 23.00°C to 32.33°C. At 5cm depth, a weak acidic to weak alkaline pH range of 6.78 to 7.71 across the months, the Conductivity (0.00 to 1.46) was relatively low in all the sampling stations across the months, Moisture ranged from 6.93 to 38.22, whereas Temperature ranged from 23.00°C to 32.33°C across the months (Table 1).

### Monthly variation in Physico-chemical properties of the soil at the Dumpsites (Surface and 5cm Depth) at Lapai, Niger state

#### pH

There was a gradual decrease in the pH of the soil collected at the surface of the dumpsites from

7.53 in January to 6.86 in July, 2020 (Figure 2). In August, 2020, the pH increased to 7.01 and later decrease to 6.99 in September; 2020. The highest pH at the surface of the dumpsites (7.53) was however recorded in the month of January, 2020, while the least (6.89) was recorded in July, 2020. At the 5 cm depth, a weak acidic to weak alkaline pH was recorded across the months. There was a gradual decrease in the pH of from 7.7 in January to 6.78 in June, 2020. The pH increased slightly to 6.88 in July and 7.05 in August, 2020 but later decrease to neutral (7.00) in September, 2020. The highest pH at 5 cm depth of the dumpsites (7.71) was however recorded in the month of January, 2020, while the least (6.78) was recorded in June, 2020 as shown in (Figure 2).

#### Conductivity

There were fluctuations in the Conductivity of the soil collected at the surface and at 5cm depth of the dumpsites across the months (Figure 3). The Conductivity of the soil at the surface was 0.63 in January 2020 which gradually decreased to 0.61 in February 2020 and drastically increased in

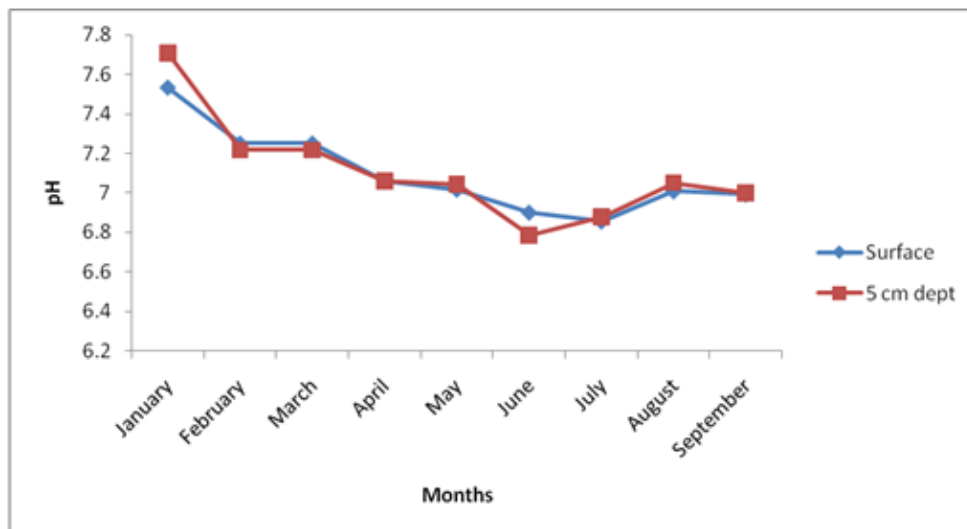


Figure 2: pH showing the fluctuation of the level of pH in the study location.

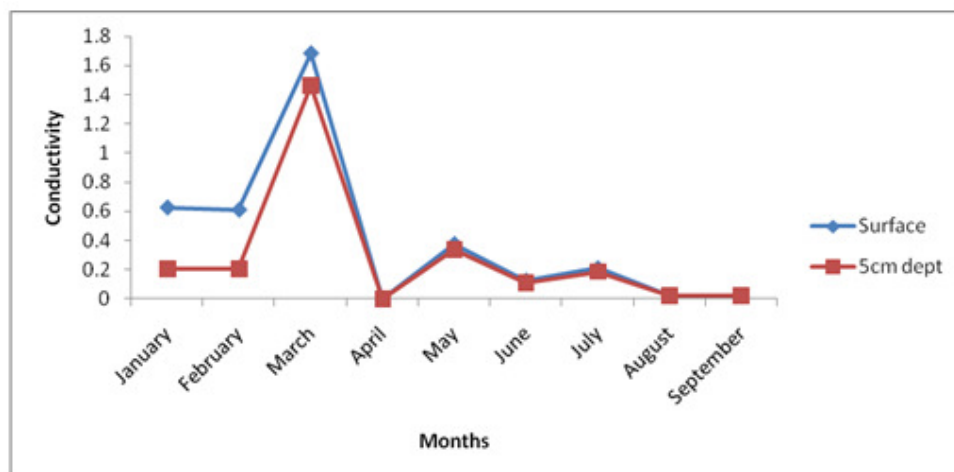


Figure 3: Conductivity level in the study sites

March 2020 to a peak 1.69 and later dropped to 0.00 in April 2020. This later increased to 0.38 in May 2020. The Conductivity decreased from 0.21 in July 2020 to 0.02 in August and September, 2020 (Figure 3). Similarly, the Conductivity of the soil collected at 5cm depth of the dumpsites was 0.21 in January 2020; this was consistent in the month of February but however rose to the peak of 1.46 in March and later dropped to 0.00 in April, 2020. The Conductivity rose to 0.34 in May 2020, but later dropped to 0.11 in June 2020 and gradually decreased 0.02 in August and September, 2020.

**Moisture**

The result of the Moisture content of the soil at the Dumpsites (Surface and 5cm Depth) at Lapai, Niger state is presented in (Figure 4). There was a gradual decrease in the Moisture of the soil collected at the surface of the

dumpsites from 16.24 in January to 6.21 in May, 2020. The Moisture content gradually increased from 13.23 in June, 2020 to 33.03 in September 2020. The highest Moisture at the surface of the dumpsites (33.03) was however recorded in the month of September, 2020, while the least (6.21) was recorded in May, 2020. Similarly, the Moisture content of the soil collected at 5 cm depth decreased gradually from 18.58 in January 2020 and reached its lowest 6.21 in May, 2020. In the month of June 2020, the Moisture content drastically increases to 15.04 and continued its increase until September 2020 where it reaches its peak 38.22.

**Temperature**

Figure 5 shows the result of the Temperature of the soil at the Dumpsites (Surface and 5cm Depth) at Lapai, Niger state.

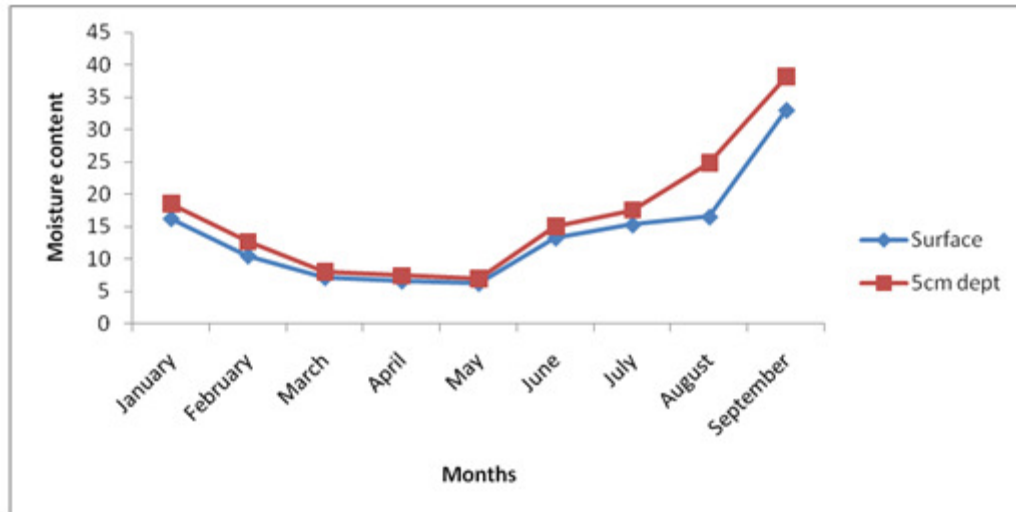


Figure 4: Moisture Content(%) level in the study sites

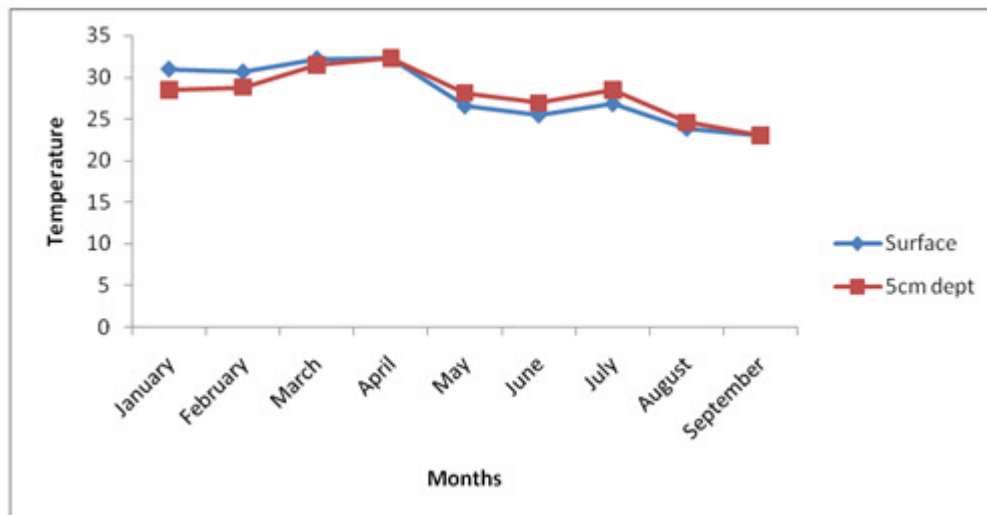


Figure 5: Showing the Temperature (°C) level in the study sites

There were fluctuations in the Temperature of the soil collected at the surface of the dumpsites across the months. The soil temperature was 31°C in January 2020 which gradually increased to its peak 32.33°C in April 2020. In May 2020, the soil temperature steadily reduced to 26.58°C and further reduced to 25.50°C in June 2020. The soil temperature slightly increased to 26.83°C in July but however reduced to 23.00°C in September 2020. Contrary to the patterns of soil temperature recorded on the surface of the dumpsites, the soil temperature at 5cm depth steadily increased from 28.50°C in January, 2020 and reached its peak 32.33°C in April, 2020. In May 2020, the soil temperature reduced to 28.13°C, this further reduced to 26.92°C in June 2020, but slightly

increased to 28.50°C in July 2020. In the month of August 2020, there was a drastic reduction in the soil temperature to 24.58°C and later dropped to its lowest 23.00°C in September, 2020 (Figure 5). The physico-chemical properties of the soil at the dumpsites investigated namely; pH, Conductivity, Moisture and Temperature showed slight significant variation from January to September 2020 ( $p < 0.05$ ). In general, a weak acidic to weak alkaline pH range of 6.86 to 7.53 was observed across the months, Conductivity ranged from 0.00 to 1.69, Moisture ranged from 6.21 to 33.03, and Temperature ranged from 23.00°C to 32.33°C was observed across the months. This is in agreement with the findings of Simon-Oke (2020) who reported the

mean soil temperature and pH to be 27.9°C and 6.0 respectively. Adeyeba and Akinbo (2002) also found mean soil temperature of 26.1°C and mean relative humidity of 72 at refuse dumps in Ibadan municipality, Nigeria.

## Conclusion

The physico-chemical properties of the soil at the dumpsites investigated namely; pH, Conductivity, Moisture and Temperature showed slight significant variation from January to September 2020 ( $p < 0.05$ ), but the pH and Conductivity of the soil examined at 5cm depth and Moisture of the soil examined at the surface showed no significant difference between the months ( $p > 0.05$ ). In general, at the surface, a weak acidic to weak alkaline pH range of 6.86 to 7.53 was observed across the months, Conductivity ranged from 0.00 to 1.69, Moisture ranged from 6.21 to 33.03, while Temperature ranged from 23.00°C to 32.33°C.

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