



Original Research Article

ETHNO MEDICINAL SURVEY AND HEAVY METAL ANALYSIS ON MUD DAUBER NEST IN ZARIA, KADUNA STATE NIGERIA

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ABSTRACT

This study was aimed to survey the ethno medicinal uses of mud dauber nest in Zaria, Kaduna State, Nigeria. Structure questionnaires as well as interview were used as instruments for data collection on fifty respondents which included the herbalists, local elders, traders, students, and house wives. Socio-demographic characteristics of the respondents were also determined. The concentration of Fe, Cd, Zn and Pb were determined using atomic absorption spectrophotometer (AAS). Thirty-two (64%) of the respondents were males. The age range 41 and above, provided the highest uses of mud dauber nest. Seventeen (17) different ailments were recorded in this study. The use of mud dauber nest for treatment of mumps was the highest with 82%, followed by ringworm and pimples (14%), stomach ache (12%), tooth ache 8%, ear rash 6% and so on%, ear rash 6% and so on. It was shown that Fe has the highest average concentration with 5.268 ± 1.050 ppm, followed by Zn with 2.199 ± 0.086 ppm, Pb with 0.766 ± 0.442 ppm and Cd with 0.059 ± 0.003 ppm. This study showed the potentials of mud dauber for treatment of various diseases and its safety profiles, therefore its conservation for sustainable use and potential for discovery of newer is very important in the field of medicine, pharmacy and biotechnology.

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INTRODUCTION

Mud dauber (wasps) belongs to the family Sphecidae or Crabronidae. In Hausa, Yoruba and Igbo languages they are called Zanzoro, Agbon, and Igba kpim respectively. They are bigger than bees but they also make a humming sound as they move around and have their nest built on the walls of buildings, ceilings, poles, trees, bridges and abandoned objects [1].

They build their nests from mud, particularly from clay soil and other biodegradable materials like paper and plant materials mixed with their saliva. Mud dauber saliva which is deposited in their nest contains phosphorus (P), Magnesium (Mg), Sulphur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Iron (Fe), and phenolic compounds [1].

The use of natural products from medicinal plants, animals and minerals in treatment of diseases has been the mainstay of

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primary health care from time immemorial where various groups of herbalists or traditional medicine practitioners use different varieties of natural products in the treatment of physical, mental, and social diseases. The healers may be sedentary or mobile, they latter follow a regular circuit within a periodic market or moving randomly from village to village [2]. Mud dauber soil is an herbal product used to cure many ailments without knowing its safety profile. The extent of drug toxicity in the body can lead to serious health problems.

Destruction of mud daubers nest in residential places in Nigeria is increasing in an alarming rate without knowing its health benefit or implication and continuous loss of mud daubers' ecosystem can connote danger in the nearest future and also biodiversity implication.

A toxic heavy metal is any relatively dense metal or metalloid that is noted for its potential toxicity, especially in environmental contexts. Heavy metal contamination in the environment has detrimental effect on ecosystem and has emerged as a serious global issue [3]. Metals such as cadmium, mercury, lead and arsenic appear in the World Health Organization's list of chemicals of major public concern. Heavy metal determination is one of the criteria for quality control of medicinal plants to ensure safety and efficacy of herbal product [4]. Toxicity profile as well as heavy metal concentration of mud dauber soil is utmost important to predict the safety associated before use. This study is therefore aimed to survey the ethno medicinal uses and to evaluate the heavy metals of mud dauber nest in Zaria, Kaduna State.

MATERIALS AND METHODS

Study Area

This ethno medicinal survey was conducted in Sabon Gari and Durumi markets which are located in latitude 11° 30' North and 7° 42' South longitude of the Greenwich Meridian in Zaria, Kaduna State as showed in Figure 1.

The study area is made up of different ethnic groups like Hausa, Fulani, Yoruba, Idoma, Nupe, Gbagyi, Bajju, Igbo, Kanuri etc. However Hausa –Fulani are the main indigenous group, while others pre-historically seem to be migrants. Growth rate is high at 3.5% with declining death rate as a result of improvement in medical sectors. In term of human population, the general census of 2006 put the population at 286871.

The distribution of peoples is not even in Sabon Gari Local Government Area. Larger population are concentrated along Palladan and Samaru; though, there is a strong belief that about 20% of every Nigeria ethnic group settles in this Sabon Gari local Government Area and this makes it to be regarded as mini Nigeria.

Sources of Data for Ethnomedicinal Survey

These data were obtained through the administration of questionnaires, interviews, and field observation.

Sample Size and Sampling Technique

Simple random sampling procedure was used with a sample size of 50 for meaningful generalization.

Instrumentation

Interview and questionnaire designed and developed by the researcher was used. The questionnaire have two (2) sections (A & B). Section A consists of the socio- demographic data; Section B consists of an open ended questions for the ethno medicinal uses of the mud dauber soil with the concept of administration.

Data Collection Procedure

The researcher self-administered the instrument with the help of a staff who is fluent in Hausa from the herbarium unit of the Department of Botany. Information obtained from the spot was subjected to data analysis.

Mud Dauber Soil Sample Collection

Mud Dauber soil (MDS) was collected from various places such as random homes, walls, within Ahmadu Bello University campus in Samaru, Zaria, Kaduna State (Plate I and II).

Mud Dauber Soil Sample Preparation and Extraction

After collection, the soil sample was pulverised into powder using mortar and pestle. One kilogram (1 kg) of the soil was weighed and soaked in 700 ml of distilled water overnight. After 24 hrs, the decanted solution was filtered and the filtrate was evaporated to dryness at 40°C on a rotary evaporator.

Heavy Metal Digestion Process of MDS

The sample was weighed in an analytical balance. Then, 0.5 g of the sample was digested with 7.5 ml nitric acid and 2.5 ml hydrochloric acid and was placed on a hot plate set at 120°C and removed when about to dry. On cooling, the digest was filtered into a beaker. Distilled water was added to the residue to make up to 50 ml. Digestion was carried out in Multiuser laboratory in the Department of Chemistry, ABU, Zaria. The concentrations of the heavy metals were analysed using Atomic Absorption Spectrophotometer.

Standard Solution of the Heavy Metal

A stock solution of cadmium, zinc, iron and lead was separately prepared by weighing 1.0 g of cadmium sulfate ($3\text{CdSO}_4 \cdot 8\text{H}_2\text{O}$), zinc metal, iron and lead respectively in 1:1 nitric acid and distilled water in 1 liter to give 1000 ppm solution. An intermediate working standard solution of 1, 2, 3 and 4 ppm was separately prepared from the main stock.

Data Analysis

The copies of questionnaire collected from the field were analysed using descriptive statistics in forms of percentage, frequencies and table. Heavy metal analysis of Mud Dauber Soil were done in triplicate and data recorded as mean \pm SEM

RESULTS

Socio- demography Data of the Respondents

The information collected from a total of 50 questionnaires which was administered during the survey indicated that all respondents had adequate knowledge on the uses of mud dauber nest for medicinal purposes of which thirty-two (64%) were male and eighteen (36%) were female. The age range 41 and above [twenty - seven (54%)] had more knowledge of the uses while those of 25 – 30 [four (8%)] had little knowledge of the nest importance. Herbalists [twenty - four (48%)] showed the highest understanding of the uses of the mud dauber nest followed by students with 16%. The elders and house wives had similar frequency (14%), 42% had no formal education, 26, 12 and 14% obtained primary, secondary education and tertiary respectively as showed in Table 1.

Uses of Mud Dauber

Majority of the respondents stated the use of mud dauber nest for the treatment of mumps with 41 (92%). Whereas leg rashes is the lowest with 1(2%). Most cited additives for preparation are water, some plant extracts: *Vitellaria paradoxa* (shear butter) oil extract and *Ziziphus abyssinia* and red potash. Mostly topical use of the mud dauber soil was reported, followed by drinking, adding to bathing soap and hair cream as in Table 2.

Results of Heavy Metal Analysis

Table 3 revealed the present of all the study heavy metals. Iron (Fe), zinc (Zn), cadmium (Cd) and lead (Pb) having average concentrations of 5.268 ± 1.050 ppm, 2.199 ± 0.003 ppm , 0.059 ± 0.086 ppm and 0.766 ± 0.442 ppm.

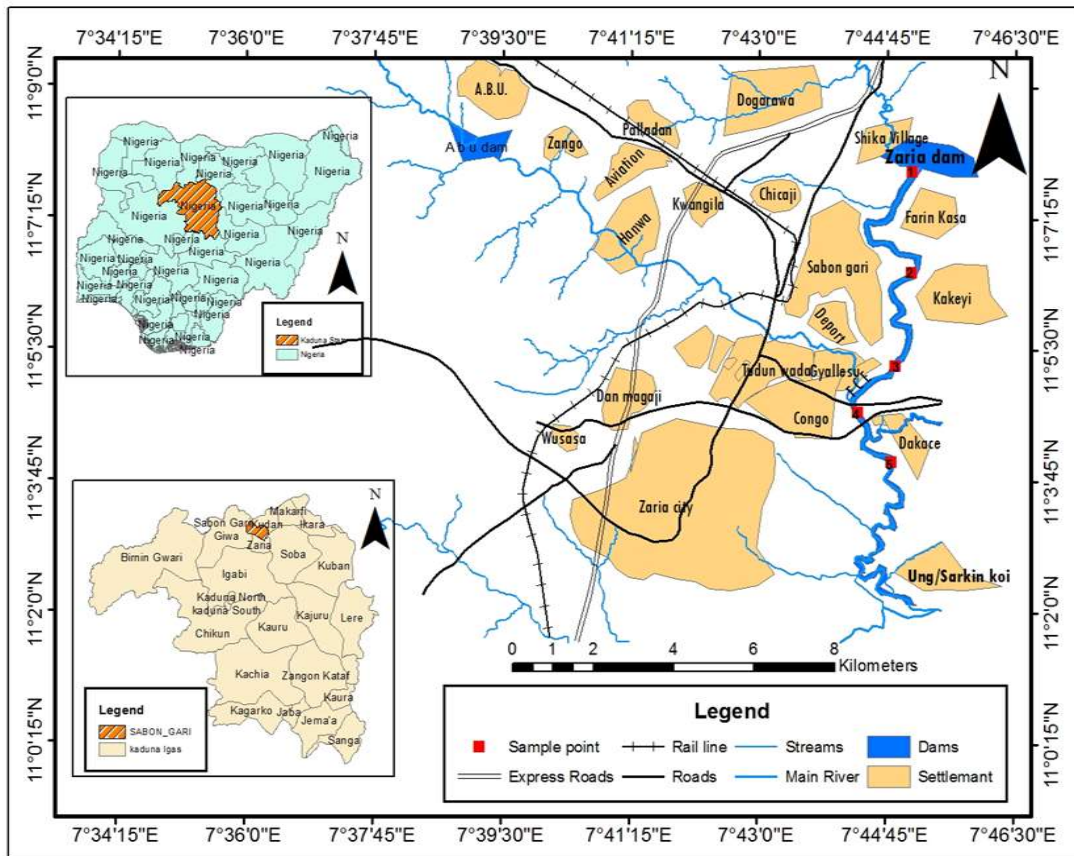


Figure 1: Map of Study Area in Kaduna State; Source: Satellite image publication [5]



Plate I: Mud Dauber Wasp building nest on ceiling



Plate II: Mud Dauber nest on carton

Table 1: Respondent socio- demography in Zaria

Bio data	Category	Frequency	Percentage (%)
Sex	Male	32	64.0
	Female	18	36.0
	Total	50	100%
Age	25-30	4	8.0
	31-35	7	14.0
	36-40	12	24.0
	41 above	27	54.0
	Total	50	100%
Occupation	Herbalist	24	48.0
	Civil servant	3	6.0
	Elder	7	14.0
	Trader	4	8.0
	Student	8	16.0
	House wife	7	14.0
	Total	50	100%
	Education	Primary	13
Secondary		6	12.0
Tertiary		7	14.0
Postgraduate		3	6.0
None		21	42.0
Total		50	100

Table 2: Uses of mud dauber soil (nest) in Zaria

S/No.	Uses	Preparation	Mode of Application	Frequency (%)
1	Mumps	Mud dauber nest + enough water to form a poultice	Rub on the Swollen part	41 (82)
2	Ringworm	Mud dauber nest + enough water to form a poultice, mixed properly Mixed with hair cream,	Scrape the infected part and the apply for male and for female use hair cream to make hair	7 (14)
3	Pimples	Mud dauber nest + potash (red) + enough water to form a poultice	Apply on the appeared pimple at night before sleeping	7 (14)
4	Stomach ache (children)	Mud dauber nest + water (enough) allow to settle	Filtrate should be given to the child	6 (1)
5	Itching (irritation)	Mixed Mud dauber nest with Ghana soap	Use for bathing everyday	6 (12)
6	Rib pain	Mud dauber nest + enough water to form a poultice	Apply on the chest and Ribs	6 (12)
7	Ulcer	Mud dauber nest with honey and Mixed	Leak every morning before breakfast or any eating	5 (10)
8	Pain (From Pelvic to Feet)	Mud dauber nest + enough water to form a poultice	Apply and Rub from the Pelvic (Top) to the feet moving downward	5 (10)
9	Dizziness	Mud dauber nest + enough water (soak)	Drink filtrate rub the residue on the forehead	5 (10)
11	Sore throat	Nest + enough water to form a poultice	Rub on the surface of the throat	4 (8)
12	Severe headache	Mud dauber nest + enough water to form a poultice	Rub on the forehead	4 (8)
13	Vomiting	Mud dauber nest + enough water allow to settle	Drink the filtrate	4 (8)
14	Ear rash (Cut)	Grind Mud dauber nest into fine particles	Take the grinded nest and apply on the cut	3 (6)
15	Cancer	Grind Mud dauber nest into fine particles	Apply the grinded particles on the affected (cancerous) part	3 (6)
16	Rashes	Mud dauber nest + 1 part of <i>Ziziphus abyssinia</i> + shear butter and mix Another part of <i>Ziziphus abyssinia</i> grind into fine particle	Rub the mixed part on the rashes and add the grinded part to pap or milk and drink	3 (3(6)
17	Leg rashes	Mud dauber nest + potash (red) + enough water to form a poultice	Apply on the infected part of the leg	1 (2)

Table 3. Heavy metals composition in Mud dauber soil in ppm

Sample	Fe	Cd	Zn	Pb
MDS1	6.896±0.000	0.063±0.000	2.0532±0.000	0.348±0.000
MDS2	5.607±0.000	0.062±0.000	2.193±0.000	0.148±0.000
MDS3	3.303±0.000	0.053±0.000	2.3536±0.000	1.069±0.000
AC	5.268±1.050	0.059±0.003	2.199±0.086	0.766±0.442
WHO	20	0.3	27.4	10

AC: Average Concentration, WHO : World Health Organization

DISCUSSION

Mud dauber nest as shown in Plates I & II were constructed by wasps with soil obtained from surrounding and binding with their saliva, which are the main compositions responsible for its therapeutic efficacy.

During this study, a total of 50 questionnaires were used to collect information from herbalist, local elders, students, house wives and traders as stated in the Table 1. Socio demographic information of the respondents indicate that, most of the respondents were male (64%). This result is in contrast with the findings of Suleima et al [6] with 80% females in their ethno medicinal survey.

The findings show that respondent belonging to the age range 41 above (54%) had more knowledge in medicinal uses of mud dauber nest. This shows that elderly people are the main custodians of traditional knowledge. These may connote threat to the indigenous knowledge after their demise. This result agrees with [7]. Most of the respondents were herbalists (48%) with no formal education (42%).

Mumps were the most reported uses of mud dauber nest with a frequency of 41 (82%). In accordance with the findings of [8], Wasp earths have been found to be associated with *Streptomyces* that appear to be 'antibiotic-producing symbionts, potentially helping to defend their wasp hosts from pathogenic microbes' [8], that may justify its uses for mumps management in tradition medicine.

This study reported the use of mud dauber nest in the treatment of ring worm, ear rash, and leg rash with frequencies of 7 (14%), 3(6%), 3(6%) and 1(2%), respectively as shown in Table 2, this also supports the findings of [9] that mud dauber earth was used in treatment of wounds sinusitis, ear, and nose infection in Liberia and Uganda. This means that mud dauber nest had potentials for anti-bacterial and anti-fungal activities.

The findings of this study also show that mud dauber nest is used in traditional treatment of pain related conditions such as stomach ache (12%), rib (12%), and pelvic pains (5%), severe head ache (8%), tooth ache (8%), boils (6%) and itching (6%), respectively which suggest that it may have anti-inflammatory and analgesic effect due to the presence of secondary metabolites like phenol, tannins and flavonoid. These phenolic compounds have been reported to play a role in analgesic activity [10]. This finding is supported by the earlier report of [1] that mud dauber nest composition is rich in phenolic

compounds which may be responsible for the claimed analgesic condition.

This study also reports its uses in the treatment of cancer (6%), scientific validation of this may serve as new source of potential anti-cancer drugs.

The findings of this study also report different herbal preparations of mud dauber nest as indicated in Table 2. The herbal remedies were often prepared by pounding the nest followed by either soaking in water, which supported the report of [9].

Conservation of wasps' nest (Plate II) utilized for both medicinal and economic purposes is necessary, thus the need for closer collaboration between herbal medical practitioners and stakeholders in the medical practices as well as conservationists so as to ensure the safe and wise use of the wasps nest

The average concentrations of the four heavy metals are as follows: iron is the highest in this study with 5.268 mg/kg which falls within the standard permissible value of 20 mg/kg according to [11]. High concentrations of iron in mud dauber soil may be due to the facts that the wasps build their nest from surrounding soil that contains significant levels of iron [12], followed by zinc (Zn), which has an average concentration of 2.199 ppm with a standard permissible limit of 27.4 ppm. Zinc is an essential element in maintaining human health problems. Cadmium with average concentration of 0.059 ppm is low compared with the standard permissible limit of 0.3 mg/kg and lastly lead (Pb), had average concentration of 0.766 ppm was found to be below the permissible limit of World health Organisation [11]. Lead is a prime environmental pollutant and a probable human carcinogen. Exposure to high lead level can severely damage the brain and kidneys and ultimately causes death [13]. All the four [4] metals are within or less than the standard permissible limits by [11].

CONCLUSIONS

This study revealed that the highest age group 41 and above with no formal education are well knowledgeable on the uses of mud dauber nest and therefore there is need to document this information. The findings of this study showed that the mud dauber nest may serve as potential for anti-bacterial, anti-viral, anti-cancer, anti-inflammatory and analgesic potentials and this

requires further scientific research which may lead to the discovery of new drugs. The study has also revealed that MDS sample accumulates four (4) heavy metals, iron (Fe), cadmium (Cd), zinc (zn) and lead (Pb) which all appear to be in different levels.

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AUTHORS' CONTRIBUTIONS

BH and AOM helped supervised the research, drafted the manuscript and submitted finally. IH carried literature search, ethno survey, and financed the work.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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