Comparative Studies Of Critical Role Of Rag Pickers On Waste Management In Relation To Financial Benefits In Portharcourt, Rivers State

Mbata, C.A., Aleru, C. P., Isomah C. J., Welenya, W. O. and Chuku P.H.
Department of Medical Laboratory Science, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Nigeria.
alfrose1@yahoo.com

***Abstract*—Microbial degradation of solid waste implies the breaking down of organic components of waste into inorganic form. The study is aimed at investigating the health risk of waste scavengers (rag pickers). Samples were collected from 80 rag pickers and 20 control subjects (Students) were used. Samples from the rag pickers such as sputum, nasal swap and feaces were inoculated on surface of dried Agar (media) yielding bacterial and fungal isolates. They include Proteus spp. Escherichia coli Salmonella spp, Klebsiella spp, Bacillus species, Mucor spp, Penicillum mycelia, Aspergillus and Candida albican. All these organisms are potential human pathogens. The various risk associated with rag pickers were investigated to assess the health impact of waste on them. The culture result showed growth of Staph. aureus 26(32%) on rag picker, 2(25%), for control, Klebsiella spp 9(11.25%) 1(12.50%), Salmonella 10 (12.5%), 1 (12.5%), E. coli 15(18.5%) 2(25%) Pseudomonas 3(3.71, 1(12.50^{6}) respectively Rag pickers had Candida albicans 5(6.25%), 0(0%) as control. In the final analysis, the Microorganisms that were present in waste dumps were also found in the samples collected from the Rag pickers where they cause disease. These bacteria and fungi have severe health implication on rag pickers, waste workers and general public if adequate precautions are not taken as recommended in this work. Despite the fact that Rag Pickers make money from their business the health implication is devastating and of great concern. It could as well be inferred that Rag pickers or scavengers may serve as vehicles or carriers of these pathogens and later distribute them to other unsuspecting and healthy individuals that come in contact with them**

Keywords—Scavengers, Degradation, Pathogens, Waste dump.

I. INTRODUCTION

The informal recovery of materials from waste represents an important survival strategy for disadvantaged populations throughout the developing world (UNDP, 1985).

Scavengers are perceived as the poorest of the poor and marginal to mainstream economy and society. They may not be able to enter formal sector employment because of poor education or physical disability (Gunn and Ostos, 1992). This inability to enter more conventional occupations and the resulting absence of real choice needs to be recognized by interventions that attempts to change the role and working practices associated with informal recycling.

According to Srikanthetai, (1993) if waste pickers do find alternative employment in the formal sector, other individuals are highly likely to replace them as long as poverty continues and waste remains accessible. The picture of scavenging that emerges from reviewing literature is that of an occupation that provides a livelihood for the poor (Kungskulniti, 1991).

Scavenging is an important survival strategy, in which impoverished individuals cope with scarcity. Scavengers typically specialize in recovering only one or a few types of materials from waste. To Medina, (1997), scavenging takes place in all stages along the waste management system that is source separation at household or place generating waste material. Here materials are reused, sold or given away, for example, old Newspapers are used for packing. During collection, scavengers sort out recyclables for sale. Scavengers salvage materials to sell for recycling, as well as repairables and re-used items that can be sold or use themselves. Meyer, (2003) reported that scavenging is a process that is well practiced in developing countries. In fact, scavenging is source of employment that attempts made to

abolish the practice in some cities are met with strong resistance.

Scavengers are ubiquitous throughout the developing world. The World Bank has estimated that up to 2% of the population in third world countries survive by recovering materials from waste (WHO, 1988).

Scavenging contributes to reduction of the amount of solid waste to be disposed and also helps to save natural resources that lead to sustainable development. According to Bartone, (2005) scavenging played important role on the economic survival of a number of industrial (e.g. steel, paper and pulp) in most developing countries.

Most rag pickers or scavengers commence their profession at the young age of five to eight years. Most of them never attended any school or have formal education in most cases, there are middle men who engage these children (Dewolfe and Smith, 1991). Apart from collecting bottles, plastics, glass pieces they also collect food-waste for their consumption. If found in excess they share it with their friends and elders. The middlemen pocket the major share of the sales and pay only paltry to the youngsters.

According to WHO, (1988) as earning members of the family, they do not heed much to advice of the elders. They commence chewing and smoking tobacco until they become addicted to alcohols and hard liquors. They have free sex with street walkers and hence become victims of HIV/AIDS.

This informal recycling (scavenging) has originally or traditionally been practiced by outcasts and marginal groups in developing countries such as gypsies, rural migrants, immigrants and members of religious minorities (Huysman, 1994).

In India, the Harijans are a cast of untouchables that deal with waste collection and recycling. Isolation as a part of social exclusion leads societies of scavengers to develop their own habits, customs, beliefs and values (Bethier, 2003). As a result of their marginalization, they are often a subject of harassment by the authorities and police and female scavengers in particular may be considered easy sexual targets (Eerd, 1996). Due to their daily contact with garbage scavengers are usually associated with dirt, diseases, squalor, and perceived as nuisance, a symbol of backwardness and even as criminals.

They survive in a hostile physical and social environment despite their contribution to significant economic growth (Medina, 2000a).

A. Socio - economic impacts of scavenging

Scavenging contributes to reduction of the amount of solid waste to be disposed and also helps to save the natural resources that lead to sustainable development (Wachukwuetai, 2010b). It creates jobs and extra income for people especially the poor. Scavenging encourages family members to sort out materials from waste in exchange for money. It supplied raw materials for a lot of recycling enterprises and this creates more jobs for people especially the youths who dominate the profession (Angaye, 2018).

According to Medina, (1997) scavenging generally renders economic and environmental benefits, such as providing income to unemployed individuals, supplying inexpensive raw materials to industries, reducing the

B. Health hazard on waste scavengers

Despite the economic and environmental benefits derived from scavenging, the "profession" has it setbacks and the health of the workers is at stake.

(Medina, 2000a). Waste from any source, be it household, industrial

(Thiarattannasun *et al.*, 2012). Modernization and progress have had its share of disadvantages and one of the main aspects of concern is the pollution it is causing to the earth - be it land, air and water (Dulac, 2001). With the increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. If the management and disposal is improperly done, it can cause serious health impacts, and problems to the surrounding environment and waste scavengers who come in contact with them (Haan *et al*., 1998)

According to Olleyet al., (2003) unattended waste lying around attracts flies, rats and other creatures that in turn spread disease. Health and safety risk associated with informal recycling include:

(1) Occupational health risk posed to waste pickers.

(2) Community health risk posed to the related community or general public (Asibor and Edjere, 2017).

The occupational hazard or health risk to waste pickers in developing countries are high because of lack of protective clothing and equipment, resulting in direct contact with waste (Contreau and Dakaadt, 1991). Risk from manual handling of mixed waste may result in direct contact with broken glass, human/animal faecal matter, paper that may have been saturated with toxic materials, containers with residues of chemicals, pesticides or solvents and needles and bandages from hospitals.

Dennison, (1996) observed that inhalation of bioaerosols and of smoke and fumes produced by open burning of waste, can cause serious health problems Strom, (1985) noted that a high percentage of workers who handle refuse, are infected with gastro intestinal parasites, worms and related organisms.

The organic fraction of municipal solid waste is an important component not only because it constitutes a sizeable fraction of the solid waste stream, but also because of its potentially adverse impact upon health.

Unless an organic waste is appropriately managed, its adverse impact will continue until it has fully decomposed or otherwise stabilized (Yang et al, 2013). Possible health hazard associated with waste scavenging include; injuries from stepping on broken bottles or sharp objects in the refuse, skin and blood infections. Other diseases include typhoid fever, cholera, which may be transmitted to others, while animal and human faeces may cause intestinal worms to those infected (Sunita, 1994).

II. MATERIALS AND METHODS

A. Study area

The study was carried out in the city of Port Harcourt, which is the head quarter of oil and gas in Nigeria. Due to the importance of the city in Nigeria, there is in flow of people with accompanied commercial activity, thus giving rise to all forms of waste generation. Samples were collected from eighty waste scavengers from the following dump sites; Elikpokoodu, Mile 3 motor park dump site, Mile 1 dump site, Eagle Island dump site, Rumuokoro dump site, Town market dump site, Ogbunabali/ Nzimiro dump site and Ada George dump site, (ten per dump site). In course of the work, a structured questionnaire was prepared for the waste workers to analyze and ascertain the economic benefit and the health implication. Samples collected from scavengers include; nasal swab, sputum and stool. Samples were also collected from twenty students as control. The waste scavengers signed informed consent form before samples were collected from them. Protective materials used include; safety boots, nose and face mask and hand gloves.

B. Examination of samples from waste scavengers & students as control.

1) Stool

Stool was collected for macroscopic and microscopic examination for intestinal worms and parasites using formol ether method and also cultured on Salmonella Shigella Agar (SSA), DCA &MacConkey.

2) Nasal Swab

This was collected from the waste workers using swab sticks and cultivated onto MacConkey agar, Blood agar and Chocolate agar plates.

3) Sputum

This was collected from waste wokers using a sterile sample container and cultured ongo a MacConkey Agar, Blood Agar, chocolate Agar and Nutrient agar.

C. Isolation, identification and characterization of bacteria in the waste scavengers

Pure cultures of bacteria, were obtained by streaking representative colonies of different cultural types which appeared on the various plates on Nutrient agar and incubated at 37°C for 24hrs. These served as stock for subsequent test.

The organisms were examined and identified considering their cultural characteristics, Gram's staining reaction, motility test and use of

Biochemical tests such as Coagulase test, Oxidase test, Indole test, Citrate test, Urease test and sugar fermentation test (Cheesbrough, 2000).

D. Isolation and identification of fungi in waste dumpsite and waste scavengers

Pure cultures of fungi were obtained by sub-culturing discrete colonies onto Sabouraud dextrose agar and incubated at 28°C for 5 to 7 days. The identification was done based on: Macroscopic, examination of fungal growth; slide culture, Microscopic examination using a mounted needle to a few drops of lactophenol cotton blue (Harrigan and MacCance 1990). Then observing sexual and asexual reproductive structures like sporangia, conidial head, anthrospores and vegetative mycelium.

E. Stool sample processing

Wet Preparation

Concentration method (Formol-ether).

1) Wet preparation

A drop of normal saline and Lugol's iodine were placed on each side of a grease free slide. Using an applicator's stick the stool is taken and emulsified on the slide. A cover slip is placed on the preparation and examined using x10 and x40 objective lens.

2) Formol ether sedimentation technique

Reagents: 10% Formalin and diethylether

Procedure: About 1gram of faeces was emulsified in 5ml of 10% formol saline in a test tube. The preparation was sieved through a guaze to remove coarse particles and collecting sieved suspension in a beaker.

The suspension was transferred to a centrifuge tube, about 3-4ml of diethylether was added and mixed for 1 minute. It was centrifuged immediately for 1 minute at 3000 revolutions per minutes,(rpm).

Using a stick, the layer of the faecal debris was loosened from the side of the tube and inverted to discard the ether, faecal debris and formol water and the sediment remained. The bottom of the tube was tapped to resuspend the mixed sediment. The sediment was transferred to a slide and covered with a cover slip. The preparation was examined microscopically using x10 objective. The deposits were recorded.

III. RESULT

Table below shows the distribution of bacteria and fungi isolated according to the number of rag pickers per dumpsite and control site. From the result *Staphylococcus aureus* was isolated from 26 (32%) of the rag pickers, while 2 (25%) from the control subjects. *Escherichia coli* was isolated from 15 (18.5%) of rag pickers and 2 (25%) of the control. *Streptococcus spp* was isolated from 12 (15%) of the rag pickers while 1 (12.5%) from control. *Klebsiella spp*, 9 (11.25%) of rag pickers, 1 (12.50%) of control. *Salmonella spp* from 10 (12.5%) of rag pickers and 1 (12.50%) of control. *Candida albican* 5 (6.25%) of rag pickers and 0(0%) of control while *Pseudomonas* was found in 3 (3.7%) of rag pickers and 1 (12.50%) of control subject.

TABLE 4.7: Distribution of Bacteria/Fungi Isolates according to the number of Rag Pickers per dumpsite

Bacteria Species	A N = 15	B N = 10	C N = 15	D N = 15	E N = 15	F N = 10	G N = 10	H N = 10	Total
Staphylococcus aureus	7(38.35%)	5(12.50%)	4(40%)	2(15.38%)	2(18.8%)	2(28.5%)	4(40%)	2(25%)	28(32%)
Escherichia coli	3(14.29%)	2(25.00%)	3(30%)	2(15.38%)	2(18.18%)	2(28.57%)	1(10%)	2(25%)	17(19%)
Strept Spp	4(19.05%)	0(0%)	2(20%)	4(30.77%)	2(18.18%)	0(0%)	0(0%)	1(12.5%)	13(15%)
Klebsiella Spp	2(9.52%)	0(0%)	1(10%)	1(7.69%)	2(18.18%)	1(14.29%)	2(20%)	1(12.50 %)	10(11%)
Salmonella Spp	4(19.05%)	0(0%)	0(0%)	3(23.08%)	1(9.09%)	1(4.29%)	1(10%)	1(12.50 %)	11(13%)
Candida albicans	1(4.76%)	1(12.50%)	0(0%)	1(7.69%)	0(0%)	1(14.29%)	1(10%)	0(0%)	5(6%)
Pseudomonas aeruginosa	0(0%)	0(0%)	0(0%)	0(0%)	2(18.18%)	0(0%)	1(10%)	1(12.50 %)	4(4%)
TOTAL	21(100%)	8(100%)	10(100%)	13(100%)	11(100%)	7	10(100%)	8(100%)	88(100%)

Interpretation

A = Elikpokwodu Dumpsite

B = Mile 3 Motor Park

C = Mile 1 Dumpsite

D = Eagle Island Dumpsite

E = Rumuokoro Dumpsite

F = Town Market Dumsite

G = Ogbunabali/Nzimiro Dumpsite

H = Ada George Dumpsite Control

N = Number of Rag Pickers and Control

Figure 4.3 is a Pie Chart showing the degree of occurrence of each bacteria specie isolated from the dumpsites and control site. From the study *Staphylococcus aureus* and *Escherichia coli* showed the highest degree of 87^{o} each followed by *Salmonella* 62^{o}, *Klebsiella* 50^{o}, *Proteus* 37^{o} while *Pseudomonas*, *Clostridium* and *Bacillus* all had 12 ^{o} each. Also the degree of occurrence of fungi isolates showed that *Aspergillus* and *Candida* showed 120^{o} each, *Mucor* 80 ^{o} and *Penicillium* 40 ^{o}. All these are showed in figure 4.4 which is presented in a pie chart.

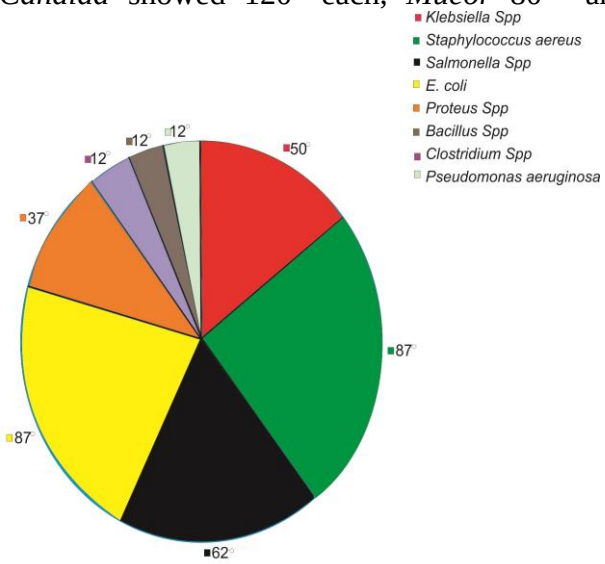

FIGURE 4.3: PIE CHART SHOWING THE FREQUENCY OF DIFFERENT BACTERIA INVESTIGATED IN THE STUDY

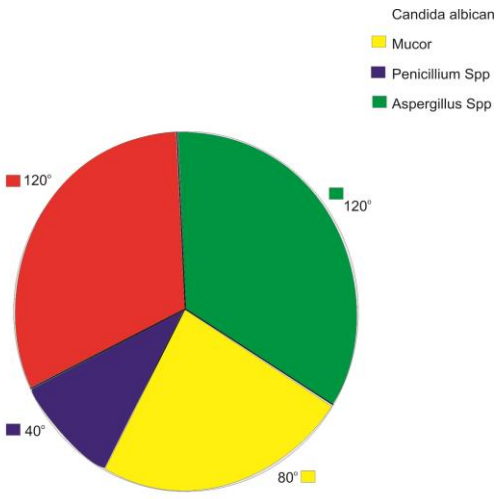

FIGURE 4.4: PIE CHART SHOWING THE FREQUENCY OF DIFFERENT FUNGI INVESTIGATED IN THE STUDY

Table 4.15 shows the distribution of income of rag pickers per month from the Questionnaire.

From the result, 4 (5%) of the rag pickers earned <N5,000.00 per month, 6(7.5%) earned between N5,001 – N10,000.00 per month, 60(75%) earned between N10,001 – N15,000.00 per month and 10 (12.5%) earned between N15,001 – N20,000.00 per month.

The extent to which the income of rag pickers satisfied the economic well being of the households was accessed from the Questionnaire. From the result, 2(2.50%) was to very large extent, 5(6.25%) to large extent, 11(13.75%) to moderate extent, 33(41.25%) to low extent and 29 (36.25%) to very low extent. All these are shown on table

TABLE 4.15: The Distribution of Income Of Rag Pickers Per Month From The Questionnaire

INCOME / MONTH	NUMBER OF RAG PICKERS
< N5000	4 (5%)
N5001 – 10,000	6 (7.50%)
N10,001 – 15,000	60(75%)
N15,001 – 20,000	10(12.50%)
TOTAL	80(100%)

TABLE 4.16: The Extent to Which The Income Of Rag Pickers Satisfy The Economic Wellbeing Of Their Household From The Questionnaire

OPTION	NUMBER OF RESPONDENT N=80	PERCENTAGE RESPONSE
VERY LARGE EXTENT	2	2.50
LARGE EXTENT	5	6.25
MODERATE EXTENT	11	13.75
LOW EXTENT	33	41.25
VERY LOW EXTENT	29	36.25
TOTAL	80	100.00

IV. DISCUSSION

Most of the microbes isolated from the waste dumpsite were seen in the samples collected from the Rag pickers which result in disease. This is as a result of the work embarked upon by the rag pickers without adequate protection. From the study carried out, the distribution of bacteria isolates according to the number of rag pickers per dumpsites suggest that:

Coagulase positive *Staphylococcus aureus* was isolated from 26(32.0%) of the Rag pickers while it was isolated from 2(25%) of the control subjects. Though some *Staphylococcus* spp are members of the normal flora of the skin and Mucous membrane, but S*taphylococcus aureus* is a major pathogen of humans causing amongst other diseases, minor skin infections (Brooks *et al*., 2004). This explains why 10 of the rag pickers had sore throat. *Staphylococcus aureus* may also cause *Pneumonia*, endocarditis or sepsis, impetigo, and scalded skin syndrome (Apicella, 2000). *Escherichia coli* was isolated from 15(18.5%) of the rag pickers while it was isolated from 2(25%) of the control subjects. Though *Escherichia coli* forms part of the normal bacteria flora of the intestine, they are the major cause of urinary tract infection and would infections (Ochei and Kolhatker, 2000).

Beta haemolytic *Streptococcus spp* was isolated from the sputum of 12(15%) of the rag pickers while it was isolated from 1(12.5%) of the control. *Streptococcus* spp causes skin infections, erysipelas and cellulites when the portal of entry is in the skin and also Streptococcal sore throat (Brooks *et al.,* 2004). This further explains why 10 of the rag pickers had cough/sore throat and 14 of them had skin infections. Brooks *et al.,* (2004) reported that 20% of Streptococcal sore throat infections are cause by *Streptococcus spp. Salmonella spp* was isolated from 10 (12.5%) of the rag packers and 1 (12.5%) of the control subject. Similarly, *Salmonella spp* was isolated from the stool of 16(78%) of the rag pickers. This explains why there is a high incidence of the typhoid (enteric) fever. The route of the disease is by ingestion of contaminated food & water.

Candida albicans was isolated in 5 (6.25%) of the rag pickers while none was isolated from the control subjects. *Candida albicans* is an opportunistic fungal pathogen and causes deep mycoses. It's chief portal of entry is the respiratory tract. Though *Candida albicans* does not produce disease in healthy individuals because growth is suppressed by other microbiota. However, if anything upsets the normal microbiotic *candida* may multiply rapidly to produce cardidiasis. It thus appears that the incidence of candidiasis is on the increase, (Medina, 2000a).

V. CONCLUSION

Scavenging represents an important survival strategy for the poor. Scavengers recover materials from waste in order to satisfy their needs. Scavengers respond to market demand and not to environmental and health considerations. The underlying factors that cause people to become scavengers are poverty resulting from under development, inability or unwillingness of individuals to obtain other forms of employment, existence by waste dumps, income earned and recyclable industrial demand for inexpensive raw materials. Scavenging has led to the production of sub –standard, fake and adulterated consumables in Nigeria as a whole as bottles are picked and sold to companies to repackage. Scavengers despite the monthly income they make have faced problems of informality and vulnerability to diseases, hence they need government assistance. Women are scared of getting involved in scavenging because of fear of being raped.

VI. RECOMMENDATIONS

In reality rag picking has posed a great threat to the society at large, I therefore make the following recommendations:

1. Indiscriminate dumping of waste around residential areas should be stopped. There should be adequate political will and policies in this regard.

2. Funds should be adequate to encourage modern waste disposal technologies.

3. The populace should be enlightened on the hazards of indiscriminate dumping of waste, hence, they should learn to minimize waste at source.

4. At household level proper segregation of waste has to be done and it should be ensured that all organic matter is kept aside for composting so as to be used as fertilizer.

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