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MICROBIOLOGICAL ANALYSIS OF DIRT PARTICLES OBTAINED FROM THE FLOORS OF MADONNA UNIVERSITY TEACHING HOSPITAL (MUTH) WARDS, ELELE, RIVERS STATE, NIGERIA

[1]*Eze, V. C., [2]Nwakwoke, C. and [2]Uzor, B.C.

[1]Department of Microbiology, Michael Okpara University of Agriculture, Umudike, P.M.B. 7267, Umuahia, Abia State, Nigeria
[2]Department of Microbiology, Madonna University, Elele, Campus, Rivers State, Nigeria.

ABSTRACT

The microbiological analysis of dirt particles obtained from the floors of Madonna University Teaching Hospital was investigated. The media used were nutrients agar for total aerobic plate count, MacConkey agar for coliforms count and Sabouraud dextrose agar for fungal count. The pour plate technique was employed. Colonial morphology, Gram staining and biochemical tests were used for identification and characterization. The analysis of variance (ANOVA) was used to show their significant difference. The mean total aerobic plate count ranged from $4.36 \pm 0.47 Log_{10}$cfu/g to $4.82 \pm 0.69 Log_{10}$cfu/g while the mean coliform count ranged from $3.81 \pm 1.3 Log_{10}$cfu/g to $4.42 \pm 0.97 Log_{10}$cfu/g. The fungal count ranged from $6.50 \pm 0.60 Log_{10}$cfu/g to $6.70 \pm 0.18 Log_{10}$cfu/g. The bacterial isolated were *Pseudomonas aeruginosa, Staphylococcus aureus, Proteus mirabilis, Serratia marcescens, Escherichia coli and Klebsiella species.* The fungi isolated were *Rhizopus stolonifer, Mucor pusillus, Aspergillus flavus, Aspergillus niger, Trichophyton mentagrophyte, Alternaria* species, *Penicillum candidum, Microsporium gypseum. Cephalosprium* species and Cladosporium species. The need for the determination of microorganisms present in hospital wards becomes necessary to serve as a guide for monitoring sanitation practices in the hospital wards.

Key words: Microbiological, dirt, particles, floor, Madonna, hospital, wards.

1. INTRODUCTION

A hospital is a large building where people who are ill or injured are given medical treatment and care. A hospital ward is a separate room or area in a hospital for people with the same type of medical condition. The hospital contains a group of compromised patients who are highly susceptible to infectious diseases because of illness and medical procedures that reduce host resistance. For this reason it should be clean and a high standard of hygiene should be maintained. As a result of poor hospital hygiene some patients during their stay in the hospital acquire infection from the environment. This type of infection is known as nosocomial infection (Hornsby, 2000; Baron and Finegold, 2004). There are various types of wards in the hospital. These include medical ward (female and male medical wards), surgical ward (female and male surgical wards), obstetrics and gynaecology ward, emergency ward, intensive care unit, pediatrics ward and casualty ward (Dougherty and Lister, 2004; Madsen, 2006). The ward should be well ventilated. Smoking should be avoided. Discrete use of anti odour sprays or special machines to remove odour from the atmosphere should be adopted. There should also be good lightening system to prevent accident (Augustowska and Dutkeiwick, 2006; Madsen, 2006).

*Corresponding author: vin13eze@yahoo.com

The floor is the surface of a room or building that we work on. Due to unrestricted activities of hospital workers, patients and visitors, dirt particles that accumulate under foot wears are deposited on the floor of the hospital wards. Over 98% of waste particles found in the floor of the wards should comprise soil particles, dead skin cells, hair strands and other possible materials that might have been shed off from the human body. However, where strict hygienic rules are not adhered to, materials like soaked cotton, used syringes, food particles, sample droplets might be found and these substances might harbour pathogenic microorganisms liable to cause serious infections. Therefore, there is the need to keep the hospital environment not only clean but also free from harmful organisms. Occasional inspection of hospital air and buildings parts for possible harmful microorganisms capable of causing heavy infection in the environment should be carried out on regular basis (McGinnis *et al.,* 1991; Dougherty and Lister, 2004). The aim of this study is to enumerate and characterize the microorganisms in the dirt particles from the floors of the Madonna University Teaching Hospital wards.

2. MATERIALS AND METHODS

2.1.Collection of Samples

The dirt particles (ward sweepings) were collected from five different wards in Madonna University Teaching Hospital (MUTH) Elele, Rivers State, Nigeria. The five

wards were medical ward, surgical ward, obstetrics and gynaecology ward, pediatric ward and casualty ward. The dirt samples were collected with sterile spatulas and poured into in sterile containers. The samples were analyzed immediately on reaching the laboratory.

Table 1 Mean counts of the microorganisms isolated from the wards in MUTH

Ward	Log_{10}cfu/g TAPC	CC	FC
Surgical	4.50 ± 0.47	4.17 ± 1.00	6.61 ± 0.55
Medical	4.36 ± 0.47	4.01± 0.33	6.56 ± 0.55
Obstetrics and Gynecology	4.82 ± 0.69	4.31 ± 0.43	6.65 ± 0.30
Pediatrics	4.75 ± 0.44	3.81 ± 1.30	6.70 ± 0.18
Casualty	4.71 ± 0.45	4.42 ± 0.97	6.62 ± 0.18

KEY: TAPC =total aerobic plate count; CC = coliform count; FC = fungal count

2.2. Chemical Reagents

The chemical reagents employed in the study were of analytical grade and were products of BDH chemicals, Poole's England and Sigma Chemical Company St. Louis Missouri, USA. The microbiological media used were products of Oxoid and DIFCO Laboratories, England. They included nutrient agar used for the estimation of total heterotrophic aerobic bacteria, purification of isolates and for stock culture; Sabouraud dextrose agar used for the isolation of fungi and MacConkey agar for the isolation of coliforms.

2.3. Enumeration of Total Heterotrophic Bacteria and Fungi

Samples of the dirt particles were serially diluted in ten folds. Total aerobic plate counts were determined using pour plate technique. Then the molten nutrient agar, MacConkey agar and Sabouraud dextrose agar at 45^0C were poured into the Petri dishes containing 1mL of the appropriate dilution for the isolation of the total aerobic bacteria and fungi and coliforms respectively. They were swirled to mix and colony counts were taken after incubating the plates at 30^0C for 48h and preserved by subculturing the bacterial isolates into nutrient agar slants which were used for biochemical tests.

2.4. Characterization and Identification of Isolates

Bacteria isolates were characterized and identified after studying the Gram reaction as well as cell micro morphology. Other tests performed were spore formation, motility, oxidase and catalase production; citrate utilization, oxidative/fermentation (O/F) utilization of glucose; indole and coagulase production, starch hydrolysis, sugar fermentation, methyl red-Voges Proskaur reaction and urease production. The tests were performed according to the methods of (Cheesbrough, 2005; Adeoye, 2007; Agwung-Fobellah and Kemajou, 2007; Ochei and Kolhatkar, 2007). Microbial identification was performed using the keys provided in the *Bergey's Manual of Determinative Bacteriology* (1994).

Fungal isolates were examined microscopically and macroscopically using the needle mouth technique. Their identification was performed according to the scheme of (Cheesbrough, 2005; Barnett and Hunter, 1972; Larone, 1986).

3. RESULTS

The results of the mean counts of the microorganisms isolated from the floors of the hospital wards are presented in Table 1. The total aerobic plate count ranged from 4.36 ± 0.47Log_{10}cfu/g to 4.82 ± 0.69 Log_{10}cfu/g. The obstetrics and gynecology ward had the highest count of 4.82 ± 0.69 Log_{10}cfu/g while the least count of 4.36 ± 0.47Log_{10}cfu/g was from medical ward. The ANOVA, P > 0.05 showed that there was no significance difference in their mean count among the wards. The coliform count ranged from 3.81 ± 1.30 Log_{10}cfu/g to 4.42 ± 0.97 Log_{10}cfu/g. The highest count of 4.42 ± 0.97 Log_{10}cfu/g was from the casualty ward while the pediatrics ward had the least count of 3.81 ± 1.30 Log_{10}cfu/g. The ANOVA, P > 0.05 showed that there was no significance difference in their mean count among the wards. The fungal count ranged from 6.56 ± 0.60 Log_{10}cfu/g to 6.70 ± 0.18 Log_{10}cfu/g. The pediatrics ward had the highest count of 6.70 ± 0.18 Log_{10}cfu/g while the casualty ward had the least count of 6.56 ± 0.60 Log_{10}cfu/g. The ANOVA, P > 0.05 showed that there was no significance difference in their mean count among the wards. Table 2 shows the fungal genera isolated from the wards and their percentage occurrence. The *Trichophyton mentagrophyte* had the highest occurrence of 34.10% while the *Microsporum* gypseum had the least occurrence of 0.55%.

Table 2 Fungi isolated from the wards and their percentage occurrence

Fungi	No of Species	Percentage occurrence (%)
Rhizopus stolonifer	45	4.93
Mucor pusillus	40	4.39
Alternaria citri	203	22.26
Chaetomium species	20	2.19
Aspergillus flavus	41	4.50
Aspergillus niger	21	2.30
Trichophyton mentagrophyte	311	34.10
Penicillium candidum	20	2.19
Microsponum gypseum	5	0.55
Cephalosporium species	15	1.64
Cladosporium species	191	20.94

Table 3 shows the bacterial genera isolated and their percentage occurrence. The *Bacillus* species had the highest occurrence of 34.54% while the *Proteus mirabilis* had the least occurrence of 0.44%.

Table 3: Bacteria isolated from the wards and their percentage occurrence

Bacteria	Total Isolated	(%) occurrence
Staphylococcus aureus	253	22.41
Escherichia coli	210	18.60
Micrococcus species	143	10.24
Bacillus species	390	34.54
Proteus mirabilis	5	0.44
Pseudomonas aeruginosa	55	4.87
Actinomyces species	67	5.93
Serratia marcescens	6	0.53

DISCUSSION

The mean bacterial and fungal counts were high for the samples from the wards. This showed that the floors of the hospital wards habour various microorganisms. This may be attributed to the fact that these microorganisms may be from the body and foot wears of patients and visitors (Gardner and Provine, 2001; Shimuld and Rodgers, 1999). This is also in line with the work of Gugnani and Shrivaster (1972) who worked on soil contaminated materials brought into a house. It is believed that there will be a decrease in the recorded viable counts of microorganisms if access to the wards is restricted because the number of microorganisms being carried to the wards by visitors will be reduced. The fungal counts being on the increase might be due to the fact that fungi form spores which survive unfavourable conditions than the non spore forming bacteria thereby making them to be more persistent in the environment. Most of the bacterial genera isolated are known to be causative agent of nosocomial infections. Therefore stricter hospital hygienic measures should be adhered to in order to reduce the risk of this nosocomial infection to the barest minimal. This can be achieved by cleaning the wards at least twice daily with antimicrobial solutions and restricting undue and unnecessary access to the wards (Madsen, 2006; Prescott *et al*., 2008). Other ways include making sure that the instruments, dressing materials, equipment and linen must be stored properly to prevent contamination. Basic personal hygiene such as hand washing must be observed after all procedures involving bed making , floor cleaning, removal of excreta or any service to patients in isolation before and after aseptic procedures. Much attention should be paid to the physical removal of dusts and dirt from wards and corridors. The methods of cleaning designed with regards to control of infectious diseases include the use of vacuum cleaners with filtered air exhausts, scrubbing machines, safe containment and disposal of waste materials incineration and of the dirty linens to the laundry. There is the need to know that whenever there is accidental splash of body fluid on the floor, the mess should be cleaned before it gets dried up to prevent the formation of biofilm (Baron and Finegold, 2004; Madsen, 2006).

Hospital wards are rooms which are meant to be aseptically clean all the times because of the condition of the individuals staying there. The cleanliness of the hospital wards determines the state of health of patients during and after their stay. This is because many patients during the course of their stay in the hospital acquire infections from the hospital environment. They can carry these infectious organisms after their discharge to the environment outside the hospital environment and transmit these organisms to healthy individuals. The hospital management should therefore set up a committee to ensure that a high standard of hygiene is maintained in the wards.

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