Assessment of Microbial Contamination and Diversity on Used Facemasks Disposed Within Kabianga Shopping Centre

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ASSESSMENT OF MICROBIAL CONTAMINATION AND DIVERSITY ON USED FACEMASKS DISPOSED WITHIN KABIANGA SHOPPING CENTRE.

BY

TIMOTHY MUMO JAMES

MIC/M/0007/2017

RESEARCH PROJECT PROPOSAL

A Research Project Submitted in Partial Fulfillment for the Award of a Degree in Bachelor of Science Microbiology in the School of Science and Technology, Department of Biological Science, University of Kabianga.

JUNE©2021.

DECLARATION

I TIMOTHY MUMO JAMES, hereby declare that this project report is my original work and it has not been submitted before for the award of a degree, either in this or other institutions of higher learning, for academic publication or any purpose. Other authors work cited herein has been duly acknowledged in the text.

Name: TIMOTHY MUMO JAMES

Registration no: MIC/M/0007/2017

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Date: _____

SUPERVISOR.

Name: Mr. J. Mwangi.

Sign: _____

Date: _____

DEDICATION

I dedicate this research project to the Department of Biological Science, School of Science, University of Kabianga and the ministry of public health. I also dedicate it to my parents Mr. and Mrs. James Mwangangi, my siblings, Mercy and Esther and all those who participated immensely in development of this research project.

ACKNOWLEDGEMENT

I express my gratitude to the Almighty God for seeing me through my entire research project development. I also thank the institution (University of Kabianga) especially the academic staff for the support they have given me to reach this point. My special thanks goes to my supervisor (Mr.J.Mwangi) whom despite of many duties agreed to guide me in developing the project. I express my deep thanks to my beloved family for supporting me financially. I also thank everybody who was constantly beside me and helped in research project development.

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DEFINITION OF TERMS.

1. FACEMASK.
   A protective mask covering the nose and mouth or nose and eyes.
2. SARS Cov-2
   Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a novel severe acute respiratory syndrome coronavirus.
3. RATIONALE
   A set of reasons or a logical basis for a course of action.
4. PATHOGEN.
   An organism that causes disease.
5. DIVERSITY.
   The state of being diverse; variety.

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ABSTRACT.

Background and Aim: The origin of the novel human coronavirus (SARS-CoV-2) and its potential for harm increased face masks in the environment due to their daily disposal by a large number of populations. Thereby posing a health risks indirectly through the release of pathogens into the environment when the facemask is poorly disposed. The used facemasks have respiratory secretions on them and can be dispersed and transmitted through the air hence putting the health of the people around the dumpsites at risk of infection by the nasopharyngeal pathogens released from the disposed facemask to the environment. This study aims at assessing the microbial contamination and the diversity of microorganisms in a used, disposed facemask.

***Methods*:** The samples of used, disposed facemasks were obtained from the Kabianga market dumpsite. 20 samples were collected. The in-vitro analysis involved inoculation of a section of facemask mask from the internal and external surfaces in an enrichment media for isolation of bacteria and successive isolation by spread plate method on selective and non-selective media. Screening for Candida species was done by contact method on Candida agar. Group or genus of isolated bacteria and fungi were preliminarily identified by Gram's stain and lacto-phenol cotton blue.

Results: The predominant isolated bacteria contaminated on the inside of the used masks were mostly gram-positive bacteria, such as **Enterococcus spp**., ***Staphylococcus aureus* and *Streptococcus pneumoniae***. Some gram-negative species, such as **Acinetobacter spp.,** ***Escherichia coli*, Klebsiella spp.** and **Shigella spp**. Were found. The fungal isolates included strains of **Candida species**.

Conclusion: The study proves that used face mask contains viable pathogenic microorganisms which are capable of causing a health risk when the pathogens are released into the environment.

Keyword: SARS-CoV-2, Facemask, Pathogen, In-Vitro analysis.

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BACKGROUND INFORMATION.

The disposable facemasks were originally developed to filter droplets containing microorganisms expelled from the mouth and nose and probably protect the human respiratory system from fine airborne particles known to be associated with various respiratory diseases.

The human upper respiratory tract is the reservoir of a diverse community of commensals and potential pathogens (pathobionts), including ***Streptococcus pneumoniae*** (pneumococcus), ***Haemophilus influenza*** and ***Staphylococcus aureus***, which occasionally turn into pathogens causing infectious diseases.

The microorganisms expelled from the mouth and nose may differ from one individual to another depending on the pathological condition of the person using the facemask. The inside layer of the facemask may contain numerous microorganisms that can either be pathogenic (able to cause an infection) or non-pathogenic (not capable of causing an infection).

When the facemask is disposed, the microorganisms remain in the mask for sometimes depending on their various adaptations to survive adverse environmental conditions, The most common nasopharyngeal pathogens may well survive or persist on the facemask surface for months and can thereby be a continuous source of transmission, Most gram-positive bacteria, such as ***Streptococcus pneumoniae***, ***staphylococcus aureus*** survive for months on dry surfaces. Many gram-negative species such as ***Bordetella pertussis*****,** ***Haemophilus influenza***, persist only for days. Mycobacteria, including ***Mycobacterium tuberculosis***, and spore-forming bacteria, including ***Clostridium difficile*****,** can also survive for months on surfaces. ***Candida albicans*** as the most important nasopharyngeal fungal pathogen can survive up to 4 months on surfaces.

These microorganisms are pathogenic, are capable of causing Upper Respiratory Infection ***(An upper respiratory tract infection (URTI) is an illness caused by an acute infection, which involves the upper respiratory tract, including the nose, sinuses, pharynx, larynx or trachea.)*** and they can be dispersed and transmitted through the air when the used mask has been poorly disposed. The dispersal of these microorganisms in the air leads to increased levels of pathogenic microorganisms in areas where the used facemasks have been disposed. This poses a danger to the health of the residents of these areas as the rate of infection by the upper respiratory pathogens dispersed to the environment from the poorly disposed used facemask becomes very high.

Acute respiratory infections, in particular pneumonia, remain one of the most important causes of death in both adults and children, with an estimated 3.5 million deaths worldwide in 2008. Sharp peaks in mortality due to respiratory infections are observed during infancy and late adulthood. With approximately 1.4–1.8 million fatal cases per year in children under the age of five.

To cause respiratory disease, bacteria first need to colonize the nasopharyngeal niche. Colonization of this niche is a dynamic process: acquisition and elimination of species, interactions among microbes and between microbes and the host, and interference by environmental factors are suggested to cause a dynamic and complex microbial interplay. In a balanced state, this ecosystem as a part of the complete human microbiome is assumed to play a major beneficial role for the human host. However, imbalances in this respiratory microbial community can contribute to acquisition of a new bacterial or viral pathogen, carriage of multiple potential pathogenic bacteria, or a viral co-infection. Subsequently, imbalances in the ecosystem may result in overgrowth and invasion by bacterial pathogens, causing respiratory or invasive diseases.

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1.1 STATEMENT OF PROBLEM.

The facemask was designed to prevent microorganisms from the nose and mouth of the wearer from spreading to others, the microorganisms is thus trapped in the inside of the facemask.

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The used masks should not be disposed in open dust bins or dumpsites as it can pose a potential health hazard to people who come in contact with such masks. Used facemask is an infectious waste and may contain any of a great variety of pathogenic microorganisms. Pathogens in infectious waste may enter the human body through the mucous membranes by inhalation. Poor disposal of used facemask may pose health risks indirectly through the release of pathogens into the environment.

1.2 RATIONALE.

During the past few months the number of patients visiting Kabianga Market Health Centre to be treated for upper respiratory infections has increased, the increased. This increase is related to the increased number of pathogenic microorganisms in the environment which has been caused by poor disposal of used facemasks which may contain the pathogenic microorganisms around Kabianga market. The infected masks have respiratory secretions on them and can be dispersed and transmitted through the air. Poor disposal of used facemask may pose health risks indirectly through the release of pathogens into the environment. Pathogens in infectious waste may enter the human body through the mucous membranes by inhalation. The increased frequency of the outbreak has engendered research interest to develop interventions to reduce the risk of illness caused by these pathogenic

microorganisms found in a used facemask. The study is aimed at assessing the microbial contamination and the diversity of microorganisms in a used, disposed facemask.

1.3 MAIN AIM.

The study is aimed at assessing the microbial contamination and the diversity of microorganisms in a used, disposed facemask.

1.4 OBJECTIVES.

-To assess microbial contamination on the used facemask.
-To isolate and identify the microbial groups on the used facemask.

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LITERATURE REVIEW.

FACEMASK DEFINITION.

A covering for the mouth and nose that is worn especially to reduce the spread of infectious agents (such as viruses or bacteria).

ROLE OF FACEMASK IN PREVENTING THE SPREAD OF INFECTIOUS DISEASES.

The spread of infectious diseases from person to person and the degree of transmission vary based on the etiology and mode of transmission.

The transmission ways are mainly classified into the following three:

(i) Direct transmission – infected droplet/aerosol transmission.

(ii) Airborne route – inhaling infected respiratory aerosols.

(iii) Contact transmission- through secretions on fomites or directly such as through physical touch resulting in hand-to-mouth, hand-to-eye or hand-to-nose transmission.

A face mask helps prevent airborne, droplet and aerosol transmission where the primary control mechanism lies in reducing exposure. Facemask helps in filtering out particles of different sizes through various mechanisms.

MAJOR MICROBIAL GROUPS IN A USED FACEMASK.

A used facemask majorly consists of the microorganisms from the upper respiratory tract. The upper respiratory system, or upper respiratory tract, consists of the nose and nasal cavity, the pharynx, and the larynx. The human upper respiratory tract is the reservoir of a diverse community of commensals and potential pathogens (pathobionts), including ***Streptococcus pneumoniae*** (pneumococcus), ***Haemophilus influenza*** and ***Staphylococcus aureus***, which occasionally turn into pathogens causing infectious diseases.

UPPER RESPIRATORY INFECTIONS.

Upper respiratory tract infections can be defined as self-limited irritation and swelling of the upper airways with associated cough and no signs of pneumonia, in a patient with no other condition that would account for their symptoms, or with no history of chronic obstructive pulmonary disease or chronic bronchitis. Upper respiratory tract infections involve the nose, sinuses, pharynx, larynx, and large airways.

A variety of viruses and bacteria can cause upper respiratory tract infections. These cause a variety of patient diseases including acute bronchitis, Pneumonia, the common cold, influenza, and respiratory distress syndromes.

Common Cold.

The pathogens that are responsible for causing the common cold include rhinovirus, adenovirus, parainfluenza virus, respiratory syncytial virus, enterovirus, and coronavirus. The rhinovirus, a species of the *Enterovirus* genus of the *Picornaviridae* family, is the most common cause of the common cold and causes up to 80% of all respiratory infections. Dozens of rhinovirus serotypes and frequent antigenic changes among them make identification, characterization, and eradication complex. After deposition in the anterior nasal mucosa, rhinovirus replication and infection are thought to begin upon mucociliary transport to the posterior nasopharynx and adenoids. As soon as 10 to 12 hours after inoculation, symptoms may begin. The mean duration of symptoms is 7 to 10 days, but symptoms can persist for as long as 3 weeks. Nasal mucosal infection and the host's subsequent inflammatory response cause vasodilation and increased vascular permeability. These events result in nasal obstruction and rhinorrhea whereas cholinergic stimulation prompts mucus production and sneezing.

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Tuberculosis.

Tuberculosis (TB) is one of the deadliest infectious diseases in human history.
Although **tuberculosis** infection rates in the United States are extremely low, the CDC estimates that about one-third of the world's population is infected with ***Mycobacterium tuberculosis***, the causal organism of TB, with 9.6 million new TB cases and 1.5 million deaths worldwide in 2014.

M. tuberculosis is an acid-fast, high G + C, gram-positive, non-spore-forming rod. Its cell wall is rich in waxy mycolic acids, which make the cells impervious to polar molecules. It also causes these organisms to grow slowly. *M. tuberculosis* causes a chronic granulomatous disease that can infect any area of the body, although it is typically associated with the lungs. *M. tuberculosis* is spread by inhalation of respiratory droplets or aerosols from an infected person.

Pneumonia

Pneumonia is an infection that inflames the air sacs in one or both lungs. The air sacs may fill with fluid or pus, causing cough with phlegm or pus, fever, chills, and difficulty breathing. A variety of organisms, including bacteria, viruses and fungi, can cause pneumonia.
Pneumonia can range in seriousness from mild to life-threatening. It is most serious for infants and young children, people older than age 65, and people with health problems or weakened immune systems.

Signs and symptoms of pneumonia may include:

- Chest pain when you breathe or cough
- Confusion or changes in mental awareness (in adults age 65 and older)
- Cough, which may produce phlegm
- Fatigue
- Fever, sweating and shaking chills
- Lower than normal body temperature (in adults older than age 65 and people with weak immune systems)
- Nausea, vomiting or diarrhea
- Shortness of breath

Pneumonia is commonly caused by a gram positive cocci, ***Streptococcus pneumoniae***. *S. pneumoniae* is an obligate parasite of humans and can be found in the nasopharynx of many healthy individuals.

HOW POOR DISPOSAL OF USED FACEMASKS MAY CAUSE UPPER RESPIRATORY TRACT INFECTION.

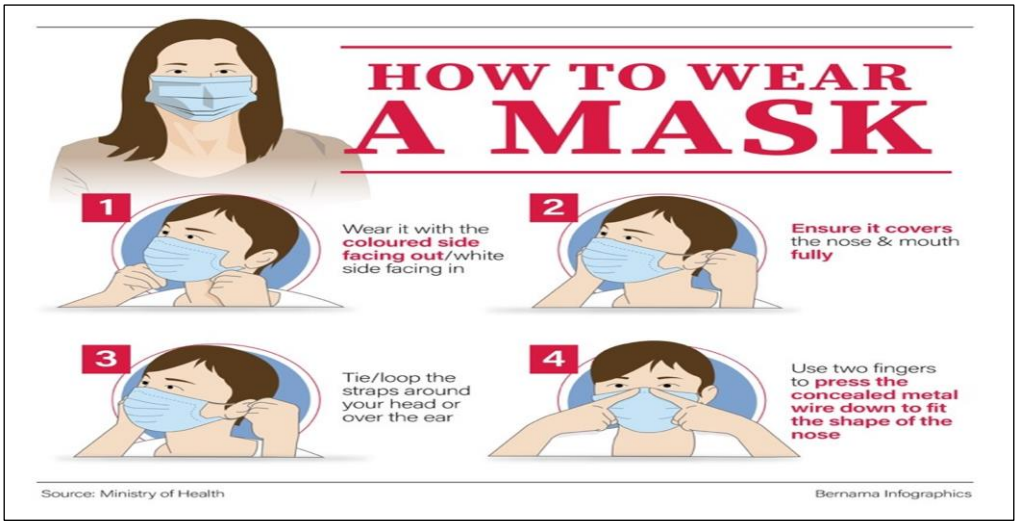
Used facemask is an infectious waste and may contain any of a great variety of pathogenic microorganisms. The used masks have respiratory secretions on them and can be dispersed and transmitted through the air. Microorganisms can be released to the air from the disposed facemask in the form of water droplets or aerosols which are produced by wind or tidal actions.

Whenever the wind blows it disturbs the microorganisms and liberate them into the air and these microorganisms remains suspended in the air for long time.

People residing in the areas where used masks a poorly disposed are posed with the risk of getting infected through inhalation of the pathogenic microorganism which have been launched into the environment from the used facemask by wind action.

Failure of wearing a facemask or wearing it properly by residents of the places where facemasks are disposed predisposes them to attack by these pathogenic microorganisms through inhalation.

HOW TO WEAR A FACEMASK.



HOW TO REMOVE A FACEMASK

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HOW TO PROPERLY DISPOSE A USED FACEMASK.

- Single-use masks that have become soiled, damp, crumpled, or soiled must be disposed of immediately.
- Take off the mask from your face carefully. Hold it by the ear loops, not the mask cover itself. Be gentle when you do this to reduce the chances of shaking loose the trapped pathogens.
- Cut off the ear loops with a pair of scissors. Without the ear loops, there are fewer chances of the mask entangling wildlife in case it ends up in the environment.
- Don't throw the used mask directly into the trash bin. Rather, put it in a sealed plastic bag. You can use a bigger bag to collect a certain volume of face masks. Other disposable items that have been worn by a coronavirus positive person such as gloves should also be placed in the plastic bag.
- Close and seal the plastic bag, then put the bag in the trash bin for the disposal schedule.
- Alternatively, call a service provider that specializes in disposing of hazardous wastes. These providers can handle all types of solid, hazardous, and medical waste disposal.
- Wash your hands thoroughly with soap and water for at least 20 seconds each time you dispose of a mask. It takes 20 seconds for the soap to break down the protective fatty envelope of the virus.

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HOW PEOPLE POORLY DISPOSE THE USED FACEMASK.

The initial threat of discarded single-use masks is that they may be contaminated with the respiratory secretions of an infected person, thus spreading the infectious germs when other people like garbage cleaners or the general public come in contact with it.

People throw used facemasks openly in road sides or in open dumpsites.

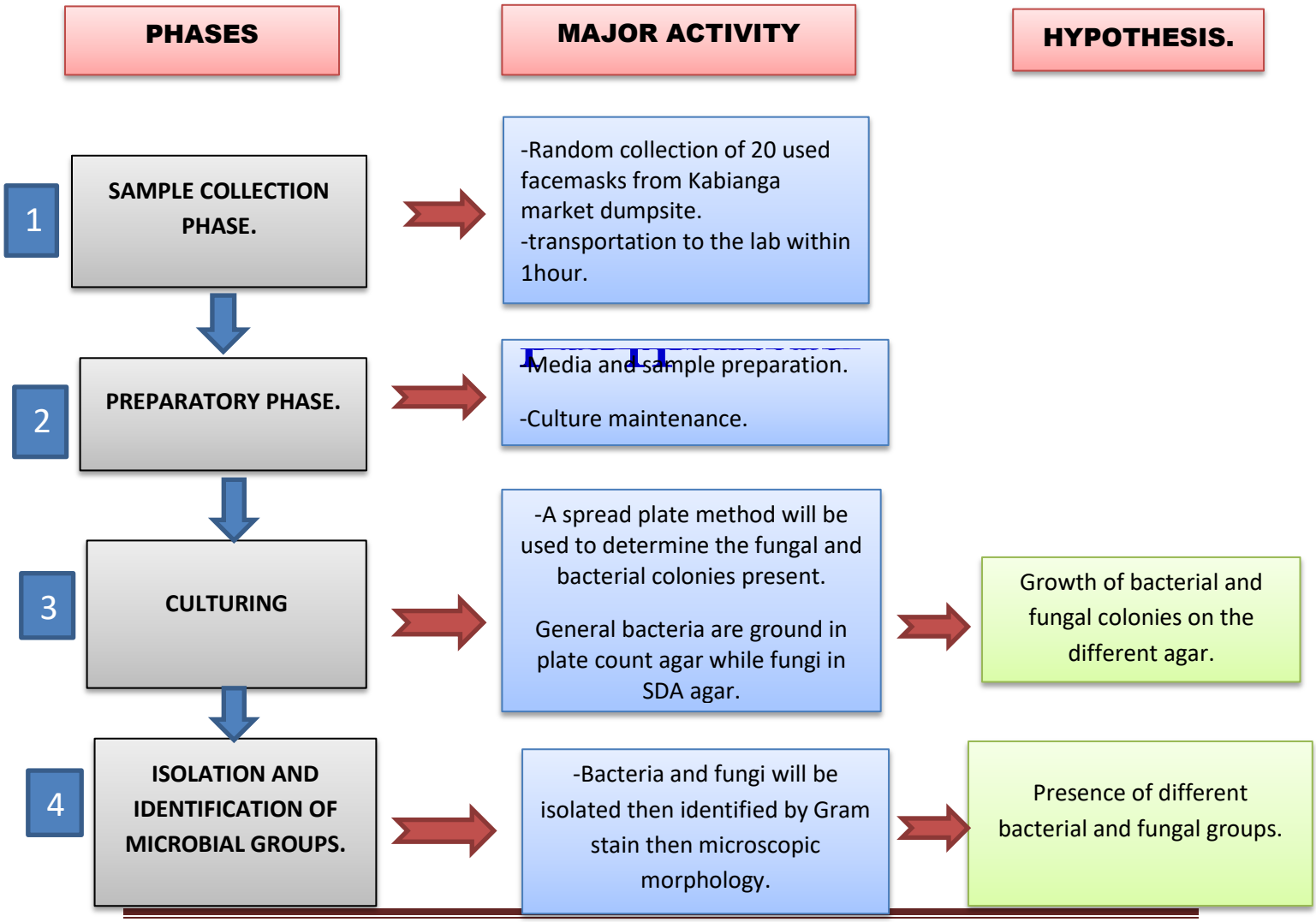
METHODOLOGY.

3.0 METHODOLOGY.

This chapter describes the study site, location of the study site, sample collection, media preparation and sample preparation. It also discusses on sampling procedure, sample size, data collection techniques and lastly data analysis.

3.1 STUDY SITE: This study will be conducted in Kabianga Market Center.

3.2 RESEARCH DESIGN.



3.3 WORK PLAN.

ACTIVITY	DURATION(MONTH)
FORMULATING RESEARCH TOPIC	MAY TO JUNE 2021
PRESENTATION OF THE PROPOSAL	JULY 2021
SAMPLE COLLECTION, LAB EXAMINATION, DATA ANALYSIS AND RESULTS.	AUGUST 2021
WRITING REPORT AND SUBMISSION.	SEPTEMBER 2021

3.4 BUDGET

ITEMS	QUANTITY	PRICE
Culture media	500g	3000
Reagents	-	2000
Transport	-	300
Printing and binding	-	500
Gloves	1 packet	1700
Lab materials	-	2000
Writing materials	-	500
Sterile cotton swabs		**1000**
TOTALS	-	KSH. 14000.

CHAPTER FOUR.

4.0 REFERENCES.

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