



# Exploring the Hand Microbiota of Fishmongers: Unveiling the Bacterial Spectrum

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## KEYWORDS

Bacterial flora,  
Bacterial infections,  
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## ABSTRACT:

**Background:** Bacteria are tiny unicellular organisms that are ubiquitous. Hands are a more significant source of infection when compared to other parts of the body. The hands of fishmongers can carry different types of pathogenic organisms, leading to food poisoning, diarrhea, and other bacterial infections, both for themselves and others. **Aims:** The purpose of this study was to assess the prevalence of bacteria, both commensals and pathogens, isolated from the hands of fishmongers and other workers. **Materials and methods:** The samples were collected from the hands of 50 fishmongers and 20 daily wage workers using sterile cotton swabs. They were transported to the laboratory without any delay and inoculated on Nutrient agar, then incubated at 37°C for 24 hours. Identification of the Genus and species of the isolated bacteria was done by the conventional method. **Results:** Out of 50 samples, the predominant organism isolated was identified as *Coagulase Negative Staphylococci (CoNS)* - (34%), followed by *Bacillus spp.* (20%), *Acinetobacter spp.* (12%), *Escherichia coli* (10%), and *Klebsiella spp.* (9%), *Staphylococcus aureus* (7%) *Corynebacterium species* (6%) and the less frequently isolated organisms were *Aeromonas species* (2%). 20 samples collected from the hands of other workers yielded *CoNS* (51%), *Bacillus species* (25%) predominantly followed by *Corynebacterium species* (18%), *Staphylococcus aureus* (3%), and *Aeromonas species* (3%). **Conclusion:** This study concluded that the percentage of pathogenic bacteria was higher in the hands of fishmongers compared to the control group and it highlights the need for more intensive efforts to promote hygiene and hand wash behavior among them.

## 1. Introduction

The fishermen community comprises fishermen, fishmongers, and port workers. Fishermen ride into the sea to catch the fish and a fishmonger is a person who stores, sells, and cleans fish in addition, there are other people who dry the fish. Among all these workers, fishmongers are at a high risk of being exposed to fish-borne infections (Yacoub A et al., 2015). They may be infected by bacterial pathogens while handling fish or from their surroundings. Handling the fish without proper gear may lead to contamination or invasion by several organisms (Clarridge JE, Zigelboim-Daum, 1985). Hands are the most exposed parts when compared to other parts of the body in the

case of fishmongers. Due to improper hand hygiene practices in the community, there is a high chance of contamination and transmission of infection from fish. As they can carry different types of pathogenic organisms, this can lead to food poisoning, diarrhea, and other bacterial infections (Versapuech J et al., 2001). The port workers have been found to be harbouring pathogens while transporting Fish and other marine products (Ampofo JA, Clerk GC, 2010). In fish markets, potential buyers encounter fishmongers during the buying and selling of fish and this can lead to the spread of the infection (Ho MH et al., 2006). This study will highlight the widespread occurrence of infectious organisms among



fishmongers and the means to reduce the spread of infection by practicing proper hand hygiene.

## 2. Methods

**Ethics:** This study was conducted at Chettinad Hospital and Research Institute, Tamil Nadu, India. This study was conducted over 2 months (02/2/ 2023 to 31/ 03/ 2023) and it was approved by the Institutional Human Ethics Committee of Chettinad Academy of Research and Education (CARE) (Ethical clearance no: IHEC-I/1458/22). All subjects gave written informed consent. Clinical and Laboratory Standard Institute (CLSI M100) guidelines for use in the laboratories of clinical microbiology were followed in this study.

**Study design:** In this study, the microorganisms were isolated and identified in the hand swabs of fishmongers and the control group, to determine the prevalence of pathogenic bacteria in the hands of fishmongers and the control group by performing various culture methods and biochemical reactions. Fishmongers included in this study were free from any skin disease, inflammation, or irritation. Individuals with other occupations and with skin lesions were excluded from this study

**Sample size:** 50 fishmongers and 20 control groups (housewives, home maids, students)

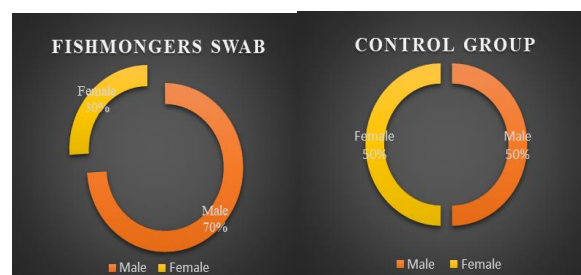
**Bacterial isolates:** The samples were collected from the hands of the study subjects using sterile cotton swabs in a sterile plastic container. The swabs were dipped in sterile glucose broth, before sample collection, to prevent drying. These swabs were then inoculated on nutrient agar, and incubated overnight at 37°C. The isolated colonies were further processed for preliminary tests which included Gram staining, oxidase test, catalase test, and motility test. The subculture was done on Blood agar, and MacConkey agar followed by biochemical tests for phenotypic characterization then the results were interpreted.

**Statistical analysis:** The analysis was done using SPSS software version 24.0.

## 3. Results:

### Sample distribution

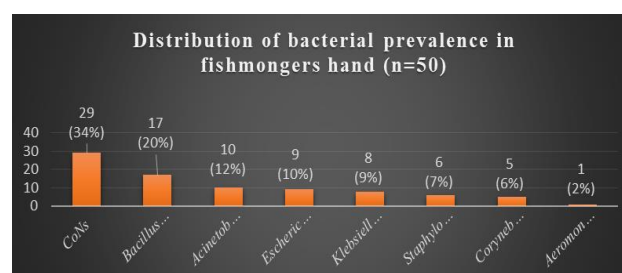
Out of 50 samples collected from the hands of fish mongers, 35 (70%) samples were taken from males and 15(30%) samples were from females, whereas among the 20-control group, 10 samples were collected from the male and 10 samples from females (50% each), as shown in [Figure 1]



**Fig no: 01** Hand swabs from fishmongers and Hand swabs from the control group

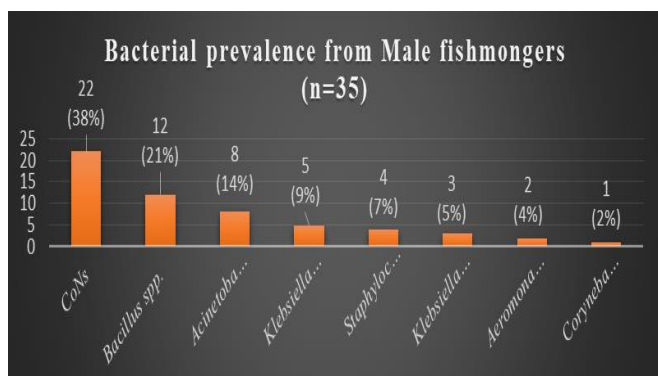
### Distribution of bacterial isolates from the hands of fishmongers (n=50)

Out of 50 hand swab samples from the fishmongers 85 colonies were isolated [Figure 2]. The highest number of isolated organisms were identified as *Coagulase Negative Staphylococci (CoNS)* 29 (34%), followed by *Bacillus species* – 17 isolates (20%), *Acinetobacter species* – 10 isolates (12%), *Escherichia coli*- 9 isolates (10%), *Klebsiella species* – 8 isolates (9%), *Staphylococcus aureus* – 6 isolates (7%), *Corynebacterium species* – 5 isolates (6%) and *Aeromonas species* – 1 isolate (2%).



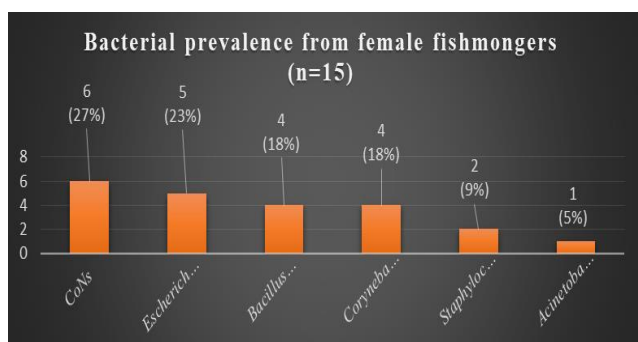
**Fig no: 02** shows the isolated organisms in the samples collected from the Fishmonger's hand

Out of 35 samples from the male fishmongers [figure:03], the bacterial isolates were identified as *Coagulase Negative Staphylococci (CoNS)*- 22 isolates (38%), 12 isolates of *Bacillus species* (21%), 8 isolates of *Acinetobacter species* (14%), *Klebsiella pneumoniae* – 5 isolates (9%), *Staphylococcus aureus* - 4 isolates (7%), *Klebsiella oxytoca* - 3 isolates (5%), *Aeromonas species* - 2 isolates (4%) and *Corynebacterium species* – 1 isolate (2%)



**Fig no: 03** Shows The isolated organisms in the samples collected from the males in the fishmongers.

The 15 samples from the female fishmongers [figure: 04], yielded *Coagulase Negative Staphylococci* (CoNS) in 6 samples (27%), *Escherichia coli* in 5 samples (23%), *Bacillus species* in 4 samples (18%), *Corynebacterium species* 4 (18%), *Staphylococcus aureus* 2 (9%), *Acinetobacter species* from 1 sample (5%).

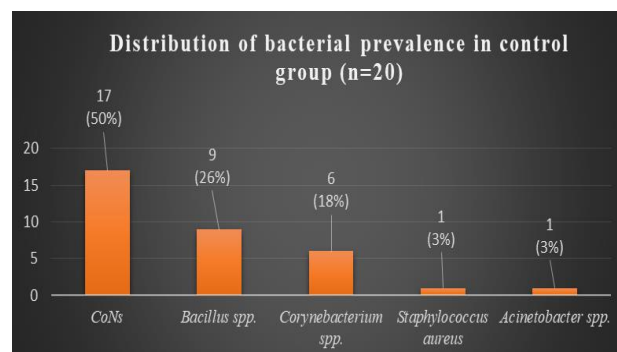


**Fig no: 04** Shows The isolated organisms in the samples collected from the Female fishmongers.

In this study, the *Coagulase Negative Staphylococci* (28), *Bacillus species* (16), *Escherichia coli* (10), and *Staphylococcus aureus* (6) were found to be common among both genders.

#### Distribution of bacterial prevalence in the control group (n=20)

Out of 20 hand swab samples from the control group 34 colonies were isolated [Figure 5]. The highest isolated organisms were identified as *Coagulase Negative Staphylococci* (CoNS) 17 (50%), followed by *Bacillus species* – 9 isolates (26%), *Corynebacterium species* – 6 isolates (18%), *Staphylococcus aureus* – 1 isolate (3%), and *Acinetobacter species* – 1 isolate (3%).



**Fig no: 05** shows the isolated organisms in the samples collected from the Control group

In the control group, out of 10 samples from males, the isolated organisms were identified as *Coagulase Negative Staphylococci* (CoNS) 8 - isolates (58%), *Corynebacterium species* 4 - isolates (28%), *Escherichia coli* 1 - isolates (7%), *Staphylococcus aureus* 1 - isolates (7%).

The 10 samples collected from the hands of the female control group, yielded *Coagulase Negative Staphylococci* (CoNS) (8) (51%), *Bacillus species* 4 - isolates (28%), *Corynebacterium species* 2 - isolates (14%), and *Acinetobacter species* 1 - isolates (7%).

#### 4. Discussion:

Due to handling raw fish, the fishmongers are at increased risk of acquiring infections which can occur in both immunocompetent and immunosuppressed persons.

This study demonstrated that the percentage of Gram-negative organisms was found to be higher in the hands of fishmongers in comparison to the control group and this could be due to their handling and processing of fish. Abraham T Yacoub et al., from Florida in 2015 reported similar results (Yacoub A et al., 2015).

The highest number of Gram-negative bacteria were isolated from the hands of fishmongers and it was found to be *Escherichia coli* and *Klebsiella species*. These two bacteria are potential pathogens. In addition, they are part of the normal flora of the gastrointestinal tract. Manos J et al., in 2015 from Sydney stated that the family of *Enterobacteriaceae* organisms rarely cause skin cellulitis in fishmongers (Manos J, Belas R 2006). Huang G et al., 2013 from Boston reported that the *Enterobacteriaceae* family of *Proteus vulgaris* and *Morganella morganii* are isolated from the hands of fishmongers which can cause skin cellulitis and urinary tract infections them (Huang G, 2013).



This study showed that *Acinetobacter species* were isolated from both fishmongers and the control group but a higher percentage was reported from fishmongers. Mary A. Adewoyin et al., 2018 from South Africa stated that *Acinetobacter species* can be isolated from environmental sources like surface water, natural human skin, etc., where it can cause severe infections in humans in clinical environments (Adewoyin MA, Okoh AI, 2018).

The genus *Aeromonas* is a Gram-negative and oxidase-positive bacillus that is commonly distributed in aquatic environmental areas (Sohn HJ, 2007). In our study, this bacterium was isolated on the hand swabs of male fishmongers (2 out of 35 samples), and Adamski J et al., in 2017 from Finland reported that it can cause fatal myonecrosis and septicemia in fishmongers (Adamski j et al., 2006).

Claridge JE et al., in 1985 and Colodner R et al., in 2002 reported that certain species of *Vibrio* are more commonly present in the environment of the fisherfolk, especially *Vibrio damsela* and *Vibrio vulnificus* and it can cause cellulitis to fishmongers (Clarridge JE et al, 1985 and Colonder R et al., 2002). In contrast to our study, no species of *Vibrio* were isolated from fishmongers.

These bacteria can spread from the fishmongers to other persons often via contaminated hands where these infections can occur in both the immunocompetent and the immunosuppressed, latter this will lead to an increase the morbidity and mortality (Novoslavskij et al., 2016, Walczak N et al., 2017 and Zaheen Z et al., 2022).

## 5. Conclusion:

The hands of fishmongers were found to be more contaminated than the control group. This study helps to highlight the need for more intensive efforts to promote hygiene and hand wash behavior among them. Most importantly, Fishmongers should be advised to wear gloves while handling the fish, which will help to reduce exposure. If hand hygiene behavior implements important interventions like health education, it will result in decreasing the risk of disease among them and others.

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