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Bacterial And Fungal Contaminations In The Disposable Plastic And Plant Based Cutlery Running Title: Contamination In Pant And Plastic Cutlery

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Abstract

Introduction: Bacterial contamination can occur in the cutlery. Poor hygiene of cutlery has an important role in the growth and spread of bacteria.

Aim: This study is done to screen the disposable cutleries for their bacterial load and the potential risk for users.

Methods: Various types of cutleries are in use in different food outlets. Randomly the disposable plates and cups made with different materials were collected from different food stalls. Those plates were transported to the microbiology lab in sealed pouches to prevent further

contamination. The plates were taken and 5 ml of sterile saline was added and rinsed thoroughly.

Then the washed saline was collected in a disposable sterile plastic container. From the washed saline 50 microlitre is pipetted on to the culture media to enumerate and identify the bacteria present. After the incubation period the plates were checked for the total CFU and the type of bacteria. For the isolation of fungi sabouraud's dextrose agar was used and incubated at room temperature. The growth of bacteria and fungi were observed and tabulated category wise.

Results: Then after the incubation period the plates were examined for the total colony forming unit and the type of the bacterial species present. In many samples the count was innumerable and shows the coliform growth.

Conclusion: In this study ,it was observed that the cutleries made of plant and plastic has bacterial contamination which is not acceptable in any food safety standards. The local cutlery materials, though they are packed in an attractive and salable way, are not produced by the leaders in the market, mostly done like a cottage industry without any expertise.

Keywords: Bacterial, Fungal, Contamination, Cutlery, Culture medium, Innovative technique.

Introduction

Disposable cutlery is a biodegradable used as an alternative to non-biodegradable plastics. Theirmarket share is quite low (1 percent of all plastics) with a production volume of 2.11 million tonnes in 2018, but it is predicted to grow in the future. The name "cutlery" is still a bit of a misnomer. It can be manufactured from renewable feedstocks, biodegradable , or both. Similar materials, such as starch mixes, are available on the market. It's uncertain if they and other plant-based materials (such cellulose and bamboo-based materials) fall into that group. In either case, they are made to perform the same function as plastic materials and to look to the consumeras such.

The word "cutlery" implies that they share many of the same advantages as their petroleum-based counterparts, but with the added benefit of "natural" materials. They are touted as being more environmentally friendly and sustainable than traditional plastics. However, there is little scientific data to back up such a claim. Some biodegradable plastics, for example, do not disintegrate in industrial or natural settings. When analysing and improving the environmental performance of cutlery and plastic alternatives, the primary focus is on either the manufacturing stage (e.g., carbon footprint, renewable feedstocks) or the end-of-life stage. When analysing the materials' sustainability, the performance throughout the usage phase, such as human exposure totoxins, is frequently overlooked. Along those lines, nothing is known about cutlery's chemical safety, that is, the identity of compounds present in the material, their (combination) toxicity, andhuman exposure to these compounds. These information gaps are concerning because human exposure to chemicals from cutlery and plant-based materials is expected to rise as their use expands. Apart from this the biosafety aspect is of paramount importance, the contaminations onthem, they are in a form of ready to use, meaning, no prior washing or cleaning needed. This is arisky practice. It has been overlooked from a hygiene point of view.

Plasticizers, antioxidants, and stabilisers are examples of additives that increase the functionalityof the material, as well as solvents and catalysts that facilitate manufacture. Other purposefully and unintentionally introduced chemicals are also present. Although the individual moleculeswill vary depending on the material, all of these chemical categories can be found in conventional, bio-based, and biodegradable plastics. Because of their restricted physical qualities, such as thermal resistance and barrier properties, additives are especially important for polymers produced from natural resources, such as starch and cellulose, or from microorganisms,such as PLA. Chemical migration occurs when most of these components are not covalently bonded to the polymer and can be moved to air, solids (e.g., packed products or dirt), or liquids (e.g., beverages). As a result, plastics constitute a significant source of chemical exposure to humans, as well as terrestrial and aquatic environments.

In a recent study, we found that the majority of ordinary plastic consumer products contain compounds that are harmful in vitro. This was also true for the tiny set of silverware that welooked at. As a result, the goal of this study was to see if a broader range of cutlery and plant-based materials contained toxicity-causing compounds. We expected that the in vitro toxicity of chemicals in cutlery and plant-based materials is comparable to petroleum-based,non-biodegradable plastics, and that the toxicity is higher in completed goods than in pre-production pellets.

Our team has extensive knowledge and research experience that has translate into high quality publications (Priyadharsini *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ramalingam, Selvi and Jayaseelan, 2019; Vijayashree Priyadharsini, 2019;

Girija, Shankar and Larsson, 2020; Jayaseelan and Arumugam, 2020; Kumar, Girija and Priyadharsini, 2020; Mathivadani, Smiline and Priyadharsini, 2020; Paramasivam and Vijayashree Priyadharsini, 2020; Paramasivam, Priyadharsini and Raghunandhakumar, 2020; Paramasivam, Vijayashree Priyadharsini and Raghunandhakumar, 2020; Ushanthika *et al.*, 2021),(Reddy *et al.*, 2020; Teja and Ramesh, 2020; Barma *et al.*, 2021; Samuel, 2021; Samuel *etal.*, 2021). (Jayaseelan and Paramasivam, 2020) (Iswarya Jaisankar *et al.*, 2020)(Girija, 2021)

Materials and Methods

This study was conducted with an aim to screen the disposable cutleries for the contaminations which may be a risk for the user. Randomly the disposable plates and cups made with different materials were collected from different food stalls. Those plates were transported to the microbiology lab in sealed pouches to prevent

further contamination. The plates were taken and 5 ml of sterile saline was added and rinsed thoroughly. Then the washed saline was collected in adisposable sterile plastic container and the containers were labelled for the source. From the washed saline 50 microlitre is pipetted on to the culture media to enumerate and identify the bacteria present. The samples were inoculated into Brain heart infusion agar plates and sabouraud's Dextrose agar (SDA). The plates were incubated at 37 degree C for 24 hours aerobically. The SDA plates were kept at room temperature for 48 hours for the fungal growth.After the incubation period the plates were checked for the total CFU and the type of bacteria. For the isolation of fungi sabouraud's dextrose agar incubated at room temperature were observed. The growth of bacteria and fungi were observed and tabulated category wise.

Results

Then after the incubation period the plates were examined for the total colony forming. For the study 25 disposable plastic, plant based, plastic and metal cutlery were collected. In this study itis found that in many samples, nearly 50 % have confluent growth of bacteria. In the rest of the samples the colony count was less but not acceptable. The organisms isolated were, Bacillus sps, Enterococcus, coagulase negative staphylococcus. Presence of Enterococcus in an indication of faecal contamination. There is no fungal contamination noted in this study. The following tables1,2 and 3 show the level of contamination found in the cutleries tested.

Serial number	count	Fungus	Bacteria
1	confluent	no fungus	Bacillus and Cons
2	confluent	no fungus	Bacillus, Cons andentero
3	39	no fungus	Cons and 2 Bacillus
4	confluent	no fungus	Staph. citreus
5	135	no fungus	Cons and Entero
6	40	no fungus	Citreus and 8 Bacillus
7	confluent	no fungus	Cons and Entro
8	250	no fungus	Citreus & 8 Bacillus
9	confluent	no fungus	Entero
10	65	no fungus	Citreus and Bacillus
11	confluent	no fungus	Bacillus and Cons
12	confluent	no fungus	Cons
13	confluent	no fungus	Cons
14	confluent	no fungus	Cons
15	confluent	no fungus	Cons
16	50	no fungus	1 Bacillus and Cons
17	40	no fungus	Cons
18	27	no fungus	1 Bacillus and Cons
19	65	no fungus	2 Bacillus and Cons
20	475	no fungus	Cons

Table 1: show the number of plant product tested, the number of organisms grown and the typeof bacterial species grown

Serial number	count	Fungus	Bacteria
1	44	no fungus	Cons
2	40	no fungus	Cons and Entero

Table 2: show the number of plastic product tested, the number of organisms grown and the typeof bacterial species grown

Serial number	count	Fungus	Bacteria
1	confluent	no fungus	Cons
2	confluent	no fungus	Cons
3	confluent	no fungus	Cons

Table 3: show the number of aluminum product tested, the number of organisms grown and thetype of bacterial species grown

Discussion:

The hygiene of cutlery is a very important part and influences the quality of food and drinks(Shogren *et al.*, 2019). Cutleries that are not washed can cause the disease and spores that are left behind will proliferate and contaminate the food that will produce food poisoning(Mooney, 2009). When these heavily contaminated cutleries are used for packaging forhome delivery, during the transit period and and holding time, these contaminants will spoil the food and may produce food poisoning(Kubásek and Vojtěch, 2013). The most common problem encountered is sore throat. There is no possibility of cleaning it. In addition, the sellers do not pay attention to the hygienic storage of such materials. Based on the results of laboratory tests as conducted on the cutlery sample, it is found that all samples contained bacteria due to continuous contamination from the point of manufacture, storage and the use(Zimmermann *et al.*, 2020),(Millar and Moore, 2021). Microorganisms that contaminate these materials spoil the caterer's reputation, sometimes beyond repair and eventually ruin his business(Verhoeff-Bakkenes *et al.*, 2008; Millar and Moore, 2021). Contamination with food poisoning organisms is a threat requiring constant vigilance unless kitchen equipment that comes in contact with food is adequately cleaned and sanitized(Verhoeff-Bakkenes *et al.*, 2008;Yunancy, Nurlaela and Rusli, 2020; Millar and Moore, 2021),(Giwa, 2020).

Conclusion:

In this study it is found that the cutleries samples randomly collected from different vendors contain bacteria and fortunately there is no fungal contamination. Methods should be designed tomake it clean from the site of manufacture and use. Adding chemicals to the cutlery during manufacture may become a health hazard. Safer technology is must to really go a green way.

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CONFLICT OF INTEREST

The authors would like to declare no conflict of interest in the present study.

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