

## A STUDY ON EDIBLE CUTLERY AND ITS SIGNIFICANCE ON THE INDIAN HABITAT WITH SPECIAL REFERENCE TO RESTAURANTS IN MUMBAI

**Aniket Swaraj, Yash Sheth, Zeel Sheth, Sayam Gudhka, Omkar Nirgude and Chintan Gada**  
SIES College of Commerce and Economics (Autonomous)  
anikets@sies.edu.in

### **Abstract:**

Plastic and wood are the two materials that have been globally known for their involvement in all walks of life. One such area being single use cutlery has had adverse environmental, social and physiological impact due to these two materials being actively used. Plastic and wood cutlery can alter habitats and natural processes, reducing ecosystems' ability to adapt to climate change and affecting the livelihoods, and social well-being of millions of people. “Edible - Cutlery” are the two words that can be the future of our world, the change to our environment and an innovative approach to eliminate the use of other single-use cutlery available in the market. The concept of edible-cutlery is one of the finest approaches that blink out global issues like solid-waste management, wastage of groundwater, and environmental degradation. Despite immense popularity and universal adoption, very little is known about promoting edible cutlery. The Studies conducted in the past only focus on certain components rather than the problem, causes and solutions as a whole. The purpose of this study was to highlight the negative impact of using plastic and wooden cutlery and the impending problem of wastage of groundwater for the production of large-scale paddy crops, which can be resolved through edible cutlery. Statistical test is used to hypothesize the relationship of variables. The methodology used in the research were aimed at two target audiences namely consumers and restaurants through the help of a structured form questionnaire which received 134 responses from consumers and 10 responses from restaurants. The finding demonstrates that both the target audiences had contrasting views on the adoption of edible cutlery. Outcome of the research paper helps to encourage the mass adoption of edible cutlery, and motivates businesses to adopt edible cutlery in their practices and contribute towards a greener society whereas consumers will be drawn to tilt towards a healthier alternative.

**Keyword:** *edible cutlery, sustainable agriculture, millet's, paddy crops, innovation.*

### **Introduction:**

Edible cutlery is a plant-based product in which meals can be served or taken as a meal. It is commonly recognized as EBO (eco-friendly, biodegradable, and organic) due to the product's mix of flour. Edible cutlery can be made with a variety of ingredients, but some specific Flours provide the desirable traits for the final product. Ingredients, such as wheat flour, corn flour, soybean flour, sorghum flour, and water have nutritional benefits and can enhance the product's physicochemical properties when blended with the other ingredients.

Since edible cutleries are a one-of-a-kind innovation, a growing number of companies have set up themselves in both domestic (India) and international markets. Thooshan, Gajamukha Foods (Edible Pro), Trishula, Bakeys, and Eco Sankalp manufacture edible cutlery in India, while Incredible Eats, Changzhou East Food Engineering Co, and Taizhou Jinxin Industry & Trade Co manufacture edible cutlery in international markets. These companies manage to provide edible cutlery in flavours like Salt and pepper flavour, Mango flavour, Ginger garlic flavour, Beetroot-carrot flavour, Ketchup flavour, Chocolate flavour, etc.

Our research paper aims to create awareness among consumers and restaurants and at the same time to get answers for two thought-provoking questions on a global and domestic level. The first question was aimed at the global market to check whether or not edible cutlery is a perfect alternative for plastic/wood and the second question is more concentric on the domestic market of whether or not the production of edible cutlery would solve the groundwater depletion crisis.

To achieve this we will segregate our respondents into two categories:

1. Consumers
2. Restaurants

For consumers we plan to conduct a survey through a questionnaire on a software called “Google forms” which will include questions we feel will be necessary to gain a perspective on edible cutleries and for the restaurants we plan to conduct a structured form interview by giving them physical forms with questions printed on them to understand their take on edible cutleries.

Green Innovation is considered to be a solution to the predicament of environmental sustainability and growth, paving the way to a much safer and revitalised world. Along with the ‘Swadeshi Movement 2.0’ and ‘Make in India’ boost from the Government, the concept of Green Innovation has emerged in its all-new avatar for a developing nation like India. (Dr. Arkja Singh et al., 2022).

The agenda 2030 for Sustainable Development, accepted by all United Nations Member States in 2015, the 17 Sustainable Development Goals (SDGs) Among all these goals there were two which we think will be affected in a positive manner by edible cutlery. These are

1. [GOAL 9: Industry, Innovation and Infrastructure.](#)
2. [GOAL 12: Responsible Consumption and Production](#)

Our research will result in the following outcomes:

The research will urge everyone to switch to edible cutlery which is a more sustainable alternative to plastic and wooden cutlery as it is more beneficial for mankind and the environment. This research will also urge farmers to produce more dryland crops like millets instead of paddy crops like rice. Another possible outcome would be that if edible cutlery manages to become renowned in the market on a global and domestic scale, then it will create a revolutionary change in the single-use cutlery market segment.

### **Need of study:**

A lot of research and development is done in the field of eco-friendly alternatives to the existing disposable cutleries but this is the area which has not yet been touched upon. Thus, we are conducting our research to address two important questions:

#### **1)The problem of extensive usage of plastic and wooden cutlery**

We conducted this research to understand how effective edible cutlery will be in the Indian markets as a substitute towards plastic and wooden cutlery.

As far as Plastic is concerned, it wasn't invented until the late 19th century, and its production only took off around 1950, so we have a mere 9.2 billion tons of the stuff to deal with. Only 9% of all plastic ever created has been recycled, while 6.3 billion tonnes of garbage never made it to a recycling plant and ended up in landfills and the ocean. (Roy et al., 2022). Numerous species of animals, including large mammals, birds, fish, and small zooplankton, mistake plastic for food and perish as a result. Despite being a practical option, plastic cutlery is bad for the environment and is unhealthy. Since it is a petroleum by-product, it contains toxins and carcinogens that are easily absorbed by the human body. It also takes up a lot of space and regularly fills landfills. Therefore, their disposal is now dangerous for the environment because toxins and carcinogens can seep into food through the natural ecosystem. The recent ban on plastics sparked the concept of biodegradable cutlery.

As a result, Wooden cutlery came as a replacement for plastic cutlery with properties that were favouring its use such as it being eco-friendly, de-compostable, biodegradable, durable, etc. However, despite these desirable properties Wood still ended up having some undesirable limitations which prevent it to date from being the “perfect substitute” for biodegradable cutlery.

They are as follows:

1. Wood is a porous, absorbent material that absorbs moisture and bacteria from food and water. As a result, wooden cutlery is unsanitary and should not be stored in humid areas.
2. Certain types of wood, like cedar or cypress, have potent odors and oily resins that may contaminate food when used to make wooden cutlery.
3. Wooden cutlery made from wood by-products, imported wood, or recycled wood may have been exposed to chemicals during the manufacturing or washing process
4. For safety, most wooden cutlery is carefully sanded and smoothed. But Wood may dry out and can develop splinters or cracks if improperly stored or handled.

Since, both plastic and wood have drawbacks that outweigh their advantages, edible cutlery was created.

#### **2)The problem of wastage of groundwater for the production of large-scale paddy crops**

This research aids in determining the issue of groundwater depletion. To address the aforementioned issue, edible cutlery could be an appropriate solution.

Traditionally, poor people in India ate millet as a staple and rice was their preferred choice only on special occasions such as festivals. Because of its exceptionality of being consumed only on special occasions like festivals, Rice became an aspirational food until the mid-1980s. Since then, rice cultivation has grown exponentially and millets have lost their essential place on the table. As paddy crops like rice require tons of water to be produced. Questions have been raised about whether it's environmentally viable to massively produce rice as it is leading to groundwater depletion.

“A farmer has to pay a fixed amount to deep tube-well (used as water source) owners for irrigating a certain size of paddy field for a full season. As a result, there are no incentive for him to save on irrigation as he has to pay the full amount”(Dhaka Tribune, n.d.)

Farmers, on the other hand, know nothing about water misuse, which is why they use more water than they need. Farmers draw only 25% of the water from the surface to meet their cultivation needs, and 75% is groundwater pumped by tube wells. In 1960-70 it was virtually the opposite:

only 20% was groundwater and 80% was surface water. (Dhaka Tribune, n.d.) Water waste would result in a financial loss, as well as a drop in the underground water table.

The solution to this impending problem would be to reduce the requirement for large-scale production of rice and instead switch to “millet” based Edible cutleries. Unlike rice and wheat, which require a lot of fertiliser and water, millets grow well in dry areas as rain-fed crops. They are highly nutritious, non-glutinous, and high in fibre, and they are simple to digest. The acceptance of millet-based edible cutlery in the market would create a cyclic effect wherein farmers would be encouraged to produce more millets for the production of edible cutleries.

Thus two birds would be hit with one stone. The problem of finding a perfect substitute for plastic and wooden cutlery and the second problem of solving the crisis of alleviating groundwater levels.

### **Scope of Research:**

1. This study helps in creating awareness about the requirements of restaurants and consumers concerning the cutlery market.
2. It will also enable the researchers to know whether the market is ready for the adoption of edible cutlery.
3. To shed light on the various positive and negative aspects of edible cutlery concerning sustainable development.

### **Literature review:**

Ying Zheng et al (2005) in A Review of Plastic Waste Biodegradation highlight that with more and more plastics being employed in human lives and increasing pressure being placed on capacities available for plastic waste disposal, the need for biodegradable plastics and biodegradation of plastic wastes has assumed increasing importance in the last few years. Reviewing published and ongoing studies on plastic biodegradation, this paper attempts to make conclusions on potentially viable methods to reduce impacts of plastic waste on the environment.

Francesco Razza et al (2008) in his research paper titled Compostable cutlery and waste management: An LCA (Life Cycle Assessment) approach gave insight into the LCA study, "Serving 1000 meals" has been its functional unit. The analysis demonstrates that switching from the existing scenario to the alternative scenario (based on B&C cutlery and complete organic recovery of the total waste) can result in significant improvements.

Minna-Maarit Jaskari (2009) states that the study WHAT TYPES OF CONSUMER VALUE WOOD AS PRODUCT MATERIAL ENHANCES? analyses the types of consumer value that wood as product material proposes and highlight the harmful effects of using wood as single use cutlery. The study further concludes that the wood signifies the green value that can be utilised multiple times before degrading it.

Chen et al (2011) highlights in the paper An Investigation into Sustainable Materials for Reusable Cutlery that due to its low cost, plastic cutlery has been utilised for a long time, but it also produces a lot of garbage that ends up in landfills. This report's goal is to identify a suitable replacement for plastic cutlery. They are made of plant starch, bamboo, and stainless steel.

The authors M.Dinesh Kumar et al ( 2011) bring out in the paper GROUNDWATER MANAGEMENT IN ANDHRA PRADESH: Time to Address Real Issues that the state of Andhra Pradesh accounts for 5.3% of the nation's net groundwater irrigated land and 49% of the nation's total groundwater irrigation. With paddy making up about 70% of the state's total irrigated land, the state continues to be one of the top exporters of rice, but groundwater depletion poses major problems to not only agricultural productivity and rural lifestyles.

Jun Lu et al (2012) in Decontamination of anaerobically digested slurry in a paddy field ecosystem in Jiaying region of China ) state that the aim of this study was to assess the feasibility of using a paddy field to remediate ADS while simultaneously cultivating rice.

L Rigamonti, M Grosso et al (2014) in their paper Environmental evaluation of plastic waste management scenarios state that one of the most controversial subjects in the debate about integrated municipal solid waste systems is how to manage the plastic percentage. On such a waste stream, it is possible to do both material and energy recovery, and various distinct collecting methods can be used. The paper's objective is to add to the conversation by analysing several pathways for recovering plastic waste.

Patil et al (2018) in A Study on Edible Cutlery: An Alternative for Conventional Ones state that plastics occupy up a lot of space and often fill landfills, their disposal has become dangerous for the environment because toxins and carcinogens can seep into food through the natural ecosystem. The notion of biodegradable cutlery was first sparked by the recent ban on plastics and the damage to the environment.

This survey has shown that customers are aware of the drawbacks of using throwaway plastic cutlery. They would also like to see the supply of edible cutlery expand because it is currently expensive and hard to get.

Jin Wang et al (2018) in their research paper titled Effect of Climate Change on the Yield of Cereal Crops: A Review stated apart from millets, which can flourish in a variety of climatic conditions and in arid locations because of their strong root structure, numerous forecast models showed that climate change will decrease production of key cereal crops.

N. Natarajan et al (2019) mentions in Eco-Friendly and Edible Waste Cutlery for Sustainable Environment that the objective of this paper is to review the scattered research on edible flatware that is being conducted around the globe. Additionally, reviews of the edible flatware created by particular artists have been conducted. In the final section of this study, the future direction of research in this field has also been examined. We believe that using edible dinnerware as a replacement for plastic utensils could help to protect the environment and promote sustainable growth.

Md. Sadat Rashid (2019) in his research paper titled Edible Cutleries as Sustainable Substitute for Plastic Cutleries stated that a brand-new approach and method for battling plastic pollution is edible cutlery. In addition to examining how the plastic and cutlery industries are destroying the global ecology, the report looks at edible cutlery as a viable and effective way to reduce plastic pollution in Bangladesh.

M. Uma Gowri and K.M. Shivakumar (2020) in his research paper titled Millet Scenario in India gave insight especially in comparison to rice and wheat, millets are higher in minerals and vitamins, and they have a significant potential to improve health, nutrition, fodder, fibre, livelihood, and the environment. It is a wise step towards sustainability to include millet crops in cropping systems, especially in vulnerable environments.

Sanghamitra Das (2020) highlighted that this case The Tale of the Edible Cutlery throws light on the enormous groundbreaking work carried out by Narayana Peesapaty, a former scientist from the International Water Management Institute who quit his stable situation in search of an alternative for plastic cutlery.

Cheang Hui et al (2021) in their study SINGLE-USE PLASTIC: REDUCE OR IGNORE stated that one of the most notorious countries in Asia for single-use plastic garbage generation is Malaysia. To learn more about the single-use plastic problem in Malaysia, an extensive interview was done with two environmental specialists and an environmental organisation. Edible cutlery, biodegradable shopping bags, paper bags, bamboo, and paper straws are a few substitute materials that have been introduced to replace single-use plastic.

The study by Mohd Hafizalrisman Kabir et al (2021) emphasise in A Study of Edible Cutleries by Using Sorghum Flour that though plastic cutlery is convenient cutlery, it is very harmful to nature. Further the study describes how single use Edible cutlery is a better alternative than the plastic ones.

Bisma Iqbal et al (2021) in Bio-Friendly Edible Cutlery- An Effective Alternative to Plastic Disposable Cutlery highlights the amount of moisture, ash, crude fibre etc. .This study's creation of cutlery has been found to be tasty, healthy, and environmentally friendly. It will be able to reduce the use of plastic, which will lessen the amount of chemically toxic compounds released into the environment as plastic degrades.

Dr. Arkja Singh et al (2022) signified in their paper GREEN INNOVATION: INDIA CHAPTER the importance of the ‘Swadeshi Movement 2.0’ and ‘Make in India’ boost from the Government, the concept of Green Innovation has emerged in its all-new avatar for a developing nation like India.

Roy et al (2022) examined studies on various cutlery types, edible cutlery preparation, rehabilitative qualities, and the market for edible cutlery in order to evaluate the replacement of plastic usage with a better alternative in Edible cutlery: An eco-friendly replacement for plastic cutlery. Because of their ongoing dependence and usage, it is not possible to completely eradicate plastic use, but it is possible to reduce it with a better replacement. Therefore, cutlery made of plant-based materials such rice, sorghum, wheat, soy, and rice bran flour are a preferable alternative. The best alternative to plastic cutlery is edible cutlery because it is biodegradable and environmentally beneficial.

### **Objectives:**

1. To explore the concept of edible cutlery as a healthier and eco- friendly alternative.



2. To address the problem of wastage of groundwater and environmental degradation through it
3. To understand the influence of edible cutlery on businesses and consumers.
4. To compare the characteristics of conventional Plastic, wooden disposables and edible cutlery.

**HYPOTHESES:**

Hypothesis 1:

H0: There is no significant relationship between edible cutlery and health.

H1: There is a significant relationship between edible cutlery and health

Data Set:

- 1) I generally prefer single use cutlery?
- 2) I found edible cutlery healthier than other alternatives?

Hypothesis 2:

H0: Wastage of Groundwater has no significant impact on environmental degradation.

H1: Wastage of Groundwater has significant impact on environmental degradation.

Data Set:

- 1) I know that paddy crops require a lot of water to cultivate?
- 2) I agree that millets ( edible cutlery material) require less water and reduce waste of ground water to grow?

Hypothesis 3:

H0: Edible cutlery has no significant influence over businesses and consumers

H1: Edible cutlery has significant influence over businesses and consumers.

Data Set:

- 1) I am aware that businesses and consumers use single-use cutlery ?
- 2) Businesses and consumers prefer to adopt edible cutlery?

Parameter	Hypothesis 1	Hypothesis 2	Hypothesis 3
R Value	0.835	0.921	0.768
P Value	<0.005	<0.008	<0.004
Level of Significance	Significant	Significant	Significant

**Interpretation :**

Alternate Hypothesis is accepted.

**Research Methodology:**

This research is Exploratory in nature.

There were two target audiences selected as samples:

- 1) Consumers
- 2) Researchers

**For Consumers:**

The Sampling method used was Convenience Sampling. The respondents were of the age group of **18 to 40+** years. The sample size obtained through the questionnaire were 134 participants. The sampling frames were provided close ended questions to respond.

**For Restaurants:**

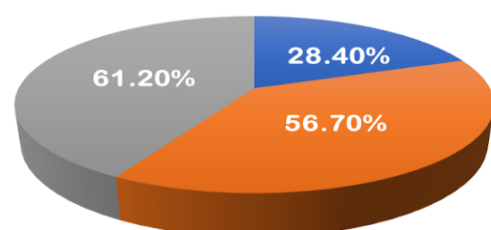
The Sampling method used was Convenience Sampling. The respondents were Restaurant owners and Worker. Sample size of 10 small, medium and large scale food chain restaurants were obtained. The method of data collection was interview method. Open and close format questions were asked to the sampling frames.

**Data Analysis & Findings:**

Combined questions:

**CONSUMERS**

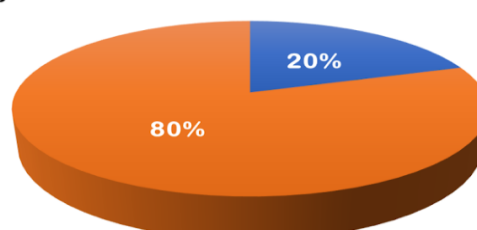
If in a food court you are given an option to select your choice of cutlery material which one would you go with?



■ A) Plastic Cutlery ■ B) Wooden Cutlery ■ C) Edible Cutlery

**BUSINESSES**

If you are given an option to select your choice of cutlery material for home delivery which one would you go with?



■ A) Plastic Cutlery ■ B) Wooden Cutlery ■ C) Edible Cutlery

In figure 1 , The restaurants and consumers were given 3 alternatives of cutleries to select From i.e. plastic, wooden, and edible cutlery.

Inference:-

Consumers: 61.20% opted for edible cutlery, 28.40% were comfortable using plastic cutlery, 56.70% chose wooden cutlery.

Restaurants: A majority of 80% of the restaurants chose wooden cutlery and while the remaining 20% opted for plastic cutlery as their preferred choice for home deliveries.

### CONSUMERS

### BUSINESSES

Have you heard of edible cutleries that can be consumed after they are used?

Have you heard of edible cutleries that can be consumed after they are used?

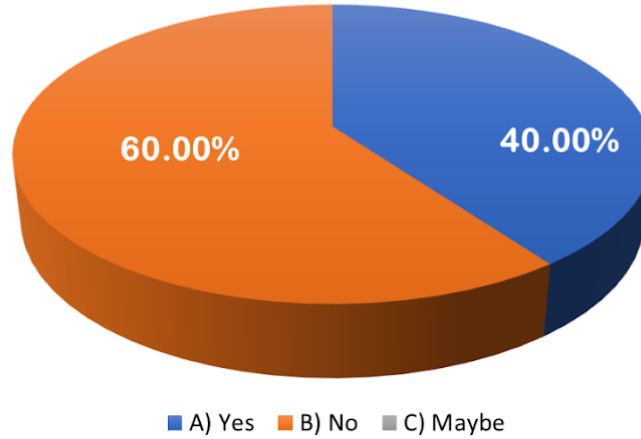
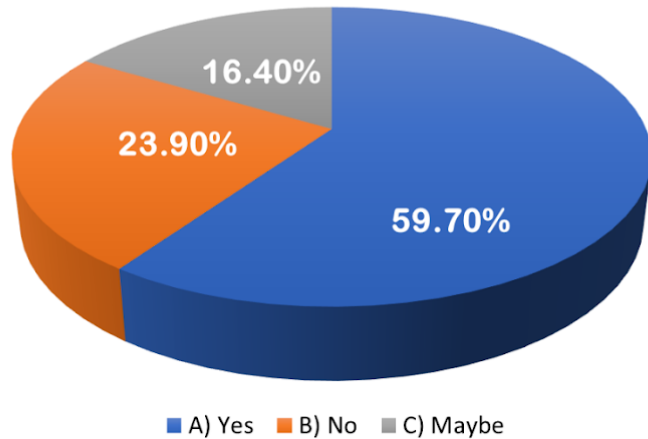


Figure 2 graphically represents the awareness of consumers and restaurants regarding edible cutleries.

Inference:-

Consumers: A huge chunk of 80 consumers had awareness about edible cutleries. The other lot of 32 were not aware and the remaining 22 were unsure.

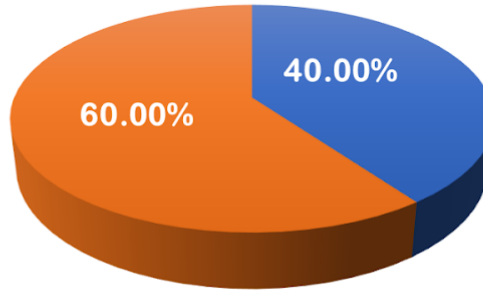
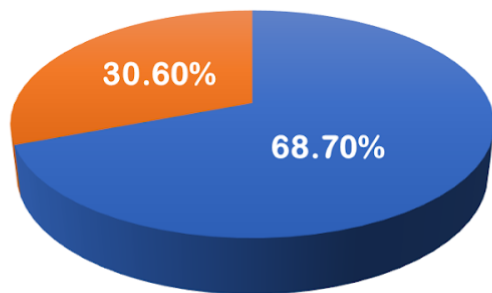
Restaurants: Contrary to consumers the restaurants had a major chunk of 6 lacking awareness while the remaining 4 were aware.

### CONSUMERS

### BUSINESSES

Would you be interested in supporting the "Let's Go Green" initiative and adopting edible-cutleries as an alternative to other single-use cutleries like plastic and wood?

Would you be interested in supporting the "Let's Go Green" initiative and adopting edible-cutleries as an alternative to other single-use cutleries like plastic and wood?



Legend: A) Definitely Interested, B) Probably Interested, C) Not Interested

Figure 3 depicts the environmental soundness of people in support of "let's Go Green initiative" by adoption of edible cutlery.

Inference:-

Consumers: Majority of 68.7% were interested in supporting while the remaining 30.6% showed slight interest

Restaurants: A hefty 60% showed slight interest while the remaining 40% were quite positive about supporting.

### You will be required to pay a premium for edible cutlery per piece. So how far are you willing to go?

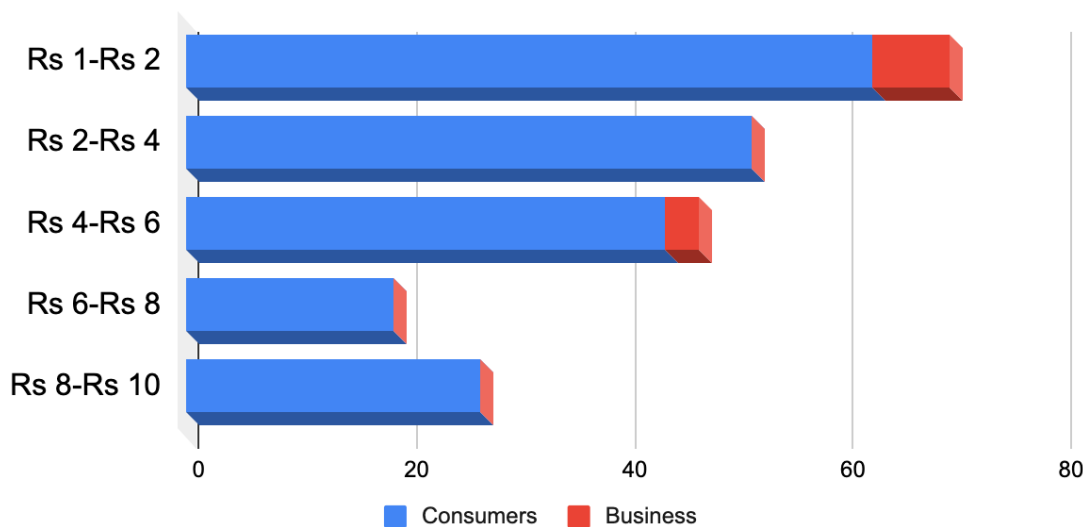


Figure 4 represents the range of premium that consumers and restaurants are opting for

Inference:-

Majority of consumers and restaurants opted for the price range of Rs 1-Rs 2 while the lowest numbers were found in the price range of Rs6-Rs8 and Rs8-Rs10 respectively.

### What problems can be solved through the implementation of Edible Cutlery

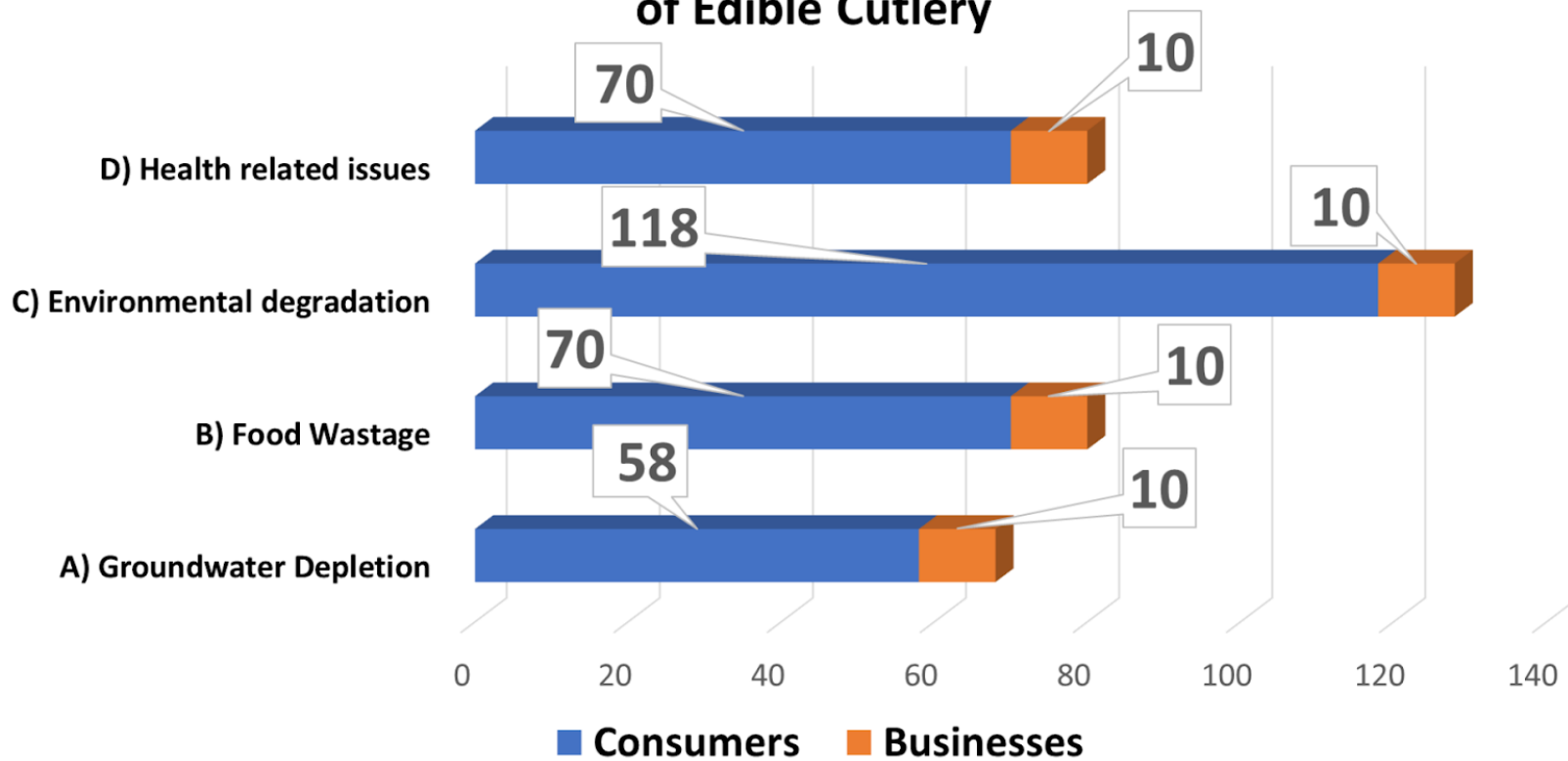
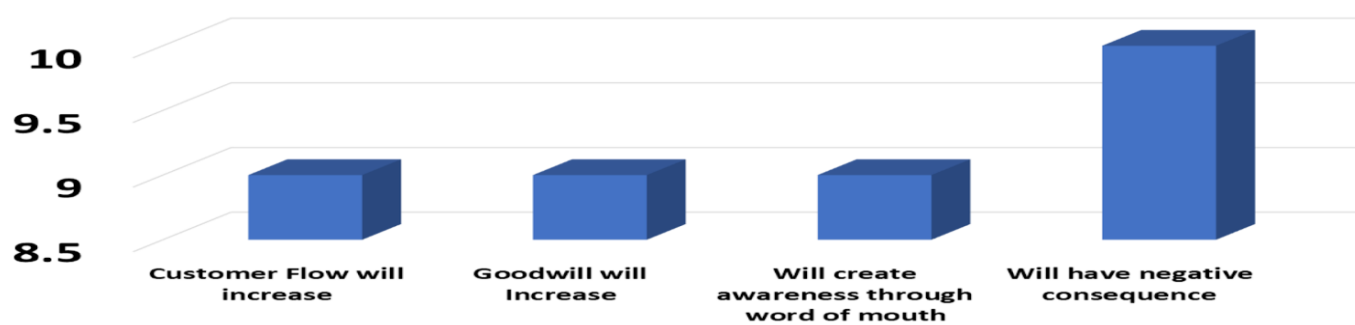


Figure 5 represents the opinions of consumers and restaurants regarding problems which can be solved through adopting Edible Cutlery. Inference:- Consumers: Environmental degradation has been opted as the highest whereas groundwater depletion has been opted as the lowest. Restuarants:The restaurants believe that all of the mentioned problems can be solved.

Standalone questions(restaurants):

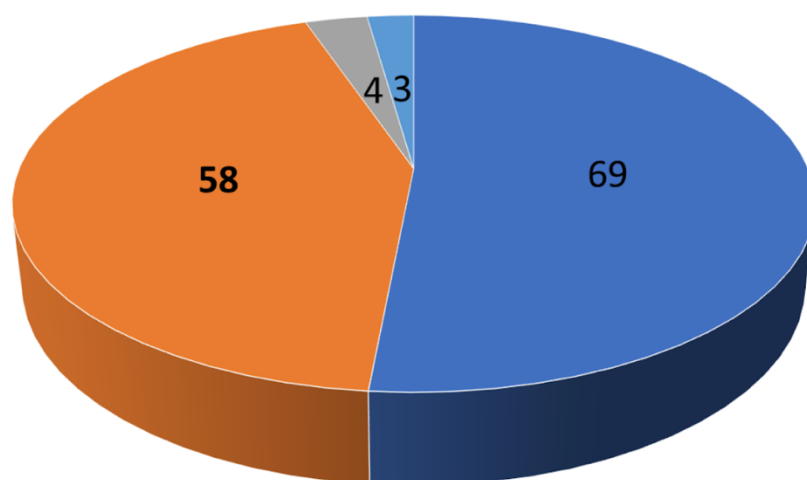
#### If you use edible cutlery, what impact do you think will it have on your customers?



Inference: Total 10 restaurants believe that there will be a negative consequence of cost while implementing edibe cutlery.The remaining responses have a split opinion of 9 each.

Standalone questions(consumers):

#### Do you agree that adopting edible cutlery can be considered as one of the best practices for preventing food wastage and addressing the problem of environmental degradation caused by plastic and wooden cutlery ?



Inference: 69 consumers strongly agreed, 58 consumers just agreed,4 partially agreed and the remaining 3 had mixed opinions about the same.

#### Limitations:

1)The accuracy of the secondary data in our research paper is largely dependent on the authenticity of data in the primary research conducted by the researchers of the referenced papers.

2)Interviews held with businesses were restricted to only 10 restaurants in Mumbai as many businesses showed resistance to voluntarily participating in the survey.

3)The future researcher will also be required to conduct a more in-depth analysis on the suitability of edible cutlery for the Indian market as the majority of responses obtained through the google form suffered from a lack of awareness about edible cutlery and therefore there is a scope of in-depth questions to be asked in the future when there is more awareness about the same.

### **Recommendation:**

Government should come up with schemes and incentives for businesses and customers to purchase edible cutlery and should subsidise the cost of it or should impose positive/negative incentives to habituate people to the alternative change. Awareness of the product is highly recommended. Since the demand for the product is low due to a lack of awareness it is difficult for vendors to preserve low costs while ensuring a high-profit revenue, which further diminishes market growth for edible cutlery. Hence, manufacturers need to increase their supply and also create new marketing strategies and target audiences based on their study of the market.

### **Conclusion:**

Given that plastic cutlery poses the greatest threat to both humankind and the environment and causes problems like cancer, soil erosion, ocean toxicity, and air pollution there was a dire need of a replacement. Wood turned out to be a great alternative. However, because of certain limiting factors of wood like turning soggy in humid environments, having splinters which affects its utility, being exposed to chemicals during its washing process, etc Wood can't be considered to be the perfect alternative for plastic. Adopting wooden cutlery could be considered as a quick solution for the growing problem of solid waste but there is a need of a long term solution with no negative consequence. Hence this paper tries to conclude to establish edible cutlery as a suitable, environmentally sustainable alternative to non-degradable plastic and wooden cutlery which will be capable of meeting the domestic and global demand. This study also emphasized the viewpoints of restaurant owners and consumers regarding edible cutlery and their level of awareness and willingness to accept the necessary change. The paper believes that edible cutlery can bring about a revolution by addressing the problem of groundwater wastage and encouraging the production of rainfed crops like millets which will be a cornerstone for promoting sustainable agriculture. Thus edible cutlery helps in meeting sustainable development goals nos. 9 and 12.

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