

## FOOD WASTE AND THE RISE OF UPCYCLED FOOD IN INDIA

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### ABSTRACT

*Food waste is a significant global problem, with India facing a particularly critical situation". Upcycled food offers a promising solution by reintegrating "inedible" food parts into the food supply chain. "While traditionally practiced in Indian households, upcycled food is gaining traction commercially. This study explores consumer preferences and early signs of upcycled food's market potential in India. Younger generations and consumers prioritizing healthy eating, sustainability, and food waste reduction demonstrate a growing receptiveness to upcycled food products. Companies like Kocoatrait and restaurants incorporating upcycled ingredients showcase this potential. "These findings suggest upcycled food has the potential to become a mainstream strategy to reduce food waste in India, with further exploration needed to optimize consumer education and marketing efforts".*

**KEYWORDS:** *Upcycled Food, Food waste, Food insecurity, India*

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### INTRODUCTION

Managing food waste presents a formidable challenge globally, with an estimated 931 million tonnes of edible food discarded each year (Food Waste Report Index 2024). One approach to tackling this issue is the production of food from recycled materials (Moshtaghian *et al.*, 2021). The coexistence of rising food insecurity and alarming levels of food waste highlights a pressing global crisis (Lundqvist, de Fraiture, & Molden, 2008), with over 700 million people experiencing severe food insecurity in 2018. Nearly half of the world's food production goes to waste, emphasizing the urgent need for action. While food insecurity arises from various factors, food waste emerges as a significant contributor (Mourad, 2016; O'Donnell *et al.*, 2015). Minimizing food waste can thus play a crucial role in addressing at least a portion of the food insecurity challenge.

Innovative solutions such as upcycled foods show promise in combating food waste (Aschemann-Witzel & Peschel, 2019; Bhatt *et al.*, 2018; Bhatt *et al.*, 2020; McCarthy *et al.*, 2020). By repurposing ingredients that would otherwise be discarded, upcycled foods offer a sustainable approach to waste reduction while potentially mitigating food insecurity. As we confront the complex interplay between food waste and food insecurity, it's imperative to prioritize strategies that promote sustainability, equity, and resilience in our food systems. Collaborative efforts across sectors and innovative research endeavours will be crucial in addressing this multifaceted global challenge.

Edible food components often discarded but possessing nutritional value can be utilized to create upcycled dishes. Take carrots, for instance, commonly consumed, yet their peels are typically discarded. However, these peels can be dried and transformed into repurposed powdered soup, safe for consumption. Numerous businesses worldwide have started selling dishes made from such ingredients. For example, Planetarians, a US-based company, has developed a plant-based protein extracted from discarded sunflower seeds, which can be used to create safe and nutritious dishes. Other enterprises like Regrained incorporate recycled grains into baked goods such as bars and puffs.

Food waste occurs throughout the entire food supply chain, from production to consumption (Scialabba, 2013). Approximately 40% of food waste transpires during production, handling/storage, and processing, with the remaining 60% during distribution, retail, and consumption (Lipinski *et al.*, 2013). Repurposing the edible portion of lost food to create food for human consumption represents one method of managing food supply chain waste. Instead of being discarded, this waste serves as a resource for food production. For instance, making biscuits with apple pomace (Alongi *et al.*, 2019) or sunflower flour (Grasso *et al.*, 2019) exemplifies this approach. These foods, produced from materials otherwise discarded, are considered value-added products and fall under the category of "upcycled foods" (Spratt *et al.*, 2021). Utilizing food by-products, scraps from meal processing, and imperfect produce, upcycled food production not only reduces waste but also benefits the environment by repurposing food into value-added products. Such foods, which have been altered to enhance their economic value, are termed value-added foods (Moshtaghian *et al.*, 2021).

## CURRENT STATE OF FOOD WASTE

The global problem of food waste is rapidly growing, fuelled by a combination of factors including changing lifestyles, urbanization, and population growth. As people shift towards more fast-paced lives and cities become more populated, food consumption patterns are changing. This has led to a significant increase in food waste generated from various sources, including homes, industries, and agriculture.

In India, the situation is particularly alarming. A staggering 40% of food wasted translates to nearly 89,000 crore rupees annually, which is roughly equivalent to 1% of the country's GDP. Households are a major contributor to this problem, as evidenced by the 68.7 million tonnes of food wasted annually in Indian homes, which translates to roughly 50 kg per person (Food Waste Report Index 2024). This highlights the need for significant changes in household practices to minimize food waste.

Urbanization and economic growth are also contributing factors, leading to increased consumption patterns and more kitchen waste (Zhao *et al.*, 2017). This kitchen waste, which includes food scraps from homes, restaurants, and other food establishments, is a major type of organic waste with a significant environmental impact (Liu *et al.*, 2019). The issue extends beyond households as food processing industries also generate substantial amounts of waste. From fruit and vegetable peelings to milk byproducts like whey, various stages of food processing create significant waste streams. For instance, India alone produces about 50 million tons of fruit waste annually (Panda *et al.*, 2016). Additionally, the massive Indian dairy industry generates millions of cubic meters of effluent waste during milk processing, further highlighting the need for improved waste management practices within these industries (Parashar *et al.*, 2016).

Agricultural practices also contribute significantly to food waste. Improper handling and storage, particularly the lack of adequate refrigeration, can lead to spoilage and waste of fruits, vegetables, and other crops (Dai *et al.*, 2018). Addressing these issues throughout the agricultural supply chain is crucial in tackling the global food waste problem. This

is where innovative approaches like upcycled food solutions began to emerge, aiming to reduce wastage throughout the supply chain.

### **CONCEPT OF UPCYCLED FOOD**

The term "food" encompasses any substance intended for human consumption, whether processed, semi-processed or in its raw form. "Food waste" refers to food and its associated inedible parts that are removed from the human food supply chain within the retail, food service, and household sectors. This definition includes both edible and inedible components of food, although the distinction between what is considered "edible" or "inedible" can vary across cultures and personal preferences. For example, while some cultures consume chicken feet, others may discard them. Similarly, perceptions of edibility may change based on processing methods, as seen with orange peel being turned into marmalade.

The concept of "upcycling" food involves reintegrating inedible parts back into the human supply chain, either for direct human consumption or for diversion to animal feed where appropriate. This practice contributes to a circular food system, where all parts of the food are utilized in useful applications, thereby improving food security (Food Waste Report Index 2024). Upcycling aims to create new, value-added, and sustainable products by converting waste materials or reusing products in innovative ways, while minimizing unnecessary resource expenditure (Sung & Sung., 2015)

Converting the edible components of discarded food into upcycled products is not a new practice in India. Examples include utilizing leftovers to create new dishes or recycling surplus ingredients to produce alternative food items. For instance, in Goa, turmeric leaves are used to make a rice dish called Patoli, while Assamese cuisine incorporates fried banana flowers known as Koldil bhaji (Sarma *et al.*, 2020). In Andhra Pradesh, Ridge gourd peel chutney, known as Beerakaya Thokku Pachadi, is prepared, and in Tripura, an exotic dal called Kothalor Chakoi is made using jackfruit seeds and yellow peas. Tamil Nadu's cuisine features Murungai Keerai Poriyal, a stir-fry made with drumstick leaves, and in Uttar Pradesh, banana peel sabzi is prepared. These examples showcase the creative ways in which food waste is minimized and upcycled to produce delicious and nutritious dishes across India. While these practices have been a staple in households for generations, there's a growing movement to bring them to the forefront of commercial kitchens, introducing these resourceful techniques to a wider audience.

### **CONSUMER PERCEPTION AND THE EMERGENCE OF UPCYCLED FOOD IN COMMERCIAL MARKETS**

In India, upcycled foods have a long history in home kitchens, but haven't yet hit the mainstream commercially. Consumer preferences are a driving force behind market trends, and these trends, in turn, can influence consumer behavior. This dynamic is particularly evident in the emerging market of upcycled foods. Consumer perception, particularly among younger generations, is driving the rise of upcycled food, a new category with promising market potential, but factors like age and lifestyle choices can influence how consumers view these products.

#### **Generational Differences in Perception**

Studies have shown that younger generations, known for their openness to innovation and heavy social media influence, tend to have a more positive perception of upcycled foods. They express higher purchase intentions and perceive upcycled foods as being of higher quality compared to older generations (Zhang *et al.*, 2021; Köpcke, 2020). Interestingly, purchase intention for upcycled foods doesn't seem to simply increase with age. Research suggests that middle-aged consumers, on average, are less receptive to upcycled foods compared to both younger and older generations.

### Lifestyle Choices and Upcycled Food

Beyond age, lifestyle choices also play a significant role in influencing purchase intentions. Consumers who prioritize healthy eating and choose organic food are more likely to consider buying upcycled foods (Coderoni & Perito, 2020). Additionally, those concerned about food waste reduction (McCarthy *et al.*, 2020) and those mindful of their food waste habits (Rahmani & Gil, 2021) are also more motivated to choose upcycled options. These recent studies reveal a growing consumer willingness to purchase upcycled food products, indicating a promising market opportunity.

### Upcycled Food in Indian Market: Early Signs of Growth

While upcycled food practices are still in their early stages in the Indian market, there are promising signs of growth. For instance, Kocoatrait, a Chennai-based chocolate company, uses upcycled cocoa husk paper and other ingredients to create various chocolate bar flavors. Their primary goal is zero waste (Kocoatrait, 2021). This trend has also reached restaurants, where some establishments are incorporating upcycled ingredients into their menus (Singh, 2021). As reported in *The Economic Times Hospitality World* (2021), numerous Indian restaurants are following suit, including SAGA in Gurgaon, Anardana Modern Kitchen and Bar in Delhi, Plural in Mumbai, and Taj Lands' End in Mumbai. These restaurants offer upcycled food alongside traditional menu items.

### CONCLUSION

““In conclusion, food waste is a significant global problem, and India faces a particularly critical situation. Upcycled food offers a promising solution throughout the food supply chain. While upcycled food has a long history in Indian households, it is gaining traction commercially”. Younger generations and consumers prioritizing healthy eating, sustainability, and food waste reduction demonstrate a growing receptiveness to upcycled food products. Early signs of upcycled food's market potential in India are evident in companies like Kocoatrait and restaurants incorporating upcycled ingredients into their offerings. “Further research is needed to explore consumer preferences in more detail and understand how to best promote upcycled food within the Indian market””.

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