Wasted Food, Wasted Lives: Hunger and Waste in India (Relationship between Food Waste and Hunger Index in context to India)

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***Abstract*—In India, we have an urgent issue where on the one hand there is so much food is wasted (78.2 million tonnes annually) and on the other hand there is significant food insecurity (233.9 million). Approximately 78.2 million tonnes of food is lost or wasted every year across the supply chain—from producer to household. There are significant environmental and economic impacts related to food waste in India. Data from the 2024 Global Hunger Index shows that out of 127 countries ranked as part of this index, India is ranked 105th. In this study, we will investigate the systems that contribute to food waste, how effective management of food waste may reduce hunger, by examining inefficiencies in food distribution systems, and the use of food redistributing strategies at both the supply and household levels, we will identify potential methods for getting surplus food to those who are food insecure. Addressing these issues is vital for establishing a more equitable and sustainable food system in India.**

***Index Terms*—Food Waste, Hunger, Food Security, Food Redistribution, Supply Chain, Global Hunger Index, Sustainability, India**

I. INTRODUCTION

Food waste is defined as any food that is discarded before humans can eat it. This includes food that could be eaten but was not, as well as parts of food items that are not utilized properly. Cultural and geographic factors play a large role in determining what is edible; therefore, to measure food waste correctly, both edible and inedible items need to be considered so that an accurate picture of consumption patterns is obtained.

There is a paradox surrounding food waste in India. While it is one of the world's biggest producers of food, the country has a food-waste problem with an estimated 78.2 million tonnes wasted each year, equal to 7.4% of the total global food waste of 1.05 billion tonnes in 2022. The amount of food wasted per capita in India is about 55 kg. Urban families waste more than rural families. India has 233.9 million people who are hungry, yet there is a very large amount of wasted food. According to the Global Hunger Index (GHI), India ranks 111th out of 125 countries and is considered to have a "serious" hunger problem. Some states in India (Andhra Pradesh, Karnataka, Kerala, Uttarakhand, and Jharkhand) have been studied for food waste, but because these studies cover a small area with small sample sizes, the estimates for food waste in India fall under the "medium confidence" category.

Structural inefficiencies add to the issue. Cold-chain facilities are not properly built and maintained in the hotter areas of India, causing huge losses when products are stored or transported. These inefficiencies create greenhouse gases from food waste that contribute to 8 to 10% of the world's total emissions, which exacerbate climate challenges and environmental problems.

In India, the situation regarding hunger remains critical and urgent. India's Global Hunger Index (GHI) score in 2024 is 27.3 with a classification of "serious"; however, this score indicates some improvement since the previous years' scores of 29.3 for 2016, 35.2 for 2008, and 38.4 for 2000. The last two GHI scores were classified as "alarming". The GHI ranking in 2024 shows India at 105 out of 127 countries; India improved its ranking by six positions since 2023, when it was ranked 111th. Although there are gradual improvements with some nutritional indicators, there are still ongoing issues regarding nutritional health, as indicated by the following data: 18.7% child wasting (the highest in the world), 35.5% of children stunted

(height too low for their age), 13.7% of children under five years of age undernourished and 2.9% of children under five years of age dying. While India is experiencing the decline of child mortality and stunting, wasting and stunted growth for children are still prevalent at levels that indicate concern about public health. In addition, although the percentage of people undernourished had gradually fallen over the last twenty years, the rates have been on an upward trend in recent years.

The United Nations Food and Agriculture Organization (FAO) says that hunger is when a person feels uncomfortable or in pain due to not getting enough food (dietary energy) on a consistent basis; this inconsistency leads to chronic hunger due to insufficient food intake over a longer length of time. The FAO has created the Prevalence of Undernourishment Indicator as a worldwide benchmark for measuring hunger. India must do something to reduce food waste, as this will have a positive impact on food security, public health, and sustainability efforts.

II. BACKGROUND OF THE STUDY

The events of food waste and hunger in India are very much related, even though they are usually dealt with differently. India has enough food to meet its population's needs; however, it wastes about 78.2 million tons of food every year. The 2024 Global Hunger Index ranks India 105th out of 127 countries, "serious" Hunger Index (27.3). The majority of the waste at three levels – supplier, retailer, and household – has created economic loss, environmental degradation, and the absence of edible item(s). Much research on addressing the issues associated with food waste has focused upon the separate issues; and the number of studies that have addressed the connection between surplus food and hungry persons is minimal. Emerging technology, redistribution channels, and sustainable policy provide opportunities to impact these intertwined are addressed. This research project will concentrate on demonstrating methods for transferring or reallocating surplus food from waste to reduce hunger, while creating a more equitable food system.

III. OBJECTIVES

- Identify the main motivations for food waste by both suppliers and private homes.
- Determine how much of the food wasted correlates with hunger given India's position on the Global Hunger Index and the fact that it has one of the highest rates of child undernourishment in the world.
- Understand what causes food to be wasted.
- Identify the role that waste management by suppliers and private households can have in the fight against world hunger.

IV. RESEARCH QUESTIONS

- How can food suppliers' and households' methods for managing food waste help reduce the impact of hunger and promote food equity in India? How does this align with the Global Hunger Index upon which India is currently ranked?
- What are specific actions and plans that can be taken to utilize food suppliers' and households' methods for managing food waste to help eliminate hunger and food insecurity in India?
- Which factors are causing restaurants and catering services in Pune to generate waste, and how does this compare to the causes of waste generation found in individual households throughout India?

Reasons for food waste and the increase in hunger:

1. High food loss levels (78.2 million tons per year) and high levels of chronic hunger (233.9 million individuals) suggest the highest level of food supply/demand imbalance.
2. Food management practices that do not allow redistribution of food and supply chain gaps contribute to malnutrition, even where the amount of food produced is adequate.
3. Food waste accounts for a significant percentage (approximately 8%-10%) of greenhouse gas emissions in the world due to the inefficiency of resources and negative impact on the environment.
4. Targeting food providers and consumers would lead to opportunities to redirect excess food, increase food security, and support policies that promote sustainability.

These points are not simply due to negligence; they represent structural barriers to the equitable distribution of food, governance, and sustainability practices.

V. RESEARCH PROBLEM

In many Indian states, although food production is sufficient and food supply appears to be adequate, the GHI scores are shockingly high, indicating high rates of hunger continue to exist in India. Several factors contribute to this contrast; inefficient homes, restaurant waste, supply chain inefficiencies, and a shortage of redistributive services. Therefore, identifying how food waste occurs in conjunction with regionalised levels of hunger highlights the need for targeted interventions based on evidence obtained from patterns of food waste.

TABLE: Hunger Severity Across States (Reflecting the Research Problem)

State	Hunger Category	Indicative GHI Score Range
Jharkhand	Alarming	30–40
Uttar Pradesh	Serious	20–30
Odisha	Serious	20–30
Gujarat	Moderate/Serious	15–30
Maharashtra	Moderate	10–20
Tamil Nadu	Moderate	10–20
Kerala	Low	<10

It can be seen from the data presented that there is a high hunger intensity in those areas, but they are also where the least efficient management and redistribution of food occur. These discrepancies highlight the issue of "food waste": that is, without addressing the issues at their source, it is impossible to adequately address hunger. Therefore, it is critical to comprehend the areas in which there is a disconnect between surplus food and the vulnerable populations that rely upon it to design strategic interventions to maximize food as a sustainable resource for such communities as opposed to a waste product.

VI. REVIEW OF LITERATURE

The UNEP Food Waste Index Report 2024 highlights the global crisis of food waste, revealing that over 1.05 billion tonnes of food were wasted in 2022, with households contributing 60%. Meanwhile, 783 million people faced hunger, exacerbating food insecurity. The report emphasizes the economic and environmental costs of food waste and urges countries to prioritize reduction efforts to mitigate climate impacts, economic losses, and global hunger.

A UNDP study highlights that India wastes as much food as the UK consumes, with up to 40% of food production lost despite widespread hunger and malnutrition. Annually, 21 million tonnes of wheat and ₹50,000 crores worth of food are wasted, preventing it from reaching the needy.

Clean India Journal, India wastes 67 million tonnes of food annually, worth ₹92,000 crores—enough to feed Bihar for a year. 21 million tonnes of wheat rot, matching Australia's yearly production. In cities, food waste dominates landfill sites, with Mumbai and Delhi generating thousands of tonnes daily, highlighting the paradox of hunger amid massive wastage

VII. METHODOLOGY

Type of Study:

Exploratory and analytical research using a mixed-methods approach (quantitative + qualitative).

Data Sources

1. Quantitative Data: The Global Hunger Index (GHI) articles; FAO/WFP; ReFED 2016; NRAI IFSR 2019; industry reports from HPG Consulting; Clean India Journal; and various food waste-related peer-reviewed journals/articles, such as Foods–MDPI, Journal of Cleaner Production, and Think India.
2. Qualitative Data: There were 65 responses from the household surveys (conducted in both English and Marathi), with 42 being in English and 23 in Marathi. The case studies included 10 different restaurants in specific zones within Pune (namely, Shivaji Nagar, and some on S. B. Road), interviews with various restaurant managers and suppliers, the views of several NGOs regarding food waste, and an examination of the documentation related to Goal (3) of the "Sustainable Development" program. The household surveys were randomly sampled in the same geographical area as the case studies above, and asked three specific questions.

Data Collection Tools

1. Utilized Excel to create graphs and charts summarizing survey results, demonstrating waste trend patterns, and comparing results with one another.
2. Used thematic coding in order to identify trends in the qualitative aspect of the data regarding waste behaviors at home (e.g., household), the operational inefficiencies of restaurants (e.g., operating at a loss), as well as those identified within the supply chain.
3. Conducted correlation analysis (Pearson) to examine the correlation between the amount of food that is wasted and the different indicators for hunger which the researcher identified.

Timeframe

The timeframe of the study included the period from 2000 until 2024 (secondary data) as well as the current year (2023) when primary data from household and restaurant surveys were collected.

Scope of the Study & Data

The study and collected data focused on the issue of food waste in India, particularly how the study mapped out the trends and food security patterns (hunger) in each of the state(s), and the collected observational data from a variety of sources including households, restaurants, canteens/messes (locations that serve food delivery) etc. The purpose of the study was to identify both the operation inefficiencies in businesses and also identify behavioral patterns that are responsible for the contribution of food waste to food insecurity and hunger.

Hypotheses:

H_0: There is no significant relationship between food waste and hunger index in context of India.

H_1: There is significant relationship between food waste and hunger index in context of India.

Testing of Hypotheses:

To test H_1, we consider:

- India's GHI score = 27.3
- Estimated food waste = 3.67 kg per capita (household + restaurant)

Regression analysis across Indian states: Global Hunger Index= $\beta 0 + \beta 1$(Food Waste) + ϵ

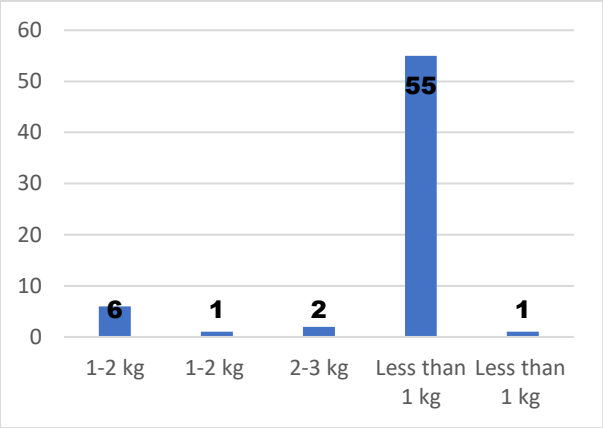
Hunger Index = $-18.27 + 10.81 \times$ (Food Waste)

Evidence:

- $R^2 = 0.357 \rightarrow$ 35.7% of hunger variation explained by food waste
- Coefficient = 10.81, p = 0.007 → Statistically significant impact of food waste on hunger
- F-statistic p = 0.00692 → Overall model is significant

This strongly supports H_1: There is significant relationship between food waste and hunger index in context of India.

Evidence



Source: Primary data

Estimation of the approximate amount (in weight or volume) of food in household wastes in a typical week

In the graph, the distribution is heavily skewed toward 'Less than 1 kg', which records an overwhelmingly high frequency compared to all other categories. Waste levels above 1 kg remain minimal, with 1–2 kg and 2–3 kg showing very low counts.

Source: Primary data

Food waste is reported most frequently under 'Rarely', followed by substantial responses in 'Sometimes' and

'Never'. 'Often' remains a minor category, indicating that habitual wastage is uncommon.

Source: Primary data

Food wasteage frequency of restaurant or canteen

The chart shows that food waste are predominantly below 5 kg, with only a single response in the 5–20 kg range.

Source: Primary data

Food waste mainly arises from ordering excessive quantities, while disliking parts of the meal contributes far less to the overall wastage pattern.

Key Observations

The study provides insight on food waste disposal behaviour within various income and occupational groups as well as their direct/indirect support for food redistribution systems were revealed through this study.

Income- and Occupation-Based Food Waste Behaviour

Food waste levels vary by income brackets. Those with income of ₹30,000 - ₹60,000 reported on average the highest amount of food waste accumulated per person at 0.75 kgs/person. Using the same method, the next most significant group was those earning ₹60,000+. Their average food waste reported was 0.72 kgs/person. The individuals who qualified in the ₹10,000 - ₹30,000 group were found to produce the least amount of food waste at 0.50 kgs/person. However, those classified in the comprising Below ₹10,000 group produced slightly more waste at 0.60 kgs, more than the next earnings group. Combining the datasets revealed that occupations produce observable deviations in food waste disposal behaviour. Various occupations appear to contribute to overall higher food waste disposal activity.

Identification of Outlier Data

Two outlier items (1.5 kg & 2.5 kg) were found from the IQR conducted to measure waste distribution based on the quartile data found through IQR analysis.

Table 2: Outliers Identified by IQR analysis

Outliers (kg)
1.5
2.5

Source: Primary data

Support for Redistribution Initiatives

Level of support is influenced by income. The ₹10,000-₹30,000 income group has a high level of positive response with 66.7% of respondents giving definite support. Individuals with an income less than ₹10,000 indicated that they are 37.5% positive, 37.5% conditional about supporting a redistribution initiative. Responses are evenly split among higher income groups.

Waste Differentiation at the Restaurant Level

Less than one year in operation is when restaurants experienced the largest amount of waste below 5 kg (5). For the first six to ten years of operation, only 1 restaurant experienced waste between 5 and 20 kg. Customer volume has a weak correlation to food waste with this data indicating that this sample indicates that these two variables don't have a significant amount of correlation to each other.

VIII. RECOMMENDATIONS

1. Establish formal methods of distributing food via working with community-based organizations

(CBOs), governmental entities and other community members to collect food that may otherwise be discarded (either due to excess or waste) and distributing to vulnerable populations.

2. Community-based businesses should conduct public education and behaviour modification programs to reduce the quantity of food waste generated by households. Programs should teach how to effectively portion meals, how to store food safely, and how much monetary value and nutritional value is lost through food waste.
3. Restaurants or canteens should implement procedures to monitor the amount of food that is being prepared each day and implement best practices for storing and donating prepared food that meets health and safety guidelines.
4. Determine best practices for minimizing spoilage, reducing wasted or unusable food from food distribution centres and ensuring that food remains fresh and suitable for consumption when delivered to food distribution centres. Conduct inventory audits of food resources within community food pantries, optimize storage capabilities, and improve the movement of food resources through food distribution centres.

IX. RESULTS & DISCUSSION

Based on the findings, food waste is significantly influenced by restaurant operation, as well as income-level type. The household has been found to have the highest average food waste in the income range of ₹30,000-₹60,000 (0.75 kg), followed closely by € > ₹60,000 (0.72 kg). On the other hand, the lowest average food waste comes from the income range of ₹10,000-₹30,000 (0.50 kg). Outlier analysis defines two extreme outliers in the dataset—1.5 kg and 2.5 kg—which are outside of the normal distribution range. There are also differences in supports for food redistribution programs at different income levels—with the ₹10,000-₹30,000 having the greatest definite support at a rate of 66.7%. For restaurants, less than a year old, the majority of the time (>5 kg waste) are from new restaurants, and also, customer volume has been shown to have a very weak correlation with the amount of waste produced (0.10296).

This Table summarises the essential quantitative outcomes.

Category	Value
Highest Waste	0.75 kg
Lowest Waste	0.50 kg
Outliers	1.5, 2.5 kg
Highest Support	66.7%
Correlation	0.10296

Source: Primary data

Overall, the findings indicate measurable, data-driven patterns that clearly reflect the waste behaviour captured in the study**.** The analysis of food waste, its drivers, and related behaviors have been identified through research on this topic. Three primary drivers of food waste are associated with the household income level, household behavior, and the restaurant operating environment. The statistically validated relationship between food waste and the Global Hunger Index shows that food security is closely connected to the availability of surplus food. Food security is directly related to how much surplus food is available. The study demonstrates the importance of effectively managing food waste and redistributing surplus food to address food insecurity in India.

X. CONCLUSION

Not only will the economic and environmental aspects of food waste affect the global food system, but the problem of food waste will also contribute to food insecurity. In this research, we used multiple sources of data to identify the main causes of household-related and food supplier-related food waste. By identifying these causes, we illustrated the gap between rural and urban areas and demonstrated inefficiencies in the supply chain that exist in both locations. By illustrating the gap between the two sectors, we also identified the potential of food redistribution as a means of alleviating hunger. Unfortunately, there are barriers preventing the reduction of food waste from happening; the most significant of which are a lack of data, a lack of cold chain systems, and a lack of coordinated efforts to redistribute food.

Based on an OLS regression analysis, it is apparent that food waste has a strong correlation to hunger in India, with each additional kg of food waste resulting in a 10.81-point increase ($p = .007$) in the Hunger Index. India will rank 105th out of 127 countries on

the Global Hunger Index in 2024, even though India produces enough food to supply the entire population, and currently wastes 78.2 million tons of food per year – this highlights the systemic inefficiencies involved with managing and distributing food.

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