Research for the Sustainable Development of the Megacities of Tomorrow - Energy and Climate efficient Structures in Urban Growth Centres

Hyderabad as a Megacity of Tomorrow: Climate and Energy in a Complex Transition towards Sustainable Hyderabad – Mitigation and Adaptation Strategies by Changing Institutions, Governance Structures, Lifestyles and Consumption Patterns

ENVIRONMENTAL AUDIT OF STREET FOOD VENDING IN HYDERABAD/INDIA

an exploratory study

Bharath Bhushan Mamidi / Anne Dahmen / Susanne Schultz / Christoph Dittrich

Analysis and Action for Sustainable Development of Hyderabad

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Environmental Audit of Street Food Vending in Hyderabad – An Exploratory Study

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Abstract

This paper aims to provide evidence-based results of the environmental impacts of the street food system in the emerging Indian megacity of Hyderabad. The key question is whether street food is more environment-friendly than mainstream restaurants' operations including processing, preparation and food sale.

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1. Introduction

Street food vending is an important part of urban life and food supply in developing countries. It is an integral part of cities with diverse communities, distinct food cultures, and large population engaged in unskilled and low paid jobs. Although street vending is an important segment of urban informality and makes significant contribution to the economy in developing countries it has been underestimated and neglected (Winarno & Allain 1986; Bhowmik 2005; Kusakabe 2006). Street food, mostly self-financed by the vendor, is a well-established and self-regulated urban institution (Kusabe 2006; Hoffman and Dittrich 2009; Nischalke 2011). Besides, it is a 'cherished part of local culture' that is also an attraction for tourists in many cities (FAO 2007). Street food plays a critical role in food security of urban population. It is found that about one fourth of Hyderabad's population avails food or beverages from street food at least once during the day (Chada & Mamidi 2012). It is critical to the production and use of a variety of food products in the region. Street food also ranks preferable to processed and convenience foods, as 'many street food items are characterised by high nutritional value, resource-efficiency, little waste and low GHG-emissions' and lower traffic volume and emission levels (Dittrich et al. 2012). Despite being environmental-sensitive, energy efficient and people-friendly street food is misunderstood as unhygienic or unsafe compared to mainstream restaurants and eateries.

Literature on street vending in general and street food in particular, is very scant. Available literature indicates potential of street food for food security especially of the urban poor, contribution to uniqueness and cultural identity of the cities and livelihoods of a large number of the urban poor (Rani 2009; Rani and Dittrich 2010; Bergmann and Dittrich 2012). Social change and new food culture makes street food no longer synonymous with cheap food (Chada & Mamidi 2012). Studies reveal that stigma of street food as unhygienic has no basis with regard to most of the street food units (Neeraja 2006). Identifying changes in dietary choices that could contribute to reduced emissions from agriculture and food production are critical since food and beverage production and consumption contributes substantially to GHG emissions (Faber et al. 2012). A recent study on carbon neutralization in Yacharam Mandal estimates average monthly household consumption of liquefied petroleum gas (LPG) at 6.8 litres or per capita per meal consumption of 0.02 litres (SERP & CEE 2012).

Of late the street food sector has been attracting attention of policy makers for its relevance to climate change mitigation. However, energy needs of the street food sector did not receive attention for research investigation or policy interventions (Tedd et al. 2003). Despite macro-studies on food sector and its environmental burden, there is no literature on the importance of the street food system concerning urban food security. Street food is also a source of livelihood particularly for those who are excluded from formal income opportunities. In Hyderabad about

18,000 vendors with their families – altogether about 100,000 people – make their living out street food eateries.

Street food vendors in Hyderabad cater to the culinary needs of all sections of the population interested in a quick bite on their way home. The street food vendors, responding to the diverse needs of the customers, offer a variety of snacks and food items to suit every taste, from the traditional *tiffin* (snacks) which includes items like *idli*, *dosa* and *samosa*, to Chinese fast food, *chaat* items, fried meats, fruit juices, ice creams and hot beverages. Around 150 types of eatables are sold by the hawkers of Hyderabad (Chada & Mamidi 2012).

Street foods change to a different flavor as time moves from breakfast to lunch and evening, with more 'light' snacks in the evening to satisfy varying taste buds. There are several new foods like frankies, pizzas, and *dimsums* that entered the street food recently with the changing food habits in the city. Type of street foods sold varies significantly with the location, such as bread and omlette, *samosa* and *chai* (tea) from morning to night in university campus where students are the main customers and traditional tiffins like *idli*, *dosa, puri* etc. in residential areas. *Chai* (tea) is the most common street food in all locations of Hyderabad which is often sold along with dry eatables like biscuits. Chai is also frequently sold solely by vendors on foot, carrying flasks and disposable plastic cups, to offer the respite to the daily wage laborers, or even a group of friends just hanging out.

Major customers of street food also include the common urban citizens that consist of employees, who are constantly on the move like marketing executives and sales representatives, for whom street food offers a quick snack at reasonable cost. The growth of the ICT sector and the accompanying outsourcing of business opened up the opportunity of vending of ready-made foods at odd times especially during the night and early hours during the day. These vendors carry cooked food on bicycles and motorcycles to serve their regular customers at designated locations.

Street food vendors in Hyderabad belong to broadly three categories based on the preparation and sale of food items: Some of these vendors prepare foods at home or in small enterprises and sell these food items on the street. The second category includes chaat *bandis* (pushcarts), the Chinese Fast Food sellers and sellers of fried and cooked vegetarian and meat items where the foods are freshly prepared at the vendor's home and brought to the vending unit just before sale. The third category includes street food vendors who take up the entire process of cooking at the point of sale itself.

Street food in Hyderabad has experienced phenomenal growth in the last 15 years and more particularly during last five years with manifold increase in the number of customers. Changing lifestyles, time constraints, cost effectiveness, access and availability explain why many Hyderabadis procure street food so often.

The Sustainable Street Food Plan (SSFP) is an action research intervention of the Indo-German research project "Sustainable Hyderabad" funded by German Federal Ministry of Education and Research (BMBF). Since 2008 the research project conducted evidence-based research, and three applied micro-projects viz., street food manual and training, capacity building of women vendors, and building visibility of street food as part of city's cultural heritage through consultations and street food festival. The SSFP aimed at integrating key elements of a decentralised, low-emission urban food provision system with food security, sustainable food demand and normative concepts of climate change mitigation (see http://www.uni-goettingen.de/de/426536.html).

This exploratory study on the potential of street food to climate change mitigation and environment implications for sustainable urban development aims at providing evidence-based results of the environmental dimension of the street food system of the emerging megacity of Hyderabad. The complex nature of environmental implications and carbon foot printing is acknowledged with innumerable processes and in varied stages of materials used, preservation, transportation, distribution, processing, and sale of food items.

Essential elements of environment audit of the food units viz., energy requirement (LPG for cooking and electricity), water consumption, mode of transportation of the customers, solid waste (waste generation), and materials used are selected as parameters of the comparative study. The study is limited to a few factors of a large and complex system of environmental implications and carbon foot print of selected food enterprises.

2. Objectives and Methods Used

The key question of the study is whether street food is more environment-friendly compared to other options like regular eateries/restaurants? If yes, in what respects is it so, and how could policy measures be focused on promoting changes in dietary choices. If not, what are the specific areas of concern that need to be addressed? The study has the following objectives:
- Identify parameters of environmental features of street food sector,
- measure resource efficiency of street food eateries vis-a-vis mainstream eateries,
- identify important factors of the food sector with potential contribution to low greenhouse emissions and climate protection.

Specific objectives of the study

Assess environment friendly nature of street food vis-à-vis mainstream restaurants' operations including preparation, processing, and sale of food in regard to
- electricity requirements,
- cooking fuel (LPG fire wood etc.),

- water consumption,
- waste generation,
- mode of mode of transport of the clients,
- space requirement, and
- packing material/parcels, serving etc.

The study aims to capture several factors of relevance to the environment implications of the street food sector. Not all factors are easily measurable and not all measurable factors are comparable. Hence, the study took into account both comparable and non comparable aspects to have a comprehensive picture while detailed analysis of findings, however, is confined to comparable factors.

Limitations/Assumptions: The study makes certain assumptions which are more of the nature of limitations of the study for the sake of ensuring comparability of different food enterprises with regard to their energy audit. The assumptions include the following:

- That carbon footprint of the materials used in the food stalls from the production by the farmer to the distribution of the ingredients to the food stalls is assumed to remain same for both street food (SF) and mainstream (MS) eateries as vegetables and other ingredients procured by these units are more or less from the same source.

- Behaviour or lifestyles of clients for this study refers to their acts, especially the consumption of food items and the mode of transportation. Behaviour of clients varied with regard to the type of eateries, e. g. street food and mainstream units. Customers' behaviour is not attributed to their environment related awareness or motives since environment is finally affected by the acts and not the motives behind them.

- Mode of transportation by customers to different eateries is an important factor with environmental implications, because of its consequences, e. g. air pollution and the carbon foot print. The study looks at transportation in a limited sense of mode of transport by percent of the clients rather than quantifying carbon foot printing due to mode of transportation and the distance travelled.

- Cost for nutrition in food items in different eateries is not within the scope of the study. However, comparative costs of similar food items are collected in different eateries.

Methods used and sample-size

Street food sector comprises a large variety of food items and forms of enterprises. A few important modes of food vending in street food sector which are comparable to similar food preparation and vending in mainstream eateries are selected for the study on environment audit. Four forms/categories of street food vending, tiffin centres, tea stall, *chat bhandars* and Chinese foods have been selected as these categories represent large section of the eateries. Eateries selected within these categories were selected from different parts of Hyderabad. Tiffin centres and meals centres of street food sector were clubbed into one category to be compared with mainstream eateries that provide tiffins and meals from breakfast to dinner time. Purposive sample comprised both street food units and mainstream units in Hyderabad. Totally 40 street food units representing four categories of street food units and around ten units of mainstream eateries (hotels, restaurants) engaged in relatively similar food preparation. Sample of eateries from street food and mainstream eateries covered for the study include 40 enterprises altogether from four categories, *chaat bhandars*, Chinese fast food, tea stalls, and *tiffin* centres (see Table. 1).

Table 1: Sample of eateries from street food and mainstream food sector

S No	Type of eatery	Street Food units	Mainstream units	Total eateries
1	Chaat bhandar	9	1	10
2	Chinese fast food	5	3	8
3	Tea stalls	6	2	8
4	Tiffin centres	10	4	14
	Total	30	10	40

Source: Own survey, 2012

Eateries covered in the sample are between 1 and 28 years old of which 18 eateries are 1 to 4 years old indicating the rapid growth of the street food sector. Only 5 eateries are 20 or more years old followed by 10 eateries from 10 to 17 years old. Street food eateries have are 1 to 25 years old with average existence of 7.15 years while the mainstream eateries are 1 to 28 years old with average existence of 11.4 years

About half the eateries sell food prepared at the unit (mainstream 6 and 13 street food eateries), while 7 eateries sell food prepared elsewhere, and remaining 14 eateries sell food both types. Most of the eateries are stationery although most of the street food eateries operate on *bandis* or stainless steel kiosks and all mainstream eateries are regular buildings. Only two eateries operate on bicycles. Details of the sample units are furnished in Annexure 1.

Street food units, in most cases, function for part of the day while mainstream eateries operate for the whole day. This difference in comparative analysis is planned to be corrected by comparing energy audit data for the aggregate number of clients served by the unit so that number of hours of operation of a unit is not important than number of clients catered to. Similarly the variety of food items made available by the eateries also varied between the mainstream and the street food and within same category of eateries in mainstream or street food. Such difference is assumed to be of minor implication when the total food items, for a plate of tiffin or a cup of tea, requiring 'x' energy units is compared with the total number of clients. An average value of a few eateries of similar type was taken towards ensuring better measures for comparison of the eateries in street food and mainstream. Each category had five to nine units owing to variation in the form and size of the street food units and average value of each category is compared with the average value of a fewer units of mainstream eateries which have relatively more similar menu.

Data is collected for a typical day of the food unit as well as data of monthly energy requirements. Data for a typical day is based on surveying the eateries in terms of number of clients served, mode of transportation of clients, the menu, and energy consumption. Structured interviews were employed to collect data from clients about their mode of transportation and the range of food items purchased. Structured interviews with vendors/restaurants covered data on materials used, waste generation, sources of energy, average number of clients served, and energy requirements per month. Data on electricity, LPG cylinders, and other fuels on monthly basis of the different eateries is compared (see Annexure 2 for the interview schedule). Number of clients served by each eatery obtained from the vendor is corrected for errors of underreporting by data based on observation on the day of the interview.

The food prices in the street food sector is around half to one eighth of mainstream eateries in Hyderabad. Street food is low cost and available at close proximity compared to mainstream restaurants. While common snacks like *idli, dosa, poori*, *vada, upma, uttapam* cost from INR 10 to 25 in street food eateries the same cost about INR 20 to 80 in mainstream eateries. Vegetarian curries for lunch or dinner cost from 10 to 30 in street food eateries which are INR 95 to 135 in mainstream eateries sampled.

Table 2: Comparative cost of food items in street food and mainstream eateries

Type of food	Street Food eateries	Mainstream eateries	Cost of MH compared to SF
Tiffin centres (idli, dosa, poori, vada, upma, uttappam)	10 to 25	20 to 80	2.86
Chai (Tea) / coffee	5 to 8	9 to 15	1.71
Chaat bhandar (Bhel puri, pav baji, golgappe, cutlet, dahi puri, pani puri, chaat, mixed chaat)	5 to 25	20 to 80	3.33
Chinese fast food (Choup suey, chowmein, noodles, fried rice, manchuria)	25 to 40	50 to 160	3.23
Roti/ chapati	5 to 6	18 to 25	5.55
Curry point - vegetarian items	10 to 30	95 to 135	8.13
Sweets/ fruit juices/ ice creams	5 to 20	17 to 80	3.88

Source: own survey, 2012.

Details of comparative cost of similar food items in street food and mainstream eateries are furnished in Annexure 3.

3. Environmental Dimension of Eateries

Street food is characterized by close proximity, minimum time consumption, and affordable prices among other features. Typically street food is supposed to be cooked or sold in temporary arrangements by the street side, for example *chat bandis*, Chinese fast food *bandis, mirchi bajji bandis*, fruit juice *bandis*, tea stalls. In contrast mainstream eateries, popularly known as 'hotels' or 'restaurants' are characterized by 'complete experience' to the customers, from comfortable seating to wider variety of foods, culinary experience and ambience for socializing. However, in reality several eateries in Hyderabad have a blend of features from both street food and mainstream eateries. For instance, the Irani hotels known for *chai* (tea and confectionaries) could be seen housing a *tiffin centre* or Chinese fast food in the entrance facing the street and street food *tiffin centre* may have part of the cooking or preparation process in a small room with remaining processes taking place on the street. Growing constraints of space have also resulted in 'self service' restaurants which are mainstream restaurants without any seating arrangements wherein customers collect food items from the counter against coupons or tokens they get for the payments they make to the cashier. Social composition of the customers of the eateries is determined by one or more factors – menu, distance from one's residence/work place, and affordability. Several *tiffin centres* and *chat bhandars* of street food in certain locations have

large sections of customers who also frequent mainstream eateries on other occasions. Significant numbers of customers were observed to visit street food units more often than the mainstream eateries and considerable section of customers are drawn towards street food *chat bhandars* and *tiffin centres*, because of their location, short distance and menu rather than cost.

Street food units keep the materials used to minimum in order to reduce the costs with minimal amount of complementary or non-food items used such as plastic/paper, while in the mainstream eateries the non-food materials used are necessary to provide the 'experience' to the customers.

What helps street food require low energy and available at low price?

Street foods are highly competitive in price, rather than being cheap, because their resource use is minimal comprising only essential and functional services and food items. Important features of street food contributing to very low global greenhouse gas-emissions (GHG-emissions) include the following:

- Limited operational time and minimal energy requirements: Many street food eateries have short operational hours of 3 to 4 hours, for instance 7 to 11 am for a *tiffin center* and 6 to 9 pm for a *mirchi bajji* joint. Short operational hours contribute to low requirement of electricity, gas and water. Street food joints operating from morning to afternoon do not require any power for lighting. While mainstream eateries with operational hours form 7 am to 10 pm offering wider variety of items increases both the storage cost and the preparation cost owing to oil being regularly heated in order to prepare different items according to demand. Similarly lights, fans or air conditioning, refrigerators etc are used from morning to night. Besides, street food joints have limited quantity of food to sell everyday without any need for storage of food items.

- Quick service: The service time is very less in a street food eatery (about 6 to 15 minutes) compared to mainstream eateries (about 10 to 30 minutes). Faster service increases the number of customers served per unit time. One of the main reasons for this is that usually customers place the order directly to the cook in a street food joint, there is no third person like the waiter to the cashier involved from placing the order to making payment in a mainstream eatery.

- Limited menu: Street food units have relatively limited variety of food items compared to mainstream eateries. Most of the street food units offer four to ten items helping increase the quantity consumed of each item and reducing need for storage space.

- Very low non- food costs: Non-food extra costs for rent, electricity, workers, etc are kept to the minimum in street food. These extra costs are the essence which provides comfort for the

customers in the mainstream eateries. Even when only one table is occupied lights of the complete room are lit in a mainstream eatery. In many street food eateries very few persons are employed for kitchen help, cooking, serving and cleaning operations.

Comparison of functionality of street food and mainstream eateries

For serving a single dish for the customer there are almost double the number of people involved in a mainstream eatery compared to its counterpart. In a mainstream eatery there is a complex system of job responsibilities among the workers, while it involves less number of workers in a street food unit with multiple roles played by each worker, from cooking to serving to bill collection.

Figure 1: Functioning of street food eatery

a)
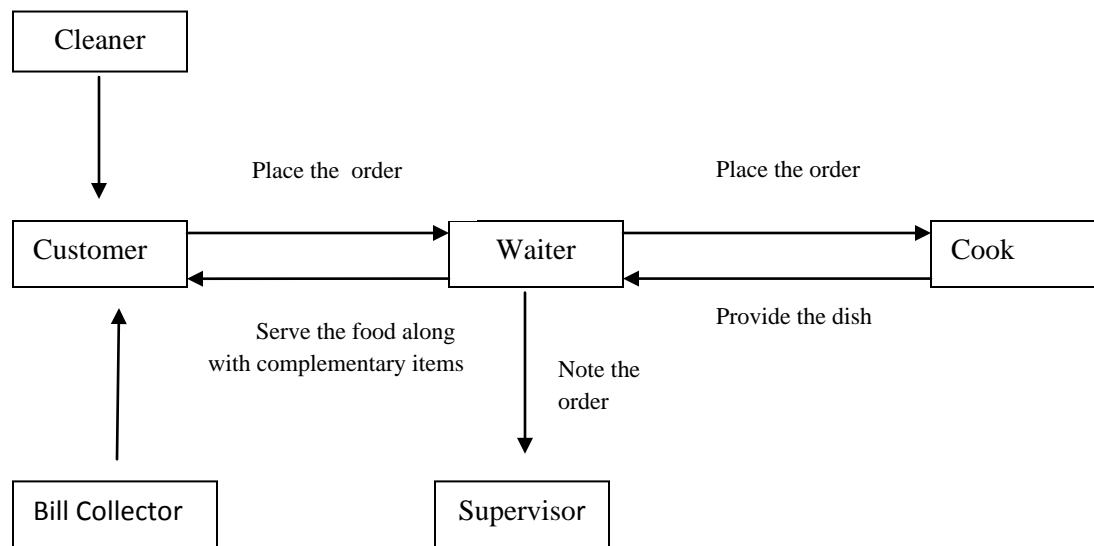
b)
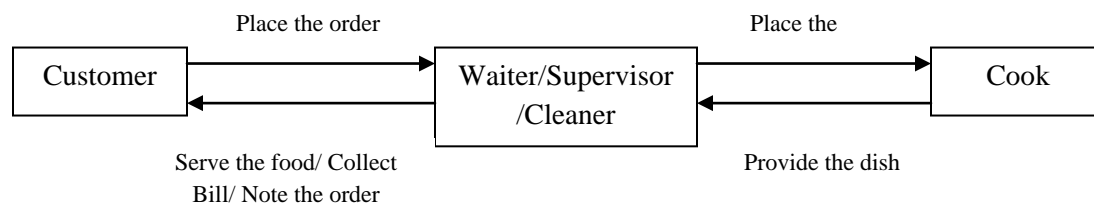
4. Findings: Environment Variables with Potential of Low-Greenhouse Emissions and Climate Protection

Environmental burden of food

Five parameters have been taken for closer examination to assess the difference of environmental impact between street food and mainstream eateries. Energy used by the eateries covered cooking fuel, electricity, and customers' transportation. Water consumption in different types of eateries was planned to be audited, but finally, it was not included in the analysis, because a proper measurement of water consumption was not possible to assess in both street food and mainstream eateries. In mainstream units there were multiple sources of water like bore well, municipal tap water, tankers, water cans etc. Similarly, street vendors also had multiple sources. It was not possible to measure waste water in the eateries. Another parameter included is waste generated by the eateries.

Energy used

Food preparation, storage and procurement use different sources of energy. These include

- Electricity,
- Cooking fuel,
- Transportation fuel,
- Cooking fuel- LPG.

Most mainstream eateries in Hyderabad prepare their food items at the unit itself and use LPG for cooking purposes. Most of the street food vendors have pre-cooking operations or up to cooking food at their home and transport the prepared food items to the *bandi*. Mostly they use LPG or in some cases kerosene, firewood, charcoal for cooking purposes.

Electricity

Electricity is used mainly for storage of perishable food items and off the shelf products like cool drinks, ice creams etc. which require refrigerators/cold storage. Electricity is also consumed while heating through microwaves or preparation of food using electric ovens in mainstream eateries.

Transportation fuel

Transportation fuel in the form of petrol, diesel and compressed natural gas (CNG) is used by most eateries in the following situations:

- Procurement of ingredients for cooking,

- transportation of food items from point of preparation to the eatery,
- by customers in reaching the destination either by car, motorcycle, public transport etc.

Food Wastage

Food wastage is one of the main factors with environmental impact. Problems associated with food wastage include,

- increase in accumulation of waste,
- improper disposal of wastes,
- health issues,
- sanitation problems,
- release of GHG emissions and other toxic gases.

All these factors directly or indirectly have environmental impacts and therefore, if controlled, can contribute to reduce the amount of GHG emissions to a large extent.

Environment friendly nature of street food vis-à-vis mainstream eateries

The environment friendliness of street food and mainstream eateries is compared on two parameters viz., preparation process, processing and delivery.

Preparation process

Preparation methods are more environment friendly for street food rather than mainstream eateries. It is mainly due to bulk preparation of food items in case of street food vendors. As a result fuel and electricity consumed is much lesser per sales unit. Mainstream eateries prepare food as per the order received and not in bulk and therefore consume more fuel and electricity.

Processing and delivery

This would include the energy consumed during the consumption of food and the mode of delivery of food. Mainstream eateries are sometimes centrally air conditioned and use electrical light throughout the day irrespective of whether customers are present or not. Street food vendors do not use such sources of energy as their customers usually eat during day-time, or need light only for a few hours if the unit operates after sunset.

The delivery process involves the wastes generated and materials used during food consumption. Street food vendors generally use paper plates, newspapers and other disposable materials in limited quantities. Mainstream eateries produce more waste because of several supplementary items served which are optional and often part of it is not consumed and goes as left overs.

Mainstream eateries have lesser wastes related to use of disposable add ons like plastic paper for serving the food in a plate or disposable cups for serving beverages. However, mainstream eateries use more water for cleaning purposes compared to street food units.

Space requirements of eateries

Space required by street food eateries is minimal compared to mainstream eateries. In the sample, street food eateries of any category used between 20 and 170 sqft., while the mainstream eateries used 100 sqft. to 3,000 sqft. While *chat bhandars* and Chinese fast food centres in street food sector require a *bandi's* space while their counterparts in mainstream occupy much large space up to 3,000 sqft. Maintenance and other facilities like furniture, fans and lights are essentials for mainstream eateries and they are required for most part of the day, necessitating more energy consumption compared to the street food eateries. Details of space requirements of the eateries are furnished for different categories in Table 3.

Table.3: Space requirement of street food and mainstream eateries

Type of Eatery	No. of eateries	Average space (sft)	Min Space (sft)	Max space (sft)
Chat bhandar SF	9	32	20	40
Chat bhandar MS	1	1200		1200
Chinese FF SF	5	70	40	100
Chinese FF MS	3	1433	100	3000
Tea stalls SF	6	32	20	60
Tea stalls MS	2	350	300	400
Tiffin/ meals SF	10	58	16	170
Tiffin/ meals MS	4	681	200	1500

Source: own survey, 12/2012

Street food and mainstream eateries – environment audit highlights

The study covered 40 eateries of street food and mainstream from four categories viz., Chat bhandars, Chinese fast foods, tea stalls and tiffin centers. Energy requirements for cooking fuel (LPG), electricity, mode of transport of customers and waste generated are measured for each eatery. Energy requirements and waste generated are calculated per customer in every eatery and average of each category for street food and mainstream for comparative assessment of the difference in environment burden of the eateries. Findings of the data are presented below for each parameter (Annexure 4).

Cooking fuel (LPG)

Cooking fuel requirement for eateries has been measured by information about the number of LPG cylinders used per month by the eatery. Each LPG cylinder used in commercial enterprises comprises 19.2 kg. The per-capita LPG consumption is derived by dividing the number of LPG cylinders used multiplied by 19.2 kg in a month by number of customers in a month. Average of each category of eatery is the total number of LPG kg used in a month in a particular category of eatery for street food and mainstream separately by the total number of customers catered to in each category. Daily average number of customers is based on the information about lowest and highest number of customers per week. Since there are some holidays, it is calculated that the enterprise works for 350 days in a year. Per capita LPG consumption is arrived in the following manner:

Per capita LPG = Number of LPG cylinders in a month X 19.2 kg

Number of customers in a month (Average # customers per day X 350 days /12 months)

Per capita consumption of LPG in street food eateries is many times lower than mainstream eateries of *chaat bhandars*, Chinese fast food and tiffin centres and very little difference in the category of tea stalls. Sample comprised 35 street food eateries and mainstream that used LPG exclusively and the remaining units using kerosene, firewood or multiple sources were excluded. There are variations within a particular category of eateries of street food and mainstream. Per capita LPG consumption in *chaat bhandars* of mainstream eateries is 554.24 % higher compared to its counterpart in street food, 65.41 % higher in Chinese fast food category, 35.32 % in tea stalls and 77.41 % in *tiffin centres*.

Table 4. Per capita consumption of LPG in different categories of street food and mainstream eateries

Eatery	Number of eateries	Customers per month	LPG kgs per month	Per capita consumption of LPG in kgs
Chaat - Street food	6	24458	364.8	0.015
Chaat -Mainstream	1	17708	1728	0.098
Chinese food- Street food	5	13229	710.4	0.054
Chinese food- Mainstream	3	19021	1689.6	0.089
Tea stall- Street food	6	48825	518.4	0.011
Tea stall- Mainstream	2	38750	576	0.015
Tiffin centre - Street food	8	48125	1613	0.034
Tiffin centre - Mainstream	4	70067	4166.4	0.059

Source: own survey, 2012

Relatively low difference in LPG consumption per capita in both street food and mainstream tea stalls is due to the fact that both eateries are required to keep the stoves in regular use to keep the tea hot. Besides, the number of customers in mainstream tea stalls is far high compared to street food tea stalls due to limited operational hours.

Comparative LPG consumption in street food vs. mainstream eateries reveals that per-capita consumption of LPG for mainstream eateries is far higher than that of the street food units, except for the category for tea stalls.

Average LPG consumption per capita in each of the category of eatery of street food and mainstream are presented in the Fig. 1.

Fig.1 Per capita LPG consumption (in kgs) in different types of eateries in street food and mainstream hotels
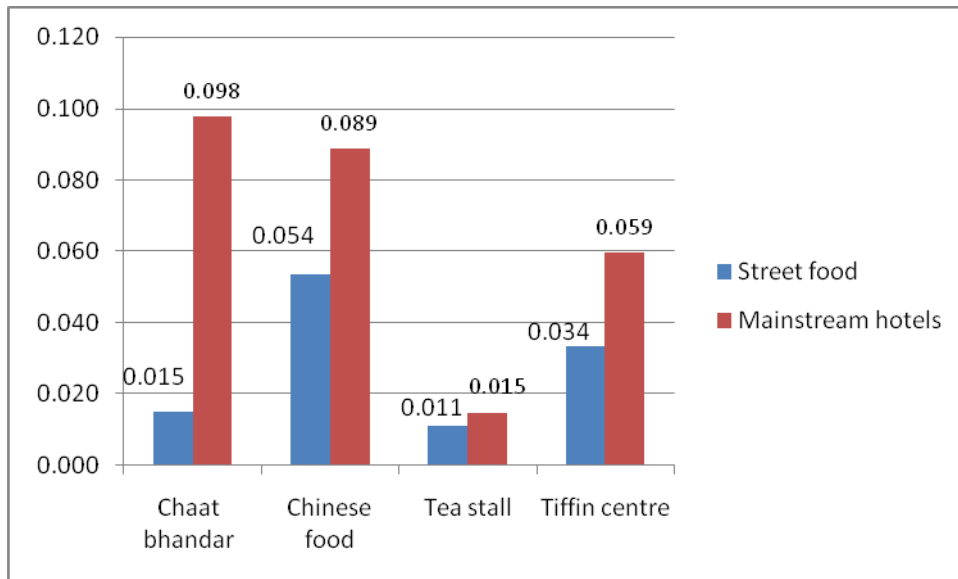
Average consumption of LPG per capita in mainstream eateries of all categories is 0.056 kg compared to 0.024 kg in street food eateries or in other words it is 133.33 % higher in the mainstream eateries.

Electricity requirements

The power required by various eateries was measured in number of units for per capita customer per day on the basis of monthly use of power in units divided by 30 to arrive at average daily requirement as maintenance and cleaning operations take place also on some holidays.

$$\text{Per-capita power in units} = \frac{\text{Average power units consumed per day}}{\text{Average no of customers per day}}$$

There are variations within a particular category of eateries of street food and mainstream. Average per capita power consumption in each category of eatery is arrived at total power consumed in particular category by total number of customers per day. Average power consumed per capita in each of the category of eatery of street food and mainstream are presented in the Fig.2.

Fig. 2: Per capita power consumption in street food and mainstream eateries
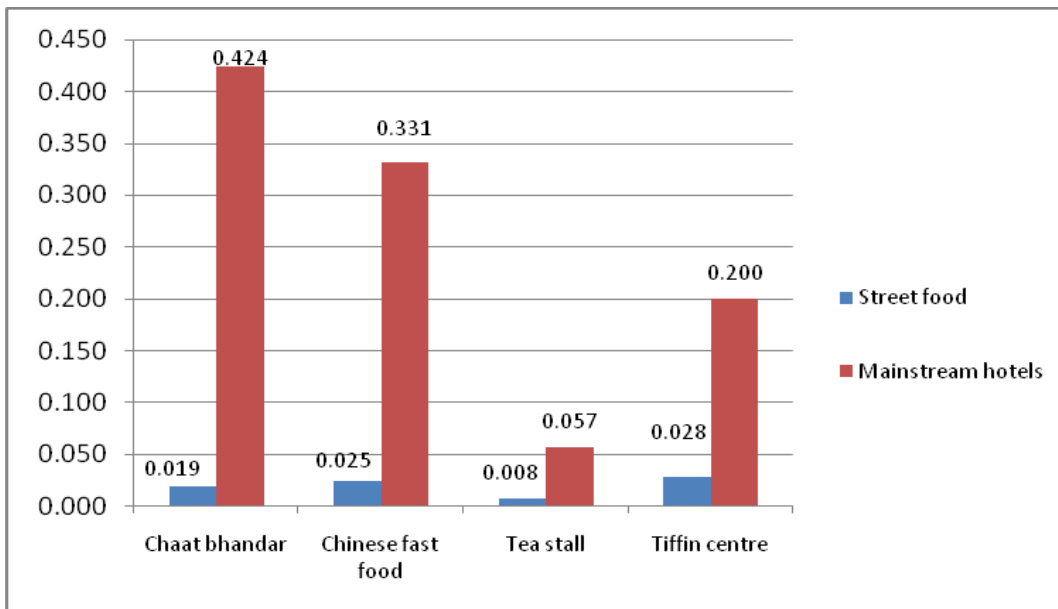
Source: own survey, 2012

Per capita power requirements in mainstream eateries is manifold high compared to their counterparts in street food eateries. It is 2104 % higher in mainstream *chat bhandars*, followed by 1227 % in Chinese fast food, 643 % in tea stalls and 611 % in *tiffin*/ meals eateries compared to their counterparts in street food. Less difference between street food and mainstream tea stalls is due to relatively very little power consumed in Irani hotels on one hand and the number of customers being far high compared to street food tea stalls that have less customers due to limited operational hours.

Comparative power consumption in street food vs. mainstream eateries reveals that per-capita consumption of power for mainstream eateries is six to twenty one times higher than that of the street food units.

Average consumption of electricity per capita in mainstream eateries of all categories is 0.206 units, which is about 984 % higher compared to 0.019 in street food eateries.

Customers' mode of transport

Street food eateries vary highly in regard to the mode of transportation of the customers compared to the mainstream units. Aggregate data for all categories of street food and mainstream units reveals that about two thirds of customers walk to street food eateries and only 4 % use car. While 61 % of customers in mainstream units use motorcycles or cars, it is only 37 % in street food units. The percentage of customers using cars and motorcycles is higher among mainstream eateries of chat, Chinese, and *tiffin centres* while the difference in customers' mode of transportation is less different compared to tea stalls in mainstream and street food.

Fig. 3: Customers' mode of transport in mainstream and street food eateries
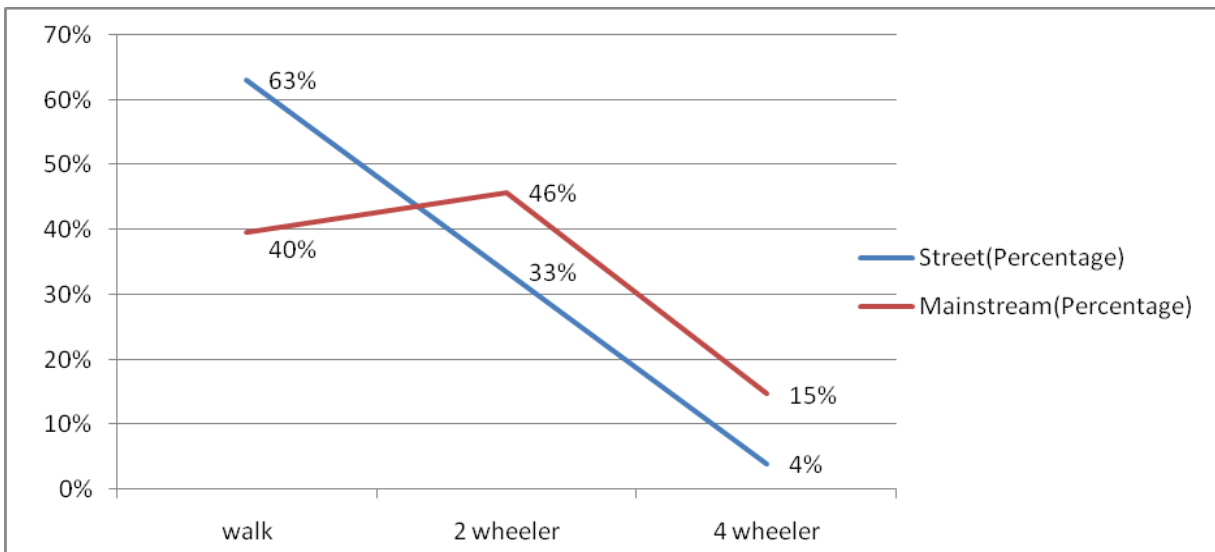
Source: own survey, 2012

Distance traveled by the customers is also short in street food units contributing to relatively much higher fuel consumption by customers of mainstream units.

Waste Generation (Including parcels)

The wastage generated in eateries is compared from mainstream to street joints by measuring the food wasted in a day and the weights of parcels served in papers, packets etc. in kg. Total wastage generated (in kg.) in a day is divided by the number of customers in a day to obtain the per-capita waste generated.

Per-capita waste generated = Avg. weight of food wasted and packing material per day

Avg. number of customers per day

The per-capita waste generated by various categories of eateries is compared across mainstream and street eateries.

Data reveals that the waste generated in the mainstream eateries is more than that in the street food units except in Chinese fast food units. For instance, in mainstream chat bhandars it is 0.082 kg per customer compared to 0.013 kg in street food. In Chinese fast food units of the street food sector, the waste generated is more than that of mainstream units. Use of disposable plates and paper is less in mainstream units compared to street food Chinese fast food units.

Per-capita waste generation in the mainstream units is significantly varying across categories of eateries. While for the street food units, the waste generated per-capita is almost same across all categories indicating perhaps that waste generation in street food units is minimal and scope for any reduction is limited. However, the data on waste is not very accurate as it is not measured and also because it is removed at different intervals during the working hours of some eateries.

Fig. 4: Per capita waste generation in different eateries in street food and mainstream eateries
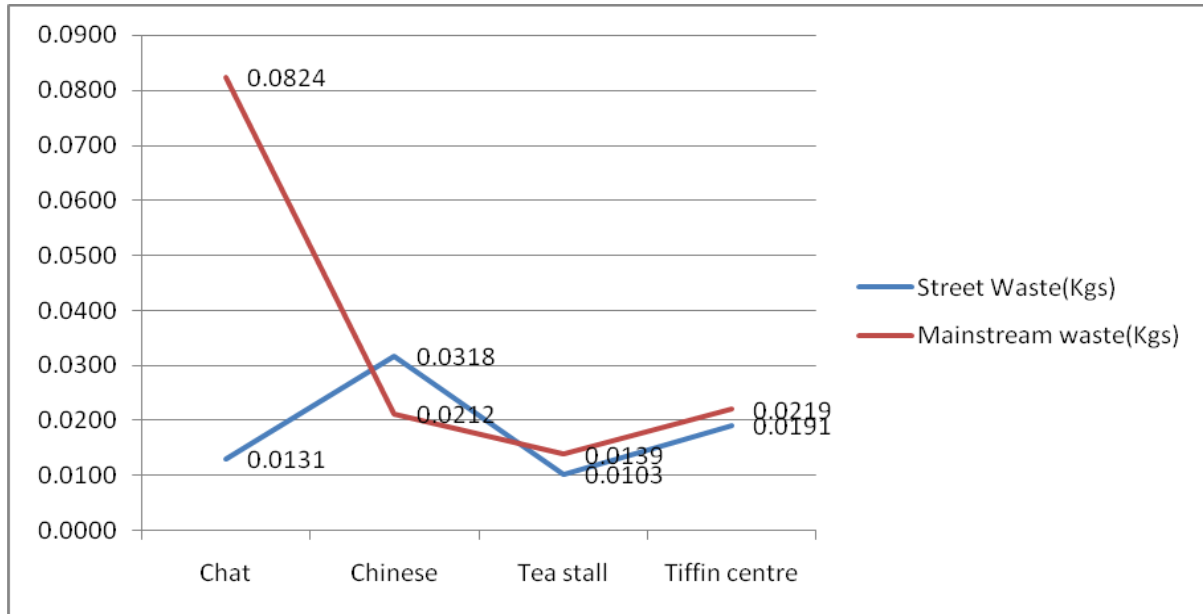
Source: own survey, 2012

5. Conclusions

Environment burden of street food eateries is manifold less than mainstream eateries. Being very functional and low on non-food components the street food eateries operate on basis of resource efficiency and very low GHG emissions. LPG consumption is common to most part of the eateries in street food and mainstream. *Tiffin centres* constitute significant part of the street food sector, and these eateries are characterized by significant resource efficiency. Per capita LPG consumption in *chaat bhandars* of mainstream eateries is 554.24 % higher compared to street food, 65.41 % higher in Chinese fast food category, 35.32 % in tea stalls and 77.41 % in *tiffin centres*.

Similarly, average consumption of LPG per capita per meal in mainstream eateries of all categories is 0.056 kgs compared to 0.024 kgs in street food eateries or in other words it is 133.33 % higher in the mainstream eateries.

Electricity consumption in street food is almost nil to minimal in most of the street food eateries. Average consumption of electricity per capita in mainstream eateries of all categories is about ten times higher compared to the street food eateries.

Per capita electricity requirement *in chat bhandars*, Chinese fast food, and *tiffin centres* is in mainstream eateries is manifold high compared to their counterparts in street food eateries. It is 2104 % higher in mainstream chat bhandars, followed by 1227 % in Chinese fast food, 643 % in tea stalls and 611 % in tiffin/ meals eateries compared to their counterparts in street food. While tea stalls use no electricity at all in most of the cases, there is use of electricity for grinders and mixers in tiffin centres. Mainstream eateries are highly dependent on power and several units use generators also when power breaks down. Refrigerators, storage, air conditioning are used with low efficiency levels in most of the mainstream eateries.

Average consumption of electricity per capita in mainstream eateries of all categories is 0.206 units, which is about 984 % higher compared to 0.019 in street food eateries.

Carbon footprint of customers' mode of transport significantly differs between mainstream and street food eateries and has very high implications to the GHG emissions. About two thirds of customers walk to street food eateries and only 4 % use car. While 61 % of customers in mainstream units use motorcycles or cars, it is only 37 % in street food customers. Large section of the customers to street food eateries do not use motor cycles or cars or consume less fuel for transportation as these eateries are in close proximity to the customers. Widely disbursed small eateries and the mobile eateries reduce transportation burden of the customers. Street food eateries being almost "at door step" of their customers significantly reduce carbon footprint of transportation of the urban population in search of their food needs. Street food eateries are most helpful in terms of low GHG emissions as large number of clients do not use motor cycles or cars.

The waste generated in the mainstream eateries is manifold high compared to the street food units except in Chinese fast food units. For instance, in mainstream chat bhandars it is 0.082 kg per customer compared to 0.013 kg in street food.

Street food is a major source of food security to all sections of the urban population who constantly visit these eateries for regular nutrition requirements or for taste and ethnic experience. Competitiveness among the street vendors is also resulting in improvements of quality and hygiene aspects of street food. Most of the street vendors in the city are found using mineral water procured in cans, and using disposable papers or prescribed plastic sheets while serving the food items in the plates. A section of the street food vendors reported using quality cooking oil avoiding reuse of used oil. Transparency of the operations in street food enterprise makes the vendors pay due attention to meet the expectations of their customers.

The vendors also are volunteering for undergoing training in food safety standards. Sustainable Hyderabad Project has already covered around 80 vendors under Training of Trainers and

Institute of Preventive Medicine, the government agency to ensure compliance of Food Safety Standards Act 2006 and Prevention of Food Adulteration Act of 1954, has started issuing registration certificates to the vendors in the city. The trend for hygienic practices like wearing uniform, providing drinking water in cans avoiding food contamination because of handling with bare hands, use of kiosks made of steel bodies facilitating daily cleaning, branding of street food enterprises, etc is also picking up in the city.

The study also reveals scope for improving street food enterprises from environment angle. Provision of potable drinking water and waste disposal services by the municipal authorities would further enhance cleanliness and safety.

Scope of improvements in street food is linked with security of the enterprises with legal recognition, protection, social safeguards, and access to institutional finance. Freedom from insecurities, threats of eviction and harassment are major incentives for the street food vendors to invest in their operations towards improved quality and competitiveness. Provision of infrastructural support covering access to space, potable water, energy needs (cooking fuel and electricity), institutional credit and insurance is vital to ensure urban food security, livelihoods of the vendors, and building a sustainable city.

Government support through infrastructural facilities and capacity building also helps promoting environment sensitive dietary choices as well protecting city's unique food culture which part of the cultural heritage.

Further research is required on street food that is so critical to the urban food security and city environment. Detailed studies are required to identify and promote positive features of street food vis-à-vis mainstream eateries with regard to their water and energy requirements, waste generation and disposal, and carbon footprint of transportation by their customers. Studies on per capita fuel requirements for a meal in households compared to street food are required to assess the rationale for why more people prefer street food to support more environment friendly food choices.

Institutional support for solar energy for lighting/ illumination also requires attentions, especially for the mobile street food vendors. Similarly, environmental friendly alternatives for packing / take away food require examination and incorporation into policy.

Annexures

Annexure- 1

Sample eateries from street food and mainstream food sector

S No	Category of eatery	How old is the eatery (years)	Type of food items sold (prepared at the stall 1, prepared elsewhere 2, both 3)	Customers per day on average
1	Chat Bandar- Street food	17	3	150
2	Chat Bandar- Street food	20	3	154
3	Chat Bandar- Street food	3	3	100
4	Chat Bandar- Street food	3	3	101
5	Chat Bandar- Street food	5	3	153
6	Chat Bandar- Street food	25	3	203
7	Chat Bandar- Street food	2	3	151
8	Chat Bandar- Street food	8	2	130
9	Chat Bandar- Street food	0.5	2	107
10	Mainstream Chat	4	3	607
11	Chinese fast food - Street food	12	3	101
12	Chinese fast food- Street food	2	1	80
13	Chinese fast food- Street food	15	3	102
14	Chinese fast food- Street food	2	1	101
15	Chinese fast food- Street food	4	3	70
16	Mainstream Chinese fast food	1	1	102
17	Mainstream Chinese fast food	2	3	293
18	Mainstream Chinese fast food	11	1	257
19	Tea Stall- Street food	5	1	262
20	Tea Stall- Street food	4	1	308
21	Tea Stall- Street food	2	1	306
22	Tea Stall- Street food	2	1	406
23	Tea Stall- Street food	1	1	120
24	Tea Stall- Street food	7	1	272
25	Mainstream Tea	10	3	543
26	Mainstream Tea	10	3	786
27	Tiffin centre - Street food	3	2	156
28	Tiffin centre - Street food	9	2	100
29	Tiffin centre - Street food	6	2	80
30	Tiffin centre - Street food	16	1	614
31	Tiffin centre - Street food	15	1	201

32	Tiffin centre - Street food	10	1	320
33	Tiffin centre - Street food	3	1	143
34	Tiffin centre - Street food	11	1	86
35	Meals centre- Street food	1	2	57
36	Meals centre- Street food	1	2	73
37	Mainstream Tiffin centre	20	1	457
38	Mainstream Tiffin centre	28	1	153
39	Mainstream Tiffin centre	8	1	614
40	Mainstream Tiffin centre	20	1	1178

Annexure -2

Environmental Audit of Eateries in Hyderabad

Interview Schedule to Elicit Information about the eatery

I. PROFILE OF THE UNIT

1. Name of the unit ……………………………………………………………………
2. Address …………………………………………………………………………………
3. Name of the owner / Vendor ………………………………………………………….
4. Age of the owner ………………. years

5. Sex: Male   Female

6. Caste you belong to? …………………General/ OBC/ SC/ ST/ Christian/ Muslim

7. Education of the owner:…………………………………..

8. Since how long you have been living in Hyderabad? ………………… years

9. Where did you live prior to this place? ………………………………………………….
     another area in Hyderabad/   another district in the state (district …………………)/
     another state ……………..

II. STRUCTURE & OPERATIONS OF THE UNIT

10. Since how many years you have been engaged in this eatery? ……………….. years
      (In the same location / or another location earlier ……………………………….)

…………………………………………………………………………………………….

11. Has someone in your family been involved in this trade before? Yes/   No

…………………………………………………………………………………………….

12. What are the working hours of your unit……AM to …AM /PM……AM/PM ……PM

13. Do you operate only in one shift? Yes/   No

    If No, working hours ……AM/PM to ………AM/PM./ ...…… PM to ………PM …..…… to
..………

14. Location /surroundings of the unit ………………………….. ……………… (on foot path,
close to Market area/ Recreational area/ Bus stand/ Railway Station/ Hospital/ School/ Others
………… ……………..)

15. Type of eatery: Stationary / Mobile/ other ………………

16. If it is MOBILE unit, is it on bandi/ cycle/ other …………………………………

17. What is the working space of your unit (in sq ft)? ………. sft

        details of use of space: for cooking …………sft, for serving ………sft., for storage ……
for cleaning of dishes …………sft, …………………………………………………………….

        …………………………………………………………………………………………….

18. Does your unit sell food items: prepared directly at the stall/ prepared elsewhere /

If "elsewhere", where…………………. (which is ….. km from vending place)

Do you also sell food items prepared by others elsewhere? Yes/ No

If yes, what are such items? …………………………………………………………………

19. Is your unit having the facilities for Pre-preparation/ Preparation (cooking)/ Storage of
materials/ Service or serving/ Cleaning of dishes, waste disposal, any other ……………………..

III. RESOURCE UTILLISATION BY THE UNIT

20. What is the kind of **cooking fuel** used? …………………,

    1) LPG cylinders   If yes, how many cylinders …………..p.m or per week
    2) Electricity   If yes, how many units .. ……………..p.m or per week
    3) Coal   If yes, how many kgs …………………..p.m or per week
    4) Kerosene   If yes, how many litres ..…………..…..p.m or per week
    5) Diesel   If yes, how many litres ………..……..p.m or per week
    6) Any other ……………,   how much……………………..p.m or per week

7) Any other ……………,   how much……………………..p.m or per week
8) Any other ……………,   how much……………………..p.m or per week

21. **Consumption of electricity** in the unit here or other place for preparation of food items
    1) Electricity consumption here: how many units pm? ……………….
    2) Electricity consumption elsewhere: how many units pm? ……………….
    3) Total electricity consumption   how many units pm? ……………….

22. **Water consumption** of the unit per month or daily whichever is convenient

    1) Source of water for cooking: Hand pump/ GHMC water tap/ Mineral water cans/ any other ……………………… How many units p.m? …………………………..

    2) Source of water for drinking purpose: Hand pump/ GHMC water tap/ Mineral water cans/ any other …………………… How many units p.m? …………………………..

    3) Source of water for dish washing purpose: Hand pump/ GHMC water tap/ Mineral water cans/ any other ……………… How many units p.m? …………………………..

23. **Materials used** for (how many / how much)
    1) packing/ parcels **Plastic Carry bags** ……… p.m   Brand/ type ………………
    2) packing/ parcels **Paper** ……………………..p.m   Brand/ type ………………
    3) serving **newspaper** …………………………..p.m   Brand/ type ………………
    4) serving **Paper plates**……………………… p.m   Brand/ type ………………
    5) serving **Paper Napkins** ...…………………p.m   Brand/ type ………………
    6) disposable cups …………………….. ……..p.m   Brand/ type ………………
    7) detergents (powder) for dish cleaning, etc… ..……p.m   Brand/ type ………………
    8) detergents (liquid) for dish cleaning, etc . ..……p.m   Brand/ type ………………
    9) any other ………………………………… p.m   Brand/ type ………………
    10) any other ………………………………… p.m   Brand/ type ………………
    11) any other ………………………………… p.m   Brand/ type ………………
    12) any other ………………………………… p.m   Brand/ type ………………

24. **Waste generation**
    1) How much vegetables, food left overs, etc is generated per day …………. kgs/ etc
    2) How much other wastes like packing material, disposable cups, paper for serving, etc is generated per day ………… kgs
    3) How it is disposed? ………………… (thrown in GHMC dust bins/ given to GHMC vehicles/ any other ………….…………

25. **Mode of transport of clients** on a typical day (in numbers or percentage)
    1) How many clients come by walk   ……………

2) How many clients come by motorcycles ……………..

3) How many clients come by cars ……………………

4) Others ? (e.g. Bicycle, Auto)

26. **Number of clients/ customers catered to** on an average per day? ……………………..

1) Peak number of customers/ clients in a week ………………………………

2) Low number of customers/ clients in a week ..…………………………..

27. What infrastructure facilities the unit has

1) Refrigerator(s) ……… (No.s) …………………………….. capacity

2) Grinder(s) ………… (No.s) …………………………. capacity

3) Mixer(s) ………………………… (No.s) …………………. capacity

4) Lighting/ illumination during the day   Yes/ No

5) Fans ……………. (Nos)

6) Air condition ……………(No.s)

7) GHMC Water connection? Yes/ No

8) Electricity connection? Yes/ No

9) Generator? Yes/ No

10) Any other …………………………………. (Nos) ………………..

11) Any other …………………………………. (Nos) ………………..

VI. FOOD ITEMS SERVED IN THE UNIT

28. What are the items that are served in your eatery?

Items/ Menu	Cost in Rs.	Quantity served	Remarks

Other items include …………………………………………………………………………………….

……

V. **DETAILS OF HUMAN RESOURCES**

29. How many persons are employed/ engaged in the unit …..……?

Type of work	Number	Male	Female	Remarks
Supervisor				
Billing clerk / cashier				
Cooks				
Kitchen assistant				
Pre preparation				
Packing/ parcel service				
Steward/ serving				
Dish cleaning				
Sweeping/ upkeep				
Water supply				
Waste disposal				
Others				
Others				
Others				
Total				

30. What is the range of payment to the employees? Rs ………….. to Rs ………….

31. What is the frequency of purchasing the materials?

Item	Frequency	Remarks
Cereals		
Pulses		
Fleshy foods		
Vegetables		
Fuel		
Spices		
Other Provisions		
Cooking oils		
Packing materials		
LPG		

Other cooking fuels		

Frequency of buying- a). Every meal, b). Every day, c). Once in 2 days   d). Once in a week e). Monthly f). Any other (Specify) ……………………….

VI. ANY OTHER / OBSERVATIONS

……

……

……

……

Signature of the research investigator

Annexure -3

Cost of comparative food in street food and mainstream eateries

Food items	Cost of Street Food (SF)	Av cost in SF	Mainstream Hotels (MH)	Av cost in MH	SF:MH cost
Tiffin centres					
Idli	10 to 15	17.5	20 to 34	37	2.11
Dosa	10 to 25	22.5	28 to 80	68	3.02
Poori	10 to 20	15	33 to 40	53	3.53
Vada	10 to 18	14	33 to 34	33.5	2.39
Upma	10 to 20	15	20 to 30	25	1.67
Uttapam	10 to 25	22.5	33 to 60	63	2.80
Pakoda	15 to 25	20	35		0.00
Tea	5 to 6	5.5	9 to 15	12	2.18
Coffee	6 to 8	7	10 to 15	22.5	3.21
Chaat bhandar					
Bhel puri	10 to 20	15	30 to 45	37.5	2.50
Pav bhaji	10 to 20	15	40 to 80	60	4.00
Golgappe	5 to 15	10	30 to 45	37.5	3.75
Cutlet	10 to 20	15	30 to 45	37.5	2.50
Ragda	15 to 25	20	30 to 50	40	2.00
Dhai puri	15 to 25	20	30 to 45	37.5	1.88
Pani puri	5 to 15	10	20 to 35	27.5	2.75
Chhatt	15 to 25	20	20 to 35	27.5	1.38
Mixed chaat	15 to 25	20	45 to 55	50	2.50
Chinese fast food					
Choupseuy	30 to 40	35	99 to 140	169	4.83
Chowmein	30 to 40	35	75 to 90	120	3.43
Noodles	30 to 40	35	50 to 90	70	2.00
Fried rice	30 to 40	35	100 to 140	120	3.43
Manchuria	25 to 40	32.5	110 to 160	135	4.15
Roti/ chapati	5 to 6	5.5	18 to 25	30.5	5.55
Curry point - vegetarian items	10 to 30	20	95 to 135	162.5	8.13
Parota, bread, omelets	15 to 25	20	35 to 65	50	2.50
Small Samosa	1 to 3	2	12 to 16	14	7.00
Fruit juices - Mosambi, mixed fruit/ etc	10 to 15	22.5	30 to 65	47.5	2.11
Sweets (Jilebi/ som papdi/ coconut burfi)	5 to 10	7.5	30 to 45	37.5	5.00
Soda -carbonated beverages	5 to 15	10	17 to 25	21	2.10

| Ice crèam/ kulfi | 10 to 20 | 15 | 45 to 80 | 62.5 | 4.17 |

Annexure- 4

Distribution of street food (SF) and mainstream (MS) eateries by consumption electricity, LPG and mode of transportation

S No	Category of eatery	Customers per day on average	Electricity consumption (units/ pm)	LPG cylinders pm	Transportation of clients		
					% by walk	% by motorcycle	% by cars
1	SF - Chat Bhandar	150	50	2	50	50	0
2	SF - Chat Bhandar	154	50	4	70	30	0
3	SF - Chat Bhandar	100	50	3	60	40	0
4	SF - Chat Bhandar	101	70	5	70	20	10
5	SF - Chat Bhandar	153	80	0	60	30	10
6	SF - Chat Bhandar	203	40	2	20	60	20
7	SF - Chat Bhandar	151	40	0	70	30	0
8	SF - Chat Bhandar	130	50	3	95	5	0
9	SF - Chat Bhandar	107	40	0	10	90	0
10	MS- Chat Bhandar	607	7500	90	15	65	20
11	SF - Chinese fast food	101	40	6	60	35	5
12	SF- Chinese fast food	80	40	6	75	25	0
13	SF- Chinese fast food	102	50	10	60	40	0
14	SF- Chinese fast food	101	120	12	60	30	10
15	SF- Chinese fast food	70	80	3	60	40	0
16	MS- Chinese fast food	102	100	8	70	20	10
17	MS- Chinese fast food	293	4000	60	30	50	20
18	MS- Chinese fast food	257	2200	20	0	40	60
19	SF- Tea Stall	262	35	3	80	20	0
20	SF- Tea Stall	308	40	3	70	30	0
21	SF- Tea Stall	306	50	3	80	20	0
22	SF- Tea Stall	406	250	5	60	30	10
23	SF- Tea Stall	120	0	3	50	50	0
24	SF- Tea Stall	272	70	10	95	5	0
25	MS- Tea Stall	543	1900	15	30	65	5
26	MS- Tea Stall	786	310	15	85	13	2
27	SF- Tiffin centre	156	100	12	50	30	20
28	SF- Tiffin centre	100	0	0	60	35	5
29	SF- Tiffin centre	80	85	0	55	40	5
30	SF- Tiffin centre	614	500	35	35	60	5
31	SF- Tiffin centre	201	300	10	75	20	5
32	SF- Tiffin centre	320	120	8	80	15	5
33	SF- Tiffin centre	143	150	4	50	45	5
34	SF- Tiffin centre	86	100	8	60	35	5
35	SF- Tiffin/ Meals centre	57	0	4	90	10	0
36	SF- Tiffin/ Meals centre	73	0	3	95	5	0

37	MS- Tiffin centre	457	120	15	75	20	5
38	MS- Tiffin centre	153	400	22	30	60	10
39	MS- Tiffin centre	614	1200	30	80	18	2
40	MS- Tiffin centre	1178	12308	150	35	50	15

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