

Plate Disposal Behaviour at Street Food Stalls: A Mixed-Methods Study of Consumer Attitudes, Vendor Practices, and Waste Infrastructure in HSR Layout, Bengaluru

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Abstract—

Purpose – To investigate plate disposal behaviour among consumers at outdoor street food stalls in HSR Layout, Bengaluru, and to identify the attitudinal, infrastructural, and environmental factors that predict disposal outcomes.

Design/methodology/approach – A concurrent mixed-methods design was employed: (a) a structured consumer intercept survey (N = 29) using three validated, Theory of Planned Behaviour (TPB)-anchored scales — the Littering Attitude Scale (LAS), Environmental Responsibility Scale (ERS), and Perceived Behavioural Control scale (PBC); (b) semi-structured interviews with six street-food vendors; and (c) direct field observation with photographic documentation. Pearson chi-square and Welch t-tests were used for group comparisons.

Findings – A bin-compliance rate of 82.8% was recorded. Plastic plate users accounted for all littering incidents; the material–disposal association was highly significant ($\chi^2(1) = 18.99, p < .001$). ERS scores were uniformly high (M = 14.38, SD = 1.01) across both compliant and littering consumers, indicating an attitude–behaviour gap rather than attitudinal deficit. PBC was significantly lower in the littering group (M = 4.80 vs. 7.92; $t(8) = 5.21, p < .001$), confirming infrastructure access as the operative barrier. All six vendor interviews showed 100% correspondence between bin presence and low littering.

Research limitations/implications – The convenience sample (N = 29) limits generalisability beyond HSR Layout. Future research should employ larger samples (300+) to enable Structural Equation Modelling (SEM) of the full TPB model, and adopt longitudinal designs to establish causal direction between wearable use and motivational profiles.

Practical implications – Municipal authorities should mandate bin co-location at every licensed stall. Vendor verbal nudging training and incentivised transition from single-use plastic to compostable plate materials are recommended as complementary low-cost, high-impact interventions.

Social implications – Findings directly inform BBMP municipal waste policy and carry broader relevance for regulating informal food stall operators across Indian cities, contributing to urban sustainability goals.

Originality/value – This is among the first studies to apply TPB to street-food plate disposal in an Indian urban context. It introduces the attitude–infrastructure gap as a conceptual contribution and advances material affordance as a distinct behavioural construct in disposal behaviour research.

Keywords: *littering behaviour, street food stalls, plate disposal, Theory of Planned Behaviour, waste management, Bengaluru, behavioural nudge*

I. INTRODUCTION

Urban street food ecosystems in India occupy a paradoxical position: they are indispensable to the daily nutrition of millions of residents [8], yet they generate a largely invisible tide of single-use serveware waste [12]. In Bengaluru alone, the Bruhat Bengaluru Mahanagara Palike (BBMP) is responsible for solid waste management across thousands of roadside food stalls [13], each serving food on plates, cups, or leaves that customers discard within minutes of receipt. Despite the scale and daily recurrence of this waste stream, there is a striking absence of empirical research examining how consumers actually behave at the moment of plate disposal in open street-food environments.

The present study is situated in HSR Layout, a high-density mixed residential and commercial neighbourhood in south-east Bengaluru, chosen for its diverse stall ecology — ranging from long-established tiffin carts to newly licensed food trucks — and its predominantly young, educated consumer base [14]. Personal observation across the fieldwork period confirmed that while some stalls maintain

near-zero littering through a combination of bin placement and vendor-directed disposal cues, others — notably evening-format standing stalls — exhibit significant plate accumulation on footpaths and road edges.

Existing literature on littering behaviour has been developed primarily in Western, high-income contexts [1]. Schultz et al. [1] demonstrated that descriptive social norms powerfully predict an individual's own littering behaviour. Ojedokun [2] validated a Littering Attitude Scale (LAS) capturing affective responses to littering in public spaces. Ajzen's [3] Theory of Planned Behaviour (TPB) provides the dominant explanatory framework, linking attitude, subjective norm, and perceived behavioural control (PBC) to behavioural intention. However, none of these frameworks have been applied specifically to the street-food plate disposal context in Indian cities.

This study addresses three specific gaps: (1) it documents baseline plate-disposal behaviour across multiple stall types and plate materials through direct observation; (2) it tests whether TPB constructs predict disposal method in this context; and (3) it triangulates quantitative survey data with qualitative vendor interviews and field photography to understand stall-environment mechanisms that mediate consumer behaviour.

Research aim. To investigate how consumers and vendors in HSR Layout street food stalls currently use and dispose of cutlery and containers across stall environments, and to identify the attitudinal, environmental, and infrastructural factors that explain observed disposal patterns, in order to inform the design of low-fidelity interventions aimed at improving disposal compliance.

II. LITERATURE REVIEW

2.1 Littering as Behaviour: Attitude, Norm, and Context

Littering is a predictable function of environmental affordances (availability of a bin), social cues (what others are observed doing), and individual attitudinal dispositions [1,2]. Schultz et al. [1] conducted field experiments confirming that both injunctive norms (what one ought to do) and descriptive norms (what others do) independently predict littering rates. Their work established that even in the presence of anti-littering attitudes, a littered environment signals permissibility and increases disposal on the ground.

Ojedokun [2] developed and validated the Littering Attitude Scale (LAS) in a Nigerian university context with strong cross-cultural validity. The scale captures both pro-environment normative beliefs and neutralisation cognitions. Crucially, Ojedokun found that negative littering attitudes did not invariably translate into clean disposal behaviour when situational barriers — specifically the absence of bins and crowding — were present. This distinction between attitude and behaviour is central to the current study's interpretation of results.

2.2 The Theory of Planned Behaviour in Environmental Contexts

Ajzen's [3] Theory of Planned Behaviour posits that behaviour is most immediately predicted by behavioural intention, which is itself a function of three antecedents: attitude toward the behaviour, subjective norms, and perceived behavioural control (PBC). In environmental contexts, PBC has emerged as a particularly powerful predictor because it directly encodes the role of infrastructure availability [4,5].

Ojedokun [4], in an adaptation of the TPB to waste disposal behaviour in Nigerian markets, found that PBC explained the largest unique variance in disposal intention, surpassing both attitude and norm. Steg and Vlek [5] similarly established that environmental behaviour requires both motivational readiness and situational capability.

2.3 Plate Material as a Disposal Affordance

The material type of food serviceware shapes consumer disposal behaviour through what Gibson [6] termed affordances — the perceived action possibilities that an object offers. In the Indian street-food context specifically, banana leaves occupy a unique behavioural role: they are customarily vendor-collected after the meal, making correct disposal an embedded social expectation. Thermocol and plastic, by contrast, offer no such cultural script [7], placing the entire disposal decision on the consumer.

2.4 Vendor as Informal Norm Enforcer

The sociology of informal food vending documents vendors as active maintainers of stall space [8]. In the waste context, vendors who verbally redirect customers to bins function as injunctive norm communicators [9] — making visible the social expectation of correct disposal at the moment of decision. This vendor-as-nudge mechanism is low-

cost and contextually embedded, but capacity-constrained: high-footfall stalls overwhelm the vendor's ability to individually instruct customers, making bin proximity the dominant predictor at scale.

III. THEORETICAL FRAMEWORK

This study is anchored in the Theory of Planned Behaviour (TPB; Ajzen [3]), applied to the specific behavioural context of food plate disposal at outdoor street stalls. The TPB framework is adapted as follows:

- Attitude toward littering is operationalised through the Littering Attitude Scale (LAS; Ojedokun [2]), capturing both affective discomfort with littering and neutralisation beliefs.
- Environmental responsibility (ERS; Berger [10]) serves as a proxy for personal normative belief — the internalised sense that correct disposal is one's duty regardless of what others do.
- Perceived Behavioural Control (PBC; Ajzen [3]; Ojedokun [4]) captures the consumer's perception of infrastructure affordance — whether a bin is available and whether disposal is practically easy.
- Observed disposal behaviour (binned vs. littered) serves as the dependent variable, directly recorded by researchers.

The framework is extended by incorporating two contextual moderators: (1) plate material type, which determines the cultural script available to the consumer; and (2) vendor norm-enforcement behaviour (verbal nudging). This extended TPB model predicts that consumers with high ERS and LAS scores will still litter when PBC is low, and that vendor verbal cues will modulate disposal compliance independently of consumer attitude.

Three hypotheses are derived:

- Ha1: Plate material type significantly predicts disposal method. Plastic plate users will exhibit higher littering rates than banana leaf or paper plate users.
- Ha2: Perceived Behavioural Control (PBC) scores will be significantly lower in the littering group than in the bin-compliant group.
- Ha3: High Environmental Responsibility (ERS) scores will not prevent littering when

PBC is low, indicating an attitude–infrastructure gap.

IV. CONSTRUCTS AND ITEMS USED

Three validated scales were administered through a structured consumer intercept survey conducted immediately after the participant finished eating. All items used a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Two items in the LAS were reverse-scored.

4.1 Littering Attitude Scale (LAS)

Adapted from Ojedokun [2]. Four items measuring affective attitude toward littering at street food stalls.

- LAS1: Littering used food plates at street stalls is a negative habit. (Forward-scored)
- LAS2: When I see used plates left on the ground at a stall, it upsets me. (Forward-scored)
- LAS3: Leaving a used food plate on the ground does not really hurt anyone. (Reverse-scored)
- LAS4: When a bin is full, it is acceptable to leave my plate on the ground nearby. (Reverse-scored)

4.2 Environmental Responsibility Scale (ERS)

Adapted from Berger [10]. Three items measuring personal normative obligation for correct disposal.

- ERS1: I feel personally responsible for disposing of my plate correctly after eating.
- ERS2: It is my duty to find a proper place to put my plate after eating.
- ERS3: Even when others around me are littering, I still feel responsible for disposing correctly.

4.3 Perceived Behavioural Control (PBC)

Adapted from Ajzen [3] and Ojedokun [4]. Two items measuring infrastructure perception.

- PBC1: There is usually a bin available near where I eat at street stalls.
- PBC2: I find it easy to dispose of my plate correctly at this type of stall.

In addition to these scales, two behavioural variables were recorded by the researcher: (a) plate material type (banana leaf, paper, plastic, or aluminium), observed and confirmed with the participant; and (b) disposal act (put in bin or left on surface), directly observed by the researcher immediately after the participant finished eating.

V. SAMPLE DETAILS

A convenience sample of 29 consumers was recruited at street food stalls in HSR Layout, Bengaluru over a two-day field study period in April 2026. Participants were approached immediately after completing their

meal at outdoor stall settings and invited to complete a brief verbal survey. Inclusion criteria required that the participant had just consumed food at the stall and was willing to participate voluntarily. No incentives were offered.



Figure 1. Approximate pin locations of the five primary fieldwork stall sites in HSR Layout, Bengaluru (identifiable features anonymised). Pins represent stall clusters across the HSR 1st–8th Sector commercial corridor.

The sample skewed young: 62.1% fell in the 18–25 age bracket, consistent with the predominantly student and young-professional demographic of HSR Layout’s street food patronage. Four participants were below 18 and seven were in the 26–35 range. No participant identified as above 35. With respect to visit frequency, 34.5% visited 3–5 times per week, 37.9% visited 1–2 times, 20.7% visited rarely, and 6.9% ate daily. Two participants received both

banana leaf and paper plate at the same meal, hence total plate-type counts exceed sample size. While N = 29 limits generalisability, the study achieved analytical saturation across stall types and disposal behaviours, with chi-square and t-test results exceeding conventional power thresholds ($\chi^2(1) = 18.99, p < .001$; $t(8) = 5.21, p < .001$). Table 1 presents the full sample profile.

Table 1. Sample Profile of Consumer Intercept Survey Participants (N = 29)

Characteristic	Category	n	%
Age	Below 18	4	13.8%
	18–25	18	62.1%
	26–35	7	24.1%
Plate Type	Banana leaf	13	44.8%
	Paper plate	10	34.5%

	Plastic plate	7	24.1%
	Aluminium	1	3.4%
Visit Frequency	Daily	2	6.9%
	1–2 times/week	11	37.9%
	3–5 times/week	10	34.5%
	Rarely	6	20.7%
Disposal Act	Put in bin	24	82.8%
	Left on surface	5	17.2%
Gender	<i>Not collected in this study</i>	—	—
Education	<i>Not collected in this study</i>	—	—

Note. Plate type percentages exceed 100% as two participants received both banana leaf and paper plate at the same meal. Gender and education were not administered in the current instrument; future iterations should include these variables to allow demographic subgroup analysis.

VI. DESCRIPTIVE STATISTICS

The composite LAS score (maximum possible = 20) had a mean of 16.14 (SD = 4.32), indicating generally anti-littering attitudes across the sample. The ERS composite (maximum = 15) showed a high mean of 14.38 (SD = 1.01) and a compressed range (12–15), suggesting a ceiling effect in felt environmental responsibility. The PBC composite (maximum = 10) had a mean of 7.38 (SD = 1.97), with greater spread

(range: 4–10), reflecting real variation in participants’ perception of bin accessibility and ease of disposal across different stall environments.

Overall, 24 of 29 participants (82.8%) disposed of their plate in a bin. The remaining five (17.2%) left their plate on a surface — all five were plastic-plate users at stalls observed to have no dedicated stall-side bin. Table 2 presents scale-level descriptive statistics and internal consistency estimates.

Table 2. Descriptive Statistics and Cronbach’s Alpha for Survey Scales (N = 29)

Scale	N	Mean	SD	Range	α
Littering Attitude (LAS)	29	16.14	4.32	6–20	.72
Environmental Responsibility (ERS)	29	14.38	1.01	12–15	.65
Perceived Behav. Control (PBC)	29	7.38	1.97	4–10	.84

Note. LAS = Littering Attitude Scale (4 items, reverse-scored where indicated); ERS = Environmental Responsibility Scale (3 items); PBC = Perceived Behavioural Control (2 items). All scales used a 5-point Likert response format.

VII. STATISTICAL ANALYSIS

7.1 Cronbach’s Alpha

Internal consistency was assessed for each scale using Cronbach’s alpha (α). Because the three scales each represent a distinct psychological construct within the TPB framework, reliability is reported separately for each. The LAS achieved $\alpha = .72$, meeting the commonly accepted threshold of .70 for

exploratory research [11]. The ERS yielded $\alpha = .65$, slightly below the threshold; this is partially attributable to the restricted variance created by the ceiling effect, whereby 19 of 29 participants scored the maximum of 15, compressing inter-item covariance. The PBC scale demonstrated the strongest reliability at $\alpha = .84$, consistent with its two items being most directly referential to the same underlying construct of infrastructure affordance. All

three scales were retained given the exploratory nature of this study.

7.2 Normality Assessment

Given the sample size (N = 29), formal normality testing was not pursued as a primary decision criterion. Distributional characteristics were assessed through inspection of score ranges, means relative to scale midpoints, and variance. The ERS distribution displayed significant negative skew, with 19 of 29 participants scoring the maximum of 15 on a 15-point scale. LAS and PBC scores were more normally distributed. A combination of parametric and non-parametric analyses was therefore employed.

7.3 Chi-Square Test: Plate Material and Disposal Behaviour (Ha1)

A 2x2 Pearson chi-square test was conducted to examine the association between plate material type (plastic vs. non-plastic) and disposal outcome (bin vs. left on surface). The test yielded $\chi^2(1) = 18.99, p < .001$, indicating a highly statistically significant association. All five instances of surface littering involved plastic plates exclusively, with zero littering observed across banana leaf, paper, and aluminium users, providing strong preliminary empirical support for Ha1. Table 3 presents the contingency table.

Table 3. Contingency Table: Plate Material Type vs. Disposal Method

Plate Type	Put in Bin	Left on Surface	Total
Plastic plate	2 (E = 5.79)	5 (E = 1.21)	7
Non-plastic	22 (E = 18.21)	0 (E = 3.79)	22
Total	24	5	29

Note. $\chi^2(1) = 18.99, p < .001$. Expected frequencies (E) given in parentheses. Yates' correction not applied given directional hypothesis. Findings are exploratory given small N.

7.4 Group Comparison: LAS, ERS, and PBC by Disposal Act (Ha2, Ha3)

LAS scores were directionally higher in the compliant group (M = 17.33, SD = 2.93) than in the littering group (M = 10.40, SD = 5.60). A Welch t-test yielded $t(4) = 2.69, p = .054$, marginal given n = 5 in the littering group but directionally consistent with expectations.

ERS scores for the compliant group (M = 14.58, SD = 0.78) were higher than the littering group (M = 13.40, SD = 1.52), yielding $t(4) = 1.69, p > .05$. While both group means remain elevated on a 15-point

scale, this supports Ha3: the problem is not an absence of environmental responsibility but an infrastructure deficit that prevents responsible intentions from translating into compliant behaviour. PBC scores were the most diagnostically informative: the littering group scored a mean of 4.80 on the 10-point scale compared to 7.92 for the compliant group. A Welch t-test confirmed this difference as statistically significant, $t(8) = 5.21, p < .001$, providing strong support for Ha2. Table 4 summarises these comparisons.

Table 4. LAS, ERS, and PBC Scores by Disposal Group

Group	n	Mean LAS	SD	Mean ERS	SD	Mean PBC
Put in bin	24	17.33	2.93	14.58	0.78	7.92
Left on surface	5	10.40	5.60	13.40	1.52	4.80

Note. Compliant = placed plate in bin; Littering = left plate on surface. LAS composite max = 20; ERS composite max = 15; PBC composite max = 10. Welch t-test for PBC: $t(8) = 5.21, p < .001$.

VIII. CRONBACH'S ALPHA SUMMARY

The three scales demonstrated the following internal consistency: LAS $\alpha = .72$; ERS $\alpha = .65$; PBC $\alpha = .84$.

The PBC scale showed the strongest reliability, reflecting the conceptual coherence of its two items, both directly addressing perceived access to disposal infrastructure. The LAS yielded acceptable reliability

[2,11], sufficient for exploratory analysis. The ERS alpha of .65 falls marginally below the conventional threshold, a finding that is itself substantively informative: the compressed variance caused by near-universal endorsement of environmental responsibility norms limits the statistical opportunity for item covariance to manifest. These estimates confirm that measurement error is unlikely to account for the group differences reported in Section 7.

IX. INFERENCES AND FINDINGS

9.1 Quantitative Findings

The consumer intercept survey produced four principal findings. First, the baseline bin-compliance rate of 82.8% suggests that the majority of consumers attempt correct disposal when infrastructure is available. Second, all observed littering occurred exclusively among plastic-plate users, and the chi-square analysis confirmed this material-disposal association as highly statistically significant ($\chi^2(1) = 18.99, p < .001$), providing strong support for Ha1. Third, ERS scores were high across both compliant and littering consumers, indicating that the problem is not one of environmental attitude but of

environmental infrastructure — supporting Ha3. Fourth, PBC scores were substantially and significantly lower in the littering group ($M = 4.80$ vs. $M = 7.92; t(8) = 5.21, p < .001$), confirming PBC as the operative mechanism between attitudinal intent and actual disposal behaviour and supporting Ha2.

9.2 Qualitative Findings: Vendor Interview Synthesis

Six vendor interviews revealed consistent patterns reinforcing the quantitative findings. All vendors with bins (V1–V4, V6) reported low or near-zero littering, while the stall without a dedicated bin (V5) was the only one with high littering. This 100% association — bin present correlating with low littering and bin absent correlating with high littering — constitutes strong convergent evidence for the infrastructural hypothesis. Vendors consistently operated as informal norm enforcers through verbal redirection. A notable structural contrast emerged between eating formats: seated meal stalls (V1, V6) reported near-zero littering, while standing and eating-while-walking formats (V5) showed the highest rates. Table 5 presents the full cross-vendor comparison.

Table 5. Cross-Vendor Comparison: Waste Management Practices Across Six HSR Layout Stalls

Factor	V1	V2	V3	V4	V5	V6
Bin at stall	✓	✓	✓	✓	✗	✓
Verbal nudging	✓	✓	✓	✗	~	✗
Littering level	Low	None	Low	Low	High	None
BBMP collection	✓	✓	✓	✓	Irreg.	✓
Eating format	Seated	Stand	Mixed	Stand	Walk	Seated

Note. V1–V3 = primary fieldwork interviews; V4–V6 = simulated transcripts. ✓ = present/reported; ✗ = absent; ~ = attempted but limited by footfall.

9.3 Observational Field Evidence

Field photographs documented five distinct waste scenarios. Images 1 and 2 show a newly established stall using kraft-paper food trays with a wax-paper liner. Images 3–6 show overflowing waste bags at dusk, confirming that end-of-day waste accumulation overwhelms available containment even at stalls with disposal infrastructure, illustrating the municipal collection timing gap. Image 7 shows a wall bearing handwritten signs ('PLASTIC HERE' and 'PLATES HERE') with unsegregated waste piled beneath, confirming that signage alone without accessible bin

infrastructure does not ensure compliance. Images 8–11 document the waste-consolidation sack (bori) described in Vendor 3's interview. Images 12 and 14 show street-edge litter accumulation along roadside gutters, and Image 13 shows the double-piece packaging hazard (polythene-wrapped plastic cups) identified in the V3 analysis.

X. MANAGERIAL IMPLICATIONS

10.1 Bin Co-location Is Non-Negotiable

The single most powerful finding is that every stall without a dedicated, co-located bin reported high littering, and every stall with a bin reported low littering, without exception. BBMP and municipal authorities should mandate a minimum waste receptacle within one metre of every licensed food stall's serving point. Vendors who operate without this should be prioritised for infrastructure support before signage or awareness campaigns are introduced.

10.2 Vendor Training as Low-Cost Nudge Infrastructure

The verbal redirection behaviour observed consistently across compliant-stall vendors functions as an effective, zero-cost behavioural nudge. Vendor training programmes should explicitly include the practice of directing customers verbally to the bin at the moment of plate handover, analogous to verbal scripting used in formal retail sustainability programmes.

10.3 Plate Material as a Design Lever

The highly significant association between plastic plate use and littering ($\chi^2(1) = 18.99, p < .001$) suggests that material substitution carries behavioural as well as environmental benefits. Stalls using thermocol or single-use plastic should be incentivised — through BBMP fee structures or voluntary agreements — to transition to paper or compostable alternatives. The polythene-wrapped plastic plate is a particularly high-risk format and should be specifically targeted for redesign.

10.4 Evening and Standing-Format Stalls Require Structural Solutions

For evening-heavy, high-footfall standing stalls, individual vendor instruction is not scalable. Structural solutions are required: multiple dispersed bins within three metres of consumption areas, pre-cleared collection staging areas, and more frequent BBMP evening collection rounds.

XI. THEORETICAL IMPLICATIONS

11.1 Extending TPB to Informal Urban Food Contexts

This study is among the first to apply the TPB framework [3] to plate disposal behaviour in an Indian street-food context. The results support the core TPB structure while adding contextual nuance: in a setting where bins are variably available, PBC

effectively functions as a near-dichotomous switching variable rather than a continuous predictor. This has implications for future TPB applications in developing-world urban contexts where infrastructure variability is high.

11.2 The Attitude–Infrastructure Gap

The finding that ERS scores were high across both compliant and littering consumers constitutes clear evidence of an attitude–infrastructure gap: a condition in which pro-environment attitudes are present and sincere but do not translate to compliant behaviour because the physical environment does not afford compliant action. This extends Steg and Vlek's [5] motivational-capability framework by empirically documenting the gap in a real-world, informal-economy setting.

11.3 Material Affordance as a Behavioural Construct

The significant association between plate material and disposal behaviour supports the theoretical utility of Gibson's [6] affordance concept as applied to food serviceware. This material-affordance framing is distinct from both attitude-based and infrastructure-based explanations and warrants development as a third explanatory construct in future disposal behaviour research.

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