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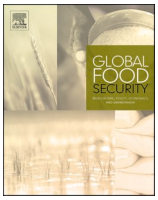

Unintended consequences of a financial incentive scheme for fruit and vegetable purchasing in an unorganised retail setting in rural India

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ABSTRACT

Consumption of fruits and vegetables in rural India is among the lowest in the world. We assessed how a financial incentive scheme influenced purchasing of fruits and vegetables in an unorganised retail setting in rural India and explored any unintended consequences. We used a mixed-methods approach, triangulating between in-depth interviews with community members, vendors, local leaders, and intervention implementors (N = 21) and fruit and vegetable purchasing surveys (N = 1109), vendor sales surveys (N = 36), and routine coupon use data. The intervention led households to use their own budgets to buy fruits and vegetables and receive the cashback. This was used to buy more fruits and vegetables (45 % and 77 % of intervention participants, respectively). Changes in purchasing behaviours unexpectedly increased farmer-to-consumer sales in the village markets. This increased the variety of fruit and vegetables purchased locally (baseline-adjusted mean difference of 2.2 items in intervention versus control villages (95 % CI: −0.7 to 5.1)) but may have negatively impacted the sales of existing vendors (baseline-adjusted mean difference of −150₹ in intervention versus control villages (95 % CI: −296 to −0.1). Financial incentive schemes have the potential to change the food environment in unorganised retail settings, which could have major consequences for diets.

1. Background

Although rural India produces over 10 % of the global stock of fruits and vegetables, local consumption is among the lowest in the world (Food and Agriculture Organization of the United Nations, 2025; Jayawardena et al., 2020). India's dietary guidelines recommend minimum daily consumption of 500g of fruits and vegetables, preferably consisting of a variety of fresh, locally available, and seasonal items (ICMR-National Institute of Nutrition, 2024). People in rural India are estimated to consume 130g of fruits and vegetables per day, with relatively little variety (Mathur et al., 2021; Minocha et al., 2018).

Food procurement and consumption is shaped by the food environment. This includes external factors like price, availability, and vendor and product characteristics (e.g., quality), and personal factors like purchasing power, accessibility, and preferences (Turner et al., 2018). While people in rural India are aware of the health benefits of fruits and vegetables, high and volatile prices (compared to less nutrient rich foods such as staple carbohydrates) and limited availability due to seasonal variation act as barriers to consumption (Choudhury et al., 2020; Kehoe et al., 2019; Surendran et al., 2020). While price is the major consideration, fruit and vegetable consumption is also influenced by preferences for fresh, high quality, and locally sourced produce (Turner et al.,

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2022).

Financial incentives can improve dietary behaviours (Afshin et al., 2017; Huangfu et al., 2024). However, financial incentives also have the potential to worsen health-related behaviours, for example if they reduce intrinsic motivation, lead to feelings of coercion or suspicion around the target behaviour, or if savings are used to purchase unhealthy items (Schneider et al., 2023; Vlaev et al., 2019).

Though much of the global population purchase groceries from unorganised retailers (Deloitte, 2021; Food and Agriculture Organization of the United Nations, 2017), most financial incentive interventions have been tested in organised retail settings in high-income countries (e.g., supermarkets)(Afshin et al., 2017; Huangfu et al., 2024; Sturm et al., 2013). In 2021, we undertook a randomised controlled trial to examine whether a financial incentive could increase the purchase of fruits and vegetables in rural Telangana, India (Kinra et al., 2023). With the caveat that the trial was likely underpowered, the weekly household purchase of fruits and vegetables was ~28 % higher for intervention versus control villages following the intervention. This corresponds to ~1.5 portions of fruit and vegetables per person per day.

To our knowledge, this was the first randomised controlled trial of a financial incentive in an unorganised retail setting (Kinra et al., 2023). While trials can test whether an intervention is effective, they do not (traditionally) show how the effect occurs (Moore et al., 2015; Skivington et al., 2021). Complex interventions can also have far-reaching, difficult to anticipate effects outside of the predefined study outcomes (Moore et al., 2015; Skivington et al., 2021). In this study, we assessed how the financial incentive scheme influenced purchasing of fruits and vegetables in an unorganised retail setting in rural India and explored any unintended consequences.

2. Methods

2.1. Study setting

The randomised controlled trial was conducted at the site of the Andhra Pradesh Children and Parents' Study (APCAPS) cohort in 29 villages of Ranga Reddy district, Telangana, that lie 25–50 km from the state capital, Hyderabad (Kinra et al., 2014, 2023). The intervention was implemented in three villages, with three villages as controls, and ran for three months (February–April 2021). During this period, a market was held twice daily (morning and evening) in each trial village where fruits and vegetables were sold by a range of unorganised vendors (e.g., local farmers, non-farmers, and mobile vendors (e.g., using automated rickshaws)) (see Additional Files for images of the village markets). Formative research showed that villagers acquired fruits and vegetables from both the village and larger markets in nearby towns/Hyderabad, or through non-purchase sources (e.g., own produce)(Surendran et al., 2020; Turner et al., 2022). The larger markets were perceived to have cheaper, better quality, and more varied produce.

2.2. Overview of the financial incentive scheme

The intervention consisted of a coupon system whereby households received a cashback reward of 50 Indian Rupees (₹) if they purchased at least 250₹ of fruits and vegetables over a one-week period in their local evening market (see Additional Files for images of the coupon booklet). The research team distributed the paper coupon booklet to households in the intervention village. Each coupon contained space for 25 stamps of 10₹ value and was only valid for one calendar week. During the evening market, participating shoppers brought their fruit and vegetable purchases to a locally recruited stamper stationed within the market, who stamped the coupon for every 10₹ value purchase made. Only purchases from vendors within the evening market were eligible for stamping. A member of the research team provided the 50₹ cashback to households reaching the target on a weekly basis. The three control villages received no intervention. All households in the intervention villages were eligible to participate in the intervention. Effectiveness of the financial incentive scheme was assessed through a cluster randomised controlled trial design, results of which have been published elsewhere (Kinra et al., 2023).

2.3. Hypothesised mechanisms

The COM-B Model for Behaviour Change proposes that capability (C), opportunity (O), and motivation (M) are essential conditions for behaviour (B)(Michie et al., 2011). The intervention primarily targeted 'motivation' and 'opportunity' to increase fruit and vegetable purchasing through (i) incentivising households (that typically spent less than 250₹ per week) to spend more on fruits and vegetables to receive the 50₹ cashback (M) and/or (ii) improving the affordability of fruits and vegetables by increasing household purchasing power (assuming the cashback would be used to purchase more fruits and vegetables (O)). It was assumed that community members already had the skills (i.e., capability (C)) to purchase fruits and vegetables, as this was common practice prior to the intervention.

2.4. Study design

Our study is guided by the Medical Research Council (MRC) framework for process evaluations of complex interventions (Moore et al., 2015; Skivington et al., 2021). We focus on the 'mechanisms of impact' component to understand how the intervention brought about change in the local community. We assessed whether the intervention acted through the aforementioned hypothesised mechanisms ('mediators'), whether it acted through any non-hypothesised mechanisms ('unexpected pathways and consequences'), and how the intended audience interacted with the intervention ('participant responses')(Moore et al., 2015; Skivington et al., 2021).

We used a sequential mixed-methods design. We used a deductive approach to assess whether the intervention acted through the hypothesised mechanisms, testing the predefined hypotheses with the quantitative data and adding context with the qualitative data. We used a largely inductive approach to explore the unintended consequences and participant responses to the intervention, first analysing the qualitative data and then quantifying/testing any hypotheses generated using the quantitative data. We analysed data collected for the process evaluation comprising: (a) semi-structured interviews, (b) vendor sales survey, and (c) villagers' end-line survey, as well as data collected for the original trial: (d) fruit and vegetable purchasing surveys and (e) routine coupon use data (Table 1).

2.4.1. Semi-structured interviews

Semi-structured interviews were undertaken with purposively sampled residents of the intervention villages, vendors, local leaders, and coupon stampers. 'Local leaders' included anganwadi workers, who provide basic healthcare and nutritional education for mothers, and elected heads of local governing bodies. We aimed for maximum variation of interviewees in terms of community members' use of the intervention (based on routine coupon usage data), vendor type, and village. Topic guides were developed for each group based on the MRC framework and the research team's observations during implementation. These were piloted in the villages and refined (see Additional Files for instruments). Interviews were conducted in Telugu by an experienced qualitative interviewer, audio-recorded with the consent of the subjects, and transcribed and translated into English by native Telugu speakers.

2.4.2. Vendor sales survey

Vendors selling fruits and vegetables in intervention and control villages (N = 36) were surveyed four times across the 12-week period (baseline, mid-line (twice), and end-line) to capture weekly sales information. These vendors largely purchased fruits and vegetables from

Table 1
Overview of data sources.

Data collection method	Trial arm	Time period[a]	Participant	Sample size
Data collected for the process evaluation				
Semi-structured interviews	Intervention	Month 3 of intervention to 2-6-weeks after intervention period	Community members (using coupon: never, sometimes but never completing, sometimes completing, always completing)[b]	N = 12
			Vendors (non-farmers, farmers usually selling in local market, farmers that began selling in market during the intervention)	N = 11
			Local leaders (anganwadi workers, elected local officials)	N = 5
			Stampers	N = 3
Vendor sales survey	Intervention and control	~4 weeks preceding, once per months 1–3	Vendor consistently selling fruits and vegetables in the village market at baseline	N = 36
End-line survey	Intervention	2-6-weeks after intervention period	Main household member doing shopping (fruit and vegetable purchasing survey respondent)	N = 555
Data collected for the randomised control trial				
Weekly fruit and vegetable purchasing survey	Intervention and control	~4 weeks preceding and 2-6-weeks after intervention period	Main household member doing shopping, reporting for household	N = 1109 households [c]
Routine coupon use data	Intervention	Months 1–3	n/a	Maximum N = 1719 households [d]

[a] Intervention implemented for three calendar months (February–April 2021).
[b] Coupon usage estimated from routine coupon use data with linked household identifiers.
[c] N = 1140 households surveyed, N = 1109 with baseline and end-line data.
[d] N = 1719 households in intervention villages (all eligible to participate in the intervention) as estimated from survey of all households in 29 APCAPS villages conducted in 2012-14 (Oakley et al., 2017).

farmers or larger markets to sell on, rather than growing their own produce. Vendors were called by phone on alternate days over a week (4 times in 7 days) and asked to report the quantity (kg/pieces) and price of fruits and vegetables purchased and sold the previous day(s) within and outside the village, and quantity spoilt/remaining (see Additional Files for instruments). All vendors consistently selling fruits and vegetables in the villages at baseline participated in the survey. Local fruit and vegetable farmers who occasionally sold their produce in the market and/or vendors who began selling in the market after baseline were excluded due to logistical issues (see limitations).

2.4.3. Fruit and vegetable purchasing survey/end-line survey

Surveys were conducted at baseline and end-line to examine the intervention's effect on fruit and vegetable purchasing with a randomly selected subsample of intervention and control households (N = 1109 households with complete base and end-line data). The main individual doing the household shopping was called by phone on alternate days over a week (4 times in 7 days) and asked to report the fruits and vegetables purchased or otherwise acquired (e.g., gifted) the previous day (s) (item, quantity (kg), amount (₹), and source) (see Additional Files for instruments). The final (end-line) survey in the intervention village (N = 555) was supplemented with questions on use of the cashback and views on the intervention (see Additional Files for instruments).

2.4.4. Routine coupon data

One coupon booklet per household was distributed in the intervention villages, each with a unique household identifier. The stamper recorded the total purchase amount (₹) for every fruit and vegetable purchase brought for stamping.

2.5. Ethics

Written consent to participate was provided by all survey and interview participants. Ethical approval was provided by the ethics boards of the Indian School of Business, India (ISB-IRB, 2019–05) and the London School of Hygiene and Tropical Medicine (15688/RR/16295), United Kingdom.

3. Analysis

3.1. Quantitative

Quantitative analyses included descriptive statistics and linear regression (Table 2, detailed description of multilevel regression models available elsewhere (Kinra et al., 2023)). We present the results of the end-line survey analysis by household socioeconomic position at baseline (SEP). We calculated this as tertiles of a modified version of the Standard of Living Index, a household asset index commonly used in India (NFHS, 2020)). When analyses have already been conducted as part of primary outcome analysis, we present the relevant result and cite (Kinra et al., 2023).

3.2. Qualitative

We used a descriptive approach for the qualitative analysis. This aims to describe participants' experiences with relatively minimal interpretation and in a language similar to their own, which is suited for applied health research (Neergaard et al., 2009; Sandelowski, 2000). The analysis was both deductive (broad, higher-level categories guided by the MRC framework) and inductive (lower-level codes guided by content of the transcripts). The qualitative analysis was conducted jointly by co-authors JL and SP and followed a three-step process: (1) developing a coding framework of higher-level categories, (2) segmenting the data into the framework's categories, and (3) sub-coding of each category to explore variation and develop inductive codes (Additional Files for final coding framework). We present anonymised quotes to support our statements (P – participant, I – interviewer).

4. Results

4.1. Characteristics of participants

Sociodemographic characteristics of households participating in the fruit and vegetable purchasing surveys are typical of rural and peri-urban populations in India (Table 3)(Kinra et al., 2023; NFHS, 2020). Characteristics of the N = 36 vendors who participated in the sales survey are described in Additional Files. We undertook semi-structured interviews with N = 12 intervention village residents (N = 4 per intervention village, N = 3 never used/sometimes used but never completed/sometimes used and completed/always completed the coupon, respectively). We undertook interviews with N = 11 vendors (N = 4 farmers always selling in the intervention villages, N = 2 farmers who started selling in the intervention villages during the trial, and N = 5 non-farmers). We also interviewed the coupon stamper in each intervention village (N = 3 total), N = 2 anganwadi workers, and N = 3 elected local officials.

Table 2
Overview of quantitative analyses by process evaluation component.

Process evaluation component	Data source	Analytical method	Outcome
Mediators	End-line survey	Descriptive statistics	Share (%) of intervention households self-reporting using cashback to purchase more fruits and vegetables, by SEP.
	Fruit and vegetable purchasing surveys	Multilevel linear regression	Baseline adjusted mean difference in household weekly FV purchased from all retailers (₹) between intervention and control villages.
Unexpected pathways/ consequences	Fruit and vegetable purchasing surveys	Multilevel linear regression	Baseline adjusted mean difference in household weekly FV purchased from (a) local retailers and (b) all retailers (kg) between intervention and control villages.
		Multilevel linear regression	Baseline adjusted mean difference in household variety (number of different items) of fruits and vegetables purchased from local retailers between intervention and control villages.
	Coupon usage	Univariate linear regression	Weekly frequency of coupon use in the intervention villages, between weeks 1 and 12.
	Vendor survey	Multilevel linear regression	Baseline adjusted mean difference in vendor weekly FV sales (quantity (kg) and amount (₹)), between intervention and control villages.
		Descriptive statistics	Average (mean) vendor FV sales (quantity (kg) and amount (₹)), by survey round and village.
Participant responses to intervention	End-line survey	Descriptive statistics	Share (%) of intervention households' self-reported (a) frequency using coupon to purchase fruits and vegetables, and (b) reason for never/seldom/sometimes using coupon to purchase fruits and vegetables, (c) preference for intervention to be continued, by SEP.

FV – fruits and vegetables. SEP – socioeconomic position.

Table 3
Baseline characteristics of households participating in fruit and vegetable purchasing and end-line surveys (N = 1109).

Characteristic		Mean (SD) (unless otherwise stated)	
		Intervention[a]	Control
Number of household members		4.6 (1.7)	4.4 (1.6)
Proportion of household members <18 years old		0.27 (0.22)	0.27 (0.22)
Household dependency ratio (ratio total n members: n economically active members)		2.9 (2.1)	2.8 (1.9)
Highest education level in household, n (%)	None	56 (10.1 %)	44 (7.9 %)
	Secondary (up to 12 years schooling)	286 (51.5 %)	320 (57.8 %)
	Higher	213 (38.4 %)	190 (34.3 %)
Household food insecurity, n (%)	Not insecure	449 (80.9 %)	395 (71.3 %)
	Mild	55 (9.9 %)	75 (13.5 %)
	Moderate	40 (7.2 %)	79 (14.3 %)
	Severe	11 (2.0 %)	5 (0.9 %)
Household asset score[b]		−0.0 (1.7)	0.0 (1.6)
Household produces FV for selling, n (%)		72 (13.0 %)	61 (11.0 %)
Household produces FV for own consumption, n (%)		149 (26.9 %)	108 (19.5 %)
Quantity FV (kg) purchased per household per week from retailer anywhere		13.7 (6.4)	11.3 (6.2)
Quantity FV (kg) purchased per household per week from local retailers only		7.4 (4.7)	5.6 (3.5)
Quantity of FV (kg) obtained from other sources (e.g. grown, foraged) per household per week		0.57 (2.1)	0.11 (0.49)
Total, N (%)		555 (50 %)	554 (50 %)

[a] The end-line survey was completed by participants of the fruit and vegetable purchasing surveys (intervention villages).
[b] Derived from principal component analysis of common household assets, measured with the Standard of Living Index (NFHS, 2020)). This has been mean centered, so mean = 0. A higher score indicates higher wealth. FV – fruits and vegetables.

4.2. Hypothesised mediators

4.2.1. Mediator – increase purchase of fruits and vegetables to receive cashback

Results of the fruit and vegetable purchasing survey suggests that households spent their own money (in addition to the 50₹ cashback) to reach the weekly 250₹ target. The linear regression results showed a baseline-adjusted mean difference of 130₹ (95 % CI: −76 to 337) between intervention and control households for fruits and vegetables purchased from any retailer (Kinra et al., 2023).

The interviews show the cashback amount (50₹) was largely perceived as a helpful, but not significant, amount. Some interviewees felt they should have received the cashback when they were a few stamps off (but did not reach) the target. They may have been unaware of the need to spend more to reach the threshold or been unable to do so due to financial constraints. A few interviewees (of likely higher SEP) felt the reimbursement was not worth their time, and interviewees of varied socioeconomic backgrounds felt the intervention was more useful and appropriate for families of lower SEP. Suitability of the 250₹ target was deemed to vary by household size and structure. Some participants of larger households and/or households with children reported they already purchased 250₹-plus fruits and vegetables, so 50₹ was relatively inconsequential. Others felt that the target was too high for their household size and/or structure (i.e., if primarily composed of adults).

P: It is good only [financial incentive scheme] but if you increase the amount from 50₹ to 100₹ it will be much more good. (Elected local official).

P: Most of them [community] are buying. Those who are wealthy are also coming. People are saying 'they lack nothing, they have bundles of money, they are also coming [to get the cashback]!' … We are thinking 'it is only 50₹, let it go'. (Community member, sometimes completing coupon).

4.2.2. Mediator - purchase additional fruits and vegetables with cashback amount

77 % of end-line survey respondents stated that they used the cashback to purchase more vegetables and 45 % to buy more fruit (Table 4).

Qualitative interviewees also reported using the cashback to purchase more fruits and vegetables. This was likely driven by a unanimously positive view of fruits and vegetables, which were described as a way of "eating well" as well as an "inevitable" part of life (vegetables rather than fruit, which were perceived more as a treat, particularly for

Table 4
Attitudes towards financial incentive scheme in intervention villages (N = 555 end-line survey respondents).

End-line survey question	Share (%) of responses to end-line survey (95 % CI)				p-value
	Socioeconomic position (tertiles)				
	Lowest	Middle	Highest	Total	
Use coupon to buy vegetables					*0.58*
Never	*18.2 (13.3–24.4)*	*19.3 (14.2–25.6)*	*20.6 (15.3–27.1)*	*19.3 (16.2–22.8)*	
Seldom	*5.4 (2.9–9.7)*	*5.9 (3.3–10.3)*	*8.3 (5.1–13.4)*	*6.5 (4.7–8.9)*	
Sometimes	*11.8 (7.9–17.2)*	*11.2 (7.4–16.6)*	*13.3 (9.1–19.1)*	*12.1 (9.6–15.1)*	
Often	*7.0 (4.1–11.6)*	*11.8 (7.9–17.2)*	*10.5 (6.8–16.0)*	*9.8 (7.5–12.5)*	
Always	*57.8 (50.6–64.6)*	*51.9 (44.7–59.0)*	*47.2 (40.0–54.5)*	*52.3 (4.8–56.5)*	
Data missing	*0.0*	*0.0*	*0.6*	*0.2*	
Total, N (%)	*187 (100)*	*187 (100)*	*181 (100)*	*555 (100)*	
Main reason for non-use of coupon for vegetables[a]					*0.07*
Source elsewhere	*37.9 (27.0–50.1)*	*47.1 (35.5–59.0)*	*35.5 (25.6–47.0)*	*40.0 (33.6–46.8)*	
Forgot coupon	*1.52 (0.2–10.1)*	*5.9 (2.2–14.7)*	*9.2 (4.4–18.2)*	*13.8 (9.7–19.2)*	
Distance	*13.6 (7.2–24.3)*	*10.3 (5.0–20.1)*	*17.1 (10.2–27.3)*	*13.8 (9.7–19.2)*	
Coupon not received/unaware of scheme	*19.7 (11.8–31.1)*	*10.3 (5.0–20.1)*	*2.6 (0.7–10.0)*	*10.5 (7.0–15.4)*	
Did not want to carry coupon	*15.2 (8.3–26.0)*	*8.9 (4.0–18.4)*	*17.1 (10.2–27.3)*	*5.7 (3.3–9.8)*	
Total, N (%)[b]	*66 (87.9)*	*68 (82.4)*	*76 (81.5)*	*210 (83.8)*	
Use coupon to buy fruit					*0.03*
Never	*44.0 (27.0–51.3)*	*49.5 (42.3–56.6)*	*49.4 (42.1–56.8)*	*47.6 (43.5–51.8)*	
Seldom	*12.5 (8.4–18.1)*	*12.4 (8.5–18.0)*	*17.1 (12.2–23.4)*	*13.9 (11.3–17.1)*	
Sometimes	*12.0 (8.0–17.5)*	*12.4 (8.4–18.0)*	*13.6 (9.3–19.6)*	*12.6 (10.1–15.7)*	
Often	*13.0 (8.9–18.7)*	*16.7 (12.0–22.7)*	*13.6 (9.3–19.6)*	*14.5 (11.8–17.7)*	
Always	*18.5 (13.5–24.8)*	*9.1 (5.8–14.2)*	*6.3 (3.5–11.0)*	*11.3 (9.0–14.3)*	
Data missing	*1.6*	*0.5*	*2.8*	*1.6*	
Total, N (%)	*187 (100)*	*187 (100)*	*181 (100)*	*555 (100)*	
Main reason for non-use of coupon for fruit[a]					*0.09*
Fruit unavailable in local market	*32.5 (24.9–41.2)*	*37.7 (30.0–46.1)*	*29.1 (22.2–37.1)*	*33.1 (28.7–37.8)*	
Source elsewhere	*19.8 (13.8–27.8)*	*23.2 (16.9–31.0)*	*22.7 (16.5–30.3)*	*22.0 (18.2–26.3)*	
Distance	*10.3 (6.1–17.0)*	*4.4 (2.0–9.4)*	*11.4 (7.1–17.8)*	*8.6 (6.3–11.8)*	
Do not buy fruit	*7.1 (3.8–13.2)*	*4.4 (2.0–9.4)*	*7.8 (4.4–13.6)*	*6.4 (4.4–9.3)*	
Coupon not received/unaware of scheme	*9.5 (5.5–16.1)*	*6.5 (3.4–12.1)*	*2.1 (0.7–6.4)*	*5.9 (4.0–8.7)*	
Total, N (%)[b]	*126 (79.2)*	*138 (76.2)*	*141 (73.1)*	*405 (76.0)*	
Use of reimbursement amount					
Purchase more vegetables	*79.4 (72.7–84.8)*	*75.0 (68.1–80.8)*	*78.0 (71.2-83.)*	*77.4 (73.6–80.8)*	*0.14*
Purchase more fruit	*52.0 (44.3–59.2)*	*42 (35.2–49.6)*	*40 (33.4–48.0)*	*44.7 (40.5–49.0)*	*0.03*
Purchase other groceries	*18.8 (13.6–25.4)*	*15.6 (11.0–21.6)*	*23.7 (17.9–30.6)*	*19.3 (16.2–22.9)*	*0.05*
Data missing	*9.1*	*3.7*	*4.4*	*5.8*	
Total, N (%)	*187 (100)*	*187 (100)*	*181 (100)*	*555 (100)*	
Prefer scheme to continue in village					*0.72*
Yes	*91.4 (86.5–94.7)*	*90.4 (85.2–93.9)*	*89.4 (84.0–93.2)*	*90.4 (87.7–92.6)*	
No	*7.0 (4.1–11.6)*	*6.4 (3.7–11.0)*	*8.3 (5.1–13.4)*	*7.2 (5.3–9.7)*	
Not bothered	*1.6 (0.5–4.9)*	*3.2 (1.5–7.0)*	*2.2 (0.8–5.8)*	*2.3 (1.4–4.0)*	
Data missing	*0.0*	*0.0*	*0.6*	*0.2*	
Total, N (%)	*187 (100)*	*187 (100)*	*181 (100)*	*555 (100)*	

[a] Only reported by participants self-reporting using the coupon Never/Seldom/Sometimes for relevant item (vegetables or fruits).
[b] Only five most common reasons for non-use presented as questions were semi-qualitative (presented estimates do not sum to 100 %). Total N (for 100 % of respondents) presented.

children). There was limited variety of fruits available in the village market during the trial, which likely explains why the cashback was used less to purchase fruits.

P: Weekly on Tuesday they are giving us amount [research team provide weekly cashback] and vegetables also sold out more … it will be full rush at 5.00pm. (Vendor, farmer started selling during intervention).

P: Before [the intervention] … whoever don't have money they use to go and take less, some tomatoes like that and goes … Previously they made purchases based on money that they have, but now they are purchasing more. (Community member, using coupon but never completing).

4.3. Unintended consequences

The qualitative interviews highlighted four unintended consequences of the financial incentive scheme: changes to the village market, reduced vendor profits, intervention misuse, and spending on less healthy items.

4.3.1. Changes to the village market

Community members reported purchasing fruits and vegetables from the village market more frequently to get their coupon stamped. Before this, interviewees reported doing bulk purchases every few days from larger, outside markets, which reduced fruit and vegetable consumption between market visits. According to vendors and community members, increased business in the village market led local farmers (and other vendors) to sell their produce locally. This was believed to have increased the variety and quality of fruit and vegetables in the village.

P: When coupons were not there, some people used to go and bring vegetables sufficient for four days. If vegetables are finished, we'll think why to go to market, 'let us cook potato or something'. But when coupons were there, compulsorily every day we used to go. (Anganwadi worker).

I: How you felt about this scheme in village? P: Nice madam, giving amount, more and fresh vegetables, previously we use to go every Sunday to Kandukur Gate to buy different varieties of vegetables. Now we can find more vegetables here itself and vendors are bringing all vegetables to sell so most of them are buying here. (Community member, completing coupon often).

These trends were confirmed by the quantitative data. Results of the fruit and vegetable purchasing survey showed a greater difference in fruit and vegetables purchased in the village market (baseline-adjusted mean difference in intervention versus control villages of 5.9 kg (95 % CI: 2.6–9.1) than purchased from any retailer (4 kg (95 % CI: −6.4 to +14.4)). After the scheme, the variety of fruits and vegetables purchased in the village market was greater in the intervention arm; baseline-adjusted mean difference of 2.2 items in intervention versus control villages (95 % CI: −0.7 to 5.1). The average frequency of coupon use increased by 0.5 days (from 3.2 to 3.7 days per week) across the trial period (95 % CI: 0.3 to 0.6).

4.3.2. Reduced vendor profits

Vendors reported varying effects of the intervention on their profits in the in-depth interviews. Vendors who began selling in the market during the trial period (largely local farmers) reported improved profits. On the other hand, vendors selling prior to the intervention reported mixed impacts. Those who felt the intervention reduced their profits cited increased competition from new vendors and misuse of the scheme by community members (see 'intervention misuse' below).

P: After scheme started, it is good for us, how means, before we used to go once 3-4 days to market to purchase vegetables and sell here, but now we are going every day and bringing and selling vegetables. We are able to sell the stock well. (Vendor, non-farmer.)

I: So, are the buyers happy with this scheme? P: They are happy with this scheme, but for us it is not useful … One new vendor started selling in the market. If she was not there, we would have sold vegetables for at least 10₹ profit. (Vendor, non-farmer).

The vendor survey also suggests the intervention reduced profits for vendors selling in the village prior to the scheme. The average baseline-adjusted mean amount sold was 150₹ lower in intervention than in control villages (95 % CI: −296 to −0.1) across the trial period (see Additional Files). However, descriptive analyses demonstrate extensive variability in sales across villages and time (see Additional Files).

4.3.3. Intervention misuse

Vendors, community members, and stampers reported that shoppers used various strategies to receive the cashback without spending 250₹ on fruits and vegetables in the eligible village market. This included bringing fruits and vegetables purchased from ineligible vendors, returning items previously purchased in the village market, and pressuring stampers to give additional stamps. Interviewees reported that this could lead to arguments between shoppers and vendors in the market, as vendors worried about the impact on their sales.

P: Don't know from where they are buying and what they are doing, they will start quarrelling with us … 'We will buy from anywhere [from ineligible vendors] and we will get the stamps', like that they will say … What was said is they have to buy here and get the stamps here only. I: Yeah, that's what was said …. P: If I say that, they get angry. (Vendor, non-farmer).

P: They are making entries as buying more madam. If they are buying for 40₹ then they are getting the entries as 60₹ or 100₹ like that. I: They will show there to that sir [stamper] to estimate the quantity and give the stamps right? P: He is seeing madam, but how many people he will observe? He can't see people who are coming from home directly and getting the stamp. (Vendor, non-farmer).

The research team distributed coloured carrier bags to local vendors of one village to estimate the degree of intervention misuse. Only fruits and vegetables in the correct bag were eligible for stamping during this one-week period. The share of completed coupons reduced from 49 % to 44 % during this week (not shown).

4.3.4. Spending on less healthy items

While community members mostly spoke of using the cashback to purchase fruits and vegetables, a handful of interviewees mentioned buying less healthy items such as sugar and oil.

P: Yes it is useful for us with that 50₹ we get at least 1 kg *sugar, if not one time vegetables we can buy.* (Community member, coupon always completed).

19 % of end-line survey participants reported using the cashback to buy groceries other than fruits and vegetables (Table 4). We lack data on the type of groceries purchased.

4.4. Participant responses to the intervention

Community members largely reported feeling positive about the scheme and no interviewees mentioned feeling coerced by the financial incentive. In contrast, community members largely wanted a larger cashback amount. While a few interviewees were worried that they would not receive the cashback after spending more, no one reported feeling suspicious of the intervention's objective to increase the purchase of fruits and vegetables. Instead, barriers to participation were largely practical and related to the intervention design. Though the coupons were only eligible in the village markets, interviewees often reported sourcing fruits and vegetables from larger, outside markets. As there was limited variety of fruit available in the village market during the trial, community members believed fruit was ineligible for stamping. Community members and local leaders strongly supported the scheme continuing. While local leaders believed behaviours had already returned to normal after completion of the scheme, no interviewees (local leaders, community members, vendors) reported purchasing dropping below pre-intervention levels.

P: It worked madam, it is good, and it will be good also if you again continue this. You don't step back, go forward with this. (Elected local official).

P: When scheme was there, definitely without missing they were going every day to buy, for the sake of getting the stamps, people were going. When they go, definitely they used to buy something, for sure, even though there were vegetables at home. I: How is it now then, after the scheme? P: That's what madam, now if they have something or the other at home or with some chutneys they are eating [old habits]. (Anganwadi teacher).

The end-line survey confirms the community engaged positively with the scheme and that barriers to participation were largely practical. 52 % of households reported always using the coupon to buy vegetables; 58 % and 47 % of the lowest and highest SEP households, respectively ($p = 0.58$) (Table 4). 11 % of households reported always using the coupon to buy fruits; 19 % and 6 % of the lowest and highest SEP households, respectively ($p = 0.03$). Sourcing from ineligible sources was a major reason for using the coupon never/seldom/sometimes to purchase vegetables or fruits (40 % and 22 % of households, respectively). Lack of fruits sold locally was the main reason for using the coupon never/seldom/sometimes to purchase fruits (33 % of households). 90 % of households preferred for the scheme to continue in their village, which was similar by SEP ($p = 0.72$).

5. Discussion

This study aimed to understand how a financial incentive scheme influenced purchasing of fruits and vegetables in an unorganised retail setting in rural India, and to explore any unintended consequences. The intervention acted on fruit and vegetable purchasing through both hypothesised mechanisms; households used their own budgets to buy more fruits and vegetables and receive the cashback, and subsequently used the cashback to buy more fruits and vegetables. Community members responded positively to the scheme; 90 % wished for it to continue. The intervention unexpectedly increased the number of vendors and variety of fruits and vegetables in the village market, which may have negatively impacted the profits of existing vendors.

The financial incentive scheme influenced fruit and vegetable purchasing by motivating households to buy more fruits and vegetables to receive the cashback. While lower SEP households used the intervention more, households across socioeconomic backgrounds participated, despite the relatively low cashback amount (which corresponds to

between 1.5 % and 4 % of weekly household income (Kinra et al., 2023)). This corroborates evidence from behavioural economics on the effectiveness of even small incentives on changing behaviours (Vlaev et al., 2019). The intervention also acted by improving household purchasing power, as participants reported using the cashback to purchase additional fruits and vegetables. This supports existing evidence on the financial barriers to fruit and vegetable purchasing in rural India and highlights intrinsic motivation (in addition to the extrinsic financial incentive) to purchase fruits and vegetables in this setting (Choudhury et al., 2020; Kehoe et al., 2019; Surendran et al., 2020). Recipients may also have been motivated to spend the cashback on fruit and vegetables because it was distributed in the village market as part of a fruit and vegetable scheme (Hastings and Shapiro, 2018). We found no evidence that people felt coerced or distrustful of the scheme or its objectives, as can occur with financial incentives (Schneider et al., 2023; Vlaev et al., 2019). Barriers to participation in the scheme were largely practical and related to its design, for instance the cashback amount and vendor eligibility.

The financial incentive scheme unexpectedly impacted the food environment in the village. Increased business in the village market led farmers (who usually sold in outside markets) to sell locally, which increased the variety of fruits and vegetables purchased in the village. It also led households to purchase fruits and vegetables more frequently, instead of buying in bulk once a week. These outcomes are in line with Indian nutritional guidelines, which recommends the consumption of fresh, locally available, and seasonable fruits and vegetables (ICMR-National Institute of Nutrition, 2024).

It is difficult to predict the longer-term impact of such changes to the external food environment (Turner et al., 2018). The fruit and vegetable supply chain in India is characterised by multiple intermediaries, which drives prices up (Gandhi and Namboodiri, 2006; Negi and Anand, 2014). So, increased farm-to-consumer sales might reduce fruit and vegetable prices and subsequently increase purchasing. In previous studies in rural Telangana, freshness, quality, and local sourcing were drivers of fruit and vegetable purchasing, and participants wanted a greater range of high-quality fruits and vegetables in their village market (Surendran et al., 2020; Turner et al., 2022). This suggests that changes to the village food environment could have a knock-on effect on purchasing behaviours (Turner et al., 2018). On the other hand, increased farm-to-consumer sales could increase prices, for instance by reducing economies of scale. Consumption would be more vulnerable to seasonal or other fluctuations in local fruit and vegetable harvests. During the trial, the coupon was rarely used to purchase fruits as they were relatively unavailable in the village market. The intervention also led to disagreements between villagers and vendors, as the manual, paper-based design (for use in the unorganised retail setting) made it relatively vulnerable to misuse. This could have an (adverse) knock-on effect on consumption, as trust and vendor loyalty are drivers to fruit and vegetable purchasing in this unorganised retail setting (Turner et al., 2022).

5.1. Strengths

To our knowledge, this is the first study to explore the impact of a financial incentive scheme implemented in an unorganised retail setting. We used large, representative surveys to examine whether the intervention acted through hypothesised mechanisms. To understand any unexpected consequences, we used a largely inductive and descriptive qualitative methodology, incorporating the perspectives of a range of stakeholders such as local vendors, community members who engaged to varying degrees with the intervention, local leaders, and intervention implementors. We triangulated these results with a range of quantitative datasets to test ideas generated by the community.

5.2. Limitations

Participants may not have reported negative feelings towards the scheme or purchases of unhealthy items to the research team. However, several sensitive topics were discussed in the interviews (e.g., intervention misuse) and triangulation between data sources showed similar results, so reporting bias may have been relatively minor. We were unable to explore how the intervention affected consumption of fruits and vegetables or other (potentially less healthy) foods as we did not collect this data. We did not measure fruit and vegetable purchasing after scheme completion, however qualitative results suggest the intervention did not adversely impact long-term behaviours (which is a concern with financial incentives). Due to logistical constraints and innate flexibility of vendors selling in the market, we restricted the sales survey to vendors regularly selling in the local market. This meant we were unable to explore intervention effects on vendors who sold irregularly, including those who started selling during the intervention period. This highlights the added complexity of evaluating such schemes in unorganised retail settings.

6. Conclusion

Financial incentive schemes have the potential to change the food environment in unorganised retail settings, which could have major implications for diets. Our findings were likely impacted by characteristics of the local area (e.g., proximity to larger markets in urban centers) and trial period (e.g., seasonal availability of fruits and vegetables). Future studies could assess the long-term impact of such schemes on the food environment (including pricing), purchasing, and consumption of healthy and less healthy items, exploring differences across settings and seasons. Studies could evaluate the feasibility and effectiveness of different incentive models on purchasing behaviours (e.g., targets/incentives relative to household size, non-cash incentives (e.g., fruits and vegetables)) and explore strategies for maximising intervention benefits for all stakeholders (e.g., both consumers and sellers), while considering typical issues of financial incentives (e.g., cost-effectiveness, sustainability, and potential lack of long-term impact on behaviours (Vlaev et al., 2019)).

CRediT authorship contribution statement

Judith Lieber: Conceptualization, Formal analysis, Funding acquisition, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Sanjay Kinra:** Conceptualization, Funding acquisition, Supervision, Writing – review & editing. **Srivalli Addanki:** Data curation, Investigation, Visualization, Writing – review & editing. **Swarnaa Prabhakar:** Data curation, Formal analysis, Writing – review & editing. **Santhi Bhogadi:** Data curation, Investigation, Project administration, Writing – review & editing. **Poppy A.C. Mallinson:** Data curation, Formal analysis, Funding acquisition, Writing – review & editing. **Anura V. Kurpad:** Conceptualization, Funding acquisition, Writing – review & editing. **Helen L. Walls:** Conceptualization, Funding acquisition, Writing – review & editing. **Bharati Kulkarni:** Conceptualization, Funding acquisition, Writing – review & editing. **Shilpa Aggarwal:** Conceptualization, Funding acquisition, Writing – review & editing. **Richa Pande:** Conceptualization, Investigation, Writing – review & editing. **Kiruthika Selvaraj:** Conceptualization, Investigation, Writing – review & editing. **Arindam Debbarma:** Conceptualization, Investigation, Writing – review & editing. **Sarang Deo:** Conceptualization, Funding acquisition, Project administration, Writing – review & editing. **Nanda Kishore Kannuri:** Conceptualization, Funding acquisition, Project administration, Writing – review & editing.

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT in order to check grammar and reword short phrases. After using this tool/ service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.gfs.2025.100869.

Data availability

Data will be made available on request.

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