

The interplay between the market food environment and barriers to healthy diets for women in rural Bihar, India

Martin Watts^{a,*}, Gregory S. Cooper^a, Anjali Purushotham^a, Bhavani Shankar^a,
Santhi Bhogadi^b, Helen Harris-Fry^c, Suneetha Kadiyala^c, Aakriti Gupta^c, Fanny Sandalinas^c,
Shriya Bajaj^a, Navin Bhushan^d, Vikash Kumar^e, Ashwini Chhatre^b, Raja Sriswan Mamidi^f,
Emily Fivian^c

^a *Institute for Sustainable Food and School of Geography and Planning, University of Sheffield, United Kingdom*

^b*Bharti Institute of Public Policy, Indian School of Business, Hyderabad, India*

^c*Department of Population Health, Faculty of Epidemiology and Population Health, London School of Hygiene & Tropical Medicine, London, United Kingdom*

^d*MicroSave Consulting, Delhi, India*
^e*MicroSave Consulting, Patna, Bihar, India*

^f*National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India*

ABSTRACT

Understanding the barriers that women in rural, low-income settings face in acquiring nutrient-sparse foods (NDFs) is fundamental to improving health. Most existing evidence comes from quantitative studies. However, complementary qualitative insights can deepen understanding of individuals' lived realities and inform contextually relevant strategies to address these barriers. We qualitatively examined how gender norms and other socioeconomic inequalities shape women's interactions with their market food environment for acquiring NDFs in rural Bihar, India's poorest and most undernourished state. We also considered men's experiences to understand gender differences in barriers. We sampled 12 villages across two districts (Bhojpur and Samastipur) and conducted 12 focus groups with women and 76 interviews with women and their spouses. A complementary survey was also conducted to contextualise our qualitative findings.

The unaffordability of NDFs, caused by low income and high prices, was the main barrier to acquisition. This barrier was most pronounced for the poorest and was greatest during seasonal price spikes. Women faced unique affordability challenges due to their exclusion from markets, driven by restrictive gender norms that stigmatise their participation and view markets as unsafe spaces. Consequently, women relied on expensive local sources or travelled longer distances to more distant markets, diminishing food budgets. Affordability barriers for the poorest and lower-caste women were compounded by pay discrimination and gender norms that restricted women's livelihood opportunities. Our insights suggest that providing women with cash transfers, alongside the development of safer, more inclusive markets, could improve women's acquisition of NDFs and their nutritional health.

1. Introduction

Poor diet quality is a leading cause of mortality in India and globally (Afshin et al., 2019; Agrawal et al., 2019), representing a significant public health challenge (Ravishankar, 2012). Inadequate consumption of nutrient-dense foods (NDFs), such as fruits, vegetables, and animal-sourced foods (ASFs), is associated with higher rates of cancers, cardiovascular diseases, child stunting, and mortality (Aune et al., 2017; Headey et al., 2018). In India, the average consumption of NDFs remains less than half of the recommended intake (Choudhury et al., 2020).

Although agriculture remains a major source of employment, most food consumed in India (and globally) is purchased from markets (GloPan, 2016; Nordhagen et al., 2023). In rural areas, markets are a key

source of NDFs (Headey et al., 2019; Hofman and Trevenen-Jones, 2024), especially for landless households and marginal farmers who cannot produce and store perishable NDFs year-round. Previous research has established a positive, albeit sometimes weak, relationship between people's market access and healthy diets (Headey et al., 2019; Matita et al., 2021; Stifel and Minten, 2017), although this relationship may depend on factors such as the quality of markets, the types of food available (e.g., ultra-processed foods), food affordability, and how market 'access' is measured (Ameye et al., 2025). Market participation is rarely uniform; women worldwide face restrictive gender norms constraining their agency, choices, and decision-making power regarding healthy food (Parsons, 2016; Quisumbing et al., 2023; Rubin et al., 2019). Such barriers to acquiring healthy food are widespread among

* Corresponding author. Institute for Sustainable Food and School of Geography and Planning, University of Sheffield, United Kingdom.
E-mail address: m.a.watts@sheffield.ac.uk (M. Watts).

women in rural India and are compounded by intersecting socioeconomic factors, including caste, religion, education, and income-based dimensions (Fivian et al., 2024; Gausman et al., 2018; Heemann et al., 2022; Minocha et al., 2018).

In many rural settings, markets are socially perceived as men's spaces, with restricted women's participation in the buying and selling of food (Ratner and Wyckoff, 2015). Traditionally, in rural India, men or senior household members purchase the household's food, and therefore, more regularly engage with markets (Chorghade et al., 2006; Kehoe et al., 2019). According to Diamond-Smith et al. (2016), this can give these household members greater influence over food purchase decisions, and potentially deprioritise purchases of healthy foods, although other evidence from rural India suggests that household members may also cooperate in decisions to purchase nutritious foods (Harris-Fry et al., 2023).

Addressing barriers to women's market access is crucial for several reasons. First, women's involvement in food acquisition can enhance the healthiness of their own and other household members' diets (Amugsi et al., 2016; Shourove et al., 2023), although the evidence remains mixed. Nonetheless, if women have stronger preferences for nutritious food or greater nutrition knowledge, their exclusion from markets could lead to the overlooking of these capacities and the missing of opportunities to improve household dietary quality. Second, men's increasing outmigration from rural areas is shifting food purchasing responsibilities to women (Choithani, 2020; Lei and Desai, 2021), underscoring the need to better support their market access. Third, unequal access to markets reflects a denial of women's rights and agency, reinforcing gender inequality (MacArthur et al., 2022). Therefore, understanding the diverse barriers that women face in accessing markets and achieving healthy diets is essential for developing interventions that address these challenges, achieve food security (e.g., targeting food 'agency' (Clapp et al., 2022)), and help meet multiple Sustainable Development Goals (SDGs), including zero hunger (SDG 2), good health and wellbeing (SDG 3), gender equality (SDG 5), and reduced inequalities (SDG 10).

Most evidence regarding the role of market food environments in healthy diets relies on large-scale quantitative surveys (Marla and Padmaja, 2023; Pingali and Abraham, 2022; Tharrey et al., 2024). However, individuals' food choices within their food environment are influenced by various social, cultural and economic factors, including gender norms and preferences (Swinburn et al., 2013; Turner et al., 2018), which may be challenging to capture through quantitative research alone. Qualitative research provides a complementary perspective by elucidating the processes and perceptions underlying these dynamics through people's lived experiences of their food environment (Neve et al., 2021). Further, qualitative research can amplify the voices of marginalised groups, making their challenges and experiences salient, helping develop more equitable interventions. Despite this, few studies have qualitatively examined how gender norms and other socioeconomic factors influence individuals' interactions with their rural food environment (Konapur et al., 2022; Surendran et al., 2020) or how rural food environments in LMICs influence healthy diets (Choudhury et al., 2025).

This paper addresses these gaps by investigating how rural women experience and navigate their market food environment through an in-depth qualitative exploration of the barriers they encounter and the socioeconomic inequalities that shape them. Using primary data collected in rural Bihar, India, we aim to: i) examine how gender and other forms of socioeconomic inequality influence women's experiences and interactions with their market food environment in acquiring NDFs; ii) explore spatial and temporal variations in the barriers faced by women; and iii) identify nutrition and market-based actions that could help reduce these barriers in rural India. This study's conceptualisation, illustrating the interacting domains underpinning the market food environment and gender dynamics, is displayed in Fig. 1. Fig. 1 was iteratively developed through a review of the literature in each domain; the examples listed are those recognised as potentially interacting with

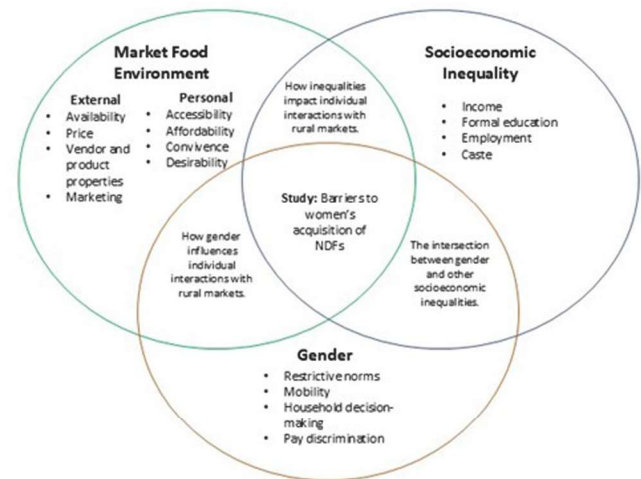


Fig. 1. Conceptualisation of the study and overlap between the key domains.

and influencing access to healthy diets (see the paragraphs below). In our study, Fig. 1 also guides our data analysis (Section 2.3).

The food environment is conceptualised as “the interface where people interact with the wider food system to acquire and consume foods” (Turner et al., 2018 p 95). Two food environment domains determine individuals' food acquisition: i) the external domain encompassing food availability, price, vendor characteristics, and market information and advertising, and ii) the personal domain, including people's ability to physically access and afford food, as well as their own food preferences and desirability (Turner et al., 2018, 2020). Subsequently, the interaction between individuals' food environment and their acquisition of NDFs is mediated by various cognitive and social factors, such as taste, aspirations, cultural norms, and taboos (Fanzo et al., 2020; Laraia et al., 2017).

Traditional and informal vendors dominate the local market food environment in rural India (Cooper et al., 2022). These spaces often lack basic infrastructure such as lighting, roofs, walkways, running water and toilets (Kehoe et al., 2019; Nandi and Nedumaran, 2022), often creating unwelcoming environments, particularly for women (Prasad, 2018). Women may also face exclusion from markets due to restrictive gender norms that constrain their mobility and participation in public spaces (Earnshaw and Karpyn, 2020; Schneider et al., 2023; Uteng, 2012), reflecting the persistence of strong patriarchal structures in rural India. The seasonality of food production also affects food availability and prices in rural markets (Gelli et al., 2020; Morgan et al., 2016). The absence of cold storage facilities in most rural Indian markets also exacerbates spoilage of perishable NDFs during warm, wet seasons, affecting availability and prices (Kehoe et al., 2019). The magnitudes of these temporal seasonal effects on NDF affordability may vary spatially. For example, long distances to markets for buyers may increase food costs due to transportation expenses, further complicating individual and market food-environment interactions.

Beyond markets, broader socioeconomic factors, such as income and education, also influence food choices. An individual's disposable income often determines the affordability of healthy diets, especially in low-income households where food comprises a significant share of total household expenditures (Hall et al., 2009; Hosseinpoor et al., 2012). Most consumers in low-income settings perceive NDF prices as unaffordable (Schneider et al., 2023), prompting trade-offs between healthiness, quantity, variety, price, and quality of diets (Bell et al., 2021; Downs et al., 2022). Furthermore, when food prices increase, evidence shows that consumption of healthy foods declines more rapidly relative to staple foods (Cornelsen et al., 2015), suggesting that NDF consumption could decline during lean seasons.

Formal education can improve nutritional knowledge, leading to modest improvements in women's diets (Girard and Olude, 2012; Raaijmakers et al., 2018), and enhance the effectiveness of nutrition-based interventions (Ruel et al., 2018). However, economic constraints experienced by low-income individuals may prevent their implementation of nutrition knowledge (Fivian et al., 2025; Madlala et al., 2024). Furthermore, in many LMICs, families tend to invest more in boys' education than in girls', contributing to persisting gender gaps in formal schooling (Schneider et al., 2023), limiting women's future employability (Bapuji and Chrispal, 2020; Choudhary et al., 2019). Employment often positively correlates with nutrition outcomes (Broussard, 2019), and barriers to women's employment can hinder their financial autonomy, limiting their food decision-making power (Chorghade et al., 2006; Diamond-Smith et al., 2016).

In addition to the above, caste is a major axis of social inequality in rural India, shaping everyday socio-economic interactions (Mosse, 2018). Unequal access to resources, healthcare, and education can shape caste-based inequalities in nutrition (Roy et al., 2004), while national-level evidence suggests that caste-based differences in fruit and vegetable consumption are primarily driven by income inequalities (Choudhury et al., 2021). Gender and caste discrimination are also invariably intertwined, with women marked more than men by their caste identity (Banerjee and Ghosh, 2019). The intersection of gender and caste discrimination can exacerbate barriers to resources, education, and employment faced by women from marginalised caste (Bapuji and Chrispal, 2020; Choudhary et al., 2019), perpetuating income inequalities and the unaffordability of healthy diets.

2. Methods

2.1. Study design and setting

We employed an exploratory case study design in Bihar (Fig. 2), India, a design conducive to understanding complex interactions and their processes (Andrade, 2009). We predominantly used a qualitative approach. However, to contextualise our qualitative findings within the broader study context, we also draw on complementary household survey data (explained in section 2.4).

Bihar is India's third most populous state, with approximately 130 million inhabitants (Government of Bihar, 2022). Over 33% live in multidimensional poverty, the highest rate in India (NITI Aayog, 2023), while 43% of children up to five years old experience stunted growth, 27% of rural women are underweight, and 63% are anaemic (IIPS &

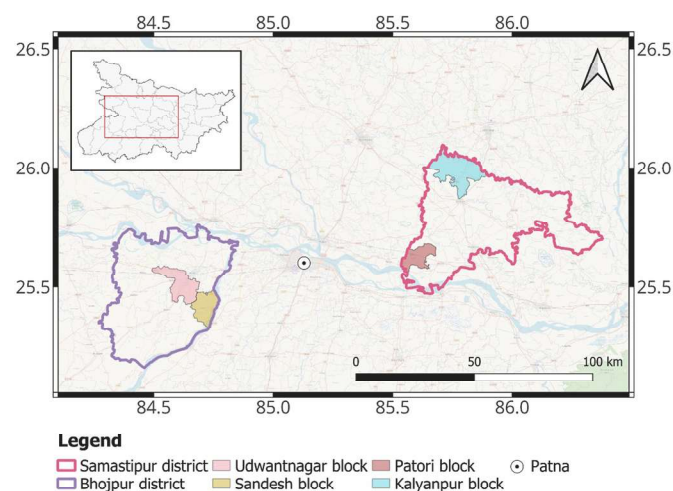


Fig. 2. Main - Locations of our four study blocks within the districts of Samastipur and Bhojpur. Inset - Geographical extent of the main map within Bihar, north India.

ICF, 2021). The average per capita consumption of fruits and vegetables ranges from 64 to 79% below India's national average, equal to only 35–45% of the WHO's recommended daily intake of 400g per capita (Choudhury et al., 2020). Agriculture supports the livelihoods of around 79 million people; however, few own their farmland, with the majority being marginal landholders (owning <1 ha) (ANSISSP & Oxfam, 2020). Consequently, the quantity and diversity of foods produced are unlikely to fulfil each household's nutritional requirements; thus, many households purchase their NDFs outside the home (IRRI & IFPRI, 2024; Scott et al., 2023). Patriarchal norms are also deeply entrenched in Bihar, creating gender gaps in education, labour, pay, asset ownership, access to credit, decision-making ability, and access to public spaces (Datta and Satija, 2020; Hankla et al., 2023; Joshi et al., 2022; Seebacher, 2023).

2.1.1. Rural markets ('haats') in Bihar

A widespread network of rural food markets, known as 'haats', extends across Bihar. These rural markets operate as nodes that supply NDFs to rural communities (i.e., sometimes involving just around 10 NDF vendors selling relatively small quantities once or twice per week). As Fig. 3 illustrates, these local markets are often relatively small, male-dominated, and lack basic infrastructure, sanitation facilities, electricity, formal food retail or advertising. Bihar also has larger wholesale markets known locally as *mandis*. However, these markets are usually located in more urban and peri-urban settings with relatively larger populations. As such, our focus is on these rural 'haat' food environments as these predominantly serve relatively rural communities, comparatively vulnerable to food and nutrition insecurity.

2.2. Sampling and data collection

We purposively selected two districts in northern and southern Bihar — Bhojpur and Samastipur — to capture variability in geographic location, poverty levels, undernutrition, market density, and agri-food systems. Samastipur lies within the vegetable production belt, while



Fig. 3. Rural markets ('haats') in Bihar (source author).

Bhojpur is situated on the relatively arid southern bank of the Ganges (Fig. 2) (see [Supplementary Material 1](#) for further information). We then randomly selected two blocks from each district and subsequently sampled three villages from each block, covering different levels of geographical remoteness ([Supplementary Material 1](#)). Within each village, we conducted in-depth interviews (IDIs) and focus group discussions (FGDs) with women aged 19–45 years and their spouses between August and September 2023. Participants were recruited via convenience sampling by local frontline workers who purposively selected individuals from diverse backgrounds, e.g., different poverty levels and caste groups.

We conducted IDIs first to gain insight into individuals' experiences and perceptions, and to explore interpersonal variation between interviewees ([Guest et al., 2017](#)). Next, FGDs investigated whether individual perceptions and experiences were held at the group level and explored any wider viewpoints through group interaction ([Lambert and Loiselle, 2007](#)). Overall, four interconnected IDI guides were administered: the first two focused on how women perceive and experience their local food environment for acquiring i) fruits and vegetables and ii) ASFs ([Supplemental Material 2](#)); the third explored barriers faced in acquiring NDFs ([Supplemental Material 3](#)); and the fourth examined spouses' roles in food decision-making, and their barriers to acquiring NDFs ([Supplementary Material 4](#)). Our FGDs typically included 8–12 female participants and were partly informed by insights from the initial IDIs, which explored the barriers women faced and their association with the market food environment ([Supplementary Material 5](#)). To facilitate engagement, we used a participatory exercise in which participants collectively identified and ranked pictograms representing the barriers identified in the IDIs.

Our local field team translated all guides into Hindi and piloted them to assess comprehension of concepts (e.g., 'affordability') and translation. IDIs were conducted in private settings and lasted approximately 40 min. FGDs usually took place in village meeting halls and lasted 1–2 hours. Responses were electronically recorded and transcribed verbatim into English. In total, 12 FGDs and 76 IDIs (20 F&V food environment, 19 ASF food environment, 24 NDF barriers with women, and 13 NDF barriers with spouses) were completed. One FGD recording was excluded due to poor audio quality.

2.3. Data analysis

We employed a combined deductive and inductive thematic approach to our qualitative analysis ([Fereday and Muir-Cochrane, 2006](#)). Immediately post IDI/FGD, 'rapid' analysis was performed ([Halcomb and Davidson, 2006](#)), noting key findings for reference during coding. To develop our initial codes, we analysed our transcripts deductively, applying the external and internal domains of [Turner et al.'s \(2018\)](#) food environment framework alongside relevant themes from the reviewed literature (see [Fig. 1](#)). Next, we inductively developed sub-codes using data-driven insight ([Fig. 4](#)). For instance, we identified sub-codes such as religious beliefs, children's preferences, and perceived food healthiness within the 'desirability' food environment domain. Regarding gender, we identified market inaccessibility as a key sub-code, and employment and cash flow fluctuations as sub-codes of socioeconomic inequality. Thereafter, sub-codes were appropriately grouped using axial and selective coding techniques to discern how the domains (sub-codes) of gender, socioeconomic inequalities, and the market food environment interacted to influence women's NDF acquisition. All transcripts were coded using QSR NVivo14. MW and SB conducted the coding, which was cross-checked by GC using a random sample of 20 transcripts to ensure consistency.

2.4. Complementary household survey data

To complement our qualitative findings, we also draw on primary quantitative data from a household dietary survey conducted in the same districts (see [Supplementary Material 6](#) for sampling information), implemented approximately 1 year after the qualitative data collection (August to November 2024). Our survey was conducted face-to-face with mothers aged 18 years or older who had a child aged 6–59 months (n = 1201), focusing on their own and their children's diets and food sources. As such, data on women's access to markets and on the foods sourced were gathered, alongside relevant sociodemographic data.

We present a subset of descriptive indicators, including the proportion of NDFs purchased by the woman respondent from markets, the gender of the household member primarily responsible for purchasing food from markets, and women's perceptions of markets. Specifically, we include measures of whether women perceive it to be unsafe or socially unacceptable to visit markets alone or without a man or male

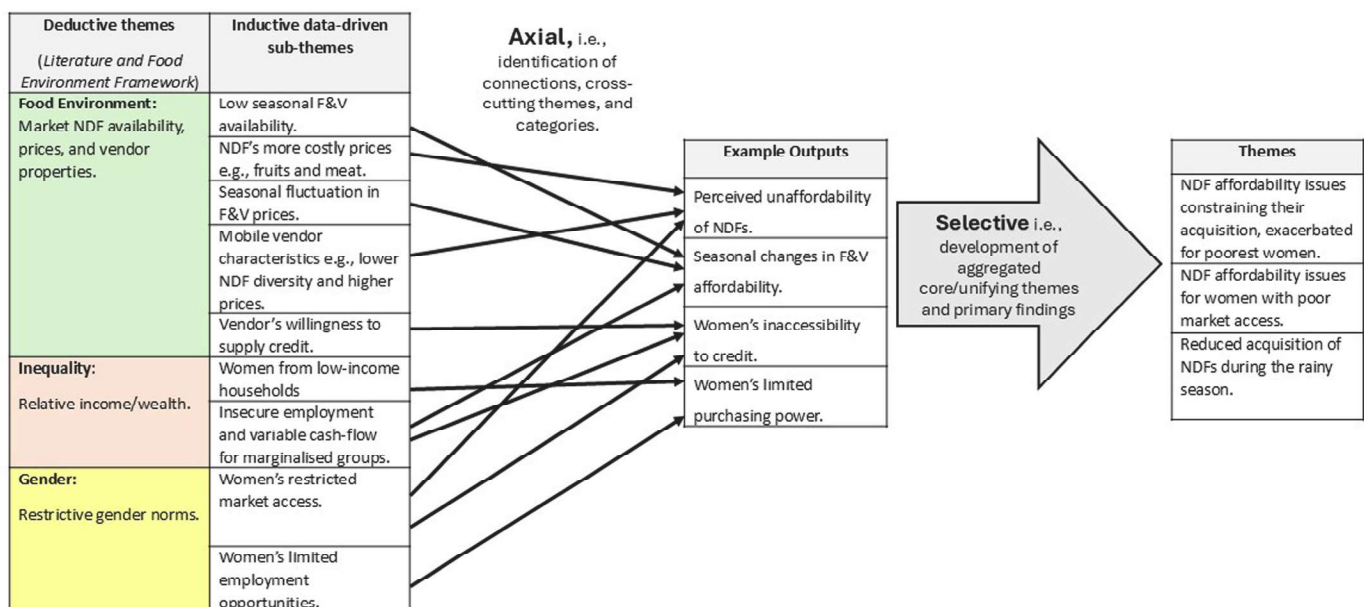


Fig. 4. Example of the qualitative coding and hybrid analytical approach.

adolescent, and whether they have done so in the previous 30 days. To explore caste-based heterogeneity, we also present these indicators among Scheduled Castes only—groups most historically marginalised within Indian caste hierarchy—and among less marginalised and higher-caste groups (i.e., Other Backwards Classes and General Caste).

3. Results

We first identify the main barriers to acquiring NDFs from markets, faced by both men and women. Then, we analyse the interactions by gender, dimensions of social and economic inequality, and variations in the market food environment. We incorporate descriptive findings from the survey data where necessary.

3.1. Major barrier to NDFs

3.1.1. Perceived unaffordability

Overall, rural markets were the primary source of NDFs for participants, including those who also produced fruits and vegetables in their fields or kitchen gardens. These participants reported that their production was insufficient to meet their households' year-round dietary needs, underscoring their reliance on local markets.

“Only one month it [kitchen garden produce] would be sufficient for.”
IDI Participant (Man)

“We don't grow our own vegetables; we buy everything from the market”
If there is no market, then there are no vegetables; if there is a market, then they [vegetables] will come [into the house].
IDI Participants (Woman)

Our survey data supports these qualitative insights, showing that over 70 % of the total quantity consumed for each NDF was purchased. The only exception was dairy, most of which was produced at home (Fig. 5).

The perceived unaffordability of NDFs was consistently raised as the primary barrier to their acquisition from local markets. Most IDI and FGD participants, often the poorest, frequently reported lacking sufficient income to purchase NDFs and that NDF market prices were high relative to staple foods such as rice. Consequently, many infrequently consumed NDFs or consumed NDFs, usually green vegetables, in small quantities.

“Everything is available in the market. It is just about the cost [of NDFs] and our income.”
FGD Participant

“We are poor people, when will we eat fruits. If all the money is spent on food [rice], how will we bring fruits. If we poor people can just get food, that is enough”
IDI Participant (Woman)

3.1.2. Seasonal variations in affordability

Market prices of fruit and vegetables fluctuated substantially throughout the year due to seasonal availability. Participants generally cited higher prices during June–September's rainy season and lower prices during October–February's winter season:

“These days [in the rainy season] green vegetables are the most expensive ... they're usually 20 rupees per kg, but right now they are 40-50 rupees.”
FGD Participant

“Vegetables are dependent on the season. In the winter season, a good amount of vegetables get harvested If I go to the market today [in the rainy season] with 100 rupees, my one bag does not get full, but at that

time [winter], if I go to the market with 100 rupees, two of my bags get full with vegetables.”

IDI Participant (Man)

Seasonal price spikes coincided with reductions in cash flow, primarily among the poorest participants, whose income came from casual agricultural labour or construction work. Some participants explained how work opportunities declined during the rainy season due to the agricultural calendar and climate conditions, before increasing again in winter during harvesting:

“He [spouse] sometimes gets work for one day, then no work for five days [in the fields] ... there has been no work for the past two months ... We do not get work during the monsoon ... we barely get work for 8–10 days.”
FGD Participant

“I get good work during winter. Like when potato is harvested, I get more work ... so, when the money comes in, a few things like green vegetables are bought.”

IDI Participant (Man)

This untimely overlap worsened affordability barriers, prompting these participants to reduce the quantities of NDFs purchased:

“In the rainy season, I make potato curry because potatoes are available and cheap these days. When the vegetables become unaffordable, we eat only potatoes we buy more vegetables [in the winter season].”
IDI Participant (Woman)

“Our income declines, and then the prices of vegetables increase, then we have to buy half of what we usually get.”
FGD Participant

Such seasonal barriers were discussed less frequently by wealthier participants with more stable employment, such as taxi drivers. While these participants noted seasonal changes in market prices, these changes reportedly had little effect on their NDF purchases, highlighting how their relative wealth buffered them against seasonal price volatility and reduced their price sensitivity.

“If there is something that we want to eat, whether the price goes higher or lower, we will get it. [There should be] no deficiency in eating.”
IDI Participant (Woman)

Most participants mentioned that market prices for most ASFs remained comparatively stable. However, given lower-income participants' vulnerability to seasonal cash flow instability, the perceived affordability of ASFs still varied.

“Yes, things do change [when income decreases]. Green vegetables, meat, fish, and spices, we do not consume these. When there's a better flow of income, we start consuming these foods again.”
FGD Participant

Fish, however, could be an exception. Several participants described how river water levels rose during the monsoon rains, leading to higher fish abundance and lower market prices. Prices reportedly dropped from 150 rupees per kg to 50, thereby enhancing participants' purchasing power, enabling them to acquire fish at affordable rates.

“Fish is cheaper during that time [monsoon] ... it's 50 rupees per kg ... because of the fish [increased availability] ... flooding can be a good thing.”

“When there is flooding, we get to eat fish a lot ... whenever we are in the mood for it.”

FGD Participants

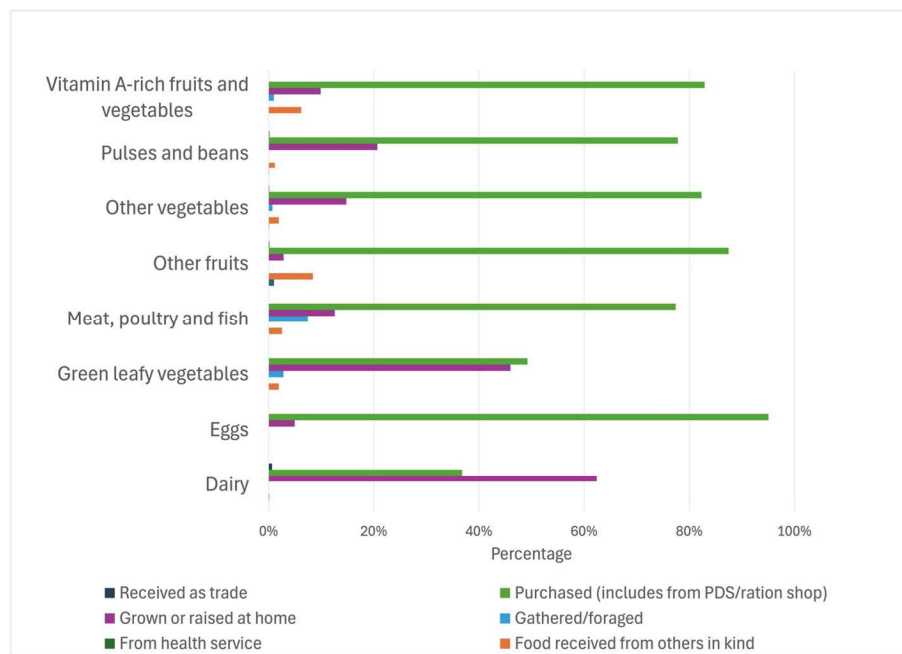


Fig. 5. Households reported sources of NDFs in rural Bihar.

3.2. Interaction between gender, inequality, and market food environment

Unique challenges faced by women, rooted in unequal gender power dynamics, shaped their experiences of the market food environment differently from those of men, and often compounded other socio-economic constraints in acquiring NDFs.

3.2.1. Restricted market access

A key pathway through which gendered differences emerged was women's restricted market access, driven by two reinforcing factors.

First, restrictive gender norms stigmatised women's participation in markets. Many women reported seldom visiting markets, usually due to mobility restrictions imposed by their households, which followed local norms. These norms dictate that women, especially younger married women, should leave the village only under specific circumstances, such as seeking healthcare or purchasing women-specific products (e.g., clothes for themselves).

"My husband goes [to the market], I do not go. He does not let me go."
IDI Participant (Woman)

"We do not go [to the market] because then people will say that the daughter or daughter-in-law is going out ... they do not go out."
FGD Participant

Other women mentioned going to markets out of necessity when other household members were unavailable, although they felt it was inappropriate for them to do so.

"If the husband is away, we go [to the market]. It is not good, but we have to go out of necessity."
FGD Participant

Findings from the household survey align with these qualitative insights (Table 1). In 66% of households, the member primarily responsible for purchasing food from markets was a man. Among the remaining 34%, nearly half of the women were mothers or mothers-in-law. Similarly, 40% of women believed it was not socially acceptable for a woman to attend a market alone or without a man, reflecting the internalisation of restrictive gender norms that reinforce patriarchal expectations about women's behaviour and mobility – insights also echoed in women's qualitative remarks.

However, this was not a universal experience among women. Some women in various communities expressed fewer reservations about visiting markets, which were considered part of daily life:

"Participants collectively: They [women] do go [to the market]."

Participant 1: They do go to the market.

Participant 2: If they have work at the market, they do go.

Participant 1: They go shopping"

FGD Participants

This divergence in perspectives and experiences may reflect caste-related differences. The survey findings support this interpretation. For instance, women from the Scheduled Castes were more likely than those from Other Backwards and General Castes to have visited the market without male company (64% versus 55%) (Table 1). They were also less likely to perceive visiting the market as socially unacceptable (27% versus 36%).

Second, many women also described their local markets as unsafe environments—a perception that reinforces restrictive gender norms framing local markets as inappropriate places for women and, together, contributes to their exclusion from public spaces. For example, during FGDs, several women mentioned feeling scared in the marketplace, particularly after dark.

"At night it's scary ... that's why we go in the morning because we know that there are miscreants [in the market]. If they harass us, what can we do? That is why we go when the market is busy during the day. If the market stays busy, then there is less fear"

"We don't go alone [to the market] ... We feel scared unless there are five of us together"

FGD Participants

Women's safety concerns in markets were also evident in the household survey: 42% of women reported that it is unsafe to go to the market alone or without a man (Table 1). Caste-based disparities were also apparent, with women from the Scheduled Castes slightly less likely to report markets as unsafe than women from Other Backwards Classes and General Castes.

Some women expressed that the journey to the market was more

Table 1

Descriptive indicators on women's market participation, perception of safety and social acceptability, and household market engagement in rural Bihar.

	N	N (%) or mean (SD)
District	1201	
Samastipur		600 (49.9)
Bhojpur		601 (50.0)
Women's age	1201	
18–29 years		941 (78.4)
30–59 years		256 (21.3)
60 years and above		4 (0.3)
Caste, n (%)		
Scheduled Caste		383 (31.9)
Other Backward Classes		654 (54.5)
General Caste		154 (12.8)
Scheduled Tribe		10 (0.8)
Gender of household member primarily responsible for purchasing food from market in past 3 months	1189	
Man ^a , n (%)		783 (65.9)
Woman ^a , n (%)		406 (34.2) ^b
Women reporting ...		
That it is unsafe to go a market at all or without a man, n (%)	1201	505 (42.1)
Among Scheduled Castes, n (%)	383	132 (34.5)
Among Other Backward Class and General Castes, n (%)	808	379 (45.8)
That is not socially acceptable to go the market at all or without a man, n (%)	1201	395 (33.9)
Among Scheduled Castes, n (%)	383	103 (26.9)
Among Other Backward Class and General Castes, n (%)	808	519 (35.8)
Visited the market in the past 30 days without a man (%)	1201	503 (41.9)
Among Scheduled Castes, n (%)	383	244 (63.7)
Among Other Backward Class and General Castes, n (%)	808	446 (55.2)

^a Includes male and female adolescents, where applicable.

^b 43 % of the female household members primarily responsible for purchasing food from the markets was the respondent's mother or mother-in-law.

unsafe than the market itself. In remote villages, most women reported needing transportation to attend markets. Travelling on foot was considered dangerous, particularly when travelling far and through remote areas:

"We have to go far [to get to the market], so it is a barrier Going on the road is scary."

Yes, it is a barrier. It is far [to the market], and who would go that far? We would feel scared."

FGD Participants

However, transportation costs increased the expense of purchasing NDFs, disproportionately affecting poorer participants with already limited food budgets. Travel costs reportedly ranged from 5 to 40 rupees per trip, with prices increasing with distance, suggesting that women from remote areas bear a greater financial burden of unsafe spaces, with implications for affording healthy diets. Several women noted that more affordable transport would enable them to buy a wider variety of NDFs, such as eggs and fruits.

"The price of tomatoes is currently 80 rupees per kilo. If we feel like eating tomatoes, we will not be able to buy a lot using the money spent on the autorickshaw before. We will only buy 250 g of tomatoes with that money."

"30 rupees for a round trip [to the market] A sister may earn 50 rupees a day, so if she spent 30 rupees on the auto fare, what would be left?"

FGD Participants

In some less remote villages, several women reported that their local markets had limited fruits and costly vegetables, prompting trips to

other markets. Thus, proximity to markets does not always guarantee better access to healthy diets because of variations in the market food environment.

"We get everything in the market here, but it is expensive. So, we have to go to the market that is far ... it is about 8-10 kms away."

FGD Participant

Seasonality could also influence women's safety and, subsequently, their market access. Numerous participants explained that heavy rains could render their usual routes impassable, forcing them to undertake longer, more costly, and more remote routes to reach markets.

"You have to reach [the market] by taking the boat Whether we can go depends on taking the boat, and it's scary. So, it is a barrier for us."

FGD Participant

3.2.2. Responses to market inaccessibility

Some women adopted various strategies to navigate restrictions on their market access, though these often involved trade-offs that affected their ability to buy NDFs.

Some women reported travelling in groups to reach more distant markets, to avoid being recognised locally. Group travel was also perceived as more socially acceptable and safer among these women.

"We go to Pusa market ... people from our village do not go there, that's why we go. In the nearby market, there is more people from the village, so we don't go there. Everyone will say 'she comes to the market'."

FGD Participant

However, as mentioned, travelling longer distances to markets can amplify affordability barriers (section 3.2.1). Furthermore, multiple women highlighted during FGDs that vendors were reluctant to extend credit to NDFs for them, given their infrequent market appearances and the resulting lack of familiarity and trust. This challenge was reportedly greater in more distant markets, where women's 'outsider' status further reduces their access to credit.

"People in the village know who we are. But in the market, they do not know who we are and where we came from, so they do not let us borrow or take items on credit."

"[Market] vendors do not give [NDFs] on credit because the market is far, and we do not live there. Only when someone recognises us will they give credit."

FGD Participants

Such barriers to credit were particularly problematic for the poorest women, who already lacked food budgets to afford the market prices of NDFs outright:

"It is a barrier [to NDFs] ... because we don't have money, and if the shopkeeper doesn't give us food items on credit, then how will we be able to eat nutritious food?"

IDI Participant (Woman)

"How will we repay the credit if we do not have the money at home? They will only give us something [credit] when we have money. If we do not have money, we will stay hungry."

FGD Participant

Another strategy women employed involved purchasing NDFs from mobile vendors who visited their villages. Although convenient, many women expressed dissatisfaction with the quality and variety of NDFs available. Moreover, mobile vendors did not always turn up regularly:

"They [fruits and vegetable] are not fresh From the day before yesterday, those vegetables are grown, and then people buy them at Arrah [headquarter town of Bhojpur district]. The merchants then buy it and bring it over here ... so there is a difference in stale and freshness."

“When it is raining, they [mobile vendors] sometimes do not come [to the village].”

IDI Participants (Women)

Some women's reliance on mobile vendors also compounded affordability issues; NDFs were relatively more expensive compared to markets:

“He [mobile vendor] comes all the way to the village. Therefore, he will take at least 2 rupees more than what they do in the market.”

“What are we to do ... if it [NDFs] is not available to us, we have to buy it paying 2 rupees more.”

FGD Participants

Similar experiences regarding other sources of NDFs in villages were also voiced; convenience stores reportedly lack fruit and vegetable diversity beyond potatoes and onions. However, when available, seasonal vegetables sold by local farmers were inexpensive, improving their perceived affordability.

“The prices at the Sandesh market are costlier than here [in the village]. Here, the vegetables are local, so they are less costly. People sell their produce from their kitchen garden.”

IDI Participant (Woman)

Dairy items, i.e., milk, were instead sourced from local milk centres (for participants who cannot afford to keep livestock). Interestingly, women did not experience the same social restrictions when buying milk, suggesting that restrictive gender norms may be linked to the marketplace itself as a social space rather than to the act of purchasing food. However, the milk sold was often undesirable, implying a trade-off between access to healthy food and quality.

“They mix water in with the milk, so what is the point in buying it? They are just trying to earn money. There is no point in spending money and getting milk mixed with water.”

FGD Participant

3.2.3. Gender dynamics outside markets

Restrictive gender norms and gender-based discrimination outside market spaces also hindered women's ability to acquire NDFs. This was reflected in limited employment opportunities for women and wage discrimination.

Some women emphasised the lack of suitable local employment opportunities, which some felt would help them afford more NDFs. The lack of women's job prospects appeared to be linked to restrictive gender norms that limited their mobility and the scarcity of employment opportunities in villages. These women preferred jobs doable at home, such as crafts and bangle-making.

“It would not be honourable [to work outside the village] ... People would say that the girl is going out to work. They would then look [down] at the family.”

“There is no work here for women, that is the issue ... There is no company or anything here where we could work.”

FGD Participants

“If there are jobs suitable for women, then we would do it ... it is better if we can work from home, if possible.”

IDI Participant (Woman)

Most employed female participants were casual agricultural workers, a common livelihood strategy for women of scheduled caste in rural Bihar (Kumar, 2025). During FGDs with these women, they mentioned receiving less pay than men (100 rupees per day compared to 200), potentially a consequence of their gender and/or caste. They recurrently referenced this pay disparity when discussing the unaffordability of vegetables, but felt unable to voice their frustrations to employers.

“If we work 6 hours, we only get paid 100 rupees. How can we spend that on an autorickshaw [to get to the market] while the vegetables also cost 60 – 70 rupees per kg?”

“We only get 100 rupees, so we have to manage with that. Buy vegetables with that, manage the children's education with that, manage everything with that small amount.”

FGD Participants

Due to their lack of employment and pay, and their work in casual seasonal labour, women were particularly vulnerable to seasonal fluctuations in NDF prices. Women's cash flow instability often deters them from taking loans to afford food during the rainy season, out of fear of debt:

“During the monsoon season, we do not get work for three months ... there is no work for us.”

FGD Participant

“The debt would only increase ... My husband has a job for five days, but what about when he does not get any work? He will earn and give me money, but what if I do not get money tomorrow?”

IDI Participant (Woman)

Because women faced difficulties earning income, most cash used to acquire NDFs came from their spouses. As spouses also frequented markets, they could influence food choices.

3.2.3.1. Household food choices. Participants reported that food choices were sometimes made collectively among household members. However, some women reported making the decisions because they prepared the meals, while others noted that their spouse or parents-in-law decided. Overall, we found little discrepancy between women's and their spouses' decision-making, which mainly considered finances and household food preferences.

Both participant groups emphasised affordability, which sometimes meant replacing expensive NDFs, such as meat and non-seasonal vegetables, with cheaper NDFs or potatoes. Potatoes were inexpensive, storable, tasty, filling, and versatile for meals.

“We eat potatoes more [than vegetables] because, as I said, when we have money, we also eat green vegetables. If vegetables are cheap, then we buy them, and if vegetables are expensive, then we do not buy them”.

IDI Participant (Woman)

“If we get costly vegetables, we get less. If there is money, they are bought, or else [sponge gourd] would be eaten, or potato would be used ... we need to fill the stomach anyhow, right?”

IDI Participant (Man)

Fruits were generally regarded as even more unaffordable and seldom bought, except by wealthier participants who occasionally purchased fruit for their children. Overall, fruits were seen as luxury items, enjoyed during special religious occasions.

“Poor people cannot eat fruits every day. Even eating dal and vegetables is not affordable every day.”

IDI Participant (Woman)

“[we get] fruits if there are any festivals or celebrations happening. Otherwise, we rarely have them.”

IDI Participants (Man)

Regarding nutrition knowledge, most women learned about healthy foods from village meetings, doctors, and *Anganwadi* daycare centres. However, household-level decisions prioritising affordability usually hinder women from applying their nutritional knowledge in markets. Overall, formal education did appear to influence women's grasp of nutrition knowledge.

“We should eat meat. They tell us all this. There is no income, so how will it happen?”

FGD Participant

“We should eat green vegetables, drink milk, eat eggs, meat, and fish ... we get vitamins and calcium from it ... but because of that [lack of income] we cannot do it.”

IDI Participant (Woman)

Both groups of participants expressed a desire to increase their household's NDF intake, mainly fruits and ASFs, to support their children's physical and mental development. Multiple poorer women declined when asked hypothetically if they would buy more NDFs with increased income, opting instead to fund their children's education. Similarly, several women who own livestock sold milk rather than consume it, using the proceeds to fund education. This was despite their desire to increase their children's milk intake. In contrast, most male participants agreed to buy more NDFs if their cash flow increased.

“Any money is spent on educating the children, so we would save that money ... if we spend the money on food, how will we be able to educate our children?”

(responding to why she is selling milk) “It is due to our lack of money. How will we bear the expense of their education?”

IDI Participants (Women)

Another significant determinant of food choices was household members' food preferences. However, this could reduce the purchases of green vegetables because some children reportedly dislike the taste. Instead, children enjoyed the taste of processed food, potatoes and ASFs, namely eggs and chicken. However, these ASFs were often unaffordable.

“Food is prepared according to the choice of the children. Sometimes the children will say they want to eat Maggi [instant noodles].”

“The children don't like [green leafy vegetables]. If we make them, they will say, ‘Give us plain roti!’”

IDI Participants (Women)

Vegetarian parents-in-law could also ban ASFs in the household, reducing their acquisition, given the challenge of food preparation outside the home:

“Sometimes, we do not get meat or fish because we feel scared of our in-laws.”

FGD Participant

“If I bring fish or chicken [from the market], that won't work as it will have to be cooked at home.”

IDI Participant (Man)

Acquiring ASFs can be further restricted by religious practices that prohibit their consumption. During Shravan (July–August), Hindu participants avoid eating ASFs, meaning that although the affordability of fish improves (section 3.1.2), participants cannot consume fish. This highlights religion's mixed role in healthy diets.

“We want to eat [fish], but it is a barrier. How can we eat meat and fish during Shravan? It is a rule.”

FGD Participant

4. Discussion

Our study explores how gender and other intersecting socioeconomic factors influence women's interactions with their market food environment to acquire nutritious food in rural Bihar. In turn, we make an important contribution to the interdisciplinary literature on food environments and public health; our study provides unique insight into how gender norms, discrimination, and socioeconomic factors, such as

wealth, employment, cash flow, caste, and rurality, can constrain women's ability to interact with rural market spaces to access healthy diets. These food environments are characterised by high, volatile NDF prices, creating affordability barriers for the rural poor. Restrictive gender norms intersect to exacerbate affordability barriers for women, increasing the cost of purchasing NDFs for households already experiencing food budget constraints. Fig. 6 visually depicts these intersections and the main pathways underpinning women's acquisition of NDFs, based on our synthesis of the above-presented findings.

4.1. Summary of key findings

Affordability was the main barrier to acquiring NDFs from local markets, aligning with other food environment studies in LMICs (De Filippo et al., 2021; Surendran et al., 2020). This barrier was pronounced among low-income individuals who struggle to afford the higher prices of NDFs, supporting existing evidence that low incomes limit access to healthy diets (Hall et al., 2009; Hosseinpoor et al., 2012). Our findings suggest that restrictive gender norms compound the problem of low incomes and high prices by reinforcing structural barriers that limit women's autonomy in accessing and purchasing food from markets. For instance, some women's limited mobility increases the cost of purchasing NDFs by compelling them to buy more expensive, lower-quality, and less diverse produce from mobile vendors. Such gender norms also indirectly restrict food budgets by depriving women of livelihoods for relatively higher caste women, and equal pay for lower caste women. Limited food budgets can then lead to substituting NDFs with cheaper, less nutritious foods. Similar trade-offs for economically marginalised consumers regarding food healthiness, price, and quantity have also been documented in Bihar (Travasso et al., 2023) and other LMIC settings (Bell et al., 2021; Downs et al., 2022).

Acquiring food without social stigma is essential for equitable access to nutritious food (Earnshaw and Karpyn, 2020). In rural patriarchal settings, social stigmas restrict women's mobility (Das et al., 2023; Uteng, 2012), reducing access to healthy food (Schneider et al., 2023). In Bihar, social stigma often prevented women from using their local markets, prompting some to travel further afield. This response strategy risks exacerbating existing affordability barriers, as longer distances to markets can increase transport costs, further reducing food budgets. The inability to afford transportation also endangers women's safety when travelling on foot. Without safe market access, women may struggle to achieve high-quality, healthy diets or buffer against lean seasons (Hirvonen et al., 2017; Nandi et al., 2021; Onyeneke et al., 2019). Women in rural Bihar often encounter such market access issues, particularly during the rainy season, potentially endangering low-income women from remote areas.

Concerning food decision-making, our evidence suggests that the implications of women's restricted market access, specifically for acquiring NDFs for the household, are less severe. Spouses who frequent markets followed similar decision-making factors, e.g., affordability and household members' food preferences. While this finding implies limited gender discrimination in household food decision-making, as other studies in India have found (Surendran et al., 2020), women in rural Bihar still face restricted autonomy and financial capability in physically buying food compared to men. Therefore, interventions are still required to improve women's access to markets and reduce existing gender inequality gaps.

Additionally, strongly catering to children's preferences can reduce NDF intake among low-income households by partially allocating already limited food budgets to unhealthy foods (Wertheim-Heck and Raneri, 2020). We found that some children disliked green vegetables and sometimes preferred unhealthy foods, resulting in fewer NDF purchases. However, it was unclear whether this was because of budgeting for unhealthy foods. Nevertheless, our findings suggest the need to promote healthy child-feeding practices. Lastly, despite the common assumption that women make healthier food choices for their children,

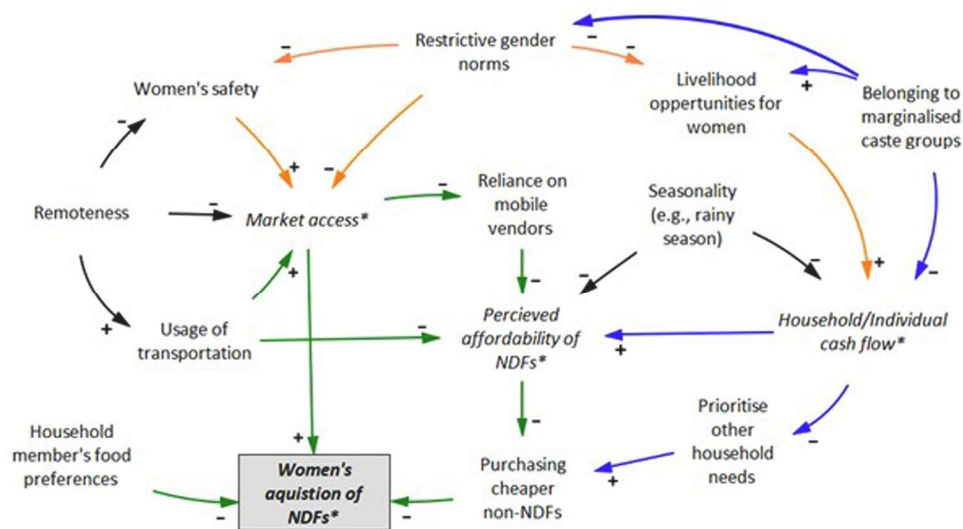


Fig. 6. Main pathways influencing rural women's acquisition of NDFs. A more detailed account of these interacting pathways is presented in [Supplementary Material 7](#). Green arrows denote the relevant elements of the food environment, orange arrows denote gender-specific factors, blue arrows denote socioeconomic factors, and black arrows denote interactions with remoteness and seasonality. The polarity at the end of each arrow indicates the direction of association between two variables, e.g., whether an increase in one variable is associated with an increase (+) or a decrease (-) in the following variable. For example, restrictive gender norms reduce women's market access (section 3.2.1). In turn, decreased market access leads to an increase in their reliance on expensive mobile vendors, which reduces the affordability of NDFs, especially for those with limited cash flow (section 3.2.2). Variables in italics containing * highlight where an intersection occurs between the gender, socioeconomic inequality and/or the food environment.

we found that financial constraints may lead women to prioritise other needs (e.g., children's education) over healthy diets.

Trends from our study suggest that women from marginalised castes may face fewer restrictions on their mobility and, consequently, greater access to markets and livelihoods. This aligns with evidence that higher- or less-marginalised castes are more socially conservative, enforcing norms that limit women's mobility and autonomy (Sankaran et al., 2017)—forms of control often seen as essential for preserving caste hierarchy (Deshpande, 2002). However, the relatively fewer constraints experienced by women from more marginalised caste groups on their mobility are not necessarily due to more progressive gender norms, but rather to economic necessity. As such, while women from more marginalised caste may face fewer of the identified trade-offs resulting from navigating restrictive gender norms (e.g., relying on pricier mobile vendors), they may experience the greatest unaffordability barriers overall, as these groups are typically among the poorest (Zacharias and Vakulabharanam, 2011). The role of caste in shaping women's market access remains an understudied field, with few studies recognising its significance (e.g., Kehoe et al., 2019). Our study contributes to this limited body of literature by revealing how gender-based barriers to market access and acquiring NDFs are not experienced equally across caste groups. These differences need to be recognised in the design of interventions aimed at improving women's market access and diet quality.

Consistent with other studies in India (Rathi et al., 2025; Sekhar et al., 2018; Surendran et al., 2020), NDF prices in Bihar fluctuate. For example, vegetable prices rise during the rainy season and fall in winter, whereas fish prices can decrease during the rainy season. These perceptions generally align with seasonal trends in Bihar's food price data. According to the AgMarketNet portal (Government of India, n.d.), some vegetables, including tomato, cauliflower, cabbage, and brinjal, sell for 5–10 INR/kg in markets during peak harvest months, when labour requirements are highest (i.e., December and January), rising to 40 INR/kg during the rainy off-season. However, some vegetable prices, including okra and spine gourd, can drop to 10 INR/kg during the rainy season and reach 50 INR/kg in winter and summer, offering cheaper alternatives during periods of low cash flow. Additionally, fruits such as mango and lychee are harvested during the rainy season, which could

help improve women's nutrition during this period, although Fig. 5 indicates that the impact of fruit production on nutrition would likely be limited. Our study builds on the effects of price spikes on the affordability of healthy diets by highlighting their overlap with seasonal cash-flow instability—an untimely trend that disproportionately affects poorer households and women, given women's limited livelihood options and pay (section 3.2.3). Other studies in LMICs also note that the impacts of seasonal price spikes on access to healthy food are usually more significant for lower-income groups (Nago et al., 2012).

4.2. Policy implications

We propose two key factors to target in designing these interventions: 1) addressing women's economic constraints, and 2) 'gender-sensitive' markets inclusive for women.

4.2.1. Addressing women's economic constraints

The unaffordability of NDFs limits their acquisition by the rural poor. Restricted market access, difficulty obtaining credit, low wages, and unemployment exacerbate these economic barriers for women, reducing budgets for the poorest households already experiencing food budget constraints. Addressing these intersecting inequalities requires increasing access to financial resources, particularly among the poorest and lower-caste women. Cash transfer schemes offer a potential option. Cash transfers have increased diet diversity and household food consumption in LMICs (Bastagli et al., 2016), and when targeted towards women, can increase purchases of NDFs (Harris-Fry et al., 2022). In Bihar, cash transfers funded by India's poor welfare scheme reduced food insecurity (Makkar et al., 2022) and could be leveraged to support women buying NDFs. Financial mechanisms should account for fluctuations in NDF prices and cash flow, i.e., less provision or more targeting depending on the season.

Alongside cash transfers, nutrition-related behaviour change communication strategies could be employed and be attuned to religious and financially challenging periods. For example, during Bihar's rainy season, strategies may promote cheaper NDFs, such as okra and gourds, while avoiding ASFs during religious periods (i.e., Shraavan). Employing complementary behaviour change strategies alongside cash transfers to

rural poor women can enhance their effectiveness for improving their households' nutrition (Ahmed et al., 2025), while interventions targeting disadvantaged groups must consider their 'lived realities', including food price fluctuation, changing financial situations, and other household priorities (Hawkes et al., 2024). Hence, activities should incorporate a food budgeting element, guiding households in strategising their food choices across seasonal challenges, while also encouraging the use of cash transfers towards healthy food alongside other priorities, e.g., children's schooling. Activities should involve all food decision-makers, including men, whose involvement in such nutrition-related activities can boost households' purchases of healthy foods (Thakur et al., 2025).

4.2.2. Gender-sensitive markets

Given the gendered barriers to market access, some women were compelled to purchase more expensive NDFs from mobile vendors. While alleviating the monetary, psychic, and time costs of attending markets, mobile vendors were unreliable and sold low-quality and less diverse produce. Furthermore, this method of acquiring NDFs does not encourage women's involvement in public spaces (SDG 5). Markets should become safer and more suitable spaces for women (i.e., 'gender-sensitive') to encourage their participation (Das et al., 2023) and access to more affordable, higher-quality, and more diverse NDFs. India's national government recently earmarked resources to i) upgrade the facilities of existing rural markets and ii) increase the density of food markets (Government of India, 2019, 2020), offering a potential funding source to facilitate this transition.

To develop gender-sensitive markets, their design should be participatory and co-designed with rural women to ensure that facilities, infrastructure, governance, and policies consider their needs in the marketplace (Aberman et al., 2021). India's National Bank for Agriculture and Rural Development (NABARD) recently commenced developing rural markets in Jharkhand, including a component focused on women's wellbeing. NABARD (2021) reported that women felt safer when vendors were familiar (i.e., locals or self-help group members) and appreciated having a space for social gatherings. Utilising rural markets for social meetups is not uncommon in rural India (Akoijam, 2018; Velayudhan, 2016), and establishing designated spaces for women in markets could accommodate visits from groups, which are more socially acceptable and safer to travel in (section 3.2.1). NABARD (2021) also report that women appreciate well-maintained sanitation facilities, e.g., gender-specific toilets, consistent with other rural market studies in India (Akoijam, 2018; Ray et al., 2014). However, implementing and maintaining such facilities may incur additional running costs, possibly borne by vendors selling in these markets. Careful consideration regarding these potential trade-offs among market actors, consumers, and vendors should be thoroughly discussed during the co-design phase.

While these features could enhance women's market experience, policies that improve women's mobility to access markets are also required. Providing women with decent employment to increase their financial autonomy could increase their empowerment and subsequent mobility (Das et al., 2023). Mahatma Gandhi NREGA, a government rural livelihoods initiative targeting the poorest households (Government of India, 2024), could focus on women to increase their financial autonomy, mobility, and food budget. Similarly, engaging women as market vendors could empower them, increase their participation in markets, and enhance the gender sensitivity of those markets (NABARD, 2021). However, strategies enhancing women's access to markets may increase their exposure to advertisements for unhealthy foods, especially when travelling. Taken together, these dynamics suggest that, despite the inherent importance of improving women's access to markets (e.g., to reduce gender inequalities), these dynamics suggest that improving women's market access does not unambiguously translate into improved diets. While markets remain a primary source of NDFs in rural Bihar, whether women's enhanced access leads them to purchase more NDFs likely also depends on accompanying food price and income dynamics, as well as individual market food environments.

This remains an open empirical question that requires further investigation.

4.3. Strengths and limitations

Our study employed multiple qualitative data collection methods, alongside a substantial qualitative sample size, to draw our conclusions, which were contextualised using a large-scale household survey. Few food environment studies use qualitative research (Choudhury et al., 2025), and our integrated IDIs and FGDs provided a thorough exploration of the interface between socioeconomic inequalities and the market food environment for attaining healthy diets. In capturing women's lived experiences, we elucidated the processes underpinning the unique challenges marginalised women face in accessing healthy diets, women's responses, and the indirect trade-offs created; for example, the exacerbation of affordability barriers associated with using more distant markets to avoid local recognition. Furthermore, our integrated approach also allowed us to triangulate deeper individual narratives and experiences with perceptions and norms explored through group interactions, which we then contextualised with wider primary quantitative data, enhancing the trustworthiness of our findings (Lambert and Loisel, 2007). Finally, we also explored spouses' viewpoints and experiences, which deepened our understanding of the barriers to NDFs uniquely faced by women.

Our use of frontline workers during sampling may have risked selection bias. Furthermore, insufficient household-level data per village prevented us from randomly stratifying participants by socioeconomic characteristics. However, since we aimed to understand key processes by which inequalities interact with the market food environment, we deemed purposive sampling of IDI and FGD participants suitable. Given the identified key themes of NDF prices, volatility, and affordability, these barriers could have been studied quantitatively, thereby improving the internal validity of our findings. Additionally, our data collection occurred during the rainy season, potentially introducing a recency bias regarding seasonality. However, our findings regarding seasonality are consistent with other studies in Bihar (Travasso et al., 2023). Our more granular findings might be site-specific; however, our analysis of these findings alongside broader literature from India and other LMICs highlights some generalisability. Lastly, our study did not explicitly apply an intersectionality lens. Future work should therefore i) explore women's barriers to NDFs in other Indian states, ii) utilise a mixed-methods approach to study affordability barriers, and iii) use an intersectional lens to provide deeper insight into how underlying power structures influence inequalities in NDF acquisition.

5. Conclusion

Our study demonstrates how gender norms and other socioeconomic inequalities can interact to exacerbate barriers to acquiring NDFs from market food environments in rural Bihar. Restrictive gender norms can exclude women from rural market spaces and livelihood opportunities, compounding challenges of affordability and access, and limiting women's autonomy in securing healthy diets. Complementary interventions that alleviate budget constraints and enhance women's safety and inclusion in markets could help increase women's acquisition of NDFs. While there is abundant quantitative evidence indicating how food environments can shape the diets of socioeconomically disadvantaged individuals, this study provides qualitative insight that unpacks the nuanced interplay among market food environments, individual socioeconomic factors, and gender norms in LMICs that influence access to healthy diets. By analysing the barriers created, contextualised interventions can be developed to empower rural Indian women to enhance their participation in public spaces and improve their nutritional health.

Ethical statement

Ethics approval for this study was obtained from the ethics committees of the University of Sheffield (reference number 052923, date June 20, 2023) and the National Institute of Nutrition (reference number CR/11/IV/2022, date September 23, 2022). All participants gave written informed consent to participate in this study.

CRedit authorship contribution statement

Martin Watts: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Writing – original draft. **Gregory S. Cooper:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Supervision, Writing – original draft, Writing – review & editing. **Anjali Purushotham:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing. **Bhavani Shankar:** Conceptualization, Funding acquisition, Project administration, Supervision, Writing – review & editing. **Santhi Bhogadi:** Investigation, Project administration. **Helen Harris-Fry:** Funding acquisition, Project administration, Writing – review & editing. **Suneetha Kadiyala:** Funding acquisition, Project administration, Supervision. **Aakriti Gupta:** Writing – review & editing. **Fanny Sandalinas:** Data curation, Formal analysis. **Shriya Bajaj:** Formal analysis, Writing – original draft. **Navin Bhushan:** Project administration, Supervision. **Vikash Kumar:** Project administration, Supervision. **Ashwini Chhatre:** Funding acquisition. **Raja Sriswan Mamidi:** Funding acquisition, Project administration. **Emily Fivian:** Conceptualization, Funding acquisition, Investigation, Methodology, Supervision, Writing – review & editing.

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.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.healthplace.2026.103618>.

Data availability

The data that has been used is confidential.

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