



Drivers of food acquisition practices in the food environment of peri-urban Hyderabad, India: A qualitative investigation

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ABSTRACT

This study investigates drivers of food acquisition practices in the food environment of peri-urban Hyderabad, India. We used a multi-method qualitative methodology that included in-depth interviews ($n = 18$) and an innovative qualitative geographical information systems (Q-GIS) approach, featuring participatory photo mapping and follow-up graphic-elicitation interviews ($n = 22$). Secondary data from eight focus group discussions ($n = 94$) was used to corroborate findings related to fruits and vegetables. Thematic analysis identified three primary drivers of food acquisition practices among adults: 1) Food prices and affordability; 2) Vendor and product properties, including (a) quality and freshness, and (b) adulteration and contamination; and 3) Social capital. Drivers of food acquisition and consumption among children and adolescents were a key concern for our participants, and included food availability and accessibility, desirability, and convenience. Findings reveal a need for targeted interventions in external and personal food environments to improve diets, nutrition, and health in this setting.

1. Introduction

Food systems and food environments are changing rapidly in low- and middle-income countries (LMICs), set against a backdrop of globalization, urbanization, economic development, technological advancement, and shifts in agricultural systems (High Level Panel Of Experts On Food Security And Nutrition, 2017; Pingali et al., 2019; Satterthwaite et al., 2010). Shifting dietary and lifestyle patterns are fuelling a nutrition transition (Popkin, 2015; Popkin et al., 2012), resulting in an emerging double burden of malnutrition characterized by persistent undernutrition and the increasing prevalence of overweight, obesity, and diet-related non-communicable diseases (NCDs) (World Health Organization – WHO, 2017; Popkin et al., 2020).

In India, the double burden of malnutrition is a pressing public health challenge (Bailey et al., 2018; Ravishankar, 2012; Shetty, 2012).

Malnutrition and dietary risks are estimated to be the leading risk factors contributing to disability-adjusted life-years (DALYs), respectively (Institute For Health Metrics And Evaluation - IHME, 2018). Estimates from the Global Burden of Disease study attest to the extent of the double burden of malnutrition in India, with an estimated 1520 disability-adjusted life-years per 100 000 population lost in 2017 due to iron, zinc and vitamin A deficiencies, whilst 2703 disability-adjusted life-years per 100 000 population were lost due to high low-density lipoprotein cholesterol or high Body Mass Index (BMI) (Institute For Health Metrics And Evaluation - IHME, 2019).

Recent calls have been made to improve knowledge and understanding of food environments and drivers of food acquisition in LMICs (Global Panel On Agriculture And Food Systems For Nutrition – Global Panel, 2017, High Level Panel Of Experts On Food Security And Nutrition, 2017, United Nations System Standing Committee On Nutrition –

Abbreviations: LMICs, Low- and middle-income countries; Q-GIS, Qualitative geographical information systems; IDI, In-depth interview; APCAPS, Andhra Pradesh Children and Parents Study; NCDs, non-communicable diseases; DALYs, disability-adjusted life-years.

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UNSCN, 2019, Downs et al., 2020). Food environments form the series of physical, economic, socio-cultural, and policy opportunities, constraints and conditions that influence what people eat (Food And Agriculture Organisation Of The United Nations – FAO, 2016, Swinburn et al., 2013). Interactions between external food environment dimensions of food availability, price, vendor and product properties, and marketing and regulation; and personal dimensions of food accessibility, affordability, convenience and desirability shape food acquisition and consumption (Fig. 1) (Turner et al., 2018). There is a critical need to unpack the black box of interactions and unknown mechanisms that link these various dimensions and the frequent, multifaceted, situational, dynamic and complex ways in which people acquire, prepare, and consume foods as part of daily life (Travert et al., 2019; Sobal and Bisogni, 2009; Furst et al., 1996).

A recent systematic scoping review of food environment research from LMICs identified the nascent yet rapidly emerging body of literature (Turner et al., 2019). To date, only a handful of studies have focused on food environments and drivers of food choice in India (Bailey et al., 2018; Daivadanam et al., 2015; Finzer et al., 2013; Gupta et al., 2016; Li et al., 2019; Maxfield et al., 2016; Patel et al., 2017; Rathi et al., 2016, 2017; Surendran et al., 2020). Within the qualitative literature, studies have investigated drivers of food choice (Bailey et al., 2018; Daivadanam et al., 2015), as well as perceptions and experiences of school food environments (Rathi et al., 2016, 2017; Maxfield et al., 2016) and fruit and vegetable environments (Surendran et al., 2020). Beyond these pioneering studies, there remains limited in-depth knowledge and understanding about food environments and drivers of food acquisition practices as part of daily life in India.

In this article, we investigate drivers of food acquisition in the food environment of peri-urban Hyderabad, India. We implement a multi-scalar qualitative approach to address community, intra-household and individual level drivers of food acquisition and consumption, grounded in socio-ecological theory and the recognition of multi-scalar determinants of health-related behaviours (Brug et al., 2008; Rao et al., 2007). Our study features two villages from the Andhra Pradesh Children and Parents Study (APCAPS), a transitional setting that features a high prevalence of chronic diseases and risk factors amongst adults aged 30–84 years (Hayter et al., 2015). We draw from multiple methods, including in-depth interviews and a novel qualitative geographical information systems (Q-GIS) approach, featuring participatory photo

mapping and follow-up graphic- and photo-elicitation interviews. Participatory methodologies place participants at the centre of the research activities to enable the investigation of emic perspectives and lived experiences, and have been combined with visual methods such as participatory photography and graphic- and photo-elicitation techniques, also known as ‘Photovoice’ (Coleman, 2016; Collier, 1957, 1987; Copeland and Agosto, 2012; Harper, 2002; Rose, 2007; Wang and Burris, 1997; Wang, 1999). Participatory techniques such as Photovoice have been used previously to explore the interconnections between place and daily life, assisting understanding about socio-ecological interactions between natural, built, social and symbolic environments that shape health and well-being (Coleman, 2016) in both high income countries (Milton et al., 2015; Dennis et al., 2009) and LMICs (Corbett and Rambaldi, 2009; Birgante, 2010; Gotschi et al., 2009).

Findings from this article seek to improve knowledge and understanding about how people perceive and experience drivers of food acquisition and consumption as part of daily life, with a view to informing policies designed to improve the healthiness of food environments and diets in peri-urban Indian settings.

2. Methods

2.1. Study design

We implemented a multi-method qualitative methodology that included; 1) in-depth interviews, and 2) a qualitative-geographical information systems (Q-GIS) approach, featuring participatory photo mapping and follow-up graphic elicitation interviews. Our approach is grounded in socio-ecological theory and the recognition of multi-scalar determinants of health-related behaviours (Brug et al., 2008; Rao et al., 2007).

2.2. Study setting

We purposively selected two peri-urban villages, Patelguda, featuring a high level of urbanicity, and Thummaloor, with a low level of urbanicity, in order to capture the range of peri-urban environments in this setting (Table 1). Evidence from the wider APCAPS study identified a high prevalence of chronic diseases and risk factors amongst adults aged 30–84 years in this peri-urban community, including underweight

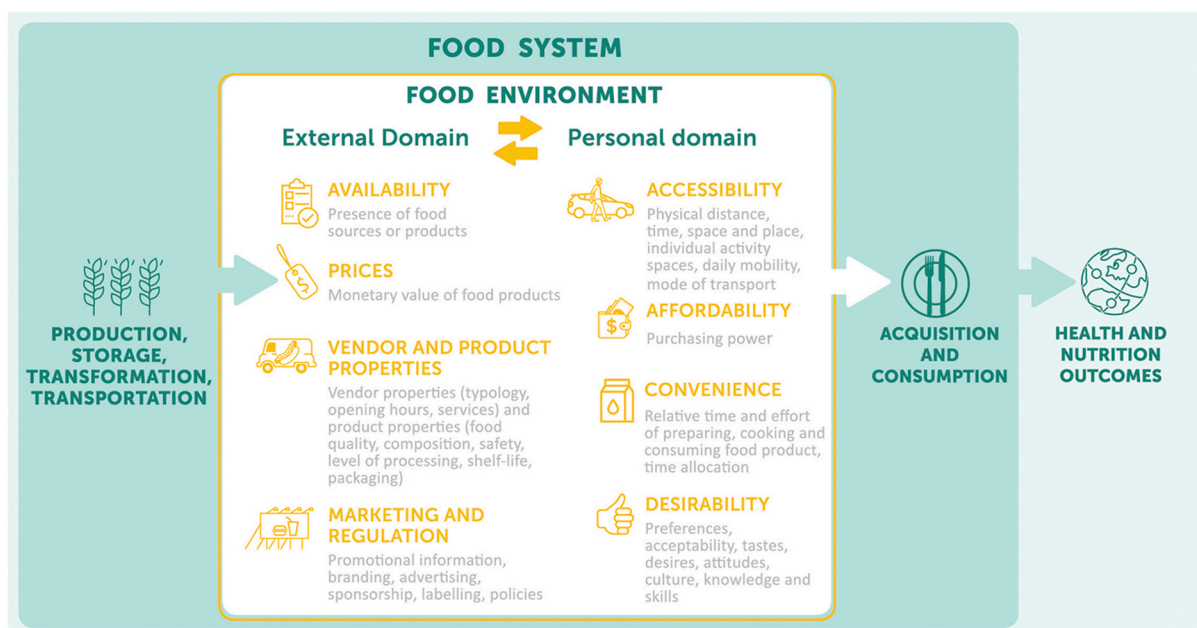


Fig. 1. A globally applicable food environment conceptual framework. Source: Turner et al. (2018).

Table 1
Descriptive characteristics of the study sites from the APCAPS survey data.

Site	Population (APCAPS HH survey)	Urbanicity ranking (Multi-component scale 2013) ^a	Food vendor count (n)	Availability of food vendors by typology (n, %) ^b						
				Street vendor	Ready to eat shop with seating	General store	Other shop with walls and roof	Village market	Ration shop	Others
Patelguda	2745	High	36	2 (5%)	3 (8%)	19 (53%)	9 (25%)	0 (0%)	1 (3%)	2 (6%)
Thummaloor	2484	Low	30	1 (3%)	2 (7%)	14 (47%)	11 (37%)	1 (3%)	1 (3%)	0 (0%)

^a The APCAPS multi-component urbanicity index 2013 was created by the wider APCAPS research project to provide an indication of each village's level of urbanicity relative to the 28 other villages at that time point. The 11 indicators that displayed a significant contribution to the construct of urbanicity de-termined by Principal Component Analysis (PCA) were: presence of post office, % of residents owning a phone, % of residents owning a two- or four-wheeler, presence of banks and credit coop societies, % of residents working in skilled non-manual or professional roles, presence of colleges, presence of healthcare facilities, % of households with a private supply of water, % of households classified as "pucca", night-time light intensity, % of residents owning a television. Higher scores indicate higher urbanicity. PCA tertiles were compared to classifications obtained from a simple face validity study where 8 fieldworkers, all with several years of experience working in the APCAPS villages were asked to rank all 29 villages based on their perception of each village's urbanicity. These eight rankings were combined to create urbanicity tertiles for all villages and the kappa statistic for agreement between tertiles from the face validity study and the PCA tertiles indicated a strong degree of agreement (0.86).

^b Data collected as part of the 2016 APCAPS built environment survey.

(BMI <18.5 kg/m²: men 31%, women 20%); overweight (BMI ≥25 kg/m²: men 18%, women 24%) and hypertension (BP > 140/90 mmHg: men 20%, women 13%) (Kinra et al., 2014). Formative focus group discussions investigating perceptions of health and chronic disease amongst APCAPS residents indicated concerns around the transitioning food environment and changing diets over the past decade (Hayter et al., 2015).

2.3. Sampling and data

We anticipated that a sample of 40 participants from 20 households, including one male and female from each household, would yield sufficient data to achieve thematic saturation, although we were prepared to sample additional participants if needed. Simple random sampling was used to prevent the purposive selection of households with a pre-existing rapport with the field team, and to give all households an equal chance of selection given the risk of participant burden within the multi-wave APCAPS cohort. APCAPS census data from the 2012–2014 household survey was used to create a randomly generated roster of eligible households with ≥1 male and ≥1 female aged 18–65 registered at the residence. Households were randomly assigned to one of the two methods outlined, either in-depth interviews or the qualitative-geographical information systems (Q-GIS) approach. This study design facilitated methodological comparison, although this is beyond the scope of the current article. Recruitment was conducted by telephone in sequential order from the household roster. The index person for each household and their spouse were recruited if they were confirmed eligible and willing to participate, with other eligible household members invited to participate in cases where the index person or their spouse were not willing to participate. Additional households were recruited in cases where no household members were willing to participate, and also in cases of attrition or deviance from the study protocol. A flowchart documenting the recruitment process is provided (Supplemental Material 1).

Guidelines for qualitative public health research informed our study design (Green and Thorogood, 2013; Chandler et al., 2013). Participatory training workshops focusing on qualitative research skills were held with the field team prior to data collection to ensure data quality, informed by established training manuals (Haaland et al., 2006). The field team were fluent in both Telugu and English, and held extensive local knowledge and fieldwork experience in the APCAPS. The primary data collection protocol and tools were developed by the lead author in English and translated into Telugu by the field team. The protocol was pilot tested with a member of the non-academic support staff from the National Institute of Nutrition. Reflexive group discussions with the field team refined the protocol and topic guides, and ensured that the translated terminology was applicable within the local context. Primary data

collection was conducted in Telugu and took place between June and August 2017. Secondary data from the wider APCAPS study included qualitative transcripts from eight focus group discussions (n = 94) on drivers of fruit and vegetable acquisition and consumption conducted across 8 peri-urban sites in 2018 (Surendran et al., 2020), as well as demographic and socio-economic data from the APCAPS 2012–14 household survey.

2.4. In-depth interviews

In-depth interviews were conducted with participants (n = 18) about their current food acquisition practices, perceptions and experiences of change in their food environment over the past decade, and intra-household food acquisition, preparation and consumption. Probes focused on food sources, including market-based sources, own production, wild food harvesting, and gifts and transfers, as identified by Turner et al., 2018, as well as the external and personal food environment dimensions identified in the conceptual framework (Fig. 1). Participants were interviewed separately in a private space, either within the household or in a nearby community hall. Interviews were stopped when thematic saturation was reached. Interview audio was recorded using an encrypted dictaphone device. In-depth interviews lasted between 40 and 60 min.

2.5. A qualitative geographical information systems (Q-GIS) approach – participatory photo mapping and follow-up graphic and photo-elicitation interviews

We designed a novel Q-GIS approach featuring two stages. In stage one, participants (n = 22) were tasked with photographing their food environment and food acquisition, preparation and consumption practices over a three-day period using a GPS enabled mobile phone device. A brief training session on the functionality of the mobile device, the camera application, and ethical photographic principles was provided for participants. Guiding instructions provided on the background and screensaver of the mobile phone encouraged participants to take photographs of buying, growing, preparing, cooking and eating food, as well as any food sources, and also any non-food items, objects or activities considered to be important in shaping their diets. Data collection took place across weekdays and weekends to capture any variation in the food environment and food acquisition practices.

In stage two, each participant's geocoded photographs were downloaded, mapped and printed on chart paper. Charts visualizing the maps and photographs were used as visual stimulus in conjunction with photo- and graphic elicitation techniques in follow-up in-depth interviews with participants. The maps and photographs were used as a focal point to elicit narratives of food acquisition and consumption

practices, and explore perceptions and experiences of the food environment (Photograph 1). Probes facilitated photo-elicitation techniques, and the lead author prepared content specific questions for each photograph to facilitate further discussion. The Q-GIS topic guide featured the same structure and questions as the in-depth interview guide. An additional section was added at the end of the topic guide to explore participant perspectives and experiences of the Q-GIS approach and its feasibility. Photo-elicitation interviews were undertaken in cases where maps were not able to be produced due to missing GPS data as a result of participant deviance from the protocol. The Q-GIS interviews lasted approximately 1 h.

2.6. Data analysis

Thematic analysis was used to identify key themes in accordance with qualitative analysis guidelines for health research (Green and Thorogood, 2013). Interview transcripts and the Q-GIS charts featuring participant's maps and photographs were entered into NVivo12 software. Themes were derived from deductive and inductive techniques in an iterative process. Deductive techniques were used in the initial stages of analysis to code the data in line with the a-priori external and personal domains and dimensions of the food environment conceptual framework (Fig. 1). Inductive techniques were introduced as the analytical process developed, drawing from elements of grounded theory such as constant comparison, open coding and in-vivo coding to generate emergent themes and investigate deviant cases. The convergence of key themes, identification of established in-vivo themes, and lack of new themes as we iteratively coded our dataset instilled confidence that we had achieved thematic saturation. We applied principles of triangulation as an integral part of our analysis, both within and across cases, to strengthen validity and build breadth, depth and analytical rigour into our findings (Green and Thorogood, 2013). Triangulation, an established qualitative analytical technique, drives comparison between diverse forms of data derived from multiple methods (Green and Thorogood, 2013). Comparison between our interview transcripts, maps and photographs confirmed the regularities within the data, and revealed how participants navigate the various spaces and places within their peri-urban food environment to acquire foods as part of daily life. Key themes related to drivers of fruits and vegetable acquisition and consumption were corroborated with the secondary focus group data from the wider APCAPS study (Surendran et al., 2020) to further strengthen the validity of our findings.

Transcription and translation of interview audio was conducted by the field team, and all translated transcripts were analysed in English by the lead author. A sample of 4 transcripts were co-coded with the aid of a research assistant, followed by the blind coding of a further 2 transcripts, returning a high level of inter-coder agreement (86%). Discrepancies were resolved through discussion and the coding framework was amended accordingly. Manual coding of the photographic content from the Q-GIS charts was conducted by the lead author, collating data where discernible on the food source (including market-based, agricultural production, wild food harvesting, and transfers), vendor typology, and relevant food environment dimensions, as well as the presence of food items, preparing or cooking food, consumption of food, and location. Reporting of results was informed by established guidelines (O'Brien et al., 2014; Critical Appraisal Skills Programme, 2018). Descriptive information about the participants is provided in brackets at the end of each illustrative quote, including the participant's gender, APCAPS household identification number, age, and whether they participated in an in-depth interview or the Q-GIS data collection.

Ethical approval

This research was granted ethical approval by the Observational Ethics Committee of the London School of Hygiene and Tropical Medicine (reference number: 12 257) and the Institutional Ethics Committee

of the Indian Institute of Public Health, Hyderabad under the banner of the Public Health Foundation of India (reference number: IIPH/TRCIEC/092/2017). Written informed consent was obtained from all participants prior to data collection. All geocoded data and photographs collected by participants remain strictly private and confidential due to the sensitive nature of these data. Photographs included in this manuscript were taken for illustrative purposes by the research team, as credited, in the APCAPS setting, and are indicative of the kinds of photographs taken by the participants.

3. Results

3.1. Participant characteristics

In total, 40 participants took part in the study, including 18 in-depth interviews, 16 Q-GIS interviews, and 6 photo-elicitation interviews.

Table 2
Demographic and socio-economic characteristics of the sample.

Participant level data ^a			
Participants	Total (n = 36)	Patelguda (n = 17)	Thummaloor (n = 19)
Male	20	9	11
Female	16	8	8
Mean age	31	34	28
Education level	(n, %, [females])	(n, %, [females])	(n, %, [females])
Illiterate	13 (36%) [9]	6 (36%) [4]	7 (37%) [5]
Literate	4 (11%) [3]	2 (12%) [2]	2 (11%) [1]
Primary school education	9 (25%) [3]	6 (35%) [2]	3 (16%) [1]
Secondary school education	10 (28%) [1]	3 (18%) [0]	7 (37%) [1]
Occupation	(n, %, [females])	(n, %, [females])	(n, %, [females])
At home doing housework	8 (22%) [7]	6 (36%) [5]	2 (11%) [2]
Unskilled manual labour	14 (39%) [6]	5 (29%) [2]	9 (47%) [2]
Semi-skilled manual labour	7 (19%) [3]	3 (18%) [1]	4 (21%) [1]
Skilled manual labour	5 (14%) [0]	3 (18%) [0]	2 (11%) [0]
Skilled non-manual labour	1 (3%) [0]	0	1 (5%) [0]
Student	1 (3%) [0]	0	1 (5%) [0]
Household level data			
Households	Total (n = 20)	Patelguda (n = 9)	Thummaloor (n = 11)
Mean household asset score^b	11	10	11
Select household assets^c	(n, %)	(n, %)	(n, %)
Motorbike	8 (40%)	2 (22%)	6 (55%)
Bicycle	7 (35%)	5 (56%)	2 (18%)
Agricultural land	6 (30%)	2 (22%)	4 (36%)
Electricity	20 (100%)	9 (100%)	11 (100%)
Water pump	11 (55%)	4 (44%)	7 (64%)
Kitchen	19 (95%)	8 (89%)	11 (100%)
Refrigerator	2 (10%)	1 (11%)	1 (9%)
Television	18 (90%)	7 (78%)	11 (100%)
Radio	9 (45%)	6 (67%)	3 (33%)
Mobile phone	18 (90%)	8 (89%)	10 (91%)

^a Demographic and socio-economic data only available for 36 of the 40 participants as 4 of the female participants married into households after the completion of the 2012-14 household survey.

^b APCAPS Household asset score consists of a 24-component ownership checklist (house; kitchen; radio; tv; fridge; telephone; cooler; washing machine; agricultural land; electricity; bicycle; two wheeler; four wheeler; motor; water pump; tractor; thresher; toilet; account; cart; sofa set; table; bed; mattress).

^c Select assets related to food acquisition and consumption.

Demographic and socio-economic characteristics are provided (Table 2). At the household level, 14 of the 20 households (70%) were recipients of subsidized food rations through the means tested Public Distribution System, set at Rs. 27 000 per annum in 2016.

3.2. Key food sources and acquisition practices

Evidence from across our dataset demonstrated how people acquire foods from diverse sources as part of daily life in this transitional peri-urban setting, including market-based sources, agricultural production, wild food harvesting, and transfers (Table 3). In total, our Q-GIS participants took 1019 photographs. Among the mapped photographs ($n = 267$) included in the follow-up interviews, around half (55%) included a food source. Of these, agricultural production was most commonly photographed (33%), followed by informal market-based vendors (30%), formal market-based vendors (22%), and wild food harvesting (13%). Activity spaces among our Q-GIS participants, derived from their geocoded photographs, spanned a range of peri-urban and urban areas with key nodes of food acquisition including local villages, mandal headquarters (the central administrative village of the sub-district), and the city of Hyderabad. A reference map highlighting the key nodes collectively identified by participants from Thummaloor is provided to give an impression of the geography of food acquisition practices and the ways in which people navigate their food environment as part of daily life in this peri-urban setting (Fig. 2). Overall across our data, the majority of participants described weekly grocery shopping trips to their nearby mandal headquarter markets located 3–5 km away from their villages. These weekly trips were found to be interspersed with daily visits to small local general stores, which were typically categorised by participants into ‘emergency purchases’ of perishable items, and ‘habitual purchases’ of snacks, sweets and beverages. Food acquisition from urban areas was typically linked with work related travel. No discernible differences were found in terms of food sources utilized or foods acquired and consumed between residents from the two villages, despite the disparate levels of urbanicity.

3.3. Drivers of food acquisition and consumption practices

Three prominent drivers of food acquisition emerged consistently among adults: 1) prices and affordability; 2) vendor and product properties, with sub-themes related to a) freshness and quality, and b) adulteration and contamination concerns; and 3) social capital (Table 4). In addition, drivers of food acquisition and consumption among children and adolescents were a key concern amongst many of

Table 3
A descriptive overview of food sources discussed by participants.

Food source	Description
Market-based:	Market-based sources included formal and informal vendors in the villages, nearby mandal Headquarters, and urban areas. Commonly discussed formal vendors included weekly markets, traditional small brick and mortar shops in villages (also known as general stores), and ready-to-eat shops (also known as hotels and restaurants). Informal vendors were predominantly found to be street vendors, and included stationary vendors (including heap vendors and those with a temporary structure) and mobile vendors (such as door to door salespeople or motorbikes or autorickshaw vendors).
Agricultural production:	Agricultural sources included own production in local fields, home gardens in and around residential plots, and the farm gates of local producers.
Wild food harvesting:	Wild food harvesting sources included seasonal fruits and nuts, often harvested from in and around the villages as a leisure activity.
Transfers:	Transfer sources included ration shops provided through the Government run Public Distribution System, payment for labour (often agricultural labour), and gifts from neighbours, friends and visiting relatives.

our participants, particularly women, and we also identified three additional themes in this regard, including: 4) availability and accessibility; 5) desirability; 6) convenience (Table 5).

3.3.1. Theme 1) Prices and affordability

Prices and affordability were considered to be a key driver of food acquisition practices. Almost all participants noted price differences between smaller and larger peri-urban sites, as well as among different types of vendors. Mandal Headquarter villages located between 3 and 5 km from the study sites were considered to be a key source of foods due to the comparatively lower prices offered by wholesale vendors and weekly markets. One participant contrasted between prices in his village and the nearby mandal headquarters:

“Yes, there are differences. If we go to the headquarters to buy anything like pulses, salt, and sugar, whatever we bring from there we get that at less cost, like 5 to 10 rupees we can save.” (M, 240 253, 35 years, Q-GIS).

Participants told how they would buy groceries, vegetables and pulses in bulk at lower prices, ‘for the week’, from wholesale and market vendors in their local mandal headquarters:

“Maheshwaram is bigger as it’s a mandal headquarters. Foods are available conveniently and we buy enough to be sufficient for a week. Going there for vegetables is beneficial as the price will be a little less [...] two to three rupees less.” (M, 240 274, 30 years, IDI).

A number of participants expressed their willingness to travel further afield to purchase at relatively lower prices, further demonstrating the perceived importance of price over accessibility:

“If you go a long distance it will be because the prices are lower. No matter how far, we will go and get from those shops.” (F, 240 253, 32 years, Q-GIS).

One participant, a recipient of grain rations through the Government run Public Distribution System, described the practice of purchasing stale perishable items such as vegetables at reduced prices in the days following the weekly mandal headquarter markets, highlighting how price and affordability take precedence over freshness and quality among poor consumers in this setting.

In contrast to the mandal headquarters, local shops in the peri-urban villages were considered to cater for ‘emergency’ and ‘habitual’ purchases, leveraging dimensions of availability, accessibility, and convenience to charge higher prices for food items that were often perceived to be of lower freshness and quality than those in mandal headquarters:

“If we want something in an emergency it costs more here in our village, but we don’t get good ones. Sometimes we decide to wait while we go to Maheshwaram [mandal headquarters]” (M, 240 635, 45 years, Q-GIS).

3.3.2. Theme 2) Vendor and product properties

Freshness and quality: Perceptions of freshness and quality were considered to be key drivers of food acquisition amongst the majority of participants, particularly in relation to perishable items such as vegetables and milk. Perceptions varied by food source. For example, many participants expressed their preference to acquire vegetables directly from the fields of local producers due to their perceived freshness, and made direct comparisons with market-based vendors:

“If we go to the garden [local fields] they will be fresh so we bring from there. We don’t know when they [market vendors] take their produce and put them out. It’s not fresh, that’s why we do not want to take them.” (F, 240 635, 38 years, Q-GIS).

Among market-based vendors, local vendors in weekly village and mandal headquarter markets were widely considered by participants to

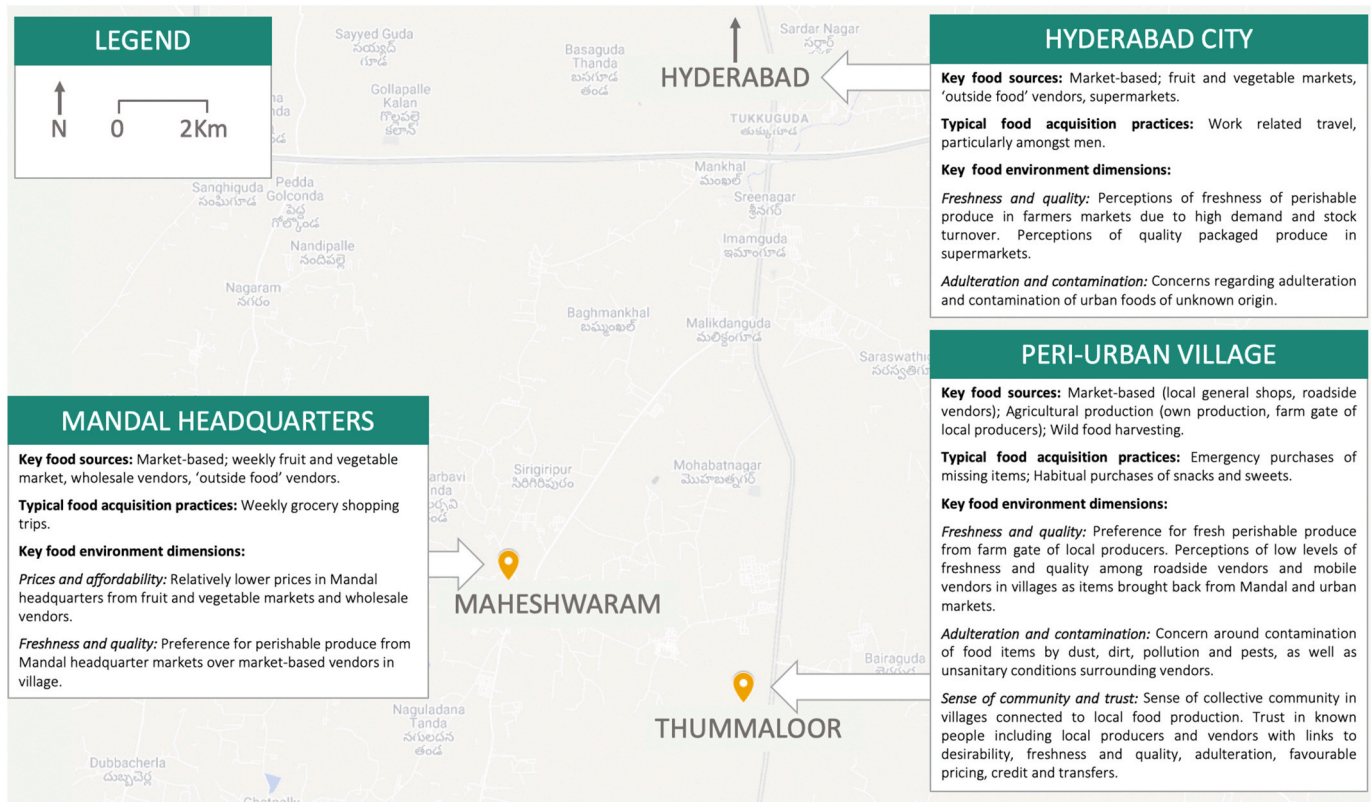


Fig. 2. A reference map depicting the key nodes of the food environment identified by our participants from Thummaloor.

provide the freshest source of quality perishables, as their produce was understood to be “cut in the morning and sold in the evening” (F, 240 635, 38 years, Q-GIS), thereby avoiding the spoilage associated with longer periods of transportation and storage. In contrast, a small number of participants noted a preference for urban fruit and vegetable vendors in Hyderabad city due to perceptions of freshness linked to higher levels of demand and stock turnover.

Roadside ‘heap vendors’ located in the villages were generally considered to provide low quality items, such as vegetables that had failed to sell in mandal headquarter or urban markets and had subsequently been brought back to the villages, exposed to the elements along the way (Photograph 2). One participant explained: “In the village they keep in small heaps, it will not be good here, that’s why we bring from the weekly market.” (F, 240 391, 20 years, IDI). Roadside heap vendors were the most commonly photographed of the market-based vendors by Q-GIS participants (n = 26; 33%), with many citing concerns about the freshness and quality of perishable produce when asked to explain their choice of subject: “Fruits, pomegranates, apples, and bananas, they keep them outside. We don’t buy from there [...] sometimes the fruits are not that fresh.” (M, 240 651, 21 years, Q-GIS).

Narratives around food processing and packaging were found to be contested. For example, some participants prized the perceived freshness of unpackaged items, such as unpasteurised milk procured directly from local producers: “Buffalo milk will be fresh, Sir! Trust... we don’t have trust in packet milk [...] it’s not healthy for the children” (M, 240 391, 22 years, IDI). Meanwhile, others described how their educated peers in the city recommended that they go supermarket shopping to purchase packaged items: “go nicely to that shop and take there, it will be available in packed form, it will be good.” (M, 240 544, 35 years, Q-GIS).

Adulteration and contamination: The majority of participants considered the adulteration of foods as a primary concern driving food acquisition practices. Participants identified a range of adulteration and contamination sources, spanning the food system from the point of production, to transformation, transportation and sale. At the point of

production, many participants cited the increasing use of ‘fertilizers’, ‘pesticides’, ‘chemicals’, ‘medicines’, and ‘drugs’ in agricultural processes, and voiced concerns regarding the perceived detrimental effects of these additives, not only to the taste of foods but also their nutrition and health:

“We used to use manure and spend time cultivating, now we are growing paddy quickly using chemicals and drugs to produce more yield, but it won’t be that nutritious, it has become like ready-made rice sir, in the past [...] it was good for health, Sir. [...] They are even injecting medicines into chickens. In the past one chicken used to grow in 3 or 4 months, now it’s 45 days! Because of that the energy is reduced, Sir. At that time, even if we ate a little we were healthy, but now we are not able to be healthy.” (M, 240 544, 35 years, Q-GIS).

At the points of transformation, transportation and sale, anxieties were manifested in sentiments of distrust with regard to unknown actors and hidden processes:

“We don’t take them [perishable items from roadside vendors] because we don’t know when they were plucked or how they were transported and kept.” (F, 240 391, 20 years, IDI).

“The wholesale shops don’t know what they are getting in the bags, they don’t know whether it’s plastic rice or normal rice! We know those who cultivate rice so we will mostly buy from farmers rather than from wholesale shops.” (M, 240 417, 26 years, IDI).

“We are getting adulterated goods. Rice is adulterated ... Everything is adulterated! [...] They are mixing rubber into the rice it seems and the rice is becoming soft! We are eating these foods ... our health is not well.” (F, 030 625, 25 years, Q-GIS).

Informal vendors were a particular cause for concern amongst many participants, grounded in tangible experiences of unsanitary surrounding conditions, the exposure of raw food items to the open elements,



Photograph 1. The use of a Q-GIS chart during a follow up interview. Credit: Christopher Turner.

including dust, dirt and pollution from passing vehicles, and contamination by pests such as flies and mosquitoes:

“The food now is just waste. [In the village] they keep heaps in the evening at 4 or 5pm in the middle of the road. Vehicles drive past and dust will fall on them. There will be flies on the heaps and the surrounding areas are not good.” (M, 240 391, 22 years, IDI).

3.3.3. Theme 3) Social capital

Social capital was particularly important in shaping food acquisition practices in this setting. Sentiments of trust, loyalty and community related to networks of ‘known people’ were embedded throughout participant’s accounts, and were closely connected with dimensions of desirability and vendor and product properties, including aspects of freshness, quality, adulteration and contamination. These sentiments were often voiced and portrayed vividly through narratives and imagery of food production, acquisition and consumption:

“We know them, they are our village people, Madam. Fresh buffalo milk will be good, pure milk, right? That’s why we bring from those people. Packaged milk will not be that good, powder gets mixed into it” (F, 240 544, 30 years, Q-GIS).

“We bring chicken from the village, there’s a chicken shop there. He gives with trust, even if we send the children, he gives good things, that’s why we only take from there.” (F, 240 284, 25 years, Q-GIS).

While eating we feel good, no?! If we go to another shop we don’t know what they will give us. We always go there and we like what they are giving us, good food will be there. We are living healthy, no? That’s why we are bringing from there.” (F, 240 391, 20 years, IDI).

Table 4

Key themes: drivers of food acquisition and consumption practices among adults.

Themes	Sub themes (if applicable)	Detail
Prices and affordability		Relatively lower prices in mandal headquarters Relatively higher prices in villages Affordability of bulk purchases Affordability of spoiled perishable items
Vendor and product properties	Freshness and quality	Preference for fresh perishable produce from farm gate of local producers, and mandal headquarter fruit and vegetable markets Spoilage associated with transportation and storage Packaged vs unpackaged foods Low freshness and quality of perishable produce from roadside vendors and mobile vendors
	Adulteration and contamination concerns	Point of production: Use of pesticides, fertilizers, chemicals and medicines Point of transformation: Adulteration of raw produce; preparation of ready-to-eat outside foods Point of transportation: Contamination of produce by dust, dirt, pollution and pests Point of sale: Contamination of produce by dust, dirt, pollution and pests
Social capital		Sense of community in villages connected to local food production The role of networks of known people, including local producers and vendors on: Desirability; Freshness and quality; Adulteration and contamination; Favourable prices; Credit; Transfers

Table 5

Key themes: adult perspectives on drivers of food acquisition and consumption practices among children and adolescents.

Themes	Detail
Availability and accessibility	Small local shops in and around the home and school food environments Sending children to nearby shop unsupervised
Desirability	Desirability of ready to eat outside foods, snack foods and instant foods; Influence of peers
Convenience	Childcare practices: Snacks as a mechanism for pacification; work related time constraints of parents resulting in acquisition of ready to eat outside foods for children

Social capital was also influential in shaping personal food environment dimensions such as affordability among a number of participants, both in relation to favourably reduced prices, *“they are our known people, so they don’t charge the maximum, 2 to 3 Rs less” (M, 240 391, 22 years, IDI)*, and the practice of acquiring food on credit:

“There are known people and unknown people, but if we go to the shop of a known person we go with trust [...] Oh, so many shops are there, but I mostly go to that one because they will give to us on credit. If we don’t have money, still they will give to us reasonably. They are known people to me.” (M, 030 088, 25 years, Q-GIS).

Social capital was also found to be important with regard reciprocity in the form of gifts and food transfers within the community. One participant stated: *“today, if we are starving, some lady will send food. It is*



Photograph 2. A roadside ‘heap’ vendor selling perishable fruits and vegetables in an APCAPS village. Credit: Christopher Turner.

like that in our village. We support each other.” (030 445, 46 years, IDI). In another example, one farmer explained how he benefits from the exchange of produce with friends at the local mandal headquarter market:

“We have some known people and if we ask them to give, they will give [...] it is a friendship, they will give what they have, and we will give what we have [...] we will take for free.” (M, 240 274, 30 years, IDI).

3.3.4. Theme 4) Adult perspectives on child and adolescent food acquisition and consumption: availability and accessibility

Dimensions of availability and accessibility were considered to be important to children’s food acquisition and consumption. Sending children to local vendors unsupervised was found to be a common daily practice (Photograph 3). One female participant explained how children were sent on daily food acquisition errands incentivised by the opportunity to buy chocolates: “We will send them daily for vegetables. Every day they go to buy something in that shop. After taking vegetables they will buy chocolates with the remaining money, like 2 to 3 rupees.” (F, 240 284, 25 years, Q-GIS).

Participants also expressed their concerns about children’s exposure to food vendors when travelling unsupervised to and from school, and also within the school food environment. One participant explained, “Anywhere at school, the shops are placed next to the school, is it not? They will eat chocolates at school.” (F, 030 088, 20 years, Q-GIS). Another mother, employed as a cook at a local school, described her struggles to prevent children from consuming unhealthy snacks and sweets at school, and referred to a photograph she had taken of a child holding a small sweet cake in the palm of his hand:



Photograph 3. Children buying snacks from a local shop in an APCAPS village. Credit: Christopher Turner.

“Here they are eating daily, that’s why I took the photo [...] They only decide! [referring to the children]. Their parents will not be there, they are at home. They take money from the house and eat here [referring to the photograph], they will not know, Sir. We tell the children at home, I have to say many times they are not good, like that. They do not hear and they do not care!” (F, 240 635, 38 years, Q-GIS).

3.3.5. Theme 5) Adult perspectives on child and adolescent food acquisition and consumption: desirability

Participants perceived snacks, fast foods and instant foods to be highly desirable and commonly consumed among children and younger generations, despite recognition of their unhealthy properties:

“Nobody in our house likes fast foods [...] people say that food is not good, you know, Maggi noodles, oily foods, we know this so we don’t eat them. When the children are there they will eat them, so we’ll make them.” (F, 030 062, 27 years, Q-GIS).

The influence of peers among children and adolescents was also found to be important in shaping the desirability of foods. One mother acted out a typical scenario, playing the role of her child: “Mother make this, make that, everyone is doing these foods, will you not do them mother?” (F, 240 242, 36 years, Q-GIS). Others highlighted a multitude of factors shaping the desirability of snacks and sweets among children and adolescents, including parental aspirations for overweight children:

“Small cakes, they are not costly [...] the children will ask for them because they are good. The neighbour’s children will eat them and they will ask us to bring them. The vitamins will be good, children will grow fat, they will have glamour, that’s why we bring.” (M, 030 088, 25 years, Q-GIS).

On the whole, most participants displayed limited knowledge about diets, nutrition, and health. Peer to peer learning and first-hand

experiences within the family were found to be the main sources of information. Many participants drew binary distinctions between 'good' and 'bad' foods. No participants referred to dietary guidelines as drivers of food acquisition and consumption. Despite limited knowledge, dietary related health was a prominent concern within the community. Narratives around children's diets and desirability typically focused on concerns related to the daily acquisition and consumption of 'bad foods' considered to be unhealthy, although many participants also emphasized the desire to eat 'good foods': "We should eat good food, we should give our children good food, like that we think." (M, 240 679, 25 years, IDI). For example, although fruits were discussed infrequently, when probed participants typically branded them as 'good foods for children'.

3.3.6. Theme 6) Adult perspectives on child and adolescent food acquisition and consumption: convenience

A number of participants revealed how convenience shaped their decision making in relation to feeding their children. For example, mothers discussed how they reluctantly relied on convenient and desirable sweets and snacks as mechanisms for pacification when faced with time constraints: "Children ask, they want this or that, chocolates, crisps, cake. They will cry, so we go and bring as there is no time." (F, 240 391, 20 years, IDI). Many female participants photographed children consuming ready to eat fast foods, snacks and sweets in and around the home. Others noted the importance of convenience in relation to the purchase of ready to eat outside foods for children when faced with work-related time constraints. For example, one father explained how long working hours limited time for childcare and food preparation, resulting in the purchase of ready-to-eat street foods, known as tiffin, from mobile vendors in the village to feed the children during the busy morning routine before school:

"Time, we will not get time! We will be at work by 9am. We don't have time to take care of the children. So, in the morning it will be tiffin. After giving them a shower, we give them tiffin to eat and send them [to school]. At night, it will be 8 or 9pm when we come home." (M, 240 679, 25 years, Q-GIS).

4. Discussion

This study draws from in-depth interviews and an innovative Q-GIS approach to investigate drivers of food acquisition in the food environment of peri-urban Hyderabad. Key themes included: 1) food prices and affordability; 2) vendor and product properties; including freshness and quality, and adulteration and contamination; and 3) social capital; whilst additional themes related to children and adolescents included, 4) availability and accessibility; 5) desirability; and 6) convenience. Participants engaged critically with the full range of external and personal food environment dimensions outlined in the conceptual framework (Fig. 1) (Turner et al., 2018), qualitatively validating the sensitivity and generalizability of this framing of the food environment in this LMIC setting (Green and Thorogood, 2013). Key nodes of food acquisition included peri-urban villages, nearby mandal headquarters, and the city of Hyderabad, emphasising the importance of studying food environments beyond local residential neighbourhoods (Caspi et al., 2012; Chen and Kwan, 2015; Cummins, 2007a; Kwan, 2018; Lucan, 2015).

Our findings related to the first two themes of food prices and affordability and vendor and product properties are broadly consistent with the wider literature demonstrating the importance of the external food environment in driving food acquisition practices. The emphasis placed on food prices and affordability by many participants in our study supports evidence from multiple settings across India (Bailey et al., 2018; Daivadanam et al., 2015; Finzer et al., 2013; Surendran et al., 2020), including one study of women across wealth tertiles in Delhi (Bailey et al., 2018). Whilst household expenditure on food at the national level in India has declined from over 60% in 1993–1994; the

proportion of household budgets spent on food still remains high, at around approximately 50% among rural households and 40% among urban households in 2011–2012 (Tak et al., 2019). In addition, food price inflation over the past decade has been identified as one of the most pressing challenges for food policy in India (Pingali et al., 2019). The majority of households (n = 14; 70%) in our study were eligible for subsidized food rations through the means tested Public Distribution System set at the Below Poverty Line, and low purchasing power may explain the importance allocated to food prices as a driver of food acquisition. However, studies from high-income country settings have also shown that price takes precedence over proximity when making decisions about where to source foods (Drewnowski et al., 2012; Aggarwal et al., 2014), and the prominence of price in relation to food acquisition from mandal headquarters in our study lends some support to these findings from a LMIC setting.

Regarding vendor and product properties, the preference for fresh produce acquired directly from the farm gates of known local producers highlights the prevailing strong connection to agriculture within this peri-urban setting, and supports the notion of agriculture as a key pathway to nutrition in India (Gillespie and Van Der Bold, 2017; Kadiyala et al., 2014). In addition, the pervasive concerns around food safety in the form of adulteration and contamination of perishable produce and ready to eat outside foods are consistent with narratives from other studies in India (Bailey et al., 2018; Finzer et al., 2013; Hayter et al., 2015; Rathi et al., 2016, 2017; Umali-Deininger and Sur, 2007; Surendran et al., 2020), and also other LMIC settings (Berhane et al., 2018; Holdsworth, 2019; Holdsworth et al., 2018; Omari and Frempong, 2016; Pradeilles et al., 2018, 2019; Wertheim-Heck and Spaargaren, 2016; Wertheim-Heck et al., 2014, 2015). Future conceptual and empirical food environment research may consider allocating more emphasis to food safety as a key external food environment dimension in line with existing food environment definitions (Food And Agriculture Organisation Of The United Nations – FAO, 2016, Global Panel On Agriculture And Food Systems For Nutrition – Global Panel, 2016, High Level Panel Of Experts On Food Security And Nutrition, 2017), as well as the definition of food security (Food And Agriculture Organisation Of The United Nations – FAO, 1996). Including food safety as an integral dimension of the external food environment may help to bridge the inter-related yet often distinct strands of research around food environments, food security, and food safety that share the common goal of improving diets, nutrition, and health in LMICs (Walls et al., 2019).

The third key theme related to social capital is a novel empirical contribution to the food environment literature. Sentiments of community, trust and reciprocity were found to be embedded throughout participants accounts of food acquisition, and were closely connected with dimensions of affordability and the practice of favourable pricing and acquiring food on credit, as well as food safety discourse, freshness and quality, and food transfers. These empirical findings support the more recent conceptual recognition of social capital as an important driver of food acquisition and consumption practices (Downs et al., 2020; Turner, 2020; Constantinides et al., 2021), and also add weight to continued calls over the past decade to improve knowledge and understanding of the social and cultural dynamics that influence interactions between people and their food environment (Chen and Kwan, 2015; Cummins, 2007a, 2007b). Future research and conceptual frameworks may consider the inclusion of social capital as a key dimension of the personal food environment domain. Applying a social capital lens may help capture shared ties, norms and trust (Putnam, 1993) related to food acquisition, as well as dynamics of reciprocity and exchange (Adger, 2003), and the interactions between the 'social structures between entities' (i.e. food vendors and consumers) and the 'actions of actors' (i.e. food acquisition and consumption practices) (Coleman, 1988) that are currently inadequately accounted for, with the exception of a small number of pioneering food security studies from LMICs (Misselhorn, 2009; Lee et al., 2018).

Themes four to six, derived from adult perspectives on drivers of child and adolescent food acquisition and consumption, are coherent with findings from the wider literature that highlight the importance of a diverse range of external and personal food environment dimensions. Consistent narratives surrounding the daily acquisition and consumption of sweets, snacks, biscuits and chocolates from local village shops and school settings supports mounting evidence regarding the ready availability, accessibility, desirability and convenience of these generally unhealthy items among children and adolescents in India (Gupta et al., 2016; Maxfield et al., 2016; Rathi et al., 2016, 2017) and other LMICs (Chacon et al., 2015; Chan Sun et al., 2009; Faber et al., 2014; Moodley et al., 2015; Pehlke et al., 2016a, 2016b; Soltero et al., 2017; Wojcicki and Elwan, 2014). In addition, the inter-generational dynamics at play within households, with children and adolescents found to influence household level food acquisition and consumption, supports findings from studies in India (Bailey et al., 2018; Chaturvedi et al., 2016; Daivadanam et al., 2015; Rathi et al., 2016, 2017), and other LMICs such as Ethiopia (Berhane et al., 2018) and Ghana (Holdsworth, 2019; Holdsworth et al., 2019).

In addition to these key themes, dietary related health was found to be a primary concern amongst participants. However, despite these concerns, nutrition literacy including knowledge of what constitutes a healthy, nutritious and quality diet as well as the consequences of unhealthy diets was generally found to be limited in our study, consistent with previous studies from other LMICs (Berhane et al., 2018; Downs et al., 2019; Kimoto et al., 2013; Gissing et al., 2017; Pradeilles et al., 2019).

4.1. Policy implications

We identify a number of tentative policy implications whilst acknowledging the small scale of this qualitative study and the need for further evidence. First, evidence from our study confirms the need for food environment policies and interventions that are socio-ecological in scope, capable of addressing external and personal food environment domains and dimensions and the multi-scalar drivers of food acquisition and consumption. On the basis of our findings, external food environment-based policies and interventions should seek to: 1) target improvements in the freshness and quality of fruits and vegetables at affordable prices in peri-urban villages; and, 2) regulate the sale of unhealthy snacks, sweets and sweet and sugary beverages, particularly to children and adolescents from vendors in and around schools. A recent cross-sectional assessment of the external neighbourhood food environment across the 29 APCAPS sites broadly echoes these recommendations (Li et al., 2019). At the population level, there is a need to target improvements in nutrition literacy across generations in this community to: 1) improve knowledge and understanding of the importance of dietary quality for health across the lifespan; 2) emphasise the need for increased consumption of fruits and animal source foods as part of a balanced diet; and, 3) highlight the need to moderate the consumption of ultra-processed, unhealthy snacks, sweets and sweet and sugary beverages - as has been identified in previous studies in India (Gupta et al., 2016). Targeting children and adolescents through dietary, nutrition and health related promotion activities in schools has previously been recommended in India (Jose et al., 2018), and may provide an effective entry point for interventions designed to foster healthier food acquisition and consumption behaviours and tackle the double burden of malnutrition in current and future generations.

4.2. Strengths and limitations

The strengths of this study include: 1) the implementation, sensitization, and qualitative validation of the globally applicable food environment conceptual framework; 2) the multi-method approach, including participatory methods and graphic and photo-elicitation techniques; 3) the use of a local field team with extensive knowledge

and experience of the research setting; 4) the triangulation of multiple data sources, including transcripts, maps, and photographs; 5) the use of secondary datasets to corroborate findings, including the built environment survey and FGD data on fruits and vegetables from across 8 APCAPS villages; 7) the adherence to qualitative checklists and reporting guidelines.

We identify a number of limitations. First, we recognise that the finer grained particularities of our policy implications are restricted to our study setting. However, the interrogation of our findings in relation to the globally applicable food environment conceptual framework (Fig. 1) and the wider literature provides a degree of generalizability and transferability to wider food environment research in LMICs. In addition, the sites in which this research is situated are typical of many rapidly urbanizing settings in India, as well as transitioning settings in other LMICs. Second, due to ethical considerations and the highly sensitive nature of the geocoded data the participant's Q-GIS maps and photographs are not featured in this article. Rather, indicative photographs taken in the field by the lead author are provided to offer the reader a deeper impression of the research setting. Third, we found men to be more open to discussing their thoughts and opinions in this setting. Nine of the sixteen female participants in our study were illiterate, whilst a further three were literate but had low educational attainment which may have contributed to this limitation. It is also possible that the presence of the lead author, a non-Indian male researcher may have influenced participant's responses during the qualitative data collection, although no apparent differences were observed in transcripts where the lead author was present or absent. Finally, the 2012–2014 household survey data was collected 3–5 years prior to our primary data collection in 2017. This data was used to exclusively to describe participant characteristics and we do not consider this to have influenced our analysis or interpretation of our results derived from our qualitative data. Socio-demographic data was not available for four female participants who had married into the sampled households following the completion of the 2012–2014 APCAPS household survey.

5. Conclusion

This qualitative study contributes to the emerging body of research investigating food environments and drivers of food acquisition and consumption in India, providing evidence from a peri-urban setting in Hyderabad, Telangana. Food prices and vendor and product properties such as freshness and quality, and adulteration and contamination were key themes in our study, consistent with findings from previous studies in India and other LMICs that demonstrate the role of the external food environment in driving food acquisition practices. The key theme on social capital provides a novel empirical contribution to the food environment literature, supporting the increasing recognition of the role of social networks, trust and reciprocity as key drivers of food acquisition and consumption practices. Food environment dimensions of food availability and accessibility, desirability, and convenience were found to be particularly important drivers of child and adolescent food acquisition and consumption, supporting evidence from the wider literature. Our findings reveal the need to design targeted interventions in the external and personal food environment domains to improve diets, nutrition, and health in this setting. Future conceptual frameworks and empirical research should consider the inclusion of two additional dimensions of food environments, including food safety in the external food environment domain, and social capital in the personal food environment domain. Going forwards, more in-depth qualitative research is needed to provide contextualised knowledge and understanding of food environments and drivers of food acquisition and consumption from across a range of rural, peri-urban, and urban LMIC settings.

Declaration of interest

The authors have no interests to declare.

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Appendix A. Supplementary data

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