



'I should be disease free, healthy and be happy in whatever I do': a cross-country analysis of drivers of adolescent diet and physical activity in different low- and middle-income contexts

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Abstract

Objective: To explore perceptions of how context shapes adolescent diet and physical activity in eight low- and middle-income (LMIC) sites at different stages of societal and economic transition.

Design: Novel qualitative secondary analysis of eight data sets generated as part of the international Transforming Adolescent Lives through Nutrition (TALENT) collaboration.

Setting: Diverse sites in India and Sub-Saharan Africa.

Participants: Fifty-two focus group discussions with 491 participants (303 adolescents aged 10–17 years; 188 caregivers).

Results: Analysis of pooled qualitative data identified three themes: (1) transitions in generational nutrition education and knowledge; (2) transition in caregiver–adolescent power balance and (3) the implications of societal and economic transition for diet and physical activity. Adolescents in urban and peri-urban areas could readily access 'junk' food. Diets in rural settings were determined by tradition, seasonality and affordability. Physical activity was inhibited by site-specific factors including lack of space and crime in urban settings, and the prioritisation of academic performance. Gender influenced physical activity across all sites, with girls afforded fewer opportunities.

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Conclusions: Interventions to improve adolescent diet and physical activity in LMIC need to be complex, context-specific and responsive to transitions at the individual, economic and societal levels. Moreover, solutions need to acknowledge gender inequalities in different contexts, as well as structural and cultural influences on diet and physical activity in resource-limited settings. Programmes need to be effective in engaging and reconciling adolescents' and caregivers' perspectives. Consequently, there is a need for action at both the community-household level and also through policy.

Keywords
Adolescent Health
Focus groups
Nutrition
Physical activity
Low- and middle-income countries
Qualitative study

Adolescence is a unique stage of development when young people's bodies, hormones and social environments are rapidly changing, brains are developing and cognitive capabilities are becoming more sophisticated⁽¹⁾. Nutritional requirements increase to achieve physical growth, sexual maturation and brain remodelling. Implicated in such development are the cultural, economic and social contexts of adolescents' lives⁽²⁾. Furthermore, preferences and behaviours adopted in adolescence can influence lifelong diet and physical activity habits. Developmental plasticity means that improving health during adolescence has the potential to reduce the trajectory of non-communicable diseases⁽³⁾.

Little is known about how the nutrition transition in low- and middle-income countries (LMIC), including the double burden of malnutrition (undernutrition alongside obesity), affect adolescents^(4,5). Research has shown that persisting food insecurity and lack of dietary diversity lead to macro- and micronutrient deficiencies, which impair growth and cognitive development⁽⁶⁾. Also, transition-driven exposure to fatty, sugary, salty and micronutrient-poor foods, along with reduced physical activity, can result in obesity, hypertension, diabetes and CVD in later life⁽⁷⁾. Limited qualitative research has explored adolescents' experiences of diet and physical activity in LMIC or how these vary with the transition from rural subsistence to market-based urban economies.

Studies of adolescent nutrition and physical activity tend to focus on particular groups, for example, girls⁽⁸⁾ and/or those living in higher-income settings⁽⁹⁾. Engaging adolescents with the consequences of health behaviours can be challenging⁽¹⁾. However, motivated adolescents can improve their health behaviours^(10,11). Little is known about how adolescents in LMIC think about health, diet and physical activity, or how best to engage them in improving their health. Exploring this requires social science-derived youth-centred approaches to empower adolescents to share their views on what matters in relation to health⁽¹²⁻¹⁴⁾. This approach values listening to, and working with, adolescents directly, regarding them as experts in their own lives. Understanding the role of caregivers in shaping adolescents' health behaviours is also essential^(15,16). Engaging adolescents and caregivers in this way is necessary to understand their priorities, needs and values.

With the aim of informing the development of adolescent nutrition interventions, this paper draws on

adolescents' and caregivers' views to understand how the context in which they live shapes their diet and physical activity. To achieve a synthesis of both perspectives, qualitative secondary analysis (QSA) was conducted across eight data sets comprising focus group discussions (FGD) with 303 adolescents and 188 caregivers. The data were generated as part of Transforming Adolescent Lives through Nutrition (TALENT), an international collaboration that aimed to understand adolescents' dietary behaviour and opportunities for physical activity (Barker *et al.*, this issue). The programme included qualitative and quantitative work, systematic reviews and a capacity-building programme for nutrition scientists in qualitative youth research.

Methods

Study setting

This paper draws on data collected in eight diverse sites in India (Dervan, Mumbai, Mysore and Pune) and sub-Saharan Africa (Abidjan, Cote D'Ivoire; Jimma, Ethiopia; Kiang West, The Gambia and Soweto, South Africa) at different stages of economic and societal transition (Table 1):

Data collection

TALENT was developed to engage adolescents and caregivers and to understand their priorities and values in relation to adolescent diet and physical activity. To facilitate this, a qualitative study was designed drawing on methods of youth engagement⁽¹⁷⁾. These approaches place importance on listening to adolescents' voices. The QSA team (P.H.-J., S.W. and M.B.) designed and delivered three 5-d workshops (India, South Africa and UK), training nutrition scientists (hereafter, site researchers) from each TALENT site in qualitative research (see Barker *et al.*, this issue). Online support was provided throughout. Quantitative survey data, reported in Fall *et al.* (this issue), were also collected. Using convenience sampling, a subset of survey respondents were invited to participate in a FGD. Data collection took a relational approach capturing adolescent and caregiver views separately, enabling comparison across generations and between contexts at differing stages of economic and societal transition.

FGD were selected to obtain insights into individuals' experiences and perceptions as well as the social norms

Table 1 Description of the data collection sites

Site	Setting	Description
Jimma, Ethiopia	Low-income urban	Jimma is situated 352 km southwest of the capital Addis Ababa. Ethiopia is a LIC, with nearly a quarter of its population living below the national poverty line.
Abidjan, Côte d'Ivoire	Low-income urban	Rural–urban migration and successive geopolitical crises have resulted in rapidly increasing uncontrolled urbanisation in the capital, Abidjan. Data were generated in two districts, comprising mainly low-income households/poor quality housing. Food is purchased from market stalls alongside main roads, near public amenities.
Kiang West, The Gambia	Rural villages	Data were generated in six rural villages in the Kiang West district, 160 km from the capital. The population largely comprises subsistence farmers who live in extended family compounds with few amenities.
Soweto, South Africa	Poor urban townships	Soweto is one of the most well-known historically disadvantaged townships in South Africa as it was linked to the anti-apartheid struggle and political riots. Economic transformation during the past decade has led to the rapid emergence of shopping malls, fast-food chains and transport networks.
Mumbai, India	Urban slums	42% of the population of Mumbai live in crowded urban slums. The population of these slums are diverse, including those living in poverty, as well as middle class and professional residents.
Pune, India	Rural and peri-urban villages 40–60 km from the city of Pune	Located in the state of Maharashtra, India, the villages around Pune are transitioning in terms of expansion of city limits and economic growth. The population is a mix of farmers, skilled professionals, unskilled labourers and entrepreneurs.
Dervan, India	Rural and tribal villages	Access roads are poorly lit, and the power supply to villages is erratic. Farming is the main occupation of inhabitants, yet many men go to the cities in pursuit of jobs. Basic commodities such as groceries are available in the local weekly market, shared by 10–12 villages.
Mysore, India	Urban low and middle income	Located in the Karnataka region, Mysore is a relatively large, densely populated city comprising a generally middle-class population of both skilled and unskilled labourers.

Table 2 Numbers of adolescents and caregivers that participated in focus group discussions (FGD) in each site

Site	Number of FGD participants									
	Adolescents		Younger (10–12 years)		Older (15–17 years)		Caregivers		Total number	
	Total (n)	FGD (n)	Total (n)	FGD (n)	Total (n)	FGD (n)	Total (n)	FGD (n)	Total (n)	FGD (n)
Jimma, Ethiopia	41	5	16	2	25	3	22	3	63	7
Abidjan, Cote d'Ivoire	46	4	24	2	22	2	26	2	72	6
Kiang West, The Gambia	40	4	20	2	20	2	20	2	60	6
Soweto, South Africa	38	4	19	2	19	2	37	2	75	6
Mumbai, India	36	4	17	2	19	2	23	2	59	6
Pune, India	38	4	20	2	18	2	38	4	76	8
Dervan, India	40	4	20	2	20	2	16	2	56	6
Mysore, India	24	4	12	2	12	2	6	2	30	6
Total	303	33	148	16	155	17	188	19	491	52

arising from discussions⁽¹⁸⁾. Semi-structured FGD guides were developed collectively during workshop 1, and adapted, where appropriate, to suit each site. The FGD were piloted, facilitated and observed by site researchers in participants' local languages. FGD questions explored the perceived influences on adolescent diet and physical activity (see e.g. FGD questions in supplementary material). Creative methods were incorporated to build rapport, for example, the categorisation of food pictures (Kiang West), singing (Abidjan), rhythmic clapping games (Dervan) and communication activities (Mumbai). Separate FGD were

conducted with girls and boys, and with younger (10–12 years) and older adolescents (15–17 years). Caregivers comprised mothers, fathers and other relatives. Each site conducted between 6 and 9 FGD, with a total of 30–80 participants (Table 2).

Audio recordings from each FGD were transcribed verbatim and translated into English to enable cross-site collaborative work. This process varied by site. For instance, in Mysore, half of the FGD were conducted in English, whilst in Kiang West, the material was directly translated/transcribed into English as Mandinka is not a written language. Site

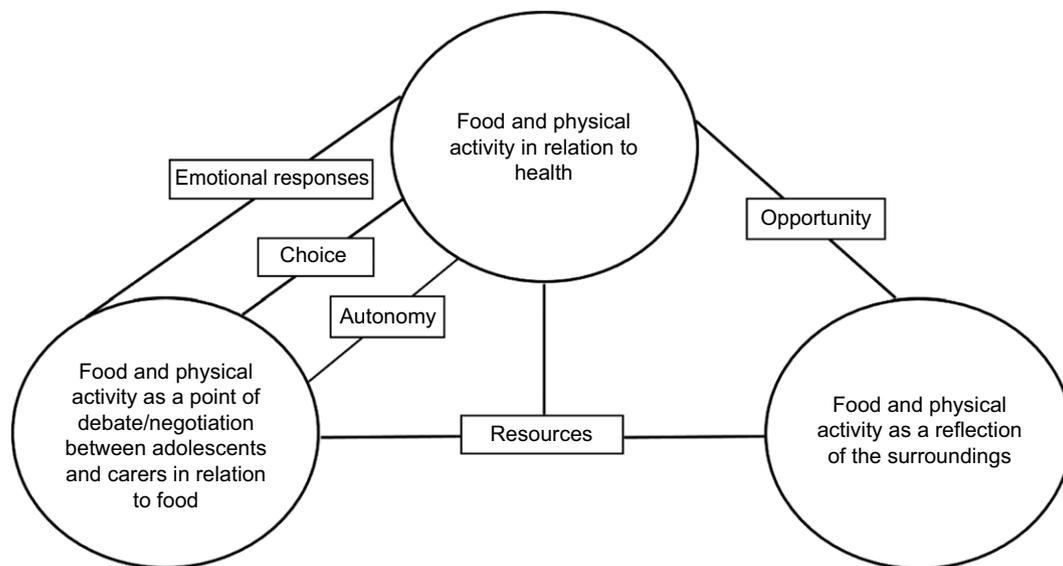


Fig. 1 Diagram depicting the three broad themes and how they relate to adolescent diet and physical activity across the eight Transforming Adolescent Lives through Nutrition (TALENT) sites

researchers, fluent in all relevant languages, either conducted and/or checked the transcription/translation against the original recordings themselves, or supervised the process.

Data analysis

This paper focuses on the QSA of data from all eight sites. Unlike many other secondary analysts, the team was actively involved in shaping the production and interpretation of the original data. An iterative process of consulting and working with site researchers was used to aid interpretation and enhance understanding of the context. The QSA team studied the transcripts prior to analysis and provided feedback on pilot FGD and site researchers’ own analysis. During workshop 2, site researchers and the QSA team collaboratively developed a common coding frame which was adapted for use in each site. The team also provided training in thematic analysis, including the use of software (NVivo v12) (site findings are reported in Abera *et al.*, Banavali *et al.*, Chopra *et al.*, Janha *et al.*, Jesson and Kouakou *et al.*, Joseph *et al.*, Reddy *et al.* and Wrottesley *et al.* this issue). At the end of the workshop, and based on this site-level analysis, a preliminary cross-site thematic map was generated (Fig. 1).

In order to conduct QSA, the data sets were pooled. A framework approach, appropriate for managing large data sets and working in multi-disciplinary teams⁽¹⁹⁾, was used. A key advantage of framework analysis is the robust audit trail produced which enhances the credibility of the work⁽²⁰⁾. With the aid of NVivo (v12), and using the preliminary cross-site thematic map (Fig. 1), data matrices for each of the main themes were generated (see example in supplementary material) to allow identification and comparison of key issues across sites. FGD with adolescents and

caregivers were analysed separately to gain an understanding of the perspectives of each group. The matrices were populated with summaries of each theme and illustrative extracts. The wider economic and social context remained central to the interpretation of the material, insights into which were partly provided by site researchers and the QSA team’s experience of those contexts. Finally, the key issues common to all sites were categorised, revisited, refined and consolidated into three themes described below and presented visually in Fig. 2. A final thematic map (Fig. 2) was drawn-up based on the underlying themes identified in Fig. 1. The QSA offered a nuanced and context-sensitive interpretation of the way that Fig. 1 themes – Food and physical activity as health, Food and physical activity as negotiation, and Food and physical activity as reflection of the environment – influenced adolescent diet and physical activity in each site. Figure 2 represents a summary of findings from this analysis and reflects the salience of transitions in the lives of adolescents and caregivers. These transitions referred both to young people’s growing autonomy and knowledge, and to the changing economic and societal landscape in each site.

Results

Transcripts from fifty-two FGD with 491 participants (303 adolescents; 188 caregivers) were analysed. Three themes were identified that described perceived influences on diet and physical activity: (1) transitions in generational nutrition education and knowledge; (2) transition in caregiver–adolescent power balance and (3) the implications of societal and economic transition for diet and physical activity.

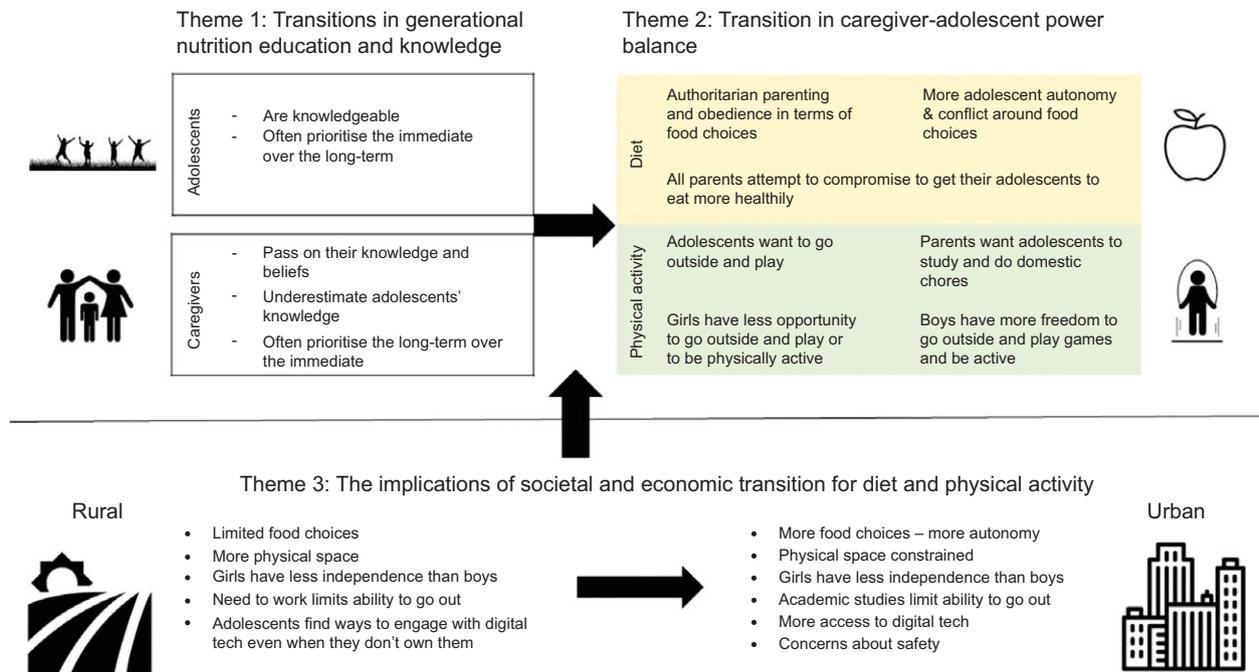


Fig. 2 (colour online) Diagram depicting the three broad themes and how they relate to adolescent diet and physical activity across the eight sites

Theme 1: Transitions in generational nutrition education and knowledge

Adolescents are knowledgeable

Across sites, adolescents demonstrated awareness of the impact of different food items on their health. Some spoke of specific nutritional elements, including the importance of proteins, carbohydrates and vitamins for health/growth, or described how nutritional deficiency could lead to ill health:

Vitamin C is good in the body... if you lack one of them you see, you have [a] disease. (Boy, aged 15–17 years, Kiang West).

All adolescents understood that 'junk' food was unhealthy, yet were not deterred from eating it. Social aspects of consuming food away from home (e.g. street food), its taste and appearance were more influential than potential health consequences in shaping their choices.

Despite the study's focus on diet and physical activity, many adolescents held a holistic view of 'good health', taking a biopsychosocial approach to well-being:

I feel that my body should be fit. I don't think I am either fat or slim... But I should be disease free, healthy and be happy in whatever I do. (Girl, aged 15–17 years, Dervan).

Making your body active and ensuring that you are healthy both inside and out. (Boy, aged 15–17 years, Soweto).

Many adolescents had learnt about the benefits of good nutrition and regular exercise from school and their parents. Digital media was also a source of information,

particularly in those sites with readily accessible digital technologies:

We had a lesson in fifth [grade]. It contained information on proteins, sugars, cereals, vitamins A, B, fibrous substances and leafy vegetables. (Boy, aged 10–12 years, Pune).

Since we watch TV shows and documentaries a lot, we were told that eating too many sweets is not good. (Boy, aged 15–17 years, Abidjan).

Adults impart knowledge and/or beliefs

Caregivers often underestimated adolescents' health-related knowledge. They attributed adolescent preferences for unhealthy, outside food to a lack of understanding and felt it was their responsibility to guide their children:

Children don't know how important it [health] is so if you do not guide them they will not know. (Man caregiver, Kiang West).

In some urbanised settings, such as Mysore, caregivers sought advice from dietitians and nutritionists, which they then passed onto their children. By contrast, in some rural settings, parents did not have access to such information and more examples of culturally constructed beliefs were evident. Caregivers would share local knowledge with each other and impart food-related beliefs to their children:

Eating a lot [of] sweets all the time is what makes children wet the bed. (Woman caregiver, Kiang West).

Health priorities and concerns are context-dependent

The transitional contexts of participants' lives shaped their health priorities and concerns. One example, common



across sites, was the avoidance of sickness. In Kiang West, located in proximity to a medical research facility, both adolescents and caregivers were well-versed in the long-term health consequences of diet behaviours (e.g. joint pain, diabetes and blood pressure):

F: *If you eat a lot of sugary things, what do they do?*

P: *It causes diabetes* (Boy, aged 15–17 years, Kiang West)

In areas undergoing transition, such as Pune, discussion revolved around hygiene and the importance of being disease-free:

[A healthy person is] One who does not have any disease (Boy, aged 15–17 years, Pune).

Those in more urbanised locales, such as Mysore, tended to focus on issues associated with the dietary consequences of economic and social transitions, for example, weight change:

Now my children are thin or whatever, later I'm worried about them getting obese also . . . junk is introduced in their system they'll get used to it and they want it. (Woman caregiver, Mysore).

In both Mysore and Mumbai, health, academic achievement and future prospects were highlighted:

If health is good then, their brain will function well and then they will study well. They will get a good job or do good in their work and progress in life. (Woman caregiver, Mumbai).

In each site, there were often parallels between the priorities reported by adolescents and caregivers. There were also some divergences, particularly in terms of adolescents' immediate health issues. In Jimma, substance misuse was only mentioned once by caregivers, but frequently by adolescents:

Those who protect themselves from different addiction and who have close and normal relation with the community are healthy and those who spend their time on drugs are unhealthy. (Boy, aged 15–17 years, Jimma).

Similarly, in Soweto, caregivers were concerned about alcohol misuse:

You will find young boys always holding alcohol in his hand and when you ask them, even we are afraid to ask them, 'where do you get that?' you are afraid to get hurt or afraid to get shot. (Man caregiver, Soweto).

Theme 2: Transition in caregiver–adolescent power balance

Caregiver–adolescent power balance related to diet

In urbanised sites such as Mumbai and Mysore, there was evidence of negotiation/conflict between caregivers and

adolescents about food and physical activity. In these sites, dietary choice was more abundant and adolescents had more autonomy over food purchasing, using this as a means to express growing independence. Home-cooked food was considered 'healthy but boring', whilst eating out was an important social activity. Adolescents spoke of pooling money to buy and share 'junk' food. Conflicts arose when caregivers felt unable to enforce healthy behaviours. Concurrently, adolescents felt constrained:

EVERYDAY we do so many things but they won't listen [Exasperation/laughs]. (Woman caregiver, Mysore).

Till they are in 10th standard, they listen to us and they are under control. Once they complete 10th and go to college they become independent . . . (Woman caregiver, Mumbai).

Conversely, in Soweto, adolescents spoke of availability, affordability and convenience driving the acquisition of unhealthy foods by caregivers at home:

When they [our parents] come back home from work, they always bring you chocolate, ice cream. (Girl, aged 15–17 years, Soweto).

In some of the rural and peri-urban settings, adolescents alluded to an acceptance of a more authoritarian parenting style and lack of dietary choice. In these areas, there was little indication of conflict around food:

My mom and dad make me eat fruits every day and do not allow me [to] eat bakery products and outside food. (Girl, aged 10–12 years, Pune)

Affordability and availability of foods in these sites dictated what caregivers could cook, leaving little opportunity for adolescents to exercise choice:

So the child should not choose. What I have is what you eat! (Woman caregiver, Abidjan).

Parental attempts to compromise in relation to adolescent diet

Where conflict was apparent, the dialogue often revolved around achieving compromise:

I'll say . . . I agreed for your choice, so now in the night you have to agree for my choice." (Woman caregiver, Mysore).

Some caregivers occasionally let their children eat 'junk' food:

Sometimes they crave the food on TV because they're not used to them. You need to appease them once in a while. (Caregiver [unknown gender], Soweto).

Even in settings where resources were limited, adolescents used food choices to demonstrate growing autonomy. In response, caregivers would make small changes to recipes to make sure vegetables were consumed:



F: *You said, they don't like tomatoes then what do you do?*

P: *Cut them into very small, mix with onions and cook. Then they will eat.* (Woman caregiver, Dervan).

Many caregivers reported frustration over their adolescents' dietary choices, comparing their own generation with contemporary youth, suggestive of a transition in the acceptability of adolescent autonomy:

Comparing to our adolescence period... we never refuse or never used to ask the questions... Nowadays whatever we give they don't want THAT. According to THEIR will and wish we have to prepare and give. (Woman caregiver, Mysore).

Caregiver–adolescent power balance and physical activity

In many of the rural settings, opportunities for physical activity were constrained. Adolescents were busy either attending school or assisting with domestic/farm work. In sites such as Kiang West, there was little free time for recreational exercise:

Whenever they are at home and there is no work you need them for, they will always go back to school until evening. (Man caregiver, Kiang West).

One common way in which adolescents demonstrated autonomy over physical activity was in discussions about domestic work, negotiating to do less where possible:

Children want to be ordered systematically. But if we try to order them by force it is not enjoyable for them and even they might ignore the order. (Woman caregiver, Jimma).

Across all sites, adolescents had to seek parental/caregiver permission to engage in outdoor activities. Fear about adolescents' safety and/or concerns about distractions from academic work led to caregivers preventing outside play:

We will be wanting to go out and play but Mother will tell us to stay in and study. (Girl, aged 10–12 years, Mysore).

Children... go to school/college then to classes and then they come home so no time at all (Woman caregiver, Mumbai).

Gender differences and physical activity

Across all sites, girls had less freedom to use outside spaces than boys for religious, cultural and safety reasons. There was a sense of anxiety among some girls and caregivers about safety:

We don't allow our female children to go out. We fear that they might go elsewhere. It is not pressure for them not to exercise, we just fear for them. We hear that a child of seven year is raped so we fear for our female children. (Woman caregiver, Jimma).

Sometimes it's the environment you live in, maybe you want to jog in the morning but it's too dark and you're scared of being kidnapped. (Girl, aged 10–12 years, Soweto).

In some sites, this was not explicitly articulated. Rather, caregivers spoke of their daughters not having other girls with whom to play as a barrier to physical activity:

My daughter does not have any friends here as we don't have many daughters here. (Woman caregiver, Dervan).

Many of the girls needed permission to engage in any activity that might interfere with their domestic or academic work. Boys were expected to achieve academically, but were afforded more freedom to engage in leisure activities:

They (parents) want us to spend our time in-doors and focus on housework and studying. (Girl, aged 15–17 years, Jimma).

F: *When you finish school and you go to the football field, what do you do there?*

P: *We play football.* (Boy, aged 15–17 years, Kiang West).

Theme 3: Implications of economic and societal transitions for diet and physical activity

How rural to urban transition influences food availability and choice

Food choices were a clear indicator of the sites' transition from rural subsistence economies (Dervan, Kiang West) to urban contexts (Soweto, Mumbai). Many barriers to healthy diets were context-specific. For example, in sites of increasing urbanisation such as Abidjan, the food available to school-going adolescents was considered 'dirty' and unsafe:

At school, there is lack of cleanliness on the markets where we buy food. (Boy, aged 15–17 years, Abidjan).

Generally, diversity of choice was associated with increased urbanisation and adolescent autonomy. Within urban settings, 'junk' food was commonplace, cheap and easily accessible:

I think what makes it difficult for us to eat healthy in Soweto is that there is a lot of tuck shops but they sell junk food. (Girl, aged 15–17 years, Soweto).

Despite knowing the health consequences, adolescents talked excitedly about its taste, appearance and the social aspects of eating with friends. Eating out meant they could access a variety of foods with different tastes not available at home:

[We] get bored eating the same food at home so, to break the monotony, we eat out. (Boy, aged 15–17 years, Mumbai).



In overcrowded urban areas, such as in Mumbai, adolescents were physically constrained by their surroundings. Purchasing and sharing 'junk' food with friends enabled them to demonstrate growing autonomy and carve out time/space away from their families.

In rural areas, although adolescent diet was generally dictated by caregivers, 'junk' food began to permeate areas such as Dervan and Kiang West. In Dervan, adolescents reported that they were sometimes given money, which they spent on cheap 'junk' foods from roadside vendors. The taste and packaging of these foods was appealing:

I like the taste and if it is more spicy, then I like it better. (Boy, aged 15–17 years, Dervan).

How rural to urban transition influences physical activity

The availability of physical space where adolescents could exercise also indicated societal transition. In urban settings and sites of increasing urbanisation, adolescents lacked open spaces that were available to adolescents in rural areas. In some sites, including Mumbai and Mysore, the emphasis placed on the importance of academic achievement in securing adolescents' futures meant that many spent much of their day in school and extra tuition classes leaving little opportunity to engage in physical activity.

There also appeared to be a relationship between stage of societal and economic transition, space and use of digital technology. Caregivers reported that smartphone use was consuming adolescents' free time:

They return from school or college. They are tired so they sleep and then 2–4 hours they use mobile. (Woman caregiver, Mumbai).

Mobile phone use was also emerging in remote rural areas with screen time starting to displace physical activity:

Those who have [laptops or smartphones] would be on them but those who do not have would go to their peers to watch for some time. (Woman caregiver, Kiang West).

Use of digital technology also seemed to be influencing adolescents' autonomy. The more access to technology they had, the more independent they were. They used digital technology to play games, as a source of nutrition information and, particularly for girls, to socialise. Across the sites, level of independence was gendered, with girls more restricted in terms of accessing outside spaces:

P: *Boys play in the ground so for the girls have no place to play because the boys are playing. . . .*

F: *What do girls do at home?*

P: *Mobile or T.V*

(Woman caregivers, Mumbai).

A perceived lack of safe outside spaces inhibited physical activity in some settings, due to crime and gang culture, and the vandalism of exercise equipment. This was most

apparent in Abidjan and Soweto where adolescents feared violent street gangs:

I don't like the neighbourhood because the neighbourhood is full of "microbes" [violent gangs; comprising young boys previously involved in armed political conflict] . . . in conflict with the law. (Girl, aged 10–12 years, Abidjan).

We do have a [netball] court, we used to have but the druggies they stole things. (Girl, aged 15–17 years, Soweto).

Discussion

QSA of the pooled data set comprising fifty-two FGD across eight different sites in India and sub-Saharan Africa highlighted three broad themes that described influences on diet and physical activity. These related to transitions in nutrition knowledge, caregiver–adolescence power balance, and in the local social and economic context. FGD captured rich data on adolescents' everyday experiences, highlighted the complexity of diet and physical activity influences, and demonstrated the salience of the broader contexts that shape their health within transitioning societies.

It was apparent that parents often underestimated adolescents' nutrition knowledge. In many sites, adolescents had a greater understanding of the connection between health, diet and physical activity than previous generations, through formal education and via digital technologies. Caregivers played a key role in imparting knowledge. For those in urbanised settings, seeking advice from healthcare professionals was a possibility, whilst in areas with fewer resources, long-standing, culturally constructed beliefs often shaped the information imparted. In the less transitioned settings, freedom from disease was seen as the main outcome from eating well and hygienically. Participants from the more transitioned areas discussed the need to maintain a healthy weight and academic performance. This may reflect the difference between those who struggle to meet basic needs and those who have greater access to food. Despite many adolescents' nutrition knowledge, wherever it was available, 'junk' food was consumed, often as a social activity and an opportunity to carve out free time/space. This suggests that the primary motive for food and physical activity choices amongst these adolescents was to fulfil social and other needs. Interventions focusing on increasing adolescents' knowledge of nutrition and its health benefits may not, therefore, result in behaviour change.

The balance of power between caregivers and adolescents appeared to be expressed through negotiations over diet and physical activity. Increasing independence, a desire for autonomy, along with vulnerability to marketing,



leads adolescents to make unhealthy food choices⁽²¹⁾. Additionally, desire for peer group belonging influenced 'junk' food consumption. This resonates with previous research highlighting the importance of peer social norms in adolescent food choice^(22,23). Food has social significance for adolescents well beyond its health-giving properties⁽⁸⁾. Caregivers were frustrated that, despite their efforts, adolescents preferred 'junk' food with their friends than home-cooked food, resonating with findings from other studies^(23,24).

Adolescents have high nutritional requirements to support physical growth, sexual development and brain remodelling⁽¹⁾, making them vulnerable to under-nutrition when diets are inadequate due to poverty and food insecurity. Malnutrition during adolescence leaves individuals vulnerable to infections⁽²⁵⁾. Urban transition has increased access to cheap and unhealthy, but tasty and desirable, obesogenic foods that are energy-dense but micronutrient-poor^(26,27), as highlighted in the current study. This is consistent with literature showing that economic and social transitions are associated with a shift from traditional diets to those high in salt, sugar and fat^(28,29). This may have a significant long-term effect on population health since data suggest that adolescents, particularly boys, who eat 'junk' food go on to be young adults who eat increasing amounts⁽³⁰⁾.

Physical activity was inhibited by many site-specific factors such as lack of space and prevalent crime in more urban settings, and prioritisation of academic performance in Indian settings. Gender largely determined opportunities for physical activity across the sites, with girls afforded less freedom to engage in physical activity due to safety concerns. Studies in both high- and low-resource settings have identified a significant fall-off in rates of physical activity as girls enter puberty⁽³¹⁾. This appears to be the result of the cultural restrictions placed on girls and/or increased self-consciousness. Physical activity for rural adolescents largely comprised household chores, though data from adolescents in rural South Africa suggest that this varies even in highly resource-constrained settings, where the poorest and younger adolescents spend most time on household chores⁽³²⁾. Digital media use with increased ownership of smartphones in peri-urban/urban settings was also a key barrier to physical activity. In keeping with data from high-income countries, caregivers in Mysore and Mumbai complained about their children sitting for long periods in front of screens.

We explored the salience of gender in different contexts. Previous research and micronutrient interventions have targeted adolescent girls, with emphasis placed on their role as future mothers⁽³³⁾. As a result, girls are at particular risk of the 'dual burden', creating additional nutrient demands, and emerging gender roles may restrict their access to good nutrition and physical activity^(34,35). The current findings expand on previous research by highlighting gender

differences in opportunities for recreational physical activity. Cultural customs encouraged a more sheltering approach to parenting girls, as well as a fear for their safety.

Strengths and limitations

QSA of FGD with a uniquely large sample of participants across diverse LMIC settings enabled a nuanced exploration of how the (shifting) economic and societal contexts in which adolescents live shape their diet and physical activity behaviours. The QSA team was involved in data collection, primary analysis and write-up of each site's research. This involvement permitted immersion in the data in a manner not usually afforded to secondary analysts. Little qualitative adolescent nutrition research exists in LMIC. This is the first known study of this kind in Abidjan and Kiang West. The inclusion of caregivers' as well as adolescents' perspectives allowed a relational approach highlighting commonalities/differences in the negotiations/conflict arising around diet and physical activity.

We acknowledge some limitations, including the challenge of working with translated data where there is a possibility that some meaning may have been lost in translation/analysis. However, the collaborative nature of TALENT and the iterative approach with which the wider team worked helped mitigate this. All site researchers were consulted throughout the QSA process, providing guidance on issues of context and interpretation.

Implications for public health and adolescent nutrition

An intergenerational perspective shows changes in adolescent diet and physical activity with economic and societal transition. Even in remote, rural areas of sub-Saharan Africa and India, participants talked of emerging transition-driven exposure to obesogenic foods and sedentary activity. Interventions need to be flexible, evolving within the context in which they are implemented to be effective, including capitalising on increasing availability of digital technology in transitioning sites. Moreover, as gender was a key driver of physical activity, the allocation of separate spaces or activities for girls is recommended.

Adolescents and their caregivers need to be meaningfully involved in designing interventions to improve diet and physical activity. This will ensure the effective engagement of adolescents and supports previous recommendations for the co-creation of interventions to improve diet and physical activity behaviours⁽³⁶⁾. Adolescents in this study were already knowledgeable about the connection between diet and health that lead them to eat unhealthily or be physically inactive. Unsurprisingly, their values are similar to those of adolescents in high-income countries, where eating unhealthy food is part of socialising with friends⁽²⁵⁾. Furthermore, the context-dependent nature of



power balance between adolescents and caregivers suggests that interventions should consider the influence of familial dynamics, supporting adolescents' need for autonomy while involving caregivers. This scaffolds previous suggestions that targeting psychosocial determinants of diet behaviours might be an effective strategy⁽³⁷⁾. Previous nutrition interventions in LMIC have often focused on micronutrient supplementation^(29,38); however, the findings from this analysis suggest that interventions need to address social and contextual factors that influence diet and physical activity.

Conclusions

Interventions to improve adolescent diet and physical activity in LMIC need to be complex, context-specific and effective in engaging adolescents and caregivers. Solutions need to acknowledge the structural barriers in resource-limited settings where choices for healthier living are restricted. Consequently, there is a need for action on both the community-household level and also through policy.

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Supplementary material

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