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RESEARCH

Factors influencing malnutrition among adolescent girls in The Gambia: a mixed-methods exploratory study

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Abstract

Background In The Gambia, existing research to understand and address malnutrition among adolescent girls is limited. Prior to the conduct of large-scale studies, formative research is needed. The aim of this mixed methods, cross-sectional study was to explore cultural contexts relevant to nutritional status, feasibility and appropriateness of recruitment and data collection methods (questionnaires and anthropometric measures), and plausibility of data collected.

Methods The study took place in May–June 2021 in

Background

In e Gambia, malnutrition in all its forms (i.e. undernutrition [underweight, stunting, wasting, and/or micronutrient deficiency] and overnutrition [overweight and obesity]) is a significant public health problem [1]. As with other age groups in e Gambia, undernutrition co-exists with rising overnutrition among adolescents (i.e. young people aged 10–19 years) [2–4]. It has been reported that girls in e Gambia are also more vulnerable to underweight, overweight and obesity than boys [2, 4], and therefore specific attention on female adolescents is warranted. Improving nutrition during this period in the life course has the potential benefits of optimising contemporary physical, psychological and cognitive health, long-term health, and the development and health of future generations [5]. Socioecological models (SEM) for understanding and addressing health behaviours and behaviour change emphasise the interactions across individual, household, community and national levels [6]. ere is limited existing research which considers these multiple levels of influence on nutrition-related health among adolescent girls in e Gambia. Available evidence in low and middle income countries (LMICs) more widely, implicates a range of individual- and household-level factors in the prevalences of underweight or stunting [7, 8], overweight and obesity [9, 10], and nutrient deficiencies and associated health outcomes such as in iron deficiency anaemia [8]. e available literature has a number of limitations, including providing sparse evidence overall (with none in e Gambia examining multiple levels of influence on nutrition), and limited focus on the wider determinants of malnutrition [11].

The Gambia has a young population with 220,980 (23%) aged 10 to 19 years [12]. National data shows that the trend of undernutrition among girls and women aged 15–49 years has improved from 17% in 2013 to 14% in 2019–20 but is still highly prevalent, whilst overweight and obesity has worsened with a prevalence of 23% in 2013 rising to 36% in 2019–20 [1]. Girls and women in this age group living in rural areas of The Gambia are more likely to be underweight than urban females (17% vs 13%) whilst the opposite is true for overweight and obesity with higher prevalence in urban areas (40% vs 25%). The prevalence of anaemia among 15–49 year-olds has decreased in the country from 60% in 2013, but remains high at 44%, according to the most recent national data [1]. Where adolescent age-specific national data are available (for cross-sectional data, but not for trends) this indicates that 28% of 15–19 year-olds are underweight, 12% are overweight or obese, and 43% have anaemia [1]. Previous research focusing on adolescents in The Gambia (mean age 16.8 years) has shown that almost 14% of secondary school-going youths (males and females combined) were underweight at the same time as more than 7% being either overweight or obese, thus indicating the double burden of malnutrition [2]. Factors associated with nutritional status were female sex, nighttime sleep duration, mother's education, and physical activity levels. Malnutrition-related research including adolescent girls therefore does exist in The Gambia, as highlighted above. However, either the full age span of adolescence (10–19 years) was not covered, or gender- and age- specific analyses were not reported. Also, previous studies conducted in the country have focused on individual-level determinants

views on research approaches that may enhance a larger study (optimal recruitment methods; feasibility and acceptability of self-reported questionnaires and anthropometric measures); 2. Assess the quality and plausibility of the data (i) obtained from the questionnaires (health, diet, physical activity, potential individual-level and wider [household; community] influences on nutritional status), and (ii) nutritional status outcomes derived from the anthropometric

group discussion) of influence could be explored, largely from adolescents' own perspectives. However, some elements of the framework (e.g. measured dietary habits at the individual level), policy analysis and views of policy actors with regard to adolescent malnutrition were conducted in subsequent phases of the research to be reported at a later date.

Study design

A mixed methods, cross-sectional study design was used in this exploratory study. Qualitative approaches aid understanding of the meanings people attach to actions, decisions, beliefs and values within their social worlds [16]. Exploring the quantitative study elements provides preliminary data on the feasibility of research protocols and the e cacy of instruments, reducing research waste [17]. Gaining knowledge using qualitative and quantitative approaches informs the design, acceptability and delivery of large scale observational studies [17] and person-centred health programmes [18]. Transparent reporting was aided by two checklists suitable for the study design: the consolidated criteria for reporting qualitative studies (COREQ) [19] and the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) checklist for cross-sectional studies [20] (Supplementary File 1). Qualitative focus group discussions (FGDs) were conducted to examine cultural norms and practices that could influence adolescent girls' nutritional status, and elements of study design that are important to the feasibility of future studies (objective 1). Quantitative data were collected via questionnaire and anthropometric measures (objective 2), with urban and rural comparisons across the datasets made where possible (objective 3). Both the quantitative and qualitative data were used to identify any required adaptations needed to optimise the data collection tools and procedures (objective 4), informing the subsequent larger survey and intervention development research. e study was conducted by the lead author (HJB) [15], supervised by the co-authors (MJM; TAA). Data collection was supported by field workers trained and managed by HJB (the 'research team'; see Data collection personnel, below).

Study setting

e research settings were urban and rural areas in e Gambia. Brikama local government area (LGA) is the most populated region in the country and is comprised of 80% urban settlements; Mansakonko LGA was selected as the rural site [21]. As the urban settlements are more densely populated than rural areas, one urban settlement and two rural villages were selected for the study to achieve equal population representation. e largest ethnic group (i.e. tribe) in Brikama are Mandinka (39.8% of the Brikama population), followed by Fula (19.7), Jola (18.6%), Wolof (10.7%) and other tribes (11.1%) [22]. A typical urban setting (a busy commercial hub with a wide range of amenities) was identified in Brikama LGA, hereafter referred to as the 'urban area'. Almost 80% of the population in the Mansakonko region identify as being Mandinka, followed by Fula (16.2%), Jola (2.4%), and other tribes (1.3%) [23]. ere are 36 villages in the region and the primary occupation is subsistence farming. Two rural areas (referred to as 'village 1' and 'village 2' or the 'rural villages', as appropriate) were identified as

girls, resident within the urban Brikama LGA or the rural Mansakonko LGA. A minimum of 4 and maximum of 8 participants in each focus group was the aim; therefore, the total target sample size was 16–32 adolescent girls.

e small but diverse sample provided 'information-rich cases for in-depth study' ([24];p.264). Further, it has been postulated that 4–8 focus groups are su cient to achieve saturation of the themes identified in the data [25].

e focus group participants also completed the questionnaires and physical measures. By design, although the questionnaire and measures captured quantitative data, the aim was not statistically representative data. e emphasis was on exploring feasibility and acceptability of the measures and the quality and plausibility of the data, as detailed in the objectives. Due to the non-probability nature of the sampling, it is not possible to know how many potentially eligible participants were made aware of the study, and thus a response rate cannot be calculated.

Building relationships with focal persons in each of the communities was an important element of reaching potential participants, and the recruitment process is further outlined below.

Engagement and recruitment in the rural areas

It was relatively straightforward to engage with the rural communities (compared to the urban setting, see below) due to the common existence of organised groups such as the Village Development Committee (VDC), tasked with the welfare of its members. us, it was possible to identify the VDC chairman in each of the villages, well known and highly regarded in their communities, who acted as focal persons. Recruitment visits were made to both villages from 24th to 27th May 2021. In village 1, the meeting was held at the *Alkalo's* compound with 35 village elders (both men and women) present. e session was very interactive and it was unanimously stated that consent would not be given for their children to participate if COVID vaccination, which they did not trust, was part of the study. ere was also concern about girls becoming anaemic because of the blood samples planned for future phases of the study. Explanations that the project was not investigating anything related to COVID, that the research would not include any vaccinations, and that the amount of blood that would be collected in future phases of the research (typically 8mls per person) would not cause harm to the participants were accepted. e community leaders indicated that they felt reassured, and that recruitment and taking consent could be done that day. Any parent present at the meeting with their child (or whose child was playing nearby) and interested in their child participating consented before leaving. At village 2, the research team met the *Alkalo* at his compound and some of the elders, facilitated by the VDC chairman.

e elders welcomed the focus on adolescents but raised concerns about their community being accessed by previous research groups with impact yet to be seen in the community. However, approval was granted at the end of the discussion. e *Alkalo* and elders spoke with parents/guardians of eligible adolescents. Where interest was registered, researchers were invited to the respective homes, met with the prospective participants and their parents/guardians and the consent procedures were carried out. Dates in June 2021 were agreed for the researchers to return to both villages for data collection.

Engagement and recruitment in the urban area

Engagement was a little more challenging in the urban area. e large geographical area meant that more than one focal person was required in di erent parts of the community, and there was less openness to non-residents, compared to the rural areas. Recruitment took place during 28th May to 10th June 2021 and included multiple consultations, telephone calls and meetings with key informants, identification of four focal persons resident in the selected urban area, and several visits to meet potential participants' parents/ guardians. Parents/guardians then discussed the project with their children, and for those registering interest, the researchers were invited to their individual homes where potential participants were met. Parental approval was granted, consent/assent and recruitment confirmed, and a date agreed for later in June 2021 for the data to be collected at the compound of one of the focal persons.

Focus group discussions

A semi-structured interview guide was developed (Supplementary File 2). e topics were informed by the study objectives, research conducted in e Gambia by the lead author [2, 4] and consequent experience of working with the target group, and previous studies conducted in other LMICs [7, 8, 11, 26, 27]. e topics included optimal enrolment methods, perceptions of healthy diet and weight, cultural norms and practices, opinions on appropriate solutions to adolescent girls' malnutrition, opinions on the acceptability of blood and urine sample collection, potential techniques for longitudinal follow up of participants, and views on the questionnaire.

Questionnaire and anthropometric measures

Questionnaire

e questionnaire comprised of six sections (Supplementary File 3). All sections were informed by the objectives and the relevant sections of questionnaires used among adolescents in e Gambia by HJB [2, 4]. Previously used sections were of bespoke design for the setting, except with regard to the physical activity questions which

were based on an adapted existing tool (see below). e first part of the questionnaire included individual and household demographic and socioeconomic questions (age, country of birth, religion, school attendance, grade, marital status, number of siblings, family type and home ownership, parental occupation and education level, and source of drinking water), followed by questions on participants' maturation status and health (menstruation, parity, malaria, treatment for parasitic worms). Further sections assessed access to community resources (food markets, health services, roads, electricity, and schools), sources of nutrition knowledge (family, peers, school, mass media, community members and healthcare practitioners), physical activity, sleep and sedentary activity. e Physical Activity Questionnaire for Adolescents (PAQ-A) [28] was incorporated into the questionnaire. As in previous use in e Gambia [2] and in similar settings among South African adolescents [29], activities that were not relevant were removed (such as hockey, skiing and ice-skating).

Questionnaire validity Critique of the questionnaire in the FGDs was a key element of the qualitative assessment of questionnaire face and content validity [30]. Additionally, the recommendations made by the adolescents were evaluated by the research team with regard to di culty or ambiguity, choice of wording and ordering of items, and decisions made about any changes required to the questionnaire. e PAQ-A tool used to measure physical activity has been shown to have high reliability based on the intra-class correlation coe cient ($r = 0.719$, $p < 0.05$; 95% confidence interval (CI): 0.569–0.822) and fair convergent validity (r

researcher who acted as facilitator, which prevented overwhelming the participants with too many people at the same time. Participants were only known to the research team in as far as their presence at the activities raising awareness of the project (described above). Confidentiality was discussed and the written permission to conduct and record the sessions was further verbally confirmed before commencing. All participants were reminded that they could stop taking part in the sessions at any time.

e FGDs were shaped by the interview guide, with probing where needed. Questionnaire completion followed the FGD with participants sat at least two metres apart to maintain confidentiality and to prevent them discussing their answers. e anthropometric measurements were then taken. In each setting, a station was created where all measurements were conducted, with screened areas for privacy. e station was divided into two sub stations with one researcher conducting the measurement while the other recorded the results. Anthropometric measurements were taken three times and the average was calculated as the final value. Only one participant at a time was permitted to attend a sub-station to ensure privacy and they had the option of having a female conduct their measurements if preferred. After completion of the measurements, the FGD was then resumed for the final session to discuss the questionnaire. Breaks were taken between sessions.

In village 1, the FGD was conducted in one of the *Alkalo's* neighbouring compounds, lasting 1 h and 43 min. Overall, the data collection process lasted just under five hours, including breaks. In village 2, the VDC chairman requested that the FGD take place at community centre meeting point (known as a *Bantaba*). e FGD lasted 1 h 19 min, and the data collection session took about four hours overall. e FGDs in the urban setting lasted for 1 h 45 min and 1 h 31 min, respectively. In total, the data collection for each of the two urban sessions lasted around 3 h 30 min.

Qualitative data management and analysis

e qualitative data were analysed using e Framework Method to generate topic summaries guided by the research objectives [37]. e analysis was positioned within a realist stance that centred participants subjective views but also encompassed underlying realities [38]. Analytical stages included verbatim transcription, followed by data familiarisation through reading and re-reading transcripts and re-listening to the audio recordings. Initial code generation was followed by developing the analytical framework. Applying the analytical framework, identifying initial themes, charting, and interpreting data were the last stages of the process. A defining feature of e Framework Method is the matrix output which consists of rows (cases), columns (codes) and 'cells' of summarised data, providing a structure into which the data can be analysed (the framework) by case and by code [37]. In the current study, after hand coding the transcripts in MS Word, cases, codes, and relevant data from the transcripts were transferred into MS Excel for charting and identifying themes. Saturation was determined by iterative analysis alongside data collection, and the charting of the anonymised participants and themes generated in MS Excel, in line with the Framework Method [37]. Five overarching themes were identified (see results) and saturation of themes was deemed to have occurred after four focus groups, although cannot be guaranteed [39]. Presentation of the themes in the results section is supported by direct quotes from the data labelled with participant's ID, rural or urban setting, and participant's age.

Rigour in the analysis was ensured by clarity in the methods and data analysis. Systematic analysis included constant comparison between cases, paying attention to 'deviant' cases that do not appear to fit the prevailing pattern or the overall argument ([40]; p.212) to enhance

di erences between rural and urban participants. Mean and standard deviation (SD), and independent samples t-tests were applied to normally distributed data. Non-parametric equivalents – median and interquartile range (IQR), and Mann Whitney U tests – were used for variables which we not normally distributed. Statistical significance for all tests was set at $p < 0.05$. As the study was exploratory, statistical inference of between group or between measure di erences in the quantitative analysis should be treated with caution. Further, the intentionally small purposive sample did not support assessing predictors of the outcomes and confounding factors in regression analysis.

Results

Data collection sessions

Although the time and date for the data collection session were previously agreed, there was a three hour delay to commencing the sessions in village 1. Participants explained that as girls they can be given additional household or farm chores which they would have to finish and were not permitted to prioritise their research participation. e girls appeared shy in the FGD in this village setting but were engaged by singing at the start of the session to establish rapport and a positive mood, and encouragement of the research team. In village 2, participants were more interactive compared to village 1.

e participants were expressive and the mood was light

under- and overnutrition; 4. Study recruitment: barriers and facilitators; 5. Study questionnaires and proposed measures are mostly feasible and acceptable. Analysis of the five themes is presented below, supported by direct quotes from the data (additional quotes supporting the analysis can be found in Supplementary File 4). As described in the methods, direct quotes to support the analysis are labelled with a unique reference number, setting (urban or rural) and age. e term 'parent' refers to parent or any other guardian.

Theme 1. Cultural norms: harmful vs bene cial to nutrition related health

Adolescents in both urban and rural settings identified similar food-related norms and practices that applied in their communities, agreeing that there was a high level of

nutritional status. ey also agreed that focusing on the food eaten and the practice of *Sita* were beneficial among adolescent girls,

> '*Eating between meals will make you healthy and have good weight*' *(P1, rural-13 years).*

Theme 2. Concepts of healthy diet and weight

When asked what, in their view, constituted a healthy diet, the rural girls commonly mentioned cooked dishes such as *Domoda* [Groundnut soup], *Benachin* [a one-pot rice, meat and vegetable dish], *Superkanja* [okra soup], and palm oil stew. ese are potentially high fat dishes, depending on the proportion of cooking ingredients used such as palm oil in savoury dishes, or were sweetened with sugar,

> '*Eating palm oil stew that has furo [fish], potatoes, bitter tomatoes, cabbage, Kucha [hibiscus leaf] is healthy diet*' *(P2, rural, 14 years).*
> '*Healthy diet is composed of mono [porridge] with sugar and sour milk*' *(P4, rural, 12 years).*

In the rural areas, but more commonly among the urban adolescents, consumption of specific food groups and nutrients was highlighted,

> '*Is a diet that contain fruits and vegetables*' *(P26, urban, 16 years).*
> '*It can be food that contain vitamins and proteins*' *(P17, urban, 11 years).*

milk added] at night to increase weight' (P1, rural, 14 years).

Suggestions for overweight and obesity treatment were the counterpart of those for underweight; that is, exercising, dieting by reducing the amount of foods/ certain dietary components eaten (such as fats, oils, and sugars), increased consumption of sour foods and

'Community leaders conduct meeting with members and put in strategies to engage the government in supporting the community about arising nutritional issues' (P32, urban, 11 years).

Several of the adolescents spoke about the significant role they felt government had to play at the national level to manage malnutrition among girls. Some rural girls recommended that the government make several fundamental improvements to community environments,

' ey should help communities like ours with electricity, good road, standard market and health facility. We walk for long distance to go to the MRC [Medical Research Council field station, Keneba]' (P16, rural, 16 years).

In the urban setting, adolescents also proposed the government put in place methods to access nutrition information for both parents and adolescents, and additionally referred to the need for education,

' e government should put in strategies to educate parents in the communities about good nutrition, because some parents are not educated and are unaware of good nutrition. In return, they will be able to help their adolescents eat good nutrition' (P19, urban, 11 years).
'Some people cook unhealthy food in their homes because that's what they can a ord, so the government should provide food for poor households and information for all households either rich or poor' (P32, urban, 11 years).

Additionally, they advocated for access to job opportunities for adolescents after finishing grade 12, free school meals, income subsidy for parents, access to farming and animal rearing facilities, and adequate access to food,

' e government should help adolescents with free school meals because the food sold at school is expensive, and sometimes when you buy it you can find a foreign body in it which means you wasted money because you will not eat it. Some food sellers bring leftover foods the following day if that food was not completely sold out the previous day and this can be poisonous to children' (P24, urban, 15 years).

e adolescents also indicated the importance, in their view, of providing resources for poor households, as this participant stated,

' e government should provide television for some households so that parents are able to watch nutrition programmes like cooking episodes and this can help them give good nutrition advice to their children' (P30, urban, 11 years).

Rural girls' recommendations to address overweight and obesity in their communities included the government providing (or withholding) food assistance, access to nutrition information and medication. In addition to nutrition information and medication access, urban girls recommended that the government ensures that adolescents living with overweight or obesity have free access to a gym, encourages PE in schools, provides access to health facilities for health and nutrition check-ups and medications, and engages parents in adolescent nutrition issues,

'Government should provide adolescents with access to free gym without paying' (P22, urban, 19 years).

Theme 4: Study recruitment: barriers and facilitators

Participants suggested various potential techniques for recruiting respondents to larger studies. Discussion included the possible challenges, enablers as well as motivators for parents and for the adolescents that might be potential future participants.

Across focus groups in both settings the importance of engaging parents in facilitating participant recruitment to the study was highlighted. It was emphasised that the researcher should meet and explain the research relevance to parents, as this quote suggests,

'Take time to talk to parents to convince them for their children to participate' (P4, rural, 12 years).

Most participants agreed that this method could be implemented by calling parents or conducting house to house visits. Another method suggested by participants from the rural community was for the researcher to organise a meeting with all the community members at the community centre.

Key potential motivating factors for parents highlighted by participants included engaging mothers during the recruitment process, and for the researcher to describe the research in detail to parents. It was considered important that researchers explain the research purpose, procedures for data collection, and the research benefits for their children,

' e parents will ask whether the study is beneficial. If they know that it is beneficial for their children then they will let them participate' (P24, urban, 15 years).

In addition, adolescents in the urban setting felt that parents' awareness about health and nutrition issues and the potential for support to influence children's health related habits would enhance recruitment,

'You know some parents usually advised their children not to eat certain foods but their children do

not follow their advice, so when someone outside come to discuss nutritional issues to their children they will be willing to let them participate because they are aware and knows the importance of nutrition and health' (P19, urban, 11 years).

e role of parents in recruiting adolescents was important across settings, but views on the extent of parental influence varied between urban and rural settings. Adolescents in the rural villages were inclined to

research would be if injections were part of the data collection,

> *'If the research involves blood and urine collection, people will agree to participate but if it involves injection they will not take part because of issues surrounding COVID-19' (P13, rural, 15 years).*

Theme 5. Survey questionnaires and measures are mostly feasible and acceptable

According to the participants, the questionnaire was not difficult, but in reality, the urban adolescents found completion easier than the rural participants. The urban residents did not mention any specific section or question that was not clear, or was difficult to answer; most of them completed the questionnaire independently and quickly, as previously noted. By contrast, in the rural villages most of the participants were assisted to answer the questionnaire. Rural participants specifically mentioned that the sedentary lifestyle section of the questionnaire was difficult for them to answer. They claimed not having mobile phones made it difficult to report the exact time in relation to questions on going to bed and length of sleep. As noted in the analysis section, reported prayer times were used to estimate the hour they went to bed.

In discussing the feasibility of repeat data collection, including by remote methods such as by phone, most of girls reported not having mobile phones to support direct conversation. This was most common in the rural areas and among the younger adolescent girls. The participants claimed that this would be the case for most of their peers. Alternative suggestions made by the girls included calling participants' parents, the VDC chair, or participants' siblings, or for the researcher to buy mobile phones for participants,

> *'You can contact our peers through their parents' mobiles or the Village Development Committee (VDC) focal person' (P1, rural, 13 years).*

Specific mobile networks were recommended. Although some stated network quality could accommodate follow up conversations, others were not sure of this because they did not have mobile phones. However, the majority agreed that network quality varies and this can be good or poor depending on the participant's location at the time of call,

> *'It depends, sometimes the network is very poor and sometimes is good' (P19, urban, 11 years).*

The respondents suggested other avenues to conduct follow up data collection and this included the researcher coming back to the community to meet participants in person, or for someone else to administer the questions on their behalf, calling participants parents or siblings and use of social media for communication. Due to the lack of mobile phone ownership, the researcher coming back to the community was the most recommended approach across all groups,

> *'Most adolescents will not have access to mobile phones, but you can come in person again for follow up if communicating by phone is not possible' (P30, urban, 11 years).*

Linked with the discourse above relating to factors influencing recruitment, positive and negative attitudes towards giving blood samples were shared by participants,

> *'Some people will be afraid of the needle and that can prevent them from joining' (P24, urban, 15 years).*
>
> *'Some adolescents may consider it an opportunity to test their blood and that can encourage them to participate' (P17, urban, 11 years).*

Adolescents also believed that their willingness to take part in a future larger study would be related to the benefits outlined in Theme 4. However, in the urban group, participants alluded to a fear of surreptitious pregnancy testing, and therefore to the rejection of urine sample collection,

> *'Many adolescents will be more willing to provide blood than urine samples' (P19, urban, 11 years).*

Questionnaire and physical measures

Questionnaire data

Results for the questionnaire data comparing urban and

ailments (e.g. toothache or headaches) that prevented them from doing exercise, and one of the participants revealed reading as the reason for not engaging in exercise. Most of the participants reported limited sedentary

Physical measures

Predicted height (from ulna length and demi-span) and measured heights were significantly correlated with each other ($r = 0.78–0.85$; p-value < 0.001). Although predicted height was not needed, as all participants could stand, it can be used as an alternative to measured height in future studies in the Gambian setting where needed. All other anthropometric physical measures by setting are summarised in Table 4. Median weight, height, mid upper arm circumference (MUAC), waist and hip circumferences, and waist: hip ratios were similar across settings.

ere was a high correlation between BMI and MUAC ($r = 0.775$; $p < 0.001$). BMI for age z-scores were lower among rural compared to urban participants ($p = 0.017$). Average height for age z-scores were also lower among rural than urban girls, however this was not statistically significant.

Nutritional status and weight perception

Overall, a similar proportion of participants were classified as underweight or normal weight based on BMI-for-age z-score cut-points (31%; 59%, respectively) or MUAC cut-points (28%; 56%) (Table 5); however, significantly more participants were underweight in rural vs urban settings, according to BMI-for-age z-score cut-points (50% vs 12.5%, $p = 0.03$; data not shown in the table due to small numbers in categories). Around 10% (BMI z-scores) or 16% (MUAC) were classified as living with overweight or obesity according to these two measures. Based on measures of abdominal obesity 21% or 31% of the girls could be considered as having excess abdominal fat according to their waist: hip ratios or waist circumference measures, respectively. Based on height for age z-score cut-points, 41% ($n = 13$) of the girls experienced stunting.

Overall, over 70% of participants classed as normal weight when measured also perceived themselves as such, and all girls classed as overweight or obese by BMI z-scores perceived themselves as being of normal weight, when asked during the focus groups. However, 70% of those classified as underweigaicBght,

Table 5 Nutritional status measures and weight status perception

Nutritional status indicator	N (%)*
	All
Weight status (body mass index for age z-scores):	
Underweight	10 (31.3)
Normal weight	19 (59.4)
Weight status (mid upper arm circumference age-specific cut-points):	
Underweight	9 (28.1)
Normal weight	18 (56.3)
Overweight/ obese	5 (15.6)
Abdominal obesity (waist: hip ratio):	
Excess abdominal fat	10 (31.3)
Abdominal obesity (waist circumference):	
Excess abdominal fat	7 (21.9)
Stunting (height for age z-scores):	
Stunted	13 (40.6)
Measured (body mass index for age z-scores) vs perceived weight status	
Underweight perceived as underweight	6 (24.0)
Underweight perceived as normal weight/ overweight	19 (76.0)

* Where counts were ≥ 4

and body weight among rural participants compared to their urban counterparts. Discussion around perceptions of healthy diet and weight disclosed low levels of awareness of nutrition, which was particularly apparent among the rural girls. is learning will inform assessing the extent and importance of these practices and of nutrition knowledge in a larger scale study. However it also signals the importance of valuing di erent forms of knowledge where possible [55], and the potential impact of access to good quality education as a determinant of health that spans individual to national levels of influence [56]. Participants suggested various strategies such as involving relevant gatekeepers, a range of study awareness raising activities such as group meetings, house to house visits, involving young people throughout, and the importance of incentives (such as books and stationery) for engaging them in research. e adolescent girls also shared some challenges such as refusal to participate linked to fear of injections and distrust of research. It was also important to have an understanding of the girls' day to day pattern of activities, such as attending school and supplementary schooling, and household chores and how these impact on taking part. Collectively, these insights were highly informative for enhancing engagement with larger-scale studies.

Good quality questionnaire and anthropometric data were obtained in this exploratory study, evidenced by negligible missing data and the plausibility of the findings. e modifications outlined will further enhance the performance of the questionnaire. Urban–rural di erences in the potential household and community predictors of malnutrition (such as access to electricity and good quality roads) was consistent with the picture seen in national data [57, 58]. Nutritional status outcome data obtained showed consistency between estimates of underweight between the measures, and in comparison with previous research among older adolescents [1, 2, 4]. Estimates of overweight were more variable but supports the use of multiple measures to mitigate against inherent limitations. For example, a large waist could be due to fluid retention and stomach distention associated with malnutrition or illnesses such as parasitic worm infection [59]. e findings are further integrated into the wider literature below.

Cultural contexts and views on diet and weight

e narratives in the current study indicated that the traditional way of communal eating, and practices such as males in the household having priority over protein-rich foods, remain common in both rural and urban households [60, 61]. Qualitative exploration of cultural food practices has previously been carried out in e Gambia [3, 62, 63] and other West African countries [64]. Much of this research has focused on rural women's views of these practices and how they influence feeding their young children [62–64]. e negative impact of food taboos on maternal and child feeding are emphasised, although Mwangome et al. [63] also highlight cultural mores that have positive impact on hygiene and childcare, and the intersection between culture and wider determinants

such as poverty. To date there has been limited inclusion of the views of adolescents on cultural food practices and the influence on nutrition [3]. Analysis of national data examining the determinants of child nutritional status [65] or of healthy eating [66] in e Gambia have no [65] or limited [66] consideration of factors beyond the individual level. Future research would benefit from inclusion of household and community cultural norms and practices in elucidating determinants of and solutions to adolescent malnutrition.

ere was high agreement between perceived and measured weight status. However, there was a suggestion that both underweight (potentially due to its high prevalence) and overweight may be normalised. Misperception of weight status among adolescents is common across diverse populations and settings [67–71] and can impact on health as correct weight perception contributes to appropriate weight control habits [68]. Research from Africa on this topic is limited, but a study among adolescents in the Seychelles suggests underestimation of overweight and obesity is associated with a positive view of large body size [68]. Traditionally, overweight is viewed as healthier than normal weight, and a sign of beauty (particularly among women), wealth, success and prestige in e Gambia [72]. is may be a contributory factor in rising obesity levels particularly among the more a uent [73].

Urban girls in the current study were encouraged by their parents to walk to school. e parent–child relationship and parental engagement in activities, as important individual-household level interactions, encourages young peoples' participation in exercise [74, 75]. More widely, studies conducted in a range of settings, including several sub-Saharan African countries, indicate parental involvement has a beneficial role in healthy BMI and diet [76], adequate physical activity levels [77], decreased engagement in risky behaviours (such as substance, tobacco, and alcohol use) [78], and lower likelihood of poor mental health [79]. Nonetheless, parental involvement in adolescents' lives may need more support in families of low socioeconomic circumstances and education levels compared to their counterparts with better access to resources [80].

Participants' own perspectives on addressing under- and overweight support consideration of social determinants and inform strategies for action beyond observational research (and therefore across levels of influence from a SEM perspective [6]). Some of their recommendations (such as the provision of school meals, nutritional education for school children and members of the public, and government support for families to supplement household food consumption) are measures promoted by UNICEF to reduce childhood malnutrition [81] and should be supported as acceptable interventions for young females. ese and other ideas (including small-scale horticulture) have provided formative intelligence for research developing a new MRC-funded community-based intervention for improving malnutrition for adolescents (reference: APP30152), led by the authors and currently underway. Urban agriculture has been shown to improve household income, food security and dietary diversity [82]; however, challenges such as water shortages can impact on the success of such programmes [83]. e importance of public contributors' views in shaping the new study will be fed back to communities as part of wider dissemination of the current research.

ere was little mention among the study participants of nutrient supplementation or food fortification. is may suggest a significant gap in the health education received at school, is consistent with reported limited access to nutrition information resources among this age-group in Nigeria [84], and should be rectified in ongoing actions to address malnutrition.

Perspectives on research approaches

e adolescents stressed the importance of the role of parents in potentially engaging in a research study. Participants clearly value parental input, and are also able to see the benefits for parents of their child's participation (such as reinforcing parental guidance on healthy eating). Among the urban girls this view was balanced with emphasis on their own autonomy particularly the need to be fully informed, and the right to decide not to participate even if their parents agree. Parental support for autonomy is associated with a number of positive outcomes in childhood and adolescence [85]. However, the degree of child autonomy varies by geographical location and thus cultures, and evidence suggests that some parental behaviours that support autonomy (e.g. o ering choices) might be less relevant in collectivist cultures than other behaviours (e.g. perceiving information from a child's point of view) [86]. Empowering women, children and adolescents is deemed essential to address childhood malnutrition in e Gambia [87], and globally stalled maternal and child mortality [88], requiring culturally sensitive approaches [89]. Urban–rural di erences in views in e Gambia indicate that cultural and structural nuances in adolescent autonomy within collectivist societies need to be further understood.

Informed consent and willingness to participate is thus influenced by the young people themselves and their parents, but also other influential members of the community, such as *Alkalos*, as the findings suggest. Traditional leaders in low income countries exercise considerable power and influence and generally enhance taking part in research when they are involved [90]. As essentially

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