

1 **Abstract**

2 *Objective:* To explore, from the perspectives of adolescents and caregivers, and using qualitative
3 methods, influences on adolescent diet and physical activity in rural Gambia.

4 *Design:* Six focus group discussions (FGDs) with adolescents and caregivers were conducted.
5 Thematic analysis was employed across the dataset.

6 *Setting:* Rural region of The Gambia, West Africa.

7 *Participants:* Participants were selected using purposive sampling. Four FGDs, conducted with 40
8 adolescents, comprised: girls aged 10-12 years; boys aged 10-12 years; girls aged 15-17 years, boys
9 aged 15-17 years. Twenty caregivers also participated in two FGDs (mothers, fathers).

10 *Results:* All participants expressed an understanding of the association between salt and hypertension,
11 sugary foods and diabetes, and dental health. Adolescents and caregivers suggested that adolescent
12 nutrition and health were shaped by economic, social and cultural factors and the local environment.
13 Adolescent diet was thought to be influenced by: affordability, seasonality and the receipt of
14 remittances; gender norms, including differences in opportunities afforded to girls, and mother-led
15 decision-making; cultural ceremonies and school holidays. Adolescent physical activity included
16 walking or cycling to school, playing football and farming. Participants felt adolescent engagement
17 in physical activity was influenced by gender, seasonality, cultural ceremonies and, to some extent,
18 the availability of digital media.

19 *Conclusions:* These novel insights into local understanding should be considered when formulating
20 future interventions. Interventions need to address these interrelated factors, including
21 misconceptions regarding diet and physical activity that may be harmful to health.

22

23

24 **Introduction**

25 Adolescents (10 to 19 year olds) formed almost a quarter of The Gambian population in 2015⁽¹⁾, a
26 proportion projected to increase⁽²⁾. The Gambia, like other low- and middle-income countries
27 (LMICs), suffers from the triple burden of malnutrition⁽³⁾; namely conditions of undernutrition such
28 as stunting, co-existing with conditions of overnutrition, including overweight and obesity, and of
29 micronutrient deficiencies including iron deficiency⁽⁴⁾. Having survived the highly vulnerable
30 infectious disease stage of childhood⁽⁵⁾, adolescents are often deemed healthy in many LMICs
31 including The Gambia despite still being at risk. Nonetheless, nutrition research has mainly focussed
32 on pregnant women, neonates and children under 5 years⁽⁶⁾. This has left a knowledge gap around
33 adolescent health, with data largely limited to anthropometry and anaemia status from either
34 nationwide surveys⁽⁷⁾ or region-specific research studies⁽⁸⁻¹²⁾. What shapes adolescent nutrition is

35 critical to understand in this community, given the potential triple benefits of interventions during
36 this period on: improving contemporary health; long-term health; and the health of future generations.

37

38 The determinants of adolescent malnutrition are multi-faceted. Delayed, stunted growth and impaired
39 development may arise from suboptimal nutrition⁽¹³⁾. Protein-energy malnutrition is rated high
40 amongst the causes of deaths in children and adolescents⁽¹⁴⁾. Many LMICs are shifting away from
41 their traditional diets, adopting convenience foods⁽¹⁵⁾. Increasing rates of overweight and obesity
42 among adolescents are related to immediate and long-term risks of developing non-communicable
43 diseases (NCDs)^(16, 17). Also, whilst high proportions of adolescents from few West African countries
44 do less than 60 minutes of moderate-to-vigorous-intensity physical activity daily, below the World
45 Health Organization recommendations on physical activity for health; there is no data on physical
46 activity of any age group in The Gambia⁽¹⁸⁾. Additionally, adolescence is a phase of the life-course
47 marked by increasing autonomy, although in many contexts, including The Gambia, opportunities for
48 autonomy are experienced differently by young women and men⁽¹⁹⁻²²⁾.

49

50 Existing international and public health organisations focus on the sexual and reproductive health of
51 women living in sub-Saharan Africa, including adolescent girls, but have failed to prioritise
52 adolescent nutrition^(23, 24). Rather, it forms an integral, albeit neglected, part of the health and nutrition
53 policies of The Gambia. These policies are focused on reducing the incidence of diet-related NCDs
54 and improving the nutritional status of the socioeconomically deprived and nutritionally vulnerable
55 groups^(24, 25). Simultaneously conducting research and implementing interventions on adolescent diet
56 and physical activity may help realise the triple benefits of investing in their nutrition. As emerging
57 adults, adolescent nutritional status is significant in breaking intergenerational cycles of malnutrition
58 and growth failure⁽²⁶⁾. In The Gambia, stunting is significantly higher in rural children under the age
59 of 5; and rural inhabitants are at heightened risk of malnutrition from food insecurity emanating from
60 unpredictable harvests⁽²⁷⁾. Understanding the perceived drivers of adolescent dietary and physical
61 activity patterns within this context will be important for informing future health programmes and
62 interventions. The way to understand such perceived drivers is to listen to the perspectives of
63 adolescents and their caregivers. As part of the Transforming Adolescent Lives through Nutrition
64 (TALENT) collaboration⁽²⁸⁾ (see Editorial, this issue), the current study took a qualitative approach
65 to explore adolescents' and caregivers' perceptions of the factors influencing adolescent diet and
66 physical activity.

67

68

69 **Methods**

70 **Setting, Research Design and Participants**

71 The study was set in six rural villages of the Kiang West district of The Gambia (latitude 13°N,
72 longitude 15°W), West Africa. Kiang West is located approximately 160 km from the capital Banjul.
73 It covers an area of 750 km², has a population size of approximately 15,000⁽²⁹⁾ and mainly comprises
74 subsistence farmers, many of whom undertake a small amount of commercial groundnut farming
75 during the annual rainy season (June to October). These are predominantly Muslim communities,
76 who live together in extended family compounds. Most compounds do not have access to improved
77 sanitation and electricity, but community taps and water-pump wells are available. The illiteracy rate
78 is high, at 53% for women and 40% for men⁽⁷⁾; and education is via either Quranic or English-medium
79 schools, or Quranic followed by English-medium schools.

80

81 Participants were selected by purposive sampling from the Keneba Demographic Surveillance Study
82 Database⁽²⁹⁾, considering the study eligibility criteria (i.e. age, gender). Contextual data was gathered
83 via a cross-sectional survey focusing on adolescent's height, weight, derived rates of stunting, body
84 mass index (BMI), and overweight and obesity. It included data on parental schooling, employment
85 status, household assets and amenities, adolescents' dietary diversity⁽³⁰⁾, and access to digital
86 technologies (Fall CHD, Abera M, Chopra H *et al.*, this issue). From the 80 respondents, a sub-sample
87 of 40 adolescents were invited to participate in a Focus Group Discussion (FGD). The sample was
88 stratified by age, gender and generation. Recruitment and consent of participants were conducted by
89 experienced field workers, who explained the study to participants in their native Mandinka language
90 using a participant information sheet. Separate information sheets and consent forms for caregivers
91 and adolescents were generated, explaining the purpose, process and potential outcomes of the study
92 including issues of anonymity, confidentiality and the right to withdraw at any stage. Caregivers gave
93 written consent for themselves and their child. Adolescents provided written assent for their own
94 participation.

95

96 This paper focuses on the outcomes of the qualitative work, using some of the quantitative data for
97 context. FGDs were chosen as the most appropriate data collection method to obtain insights into
98 adolescents' experiences and a sense of social norms arising from group discussion⁽³¹⁾. Data quality
99 focused on the depth and quality of interaction amongst participants, and adequacy of the sample for
100 addressing the research questions. Data was generated via six FGDs, each comprising 10 participants.
101 Designed to capture a diverse range of experiences, the groups included: girls (aged 10-12), boys
102 (aged 10-12), girls (aged 15-17), boys (aged 15-17), mothers and fathers. FGDs were conducted in a
103 research room at the MRCG at LSHTM Keneba Field Station by IC, MBM and REJ. IC and MBM
104 were fluent in Mandinka and familiar with the context, having worked with the MRCG for many

105 years. IC, who had previous experience of conducting FGDs, was the facilitator; and MBM together
106 with REJ, were observers. Prior to the main data collection, two pilot FGDs were conducted with 6
107 boys (11-13 years) and 8 men caregivers to assess feasibility and inform on the format of future
108 sessions.

109

110 **Data Collection**

111 FGDs were held during July 2018, with two conducted per week. Discussions were recorded using a
112 digital voice recorder (Olympus VN-541PC, Vietnam). A semi-structured FGD guide was designed
113 (see supplementary information for details of the main topics and questions) to explore qualitatively
114 perceptions of the factors influencing adolescent diet and physical activity behaviour in this
115 community. During each FGD, the researchers used creative methods to engage participants. For
116 example, adolescent and caregiver participants were given 50 laminated photos of commonly
117 available and consumed foods in Kiang West. The photos were spread on a table and participants
118 were asked to group the foods according to how beneficial they felt they were to their health. The
119 food sorting activity was allocated 10 minutes.

120

121 Prior to starting the FGD, participants were assured of the confidentiality of any data generated (and
122 the limits to confidentiality). Their anonymity and safety were guaranteed throughout all phases of
123 the research. They were encouraged to express themselves unreservedly, whilst also respecting the
124 views of others. FGDs were conducted in the mornings and lasted between 40 and 100 minutes.

125

126 **Data Analysis**

127 Audio recordings in Mandinka were directly translated and transcribed into English, since Mandinka
128 is not a written language. The Gambian field researchers performed all the translation and
129 transcription using a transcription device (Olympus AS-2400 Transcription Kit, Tokyo, Japan).
130 Participants' identities were anonymised and uniformly cited in transcripts as 'P'.

131

132 Guided by Braun and Clarke's approach,⁽³³⁾ the data were analysed thematically. To ensure accuracy,
133 audio records were checked against the English transcripts. These transcripts were uploaded into the
134 qualitative software package NVivo (v12, QSR International Ltd)⁽³⁴⁾ and coded by REJ. Themes were
135 inductively generated at first, and then, based on the research questions, a deductive approach was
136 taken. A coding framework was developed in collaboration with the other studies that formed part of
137 TALENT (see Editorial, this issue). Similar codes were organised into themes, aided by the use of
138 cross-tabulations comprising major codes and case attributes. The coding was reviewed by PHJ and

139 SW. Based on the researchers' interpretation of the data and themes, a thematic map (Figure 1) was
140 developed manually.

141

142

143 **Results**

144 Table 1 presents the demographic characteristics of those who completed the survey. Participants
145 were all Muslim of low socioeconomic background. All the adolescent participants had good diet
146 diversity score with median > 9 for all groups, and 100% of adolescents had a score >5.

147

148 **Table 1** Characteristics of the Quantitative Study Participants

149

150 Very few homes had an electricity supply, and only 4.5% of the older boys had an electric fan, but
151 radio possession was common. None of the households owned a car. Fall CHD, Abera M, Chopra H
152 *et al.*, this issue, give a comprehensive report of the quantitative data across the sites comprising the
153 wider TALENT study.

154

155 Forty adolescents from the quantitative study and 20 caregivers participated in the FGDs. The sample
156 attributes are illustrated in Table 2.

157

158 **Table 2** Attributes of the FGD Participants

159

160 Figure 1 details the major themes that emerged from the FGDs. For many participants, economic
161 factors and the local environment were interrelated in determining adolescent food availability and
162 variability in physical activity. Similarly, many pointed to the relationship between economic,
163 environmental, social and cultural factors in driving ambitious plans for social and cultural activities.

164

165 **Figure 1** Thematic map framework of the determinants of rural Gambian adolescent diet, physical
166 activity and health

167

168 **Knowledge of the links between diet and health**

169 Many participants demonstrated good awareness of the association between diet, health and physical
170 activity, depicted as the outer framework of Figure 1. In all of the FGDs, participants were able to
171 discuss the health benefits of the specific food groups and/or physical activity:

172

173 *'These are garden produce, when they are eaten, can help protect the body from many minor*
174 *ailments'* (woman caregiver, FGD6).

175

176 *'[The physical activity we do] give us energy, power or strength'* (younger girls, FGD2).

177

178 Across the FGDs, the majority of participants displayed more advanced nutritional knowledge
179 associating certain diseases with diet.

180

181 *'It [Salt seasoning] ... also causes high blood pressure...'* (man caregiver, FGD5).

182

183 *'Sugar is not good [for health], it causes diabetes'* (older girl, FGD4).

184

185 However, there were some differences in the nature of that knowledge between groups. Younger
186 participants and caregivers tended to articulate a more basic understanding:

187

188 *'If you mix them [milk and candies], it is going to cause sickness'* (younger boy, FGD1).

189

190 In contrast, only older boys and girls displayed a more in-depth understanding. They tended to speak
191 in more detail about the nutritional benefits of certain foods:

192

193 *'... vegetables, ... have vitamins, vitamin C is good in the body. All these things..., if you lack one of*
194 *them..., you have disease.'* (older boy, FGD3).

195

196 However, some discussions implied that the quality of nutrition knowledge of many participants was
197 not entirely evidence-based, but revolved around some misconceptions:

198

199 *'Milk, ... is good for men who smoke cigarettes, ... it cleans their lungs'* (older girl, FGD4)

200

201 *'Chocolate ... it can cause liver problem, spoil the liver'* (man caregiver, FGD5)

202

203 *'... the running they do is good as it makes their blood flow well...'* (woman caregiver, FGD6)

204

205 All participants showed understanding of the association between dental health and sugary foods.

206

207 *'Biscuits and chocolate can cause toothache'* (women caregiver, FGD6)

208

209 Despite concerns about adolescents' diet and physical activity levels, the FGDs highlighted that all
210 adolescents had some knowledge of the relationship between health, diet and physical activity. Being
211 in relatively higher education (Table 2), older adolescents generally had a more in-depth
212 understanding and were able to articulate the relationship between specific food groups and nutrients.

213

214 **Economic factors driving adolescent diet**

215 All participants perceived household wealth variations, along with changes in the affordability of
216 different foods, to be an important driver of adolescent diet. They suggested many were unable to
217 regularly afford nutrient-rich foods. Rather they were restricted to monotonous diets comprising
218 nutrient-poor staples:

219

220 *'When there is no money, we don't eat it [butter]; [We eat] porridge or heated rice' (younger boys,*
221 *FGD1)*

222

223 The hot climate, coupled with lack of refrigeration, hindered preservation of fresh produce. However,
224 adolescent boys and men caregivers felt that even for perennial nutritious foods like beans, their
225 consumption depended on affordability:

226

227 *'You can eat [beans] ... for up to a week ... if you have the means, it requires affordability' (man*
228 *caregiver, FGD5).*

229

230 Moreover, the majority of women caregivers indicated that the receipt of remittances impacted on the
231 foods consumed:

232

233 *'... what you used to have [in terms of diet] can now change if you have more income'*
234 *(women caregivers, FGD6)*

235

236 FGD participants, therefore, reinforced a common perception that food affordability directly affects
237 adolescent diet, and highlighted indirectly the link between diet and health. Increased household
238 wealth through remittances was seen only by women caregivers to shape the diets of adolescents.

239

240 **Social and cultural factors affecting diet**

241 Participants outlined a range of social and cultural influences on adolescent diet which mainly
242 comprised familial decision-making habits. A large proportion of participants perceived mothers as

243 the main decision-makers regarding the major meal of the day, followed by fathers. Nonetheless,
244 whilst mothers may determine what the meals comprise, limited resources restricted choices.

245

246 *'Those who cook [mothers] [decide what is eaten at home]'* (women caregivers, FGD6)

247

248 Most participants were satisfied with mother-led decision making; only women caregivers posited
249 adolescents' dislike of some meal decisions which often resulted in food wastage. Some of the men
250 caregivers felt the need for a more autocratic approach in the face of a lack of dietary choice:

251

252 *'... if you cannot get what they demand, you force them to eat what is available ...'* (man caregiver,
253 FGD5)

254

255 A minority of participants, mainly the younger girls and women, spoke of the limited role adolescents
256 played in choosing meal options:

257

258 *'Children can say: mum, today this is what we want to be cooked.'* (woman caregiver, FGD6)

259

260

261 Shaped by tradition and family size, gendered familial hierarchies in food sharing practices were
262 reported by all caregivers, older boys and young girls to influence adolescent diets. Where this
263 practice existed, adolescent boys often benefitted from more nutritious foods than girls.

264

265 *'... mostly the very elderly are dished separate meal ...sometimes joined by their grandchildren; ...
266 adolescent males join their fathers and females their mothers.'* (man caregiver, FGD5)

267

268 Moreover, most participants believed festivals, birth and wedding ceremonies had a sporadic
269 influence on the nature of adolescent diets:

270

271 *'... more 'benachin' (one-pot dish of rice, oil stew and meat or fish, and vegetables) are cooked.'*
272 (older girl, FGD4)

273

274 At such ceremonies, highly energy-dense foods are consumed, including carbonated drinks high in
275 sugar. Conversely, a small number of participants, mainly older boys and women caregivers, spoke
276 of the consumption of salad during the Muslim holy month of Ramadan.

277

278 *'During Ramadan, ... they prepare fast breaking foods like salads ...'* (woman caregiver, FGD6)

279

280 Outside of the home environment, participants suggested that some adolescents were able to access
281 nutritious foods at school, but this was not universal. Rather, nutrient-poor foods were readily
282 accessible from street vendors in close proximity to schools. Such foods included local and/or cheap
283 fruit flavoured drinks high in sugar and chemical additives or deep-fried snacks.

284

285 *'... [During break times at school], sometimes I go to look for food'* (older boy, FGD3).

286

287 In the main, FGD participants felt that the social and cultural influences on adolescent diet included
288 mothers' decision-making over domestic issues, fathers' autocracy and hierarchical family
289 structures, the nature of food available in schools, and, to a lesser extent, cultural and religious
290 events and practices. Adolescents able to purchase items from street vendors appeared to have some
291 limited autonomy over their diet.

292

293 **Environmental influences on diet**

294 All participants pointed to the influence of seasonality on rural adolescent diet and the abundance of
295 nutrient-rich green leafy vegetables in the rainy season:

296

297 *'During the rainy season, the types of foods we have are leaves like 'kucha'(sorrel), these are more
298 available during the rains...'* (older boy, FGD3).

299

300 A few participants, mainly younger boys and older girls, spoke of the consumption of fruits such as
301 mangoes common in the rainy season, and oranges and cashews abundant in the dry season:

302

303 *'We eat [mangoes] everyday if we have them, and cashews when available'* (younger boys, FGD1).

304

305 Short sojourns to urban areas also influenced adolescent's diets, with opinion split between
306 participant groups. The younger boys and girls and women caregivers perceived a dietary change
307 when in urban areas:

308

309 *'F: ...What do you eat in Sukuta (urban) that you don't eat in Manduar (village)?'*

310 *P: Bread and tea*

311 *P: Chips*

312 *P: Milk powder.'* (younger boys, FGD1)

313

314 In contrast, older boys and girls and men caregivers believed there were little or no changes in diet
315 between rural and urban areas:

316

317 *'The Gambia is all one food ... rice only.'* (man caregiver, FGD5).

318

319 Although urban environments were perceived to expose adolescents to more junk foods, their diet at
320 home was also rich in fats and oils, salt and sugar. Hence, many participants perceived the association
321 between consumption of these foods with hypertension, diabetes and poor dental health.

322

323 **Awareness of the links between physical activity and health**

324 All participants gave examples of physically active tasks that adolescents do as part of their daily
325 chores including farming and food production. Participants also demonstrated knowledge of the link
326 between physical activity and good health:

327

328 *'... the running they do is good as it makes their blood flow well ...'* (woman caregiver, FGD6).

329

330 Older girls commented on the effects of sedentary behaviour:

331

332 *'Inactivity after eating fully is not good for health'* (older girl, FGD 4).

333

334 Despite the general lack of data on physical activity, for many participants, gardening and farming
335 constituted a key form of physical activity, in addition to contributing to local food production. The
336 perception of the link between health and physical activity and knowledge of health benefits was a
337 motivator for physical activity. The majority of participants concurred that physical activity was good
338 for health, strong bones and boosted power, whilst women caregivers conceived it to strengthen
339 joints. Younger boys associated physical activity with disease prevention.

340

341 **Perceptions of cultural, economic and social influences on adolescent physical activity**

342 Cultural practices, particularly the popularity of music and dance, were commonly regarded as
343 important factors influencing adolescent physical activity. According to men caregivers, adolescents
344 organised parties and danced during school holidays and ceremonies. Women caregivers also
345 commented that at the football field, young girls grouped themselves, clapped and danced as well as
346 during breaktime at school:

347

348 *'When there is music, we dance.'* (younger boy, FGD1).

349 *'We beat the drum and dance.'* (older girl, FGD4).

350

351 Despite the lack of availability of digital technologies (Table 1), with the exception of battery-
352 powered radios, their potential influence on sedentary behaviour was mentioned in all groups,
353 highlighting the link between social factors, physical activity and health in the thematic map (Figure
354 1). Caregivers spoke of, what they felt was, adolescents' growing interest in watching television and
355 using mobile phones:

356

357 *'During weekends and in the evenings, we watch 'Mannu' (Indian film) on Joy Prime channel'* (older
358 girl, FGD4).

359

360 Although with relatively little access to digital media given only 5.3 % younger girls and 13.6 %
361 older boys reported possessing a television in the household (Table 1). The time spent using digital
362 technologies, for instance the collective watching of television, was still a concern amongst
363 participants. Many participants perceived frequent use of media devices to reduce physical activity,
364 whilst dancing, field and breaktime activities improve physical activity of adolescents.

365

366 **Environmental factors affecting physical activity**

367 All participants provided examples of the ways in which physical activity featured in rural
368 adolescents' lives as a consequence of the natural environment setting. For example, all travelled to
369 school by either on foot or by bicycle, with younger adolescents tending to do the former:

370

371 *'Some go by bicycle and some on foot to school'* (man caregiver, FGD5).

372

373 A further example was household chores including the collection of water from community taps and
374 wells, as majority of homes do not have piped water to the house (Fall CHD, Abera M, Chopra H *et*
375 *al.*, this issue). Sometimes wheelbarrows or bicycles would be used to help carry water drums:

376

377 *'After lunch, I fetch water and if there is cooking for the evening, I do it, and sweep'* (older girl,
378 FGD4).

379

380 Men caregivers also mentioned adolescents' involvement in activities such as the repair of fences and
381 the clearing of backyards, while the older boys indicated that they fetched sticks for fencing works,

382 firewood and shepherding goats. Women caregivers underscored that pounding, washing dishes and
383 laundry were activities done by adolescents, the latter common at weekends:

384
385 *'...those who have pounding would do that' (woman caregiver, FGD6).*

386
387 Lastly, the majority of participants had the opinion that seasonality appeared to affect adolescents'
388 physical activity patterns. It was indicated that young and older adolescents clear the farm in the rainy
389 season prior to sowing groundnuts and acting as shepherds.

390
391 *'We go to the bush during the rains, for working, clearing the farm, planting groundnuts' (younger*
392 *boys, FGD1).*

393
394 The activities described above have varying degrees of intensity. Enjoyable but less strenuous
395 activities include dancing, walking, cycling to school and household chores. Fetching water,
396 gardening and farming may be classified as moderate to high intensity activities. The availability of
397 outside space shaped opportunities for physical activity. Football was a frequently cited example of
398 recreational physical activity. Some women caregivers and older girls insinuated that this was
399 dominated by boys with girls were side-lined and confined supporting the boys:

400
401 *'They [girls] at the field support football teams' (woman caregiver, FGD6).*

402
403 Adolescent boys' supposed control of field spaces was a gender norm in this setting. As a result, girls
404 had little opportunity to use such spaces for their own recreation. All these environmental activities
405 are believed to form part of adolescent physical activity in the rural context, depicted as the link
406 between the natural environment and physical activity of adolescents in the thematic map (Figure 1).

407

408

409 **Discussion**

410 We have described here, from the perspectives of adolescents and caregivers, factors influencing
411 adolescent diet and physical activity in rural Gambia. To our knowledge, this is the first work of this
412 kind conducted in this context. A knowledge of the link between diet, physical activity and health
413 was expressed by majority of participants, highlighted in the thematic map (Figure 1). The older
414 adolescents particularly possessed superior knowledge of nutritional benefits of foods, probably
415 gained from attending upper basic schools (Table 2), where the curriculum consists of general science
416 education including an introduction to food. In contrast, a significant proportion of participants'

417 nutrition knowledge lacked an evidence-base reinforcing the need for effective, intergenerational
418 nutrition education. Hence, the separate theme of nutrition knowledge in the thematic map needs
419 further research. Nonetheless, the heightened awareness of many participants (through the radio, local
420 health personnel, community outreach, word-of-mouth) of the relationship between diet and high
421 blood pressure might be a response to the increasing diagnosis and prevalence of hypertension in the
422 rural adult population⁽³⁵⁾. In the same environment, high odds of hypertension in young lean rural
423 adolescents is also a cause for concern⁽³⁶⁾. Furthermore, diabetes prevalence is on the rise⁽³⁷⁻³⁹⁾.

424

425 Likewise, an association between eating sugary foods and dental health is well known, generating the
426 relatively minor but novel theme of dental health in Figure 1. Dental caries has very high incidence
427 among Gambian adolescents^(41, 42). This high risk and the associated discomfort of toothache may
428 explain adolescents' preoccupation with dental care. Whilst chewing sticks and imported
429 toothbrushes and pastes are available, there is, for many, limited access to dental services and low
430 fluoride content in drinking water in some areas of The Gambia⁽⁴³⁾. Moreover, health is borne to be
431 associated with economic conditions; an association clearly demonstrated in the thematic map via the
432 joint theme of diet. Affordability seemingly influencing the dietary habits of rural Gambian
433 adolescents is consistent with reports by The Gambian government and the United Nations
434 International Children's Emergency Fund (UNICEF)⁽²⁷⁾; and from other settings in sub-Saharan
435 Africa⁽⁴⁴⁾. Also, remittances purportedly improving food security and dietary diversity is similar to
436 other settings, e.g. Nigeria⁽⁴⁵⁾.

437

438 Perceived social and cultural factors emerged as a particularly salient theme shaping adolescent diet.
439 This theme is directly and indirectly interrelated to food availability through the natural environment
440 and economic power. Decisions about meals were considered to be driven by availability, and then
441 familial hierarchies and gendered decision-making practices, followed by cultural and religious
442 ceremonies. Women caregivers' role in decision-making around meals has been described in black
443 African and Caribbean children in London, UK⁽⁴⁶⁾. This opinion is also supported by the reports of
444 men's low participation in food preparation. Gender segregation in food consumption is a long
445 standing tradition in Gambian villages, where fathers are treated as household leaders and served first
446 with the best part of the dish or better quality foods^(47, 48). Although this practice is perceived to be
447 changing, some participants confirmed it still exists, in which case adolescent boys might benefit
448 from sharing more nutritious foods with their fathers. Moreover, the World Food Programme, in
449 partnership with the government's school feeding programme, only exists for the lower basic or
450 primary schools⁽⁴⁹⁾. Consequently, older adolescent students are deprived of this nutritious systematic
451 feeding programme.

452

453 The seasonal availability of fruits, vegetables and nuts, denoted by the major natural environment
454 theme (Figure 1), as a perceived driver of adolescent diet, has been quantitatively defined during
455 analysis of seasonality of micronutrients in this region⁽⁵⁰⁾. Comparable to neighbouring Senegal, the
456 tendency for the adolescent diet to become monotonous is, to a large extent, explained by the
457 seasonality of some foods like mangoes⁽⁵¹⁾. Moreover, opinions differed about diet variability
458 between the rural and urban areas. The development of The Gambian South Bank Road (a major
459 trans-Gambia highway) ushered in improved access to imported food commodities in the region, with
460 the creation of local shop vendors. Thus, the themes natural environment and economic factors in
461 Figure 1. are perceived to be interrelated in influencing diet and indirectly health.

462

463 Moreover, analysis of the FGDs highlighted the connection between the natural environment,
464 economic factors and the nature of physical activity undertaken by adolescents. These groups of rural
465 adolescents felt that they had high levels of physical activity inherent in living in a rural subsistence
466 farming community. When access is available to resources such as televisions, this reduces physical
467 activity in a similar way to high income settings⁽⁵²⁾. The role of other daily household chores in
468 contributing to physical activity has been highlighted in West African Serer adolescents who reported
469 pounding millet, an arduous chore completed by girls⁽⁵³⁾. Supposedly, seasonality as a component of
470 the natural environment, was discerned to discreetly shape the frequency and intensity of routine
471 adolescent physical activity by priority apportioned to gardening or farming.

472

473 The findings from this qualitative study highlight important issues to inform further research on the
474 health and nutrition of adolescents in this setting. Specifically, the consistent commentary that
475 financial constraint shapes choice, with poverty impacting on both dietary diversity and food security,
476 is a key finding. As the majority of the adolescent groups were in education, school feeding
477 programmes to help diversify foods for rural poor adolescents in both lower and upper basic schools
478 may be of benefit, alongside reviewing the health and nutrition education content of the school
479 curriculum to impart deeper nutrition knowledge. Government rapid action on socioeconomic status
480 at the individual, household and community levels via investments in sustainable diversified large-
481 scale mechanized agriculture, revitalising the fishing and local manufacturing industries and
482 improving social security and housing conditions could prove effective.

483

484 Access to open land and playing fields is a motivator for adolescent physical activity, a finding
485 consistent with previous reports from high income settings⁽⁵⁴⁾. However, sporting activities were
486 generally dominated by boys. Supporting adolescent physical activity through maintaining spaces

487 with sport amenities would impact on recreational physical activity for both boys and girls. For
488 adolescent girls, the pathway to impact can include recreational dance classes or a designated space
489 for girls' team sports.

490

491 The strengths of the current study include the rigorous methodology, participants' engagement, the
492 time allowed for discussions that yielded in-depth information, and the available supportive network
493 of qualitative researchers. The study involved caregivers of adolescents which provided an
494 opportunity to explore and obtain various perspectives about diet and physical activity. Also, the
495 FGDs were conducted by experienced local research staff, with local knowledge and good community
496 relations. Limitations include problems common to qualitative research, such as the dominance of
497 some individuals in discussions and the reluctance of some members to participate or elaborate on
498 their responses, which the facilitator tried to mitigate. Also, deeper probing questions could have
499 yielded more data.

500

501 In conclusion, this paper has demonstrated that the rural Gambian adolescents and their caregivers
502 involved in this study, understood the link between diet, health and physical activity. Perceived
503 drivers of adolescent diet and physical activity included a variety of economic, social and cultural
504 factors, underpinned by the local environment. Interventions need to address these interrelated
505 factors, including misconceptions regarding diet and physical activity that may be harmful to health.

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666 **Table 1** Characteristics of the Quantitative Study Participants

	Young Adolescents		Older Adolescents	
	Boys	Girls	Boys	Girls
Gender				
N	21, 52.5%	19, 47.5%	22, 55%	18, 45%
Age (years)	11.2 (0.6)	11.3 (0.5)	16.3 (0.6)	16.2 (0.4)
BMI (kg/m ²)	15.1 (14.4, 15.8)	15.2 (14.0, 16.0)	18.2 (17.0, 19.5)	19.3 (18.0, 20.6)
Diet diversity score	9 (8.8, 10), 21	9 (8, 10), 19	10 (8, 10), 22	9.1 (8, 10), 18
Religion	Muslim	Muslim	Muslim	Muslim
Location	Rural	Rural	Rural	Rural
Socioeconomic status	Low	Low	Low	Low
Household possessions				
Electric fan	0	0	1 (4.5%)	0
Radio	14 (66.7%)	12 (63.2%)	19 (86.4%)	14 (77.8%)
Television	0	1 (5.3%)	3 (13.6%)	0
Two-wheeler	1 (4.8%)	1 (5.3%)	1 (4.5%)	0
Car	0	0	0	0
Total years of mother schooling	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)

667 Data are reported as (N, %) for categorical variables; mean (SD) for normally distributed data;
 668 and median (interquartile range - IQR) for skewed data. Diet diversity score is reported as median
 669 (IQR), N scoring ≥ 5 .

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672 **Table 2** Attributes of the FGD Participants

Description	FGD 1	FGD 2	FGD 3	FGD 4	FGD 5	FGD 6
N	10	10	10	10	10	10
Gender	Boys	Girls	Boys	Girls	Men	Women
Age (years)	10 - 12	10 - 12	15 - 17	15 - 17	Adults	Adults
Education grade 🌟	4 (3, 5)/10	4 (3, 5.3)/9	7.5 (6.5, 9)/8	8.5 (7, 9)/8	-	-

673 Data reported as 🌟 median (IQR)/N reporting school grade.

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