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Factors Associated With Health-Related Quality-of-Life Among Adolescent Girls in North-Eastern Ghana: The Role of Nutrition, Socio-Economic Factors and Family Dynamics

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ABSTRACT

Background and Objective: Health-related quality-of-life (HRQoL) among young people is a critical indicator of subjective well-being and quality-of-life (QoL), reflecting individual burdens in relation to family, school and peer environments. Data on the HRQoL of adolescent girls is scanty in sub-Saharan Africa. This study examined HRQoL and its associated factors among adolescent girls in the Mion District of North-eastern Ghana.

Methods: The study adopted an analytical cross-sectional study design with data from the baseline survey of Ten2Twenty-Ghana study ($n = 909$) among adolescent girls aged 10–17 years using pre-tested validated scales, including the KIDSCREEN-27 for HRQoL, a health complaints checklist, a socio-economic and demographic covariates questionnaire, a qualitative 24-h dietary recall used for dietary diversity score (DDS) and anthropometry. ANOVA was used to test the differences between groups in HRQoL. Predictors of HRQoL were determined using linear mixed-effects analysis, with school included as a random intercept to account for clustering effects.

Results: The mean HRQoL score among the adolescent girls was 43.5 ± 6.7 (range 0–100), with 31.8% reporting low HRQoL. In multivariate regression analysis, higher health complaints scores ($\beta = -1.00 \pm 0.16$; $p = 0.001$), food insecurity scores ($\beta = -0.42 \pm 0.18$; $p = 0.018$) and maternal decision-making index ($\beta = -0.59 \pm 0.27$; $p = 0.028$) were inversely associated with HRQoL. Conversely, dietary diversity was positively associated with HRQoL ($\beta = 0.76 \pm 0.21$; $p = 0.001$), as was sleep duration ($\beta = 1.01 \pm 0.18$; $p = 0.003$).

Conclusion: This study highlights several determinants of HRQoL among adolescent girls, emphasising the complex interplay between health complaints, dietary diversity, food insecurity, maternal decision-making and sleep patterns. Overall, the findings

emphasise the need for integrated public health strategies addressing nutrition, food security and socio-cultural factors to improve the well-being of rural adolescent girls in Ghana.

1 | Introduction

Health and well-being are essential in all human life [1], especially among adolescent girls, as they attain about half of the adult body weight during adolescence [2, 3], which provides an opportunity to lay a strong foundation for their health and that of their future offspring [4, 5]. The presence of physical illness in childhood has been shown to negatively impact quality-of-life (QoL). Importantly, QoL during the early years is a critical determinant of QoL in adulthood, as early-life health challenges, whether psychological or physical, can interact to form complex comorbidities. These conditions may contribute to significantly poorer QoL outcomes later in life compared to individuals without such early health concerns [6–10].

Health-related QoL (HRQoL) is a health measure used to assess physical, cognitive and social functioning as health outcomes, including relationships and perceptions of health, fitness, life satisfaction and well-being that may be transformed through service and policy [11–13] Consequently, it is imperative to examine HRQoL in adolescents because it reflects not only well-being generally but also conveys information about their critical daily functioning [14]. Although several population-based studies have examined QoL among adults in African countries [15–17], research on adolescents has largely focused on disease-specific contexts, such as adolescents living with HIV [18, 19], or on reproductive health outcomes [20]. However, limited evidence exists on HRQoL among children and adolescents from the general population in Africa. To address this gap, the present study focuses on the HRQoL of adolescent girls in Ghana. Many Ghanaian children and adolescents, particularly girls, face significant challenges, including reproductive health concerns, exposure to physical and psychological violence, child marriage and school dropout, which have shaped the priorities of both research and interventions in recent years [21].

These challenges, among many factors such as lack of quality healthcare services, access to healthcare facilities, education, societal stigma and economic burden, among others, tend to affect the HRQoL of adolescent girls [9, 22]. Given that such conditions are closely linked to a country's economic context and can influence subjective well-being, HRQoL among rural adolescent girls in Ghana is likely to be lower than that observed in adolescents from high-income countries, including Norway, France, Germany and the United Kingdom [23–25].

Several studies have indicated that children and adolescents' perceptions of their HRQoL are influenced by several factors, including gender, age, personal and family characteristics, as well as the socio-economic status (SES) of the family [26–28]. A recent systematic review that examined the prevalence rate of child and adolescent mental health problems in sub-Saharan Africa, including 97,616 adolescents, indicated that the prevalence rates of depression were 26.9%, 29.8% for anxiety disorders, 40.8% for emotional and behavioural problems (EBPs) and 20.8% for suicidal contemplation. The review further identified several factors contributing to adolescent mental health morbidity, including socio-demographic characteristics such as impoverished living conditions, and having many siblings, as well as exposure to physical/sexual violence [29].

Poor nutrition during adolescence is also said to have adverse effects on mental health, socio-economic life and psychosocial health of adolescents' future offspring [30, 31]. One recent study reported a positive relationship between nutrient intake and adolescents' HRQoL and psychological well-being, as well as their physical health, social relationships and environmental domains [32]. Also, Shin et al. [33] reported that dietary habits, social support, sleep quality and depression among female adolescents account for 57% of the total change in their HRQoL. Adolescent girls with poorer HRQoL have a higher chance of developing chronic illnesses, mental health disorders and shorter life expectancies as adults and may struggle in school and social situations, which can lower their SES [34–36]. The home life of adolescents is reported to significantly impact HRQoL [37] as the workload in household activities [38], household food insecurity [39, 40] and family size [41] have been reported to hinder HRQoL of adolescent girls.

While HRQoL among children and adolescents has been widely studied, most existing research originates from high-income countries [22, 25, 36, 37]. The limited studies available from sub-Saharan Africa have predominantly focused on disease-specific populations [18–20]. To our knowledge, this study is among the first to examine HRQoL among apparently healthy adolescent girls in sub-Saharan Africa, an underserved region characterised by socio-cultural and economic contexts that differ markedly from those of high-income settings. Unlike previous studies, we examine a comprehensive range of potential predictors, including dietary habits, nutritional status, socio-demographic and household factors, time use and labour participation. By addressing these gaps, the study provides context-specific evidence to inform targeted interventions that improve the well-being of adolescent girls in rural African settings.

2 | Materials and Methods

2.1 | Study Design

This study utilised an analytical cross-sectional design with baseline survey data from the Ten2Twenty-Ghana study among adolescent girls in the Mion district, North-eastern Ghana [31]. The overall goal of Ten2Twenty-Ghana was to examine the interrelations between economic, nutritional and social trajectories during adolescence among girls in Ghana. The study employed a cross-sectional design involving 1057 adolescent girls aged 10–17 years. Conducted between November and December, 2018, data were collected through face-to-face interviews using pre-tested, validated tools, including KIDSCREEN-27 (HRQoL) and the health behaviours in school-aged children (HBSC) health complaints checklist, alongside a socio-demographic questionnaire, a qualitative 24-h dietary recall for dietary diversity score (DDS) and anthropometric measurements. The study was approved by the Navrongo Health Research Centre Institutional Review Board

(NHRCIRB323), and the questionnaire used in the interview was pre-tested in the neighbouring Yendi Municipality. Participation in the study was voluntary, and written consent was obtained from their parents. The girls also signed or thumb-printed for their assent as required by the ethics committee. The researchers were trained interviewers who could speak the local languages (Dagbani and Kokomba), were familiar with the culture of the study area, and were graduates of the University for Development Studies.

2.2 | Study Area

The Mion District was purposively selected for this study due to its relatively recent establishment and limited data on the nutrition and health of adolescent girls. Sang, the district's largest community, also serves as its capital. The district covers an area of 2714.1 km^2. It has a tropical climate with two main seasons: a dry season (November–March) marked by high temperatures and a rainy season (April–October). According to the 2021 Ghana Population and Housing Census, the Mion District has a population of 94,930, of whom 89.6% reside in rural areas; of the total population, 47,768 (50.3%) are female [42]. The 2010 census indicated that 19.5% of the female population is aged 10–19 years, the illiteracy rate is high at 71.3%, and over 90% of the population depends on agriculture for their livelihood [43]. A recent study in the district revealed that about 20% of adolescent girls from food-insecure households were depressed and reported a severe burden of anaemia among girls aged 10–17 years [25, 26].

2.3 | Study Population and Sampling Procedure

A total of 1057 female adolescents were conveniently selected from 19 primary schools across the Mion District, using secondary enrolment statistics provided by the Ghana Education Service. The selection process involved four educational circuits (clusters) in the district, incorporating all four peri-urban schools in the District Capital (Sang) and 15 larger rural schools. A 16-item screening questionnaire ensured that participants were pre- or post-menarche, aged 10–17 years, apparently healthy, non-pregnant, not lactating and free from visible signs of poor health, including mental health issues. If a selected girl was unavailable on the interview day, she was replaced by a randomly chosen classmate from the same school. Ultimately, a sample of 909 mother–daughter pairs was used in this study, accounting for missing data, such as mothers' decision-making information (Figure 1). Such exclusion was carried out under the assumption that the mothers' decision-making information was 'missing completely at random' as proposed by Mack et al. [44].

2.4 | Dependent Variable

HRQoL was measured with KIDSCREEN-27, a shorter version of the KIDSCREEN-52 questionnaire, which was preferred because it is structurally and cross-culturally validated [45]. The KIDSCREEN-27 instrument consists of 27 items used to assess HRQoL across five dimensions. These include Physical well-being, Psychological well-being, Autonomy and parental relations, Peers and social support and School environment. The Physical well-being construct comprises five items and seeks to explore the adolescent's energy, fitness and Physical activity level in the last 6 months. Psychological well-being comprises seven items that assess variables such as positive moods and emotions, the absence of loneliness and sadness and satisfaction with life. Autonmy and parental relations are made up of seven items which try to examine the quality of adolescent and parent/caregiver relationship, the extent to which the adolescents feel loved and supported by the family, feelings of having enough age-appropriate freedom, as well as the degree of satisfaction with financial resources. The Peers and social support construct comprises four items that explore the quality of the adolescents' social relations and interactions with friends and peers and the extent of their support. Finally, the School environment sub-domain consists of four items measuring the adolescents' perceptions of their cognitive capacity, learning and concentration in school, and how they understand their relationship with their teachers.

All 27 questions were scored on a 5-point Likert scale to assess frequency ('never', 'seldom', 'sometimes', 'often' or 'always') or intensity ('not at all', 'slightly', 'moderately', 'very' or 'extremely') with a recall period of 1 week. One of the intensity items uses the rating: 'poor', 'fair', 'good', 'very good' or 'excellent'. We reversed-scored four negatively formulated items following the standard guidelines before computing a summated raw score for each dimension. Rasch scores were then computed for each dimension and transformed into *T*-values using the SPSS syntax retrieved from the KIDSCREEN group [46]. The mean *T*-scores of the five dimensions represented the overall HRQoL. The *T*-scores have a mean of 50 and a standard deviation of 10; higher scores indicate better HRQoL and well-being. Based on *T*-score values, HRQoL and subscale scores were divided into poor/low, moderate and good/high categories using percentiles according to the European KIDSCREEN standards [46]. *T*-value scores below the 25th percentile was categorised as low, between the 25th and 75th percentile as moderate and those above the 75th percentile was categorised as high/good HRQoL [37].

2.5 | Independent Variables

2.5.1 | Girl Level Covariates

2.5.1.1 | Health Complaints The health complaints of the girls were measured with HBSC symptom checklists, such as headache, feeling low, irritability, backache, nervousness, abdominal pain, sleeping difficulties and dizziness [47]. Adolescent girls were asked about the frequency of these health complaints in the past 6 months. The girls reported on a 5-point scale if each health complaint's symptoms were experienced 'seldom/never', 'about once per month', 'most days', 'more than once per week' and 'about once per week'. Ratings were made on a 0–4 scale, where non-occurrence of a symptom was rated as zero (0) and occurrence on most days was rated as four (4). A summated health complaints score was created for each subject, with a minimum and maximum attainable score of 0 and 32, respectively. A score of 0 implied that the girl had not experienced any health complaints or symptoms in the past 6 months, while a higher score implied more health complaints in the last 6 months.

2.5.1.2 | Age and Anthropometry The age of the adolescents was determined using a reliable source and was entered as a continuous variable. Height and weight were measured in duplicates by trained research assistants, and the average was

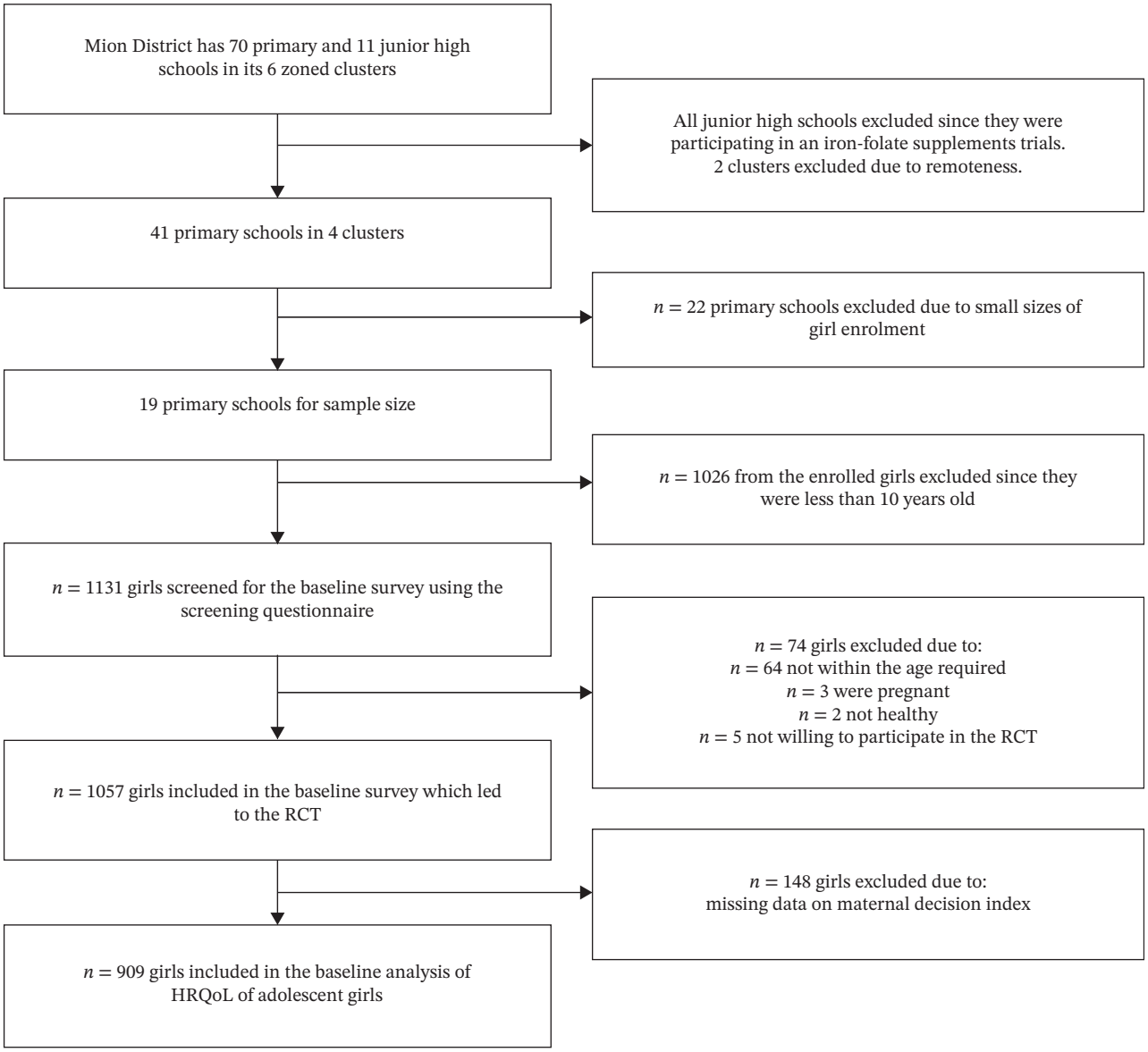

FIGURE 1 | Flow diagram illustrating the selection of the analytic sample from the Ten2Twenty-Ghana baseline survey.

used to compute the body mass index for age *z*-score (BAZ) and height-for-age *z*-score (HAZ) with WHO AnthroPlus [48]. The BAZ was categorised into three groups: underweight (BAZ was <−2SD), normal weight (−2SD ≤ BAZ ≤ +1 SD) and overweight/obese (BAZ > +1 SD). Adolescent girls with a HAZ <−2SD were classified as stunted.

2.5.1.3 | Diet Intake A single 24-h recall was used to assess the dietary intake of adolescent girls based on a 10-food group indicator [49]. The girls reported all beverages and foods consumed in the previous 24 h, including ingredients in mixed dishes. Each consumed food group was assigned a score of 1, while non-consumed groups were assigned a score of 0, yielding a total DDS ranging from 0 to 10. The food groups assessed included pulses, seeds, nuts, roots, grains, dairy, fish, meat, eggs, vegetables and fruits. A DDS of ≥5 was considered to meet the minimum dietary diversity requirement in accordance with guidelines from the Food and Agriculture Organization (FAO) [49].

2.5.1.4 | Girls' Labour Participation and Time Use Girls' labour participation was categorised into two dimensions: paid and unpaid jobs/activities during the week and at weekends. Each dimension consists of 11 activity categories, with a score of 1 assigned if the girl participated in any activity within a category; otherwise, a score of 0 was recorded. A total score was created by summing up scores for all activities to a maximum attainable score of 11. The higher the score, the higher the labour burden of the girl; less than or equal to three dangerous activities is considered a low burden; otherwise, it is considered a high burden. The list of activities included using dangerous tools, carrying heavy loads, handling chemicals (fertilizers, paint and pesticides), working with or close to animals, working under the hot sun or in the rain, working with insufficient light, working with gas, fumes, dust, working in a noisy environment, working in a smelly/dirty environment, being close to moving vehicles and working in heights. The girls' time use was determined by calculating the means for the number of hours spent sleeping, working on paid jobs, doing unpaid activities, doing domestic chores and engaging in leisure time per week.

2.5.2 | Maternal and Household-Level Covariates

2.5.2.1 | Maternal Decision-Making Maternal decision-making autonomy was assessed using an 8-item index from the Demographic and Health Survey [50]. Mothers were asked about their participation in decisions regarding finances, household purchases, healthcare, food preparation, family visits and childbearing. A score of 1 was given if the mother participated in decision-making, either alone or with others, for a maximum score of 8; higher scores indicated greater decision-making involvement.

2.5.2.2 | Household Wealth Index The international wealth index (IWI) was used to assess the wealth index of the households [51]. Households were evaluated based on ownership of durable assets, including electronics, appliances and household utensils, categorised by price. Additionally, access to electricity, water and toilet facilities and flooring material were assessed. Using the IWI SPSS syntax, a score index ranging from 25 to 100 was created. Each item was scored according to its value, resulting in scores ranging from 25 to 100. Quintiles of household wealth were determined by ranking households according to their IWI scores.

2.5.2.3 | Household Food Security Household food insecurity was measured using the Food Insecurity Experience Scale (FIES) [52], comprising eight yes/no questions. Each 'yes' response scored 1, and 'no' scored 0, resulting in a total score from 0 to 8. Higher scores indicated more severe food insecurity. Scores categorised households as food secure (0), mildly (1–3), moderately (4–6) or severely (7–8) food insecure.

2.5.2.4 | Other Household Covariates Household size, female-to-male sex ratio, literacy ratio and household dependency ratio were computed with data from a household roster in conformity with the Ghana Statistical Service [42, 43]. The dependency ratio was defined as the proportion of the dependent population (individuals aged 0–14 years and those aged 65 years and older) relative to the working-age population (ages 15–64 years). This metric reflects the burden of dependents on the economically active population. The literacy ratio represents the proportion of literate household members to non-literate members, indicating literacy prevalence and overall educational levels within the household. Last, the female-to-male ratio was expressed as the number of females per male in the household, providing insights into the gender composition. Collectively, these ratios provide valuable demographic and educational characteristics for analysis.

2.6 | Statistical Analysis

Data was analysed using SPSS V.25.0 (IBM). The characteristics of the sampled population were presented using descriptive statistics, including percentages and frequencies for categorical variables, and means and standard deviations for continuous data. In the analysis, the outcome variables were continuous measures of overall HRQoL and the total scores for each dimension of the KIDSCREEN 27 questionnaire. Covariates in this analysis were both continuous and categorical variables. Differences in HRQoL across the BAZ category (underweight, normal weight and overweight/obese), stunting, MDD-W and menarche status were examined using ANOVA. The predictors of HRQoL were assessed using a linear mixed-effects model, with girls' school included as a random intercept. A univariate analysis was first performed to identify the potential factors associated with HRQoL and its domains. In a multivariate backward elimination model, all variables with p-values ≤ 0.25 in the univariate analysis were included in a full model, and variables with the highest p-values were dropped until all remaining variables had p-values ≤ 0.05. This approach is in tandem with the recommendation of Hosmer et al. [53], who argue that the use of p-values ≤ 0.25 is a more rigorous criterion in identifying important variables for inclusion in a multivariable analysis than the traditional p-values ≤ 0.05. Variance inflation factors <5 and tolerance values > 0.2 were used in a linear regression to assess multicollinearity; no multicollinearity was detected.

3 | Results

3.1 | Participants Characteristics

The population for analysis consisted of 909 adolescent girls aged 10–17 years, with an average age of 12.3 ± 1.9 years. The majority of the participants were Muslims and Dagombas in ethnic origin (Table 1). The mean BAZ was -0.74 ± 0.9, while the mean HAZ was -0.93 ± 1.2. Overall, the prevalence of underweight was low (6.4%), while overweight and obesity were rare (2.4%). However, 17.4% of participants were classified as stunted. The mean DDS was 5.9 ± 1.2, and the majority of adolescent girls met the criteria for MDD-W. The average daily meal consumption among the girls was 2.9 ± 0.1, with the majority consuming three meals daily. The girls predominantly belonged to households with low SES, as indicated by a mean household wealth index of 48.6 ± 11.5 (out of 100). The mean maternal decision-making index (5.3 ± 1.4 out of 8) indicated moderate autonomy in household decision-making. The female-to-male ratio suggested a higher proportion of females, while the dependency ratio indicated a moderate household burden. The literacy ratio was relatively low, highlighting limited educational attainment among household members. Over one-third (35.5%) of households experienced moderate hunger, while 18.7% reported severe hunger. However, 18.5% of the participants' households were food-secured in the last month.

3.2 | Labour Participation and Time Use

In terms of time use, the girls reported adequate rest, averaging 8 h of sleep per night, and moderate leisure time (~2 h daily). School-related activities dominated their daily schedules, with an average of 6 h in school and one additional hour for personal study. Household responsibilities were common, with participants spending about 3 h per week on domestic chores. Economic engagement was limited, as over half of the girls participated in non-remunerated commercial activities. Unpaid work tended to be more demanding, with about one-third of girls classifying it as high-burden, whereas the majority (87.2%) of paid jobs were low-burden (Table 2).

3.3 | HRQoL of Adolescent Girls

The mean HRQoL score among participants was 43.5 ± 6.7 out of a possible 100, indicating generally low perceived well-being.

TABLE 1 | Characteristics of the adolescent girls in the Mion District, Ghana.

Variable	Mean ± SD	Frequency (percentage)
Age	12.3 ± 1.9	—
Age category		
10–14 years	—	784 (86.2)
15–17 years	—	125 (13.8)
Religion		
Islam	—	572 (63.3)
Christianity	—	318 (35.2)
Traditionalist	—	13 (1.4)
Ethnicity		
Dagombas	—	559 (61.9)
Kokomba	—	328 (36.3)
Others	—	16 (1.8)
Nutritional status		
Body mass index for-age *z*-score (BAZ)	−0.74 ± 0.9	—
Body mass index for age category		
Underweight	—	57 (6.4)
Normal	—	812 (91.2)
Overweight/obese	—	21 (2.4)
Height-for-age *z*-score (HAZ)	−0.93 ± 1.2	—
Stunted	—	155 (17.4)
The girl is post-menarche	—	185 (20.4)
Dietary intake		
Dietary diversity score (DDS, range 0–10)	5.9 ± 1.2	—
Minimum dietary diversity score (MDD-W)	—	822 (90.4)
Number of daily meals	2.9 ± 0.1	—
The girl ate three meals daily in the last week	—	813 (89.4)
Levels of household food insecurity		
Food secure	—	168 (18.5)
Mildly food insecure	—	248 (27.3)
Moderately food insecure	—	323 (35.5)
Severely food insecure	—	170 (18.7)
Maternal and household factors		
Maternal decision index (range: 0–8)	5.3 ± 1.4	—
Female-to-male ratio	1.6 ± 1.2	—
Household size	12.1 ± 5.3	—
Dependency ratio	1.2 ± 0.8	—
Literacy ratio	0.5 ± 0.8	—
International wealth index score (range: 25–100)	48.7 ± 11.5	—
Household food insecurity score (range: 0–8)	3.7 ± 2.6	—

TABLE 2 | Time use and labour participation of the adolescent girls in Mion District, Ghana.

Time use	Mean ± SD	Frequency (percentage)
Mean sleep hours per night	8.2 ± 1.0	—
Mean daily hours spent on household chores	2.8 ± 1.0	—
Mean leisure hours per day	1.7 ± 1.1	—
Mean hours in school per day	6.2 ± 0.8	—
Mean hours spent studying per day	0.89 ± 0.9	—
Mean paid work hours per week	0.9 ± 1.5	—
Paid job burden level (%)		
Low burden[a]	—	793 (87.2)
High burden	—	116 (12.8)
Mean unpaid work hours per week	3.1 ± 1.4	—
Unpaid job burden level, (%)		
Low burden[a]	—	589 (64.8)
High burden	—	320 (35.2)
Commercial activities	—	638 (70.2)
Has a paid job (%)	—	271 (29.8)

Note: Unless specified, values are the mean ± SD.
[a]A low burden involves less than three dangerous activities, otherwise high burden.

Across domains, the highest mean score was observed in the school environment dimension, while the psychological well-being dimension recorded the lowest (Table 3). Overall, 31.8% of adolescent girls had low HRQoL, and only 2% demonstrated high HRQoL (Figure 2). Notably, the psychological well-being dimension showed the greatest burden, with nearly all participants being classified as having low HRQoL, followed by peers and social support (51.4%), whereas school environment had the lowest prevalence of low HRQoL.

3.4 | Health Complaints of Adolescent Girls

The mean health complaints score was 3.5 ± 3.6 out of a possible 32, indicating a relatively low overall symptom burden (Table 3). The majority of the girls reported experiencing health complaints

TABLE 3 | Health-related quality-of-life (HRQoL) and health complaints among the adolescent girls in the Mion District, Ghana.

Variables	Mean ± SD	95% C. I
Overall HRQoL	43.5 ± 6.7	43.03–43.9
Sub-domains of the HRQoL		
Physical well-being	46.9 ± 11.8	46.15–47.69
Psychological well-being	34.4 ± 3.7	34.16–34.65
Autonomy and parental relation	41.7 ± 8.7	41.13–42.26
Peers and social support	42.2 ± 11.0	41.43–42.86
School environment	52.1 ± 10.7	51.45–52.84
Health complaints	3.5 ± 3.6	3.22–3.69

Note: Values are mean ± SD of *T*-scores.

more than once a week over the past 6 months. Over half experienced headaches at least once a month, while around 40% reported stomach aches during this period (Figure 3). Additionally, over one-third of the girls indicated fatigue, and approximately one-third reported irritability and nervousness. In contrast, backaches were the least common health complaints, affecting only 10.5% of the participants. Notably, about one-third of the girls reported no health complaints.

3.5 | Statistical Differences in HRQoL by Nutritional Status, MDD-W and Menarche

The results (Table 4) showed no significant differences in HRQoL scores across the BAZ categories of the adolescent girls. Likewise, there were no significant differences in overall HRQoL between stunted and non-stunted girls ($p > 0.09$). However, a significant difference was observed in the peer and social support dimension ($p = 0.04$) between stunted and non-stunted girls. The results in Table 4 also indicate that girls who did not meet their MDD-W had significantly lower scores in overall HRQoL ($p < 0.001$) and across all HRQoL dimensions, except for the school environment, compared to those who met the MDD-W. Additionally, a significant difference was found in the psychological dimension of HRQoL between pre- and post-menarcheal girls ($p = 0.04$).

3.6 | Factors Associated With HRQoL Among the Adolescent Girls in Mion District

3.6.1 | Univariate Results

In a univariate analysis, explanatory variables such as health complaints, DDS, MDD-W, mean sleep hours, mean hours spent on household chores, maternal decision index, household dependency ratio and household food insecurity were significant predictors of overall HRQoL (Table S1).

3.6.2 | Multivariate Predictors of HRQoL

A backward elimination analysis of HRQoL predictors identified DDS, maternal decision-making index, FIES and average sleep hours as significant predictors of overall HRQoL and its specific dimensions (Table 5). In detail, longer average sleep hours were positively associated with overall HRQoL ($\beta = 1.01 \pm 0.18$; $p = 0.003$), particularly in the school environment ($\beta = 1.68 \pm 0.53$; $p = 0.02$) and peer and social support (1.29 ± 0.63; $p = 0.039$) dimensions. DDS was also positively associated with HRQoL ($\beta = 0.76 \pm 0.21$; $p = 0.001$) and three sub-domains, including physical well-being ($\beta = 1.2 \pm 0.33$; $p = 0.00001$), autonomy and parental relations ($\beta = 1.0 \pm 0.27$; $p = 0.0001$) and peers and social support ($\beta = 1.6 \pm 0.56$; $p = 0.004$). Also, MDD-W was positively associated with psychological well-being ($\beta = 1.36 \pm 0.42$; $p = 0.0001$).

As expected, the health complaints score was inversely associated with the school environment dimension ($\beta = -1.00 \pm 0.16$; $p = 0.001$), with adolescent girls reporting no or minimal health complaints scoring higher in this sub-domain. Similarly, FIES showed an inverse association with both overall HRQoL ($\beta = -0.42 \pm 0.18$; $p = 0.018$) and the autonomy and parental relations dimension ($\beta = -0.56 \pm 0.16$; $p = 0.0001$). Interestingly, an inverse relationship was observed with the maternal decision-making index, where

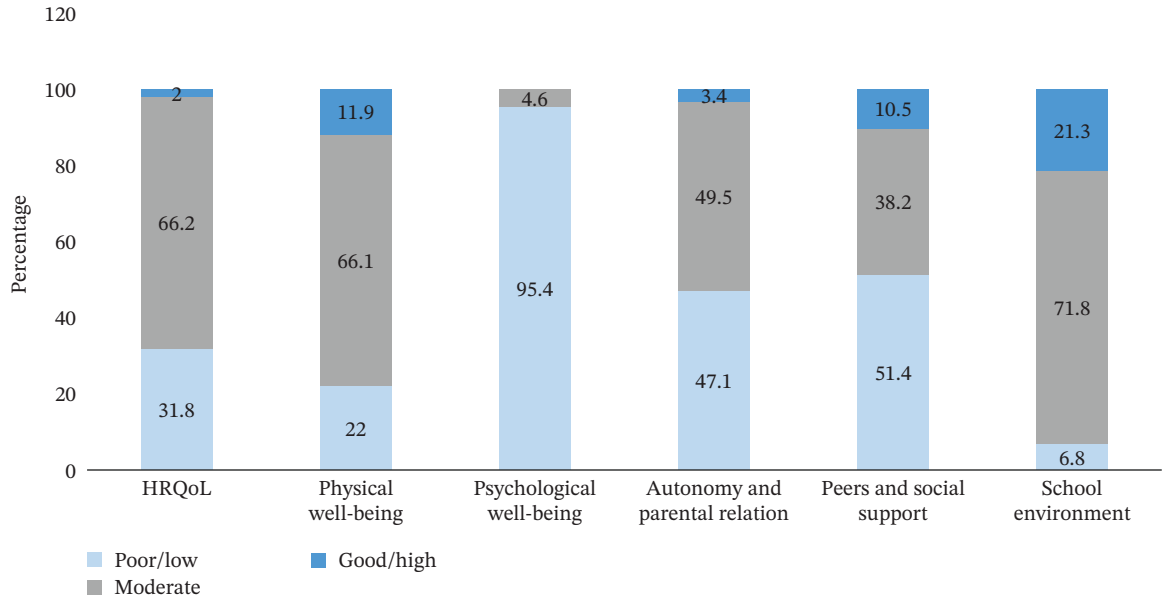

FIGURE 2 | Categories of health-related quality-of-life (HRQoL) among the adolescent girls in Mion District, Ghana.

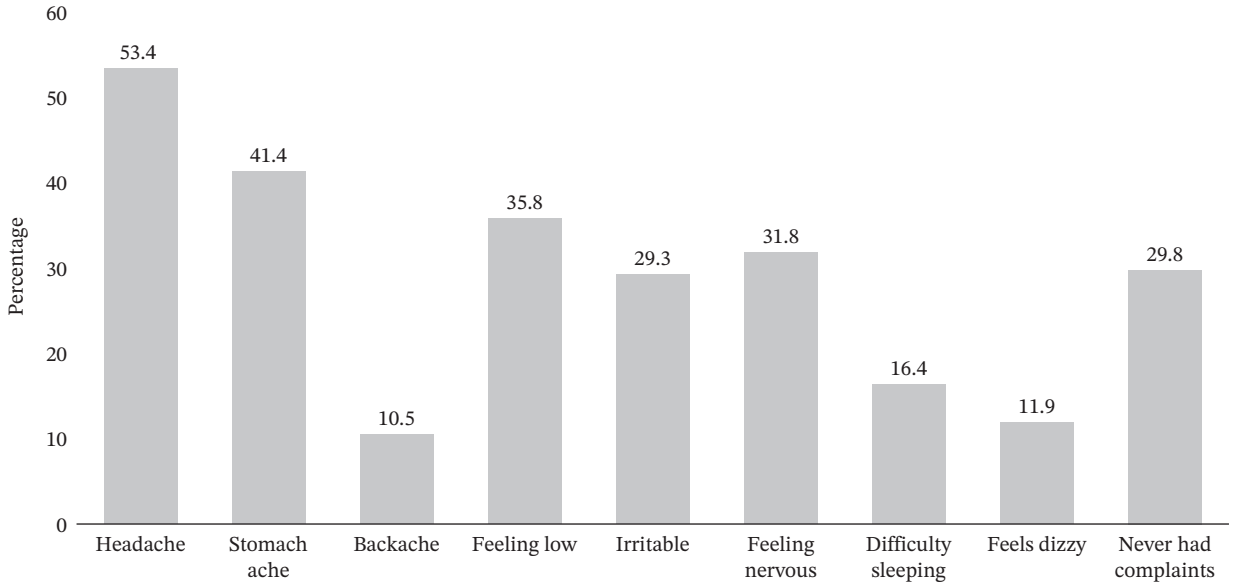

FIGURE 3 | Health complaints among the adolescent girls in Mion District, Ghana.

TABLE 4 | Differences in health-related quality-of-life (HRQoL) by nutritional status, diet diversity (MDD-W) and menarche status among the adolescent girls in Mion District, Ghana.

Outcome	Overall HRQoL	Physical well-being	Psychological well-being	Autonomy and parent relation	Peers and social support	School environment
Normal weight ($N = 829$)	43.4 ± 6.6	46.8 ± 11.8	34.4 ± 3.8	41.6 ± 8.7	42.2 ± 10.9	52.1 ± 10.7
Underweight ($N = 59$)	43.4 ± 6.0	47.6 ± 11.3	34.4 ± 3.0	41.7 ± 8.1	41.3 ± 10.7	52.2 ± 9.8
Overweight ($N = 21$)	44.5 ± 6.7	47.8 ± 11.8	35.1 ± 3.6	42.5 ± 8.7	43.6 ± 15.4	53.6 ± 12.7
p-Value	0.75	0.84	0.70	0.91	0.70	0.81
Not Stunted ($N = 748$)	43.6 ± 6.7	47.1 ± 12.1	34.4 ± 3.8	41.7 ± 8.8	42.5 ± 11.2	52.4 ± 10.6
Stunted ($N = 161$)	43.4 ± 6.7	45.9 ± 10.4	34.4 ± 3.5	41.4 ± 8.1	40.5 ± 10.1	50.9 ± 10.7
p-Value	0.09	0.25	0.69	0.62	0.04	0.12
Did not meet MDD-W ($N = 87$)	40.8 ± 6.1	43.3 ± 11.3	33.2 ± 3.8	38.4 ± 8.5	38.4 ± 11.0	50.6 ± 10.6
Met MDD-W ($N = 822$)	43.7 ± 6.7	47.3 ± 11.8	34.5 ± 3.7	42.0 ± 8.7	42.5 ± 10.9	52.3 ± 10.7
p-Value	<0.001	0.002	<0.001	<0.001	0.001	0.15
Pre-menarche ($N = 724$)	43.5 ± 6.6	47.1 ± 11.6	34.5 ± 3.7	41.7 ± 8.5	42.1 ± 10.8	52.1 ± 10.6
Post-menarche ($N = 185$)	43.3 ± 6.9	46.3 ± 12.3	33.9 ± 3.6	41.7 ± 9.4	42.2 ± 11.7	52.2 ± 1 0.7
p-Value	0.69	0.47	0.04	0.93	0.92	0.88

Note: MDD-W, minimum dietary diversity for women of reproductive age.

adolescent girls whose mothers participated in decision-making exhibited lower scores in both the overall HRQoL ($\beta = -0.59 \pm 0.27$; $p = 0.028$) and the school environment dimension ($\beta = -1.19 \pm 0.29$; $p = 0.0001$).

4 | Discussions

To our knowledge, this is the first study in Africa to explore HRQoL and its associated factors among adolescent girls aged 10–17 years using the culturally validated KIDSCREEN-27. By addressing adolescent girls' HRQoL, our study identifies a broad range of potential factors affecting their QoL. The findings show that the overall mean HRQoL score, as well as subscale scores, were below the population reference means for HRQoL, as reported by Ravens-Sieberer et al. [24], except for the school environment dimension, which was slightly higher. The HRQoL of the girls in this study was slightly lower compared to studies involving adolescent girls in northern Ghana [54] and school-going adolescents in developed eastern Norway [25]. While

TABLE 5 | Multivariate factors associated with health-related quality-of-life among the adolescent girls in Mion district, Ghana.

	Overall HRQoL		Physical well-being		Psychological well-being		Autonomy and parental relation		Peers and social support		School environment	
Outcome	**$\beta \pm$ S.E**	***p*-Value**	**$\beta \pm$ S.E**	***p*-Value**	**$\beta \pm$ S.E**	***p*-Value**	**$\beta \pm$ S.E**	***p*-Value**	**$\beta \pm$ S.E**	***p*-Value**	**$\beta \pm$ S.E**	***p*-Value**
Health complaints score	N/A	—	N/A	—	N/A	—	N/A	—	N/A	—	-1.00 ± 0.16	0.001
Dietary diversity score (DDS)	0.76 ± 0.21	0.001	1.20 ± 0.33	0.0001	—	—	1.00 ± 0.27	0.0001	1.60 ± 0.56	0.004	—	—
MDD-W (yes vs. no)	—	—	—	—	1.36 ± 0.42	0.001	—	—	—	—	—	—
Maternal decision index	-0.59 ± 0.27	0.028	N/A	—	N/A	—	N/A	—	N/A	—	-1.19 ± 0.29	0.0001
Household Food Insecurity Experience Scale	-0.42 ± 0.18	0.018	N/A	—	N/A	—	-0.59 ± 0.16	0.0001	—	—	—	—
Mean sleep hours	1.01 ± 0.18	0.003	N/A	—	N/A	—	N/A	—	1.29 ± 0.63	0.039	1.68 ± 0.53	0.002
Information criteria												
−2 Log likelihood	5990.07	—	7045.13	—	5037.36	—	6464.28	—	7037.82	—	6742.02	—
AIC	6032.07	—	7057.13	—	5067.36	—	6484.28	—	7057.82	—	6772.02	—

Note: Significant values at $p < 0.05$; MDD-W, minimum dietary diversity score using a DDS ≥5 (yes) or <5 (no); N/A, not applicable because variables were not selected for the outcome modelled.

Bunt's [54] study was conducted within the same region, it focused on a peri-urban district (Yendi), in contrast to the predominantly rural context of our study. Additionally, Norway's higher economic status significantly limits the comparability of our findings with those of Haraldstad et al. [25], as socio-cultural and economic disparities render meaningful comparisons unrealistic. Comparisons with studies from sub-Saharan Africa were also challenging due to the limited data availability. However, one study assessing QoL among Kenyan adolescents with EBPs found that girls scored lower than boys across all QoL subscales [55]. Also, the higher mean score observed in the school environment dimension is consistent with findings from previous studies conducted among adolescents in Ghana, Brazil and Norway [54, 56, 57].

The highest prevalence of low HRQoL was observed in psychological well-being and peer and social support dimensions, which is similar to Mikkelsen et al. [58], who reported the lowest HRQoL mean score in the psychological well-being dimension in a longitudinal study among Norwegian adolescents, though previous reports observed the lowest HRQoL in the physical well-being dimension [57]. Notably, a subset of the adolescent girls in our study, followed up over a year, exhibited a depression prevalence of 20% [31, 40]. These results underscore the pressing need for targeted mental health and social support interventions within schools and communities to enhance psychological well-being and peer relationships, which are crucial for improving adolescents' overall QoL.

Our findings revealed a broad range of factors influencing the HRQoL of rural adolescent girls in the district, suggesting that various aspects of their daily lives, including health status, dietary intake, household dynamics and workload, contribute to their overall well-being. In conformity with the study of Wiklund et al. [22], health complaints were reportedly predominant. This was expected since adolescent girls experience both physical and reproductive health changes, such as the onset of menarche. Although the present study found no association between menarche and HRQoL, we observed significant differences in the psychological dimension between pre-menarcheal and post-menarcheal girls. Similarly, a survey by Mastorci et al. [59] indicated that pre-menarcheal female adolescents reported a higher mood and psychological well-being score than post-menarcheal female adolescents. This could be due to menstruation-associated symptoms, which are reported to account for a decline in the activities of adolescent girls' daily life [60], and the burden of maturity that comes with the onset of menstruation. These menstruation-associated symptoms may increase health complaints among adolescents, which has a significant impact on the HRQoL, especially in the mental health domain [60]. Our findings affirm the preceding, which showed that adolescent girls with a higher score of health complaints in the last 6 months had lower HRQoL compared to those who did not have any health complaints.

Our findings were further confirmed by Bastiaansen et al. [6], who observed that the presence of physical disease has a diminishing effect on the QoL of children with mental health problems. In this study, a higher health complaints score was inversely associated with the psychological well-being dimension of HRQoL among the girls. Two-thirds of our study participants reported experiencing health complaints such as headaches and stomach aches, which aligns with the findings of Wiklund et al. [22], who also observed that many girls reported subjective health complaints, including headaches and sleep difficulties. The high prevalence of health complaints observed in our study may be partly due to the low quality of healthcare services, socioeconomic challenges [61], and the various reproductive health issues faced by adolescent girls in Ghana [62]. For example, UNICEF reported that 10% of Ghanaian adolescent girls engage in sexual activity before the age of 15, with 14% and 12% of these girls residing in the poorest and rural areas of Ghana, respectively. The report also highlights that approximately 30% of abortions are performed using unsafe methods, with many adolescents not protecting themselves against pregnancy or sexually transmitted infections during intercourse [62].

Studies [63, 64] have shown that dietary diversity enhances dietary adequacy and overall health in adolescents, mitigating the adverse effects of poor nutrition on health outcomes. Consistent with these findings, our study identified dietary diversity as a significant predictor of HRQoL among the adolescent girls. Notably, significant differences in HRQoL scores were observed across all subscales, except for the school environment dimension, between girls who met the MDD-W and those who did not. Although comparable studies among adolescents are limited, research among people living with HIV in Ghana reported a strong association between DDS and HRQoL [65]. That study further suggested that inadequate dietary diversity in resource-limited settings may negatively impact HRQoL by increasing stress and anxiety. Our findings highlight the importance of promoting dietary diversity among adolescents to improve both micronutrient adequacy and overall well-being. Interventions should focus on enhancing access to and consumption of a variety of nutrient-dense foods. Integrating dietary diversity into school-based nutrition programmes and community health strategies is essential to support adolescents' physical and psychological development.

This study found an inverse association between household food insecurity and HRQoL, particularly in the domain of autonomy and parental relations. Similarly, McRell et al. [39] reported that food insecurity negatively impacted the psychological well-being of adolescents in Kenya, suggesting that food insecurity may place strain on parent–child relationships. Our earlier analysis in the same setting also demonstrated a positive association between food insecurity severity and depressive symptoms among adolescent girls [40]. Consistent findings have been reported globally, including among children in the United States, where food insecurity was linked to lower physical and psychological functioning [66]. In Ghana, a study among people living with HIV found that food security was strongly associated with improved QoL [65]. Likewise, food-secure Malaysian adolescents exhibited higher physical and psychological functioning [67].

These findings underscore the urgent need for targeted interventions to reduce household food insecurity as a means to improve adolescent well-being. Policies should prioritise improving food access and household food security, while integrating food assistance with mental health services to address the complex and interrelated effects of food insecurity on adolescents' health and QoL.

This study found no significant association between nutritional status, as measured by BMI-for-age *z*-scores (BAZ), and HRQoL. This contrasts with previous research reporting an inverse

relationship between overweight/obesity and HRQoL [68–70], but aligns with findings by Gandhi et al. [71], who also observed no association between BAZ categories and HRQoL. The limited number of overweight or obese participants in our sample ($n = 21$) may have reduced the statistical power to detect such relationships. No association was found between stunting and overall HRQoL; however, further analysis indicated lower scores in the peers and social support domain among stunted adolescents. This may reflect the social stigma and negative labelling experienced by girls with shorter stature, which can adversely impact psychological and social well-being. To mitigate these effects, school- and community-based programmes should foster inclusivity and educate peers and caregivers to reduce stigma related to physical differences. Furthermore, addressing stunting through improved early childhood nutrition and health interventions remains essential to prevent its long-term psychosocial consequences.

In conformity with the findings of Huang et al. [72], who found that the home literacy environment affected the QoL of high school students by influencing their ability to read. This study found that household literacy was positively associated with psychological well-being. In contrast, the household dependency ratio was inversely associated with HRQoL and the physical well-being dimension. This was expected, as a few dependents in the household could mean less reliance on family resources such as food and income, thereby leading to better HRQoL. This is consistent with a previous study that found a significant negative relationship between the total number of siblings and HRQoL, implying that an increasing number of siblings decreased adolescents' HRQoL [73]. Although Elias et al. [41] reported that good HRQoL was predicted by family size among Brazilian adolescents, it was reported that adolescents who have more than four family members had two times better perception of HRQoL compared to those that had less than four family members. The better perception of HRQoL was linked to expanded family support [41].

Unexpectedly, the present study identified a significant negative association between the maternal decision-making index and both overall HRQoL and the school environment dimension, indicating that lower maternal participation in decision-making was associated with better HRQoL and higher school environment scores among adolescent girls. Traditionally, mothers in Ghanaian cultures are regarded as primary caregivers, assuming roles such as feeding and healthcare provision, which grant them substantial authority within the household. This dynamic is likely to influence the HRQoL of adolescent girls. However, the observed inverse relationship may reflect societal expectations of mothers as homemakers and family support systems, potentially altering how maternal involvement in decision-making impacts adolescent well-being. A study conducted among Brazilian adolescents reported that, having mothers as household heads implies having 3.9 times less chances of good HRQoL compared to having male household heads, that have 5.5 times more chances of better HRQoL. The study further explained that the findings could be related to social gender roles and that, being a mother and the main provider of the family could possibly take them away from activities in the home which affects the relationships and social supported expected by their children [41]. It is also noteworthy that maternal decision-making has been linked to the improved nutritional status of adolescent girls in our study population [74]. This finding highlights the complexity of maternal roles in influencing adolescent health outcomes. Interventions to empower women in decision-making should consider the socio-cultural context and potential unintended impacts on adolescents. Programmes promoting balanced family dynamics, where both parents are actively involved in caregiving and decision-making, may enhance adolescent HRQoL while addressing broader household needs.

The mean sleep duration in this study was 8.2 ± 1.0 h per night, aligning with the recommended 8–10 h for adolescents by the United States National Sleep Foundation [75] and was higher than that reported among Iranian high school students by Jalali-Farahani et al. [70]. A significant positive association was found between sleep duration and overall HRQoL, as well as all subscales, except physical well-being. This is consistent with de Matos et al. [76], who reported better HRQoL in Portuguese adolescents sleeping more than 8 h per night. Additionally, Roeser et al. [77] highlighted that good sleepers report higher HRQoL, while sleep disturbances, common in girls, significantly reduced HRQoL among German adolescents. Conversely, Jalali-Farahani et al. [70] found no such association among Iranian adolescents. These findings emphasise the importance of both sleep duration and quality for adolescent well-being. Public health initiatives should promote healthy sleep habits through school-based programmes and parental education while minimising factors like excessive screen time and stress that affect sleep quality.

4.1 | Strengths and Limitations

A key strength of this study is the use of validated, culturally adaptable instruments such as the KIDSCREEN-27 and the HBSC questionnaire to assess HRQoL and health complaints [49, 78]. These tools have demonstrated high validity and reliability across diverse settings, minimising their impact on study conclusions. Additionally, the study examined multiple predictors of HRQoL, capturing a wide range of variables, including sociodemographic and nutritional characteristics, household factors, time use and labour participation among the girls. This comprehensive approach allowed for an in-depth bivariate analysis, followed by a multivariate backward elimination analysis to identify factors associated with the HRQoL of adolescent girls. Another strength is the large sample size, which provides greater statistical power than similar studies.

However, the cross-sectional design limits the ability to establish causality between the factors and the girls' HRQoL. Thus, interpretations are restricted to observed associations. The self-reported nature of the data also introduces the potential for recall bias, though this was mitigated by training research assistants and conducting interviews in the local language. Finally, since the study was conducted among rural in-school adolescent girls, the findings may primarily apply to this population. However, given that primary school enrolment in Ghana exceeds 85% [79], the results are likely generalisable to rural adolescent girls in the Mion District and similar settings in rural Northern Ghana but may not be extended to adolescent boys.

5 | Conclusions

In conclusion, this study advances understanding by demonstrating that adolescent well-being is shaped by a convergence of

nutritional, psychosocial and household factors, underscoring the need for integrated and multi-sectoral public health strategies, not merely nutrition or education interventions to improve adolescent health outcomes in rural Africa.

Author Contributions

Fusta Azupogo and Inge D. Brouwer conceived and designed the study. Fusta Azupogo, Justina Chapirah and Inge D. Brouwer collected the data. Justina Chapirah and Fusta Azupogo performed the statistical analysis. Justina Chapirah, Mavis A. Ayimbire and Fusta Azupogo wrote the first draft of the manuscript. Ramatu Halidu, Gabriel Ajediwe Alatiah, Hammond Yaw Addae and Inge D. Brouwer contributed to the writing of the manuscript.

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Disclosure

All authors approved the final content. None of the funders contributed to the study design, conduct, analysis of the data, interpretation of findings or manuscript preparation.

Ethics Statement

This study was conducted according to the guidelines in the Declaration of Helsinki. All human subject procedures were approved by the Navrongo Health Research Centre Institutional Review Board (NHRCIRB323). Written permission was also obtained from the Ghana Education Service in the Mion District, Ghana.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. (*Supporting Information*)

Supplementary results from univariate regression of the factors associated with the health-related quality-of-life among the adolescent girls in Mion District, Ghana.