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Research

Assessing the association between diet, health-related quality of life, and anthropometric status in paediatric HIV

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Abstract

Diet quality plays a significant role in the reduction of malnutrition and improving the immune system and hence may positively impact the quality of life of children living with HIV (CLHIV). The present study compared diet quality, health-related quality of life (HRQoL) and anthropometric status of children with or without HIV, and investigated the relationship between HRQoL, diet and anthropometric status of children with or without HIV. A case-control comparison design included 105 CLHIV and 105 HIV-negative controls aged 8-19 years. Cases were selected from those receiving their ART at the state hospital, Ijaiye, Nigeria, between February and April, 2022 and controls (children living without HIV residing in the immediate vicinity of the cases within Abeokuta, who gave their consent) were chosen. Dietary intake, quality-of-life (QoL), dietary habits, diet quality and anthropometry were assessed using standard instruments and procedures. Data were analysed with significance set at $p<0.05$. Respondents with HIV had higher intakes of nuts and seeds ($p = 0.04$), and drank more sugar-sweetened beverages (SSBs) ($p = 0.01$). They also had significantly lower intakes of vegetables ($p = 0.00$), dietary fibre ($p = 0.04$) and calcium ($p = 0.00$) compared to respondents without HIV. All the HRQoL domains generally declined with age in both groups based on child's and on parent's report. Respondents living with HIV were more often excessively thin. The physical health summary score of the control group was significantly higher compared to the case group for the children's report ($p < 0.05$). BMI-for-age had a significant relationship with the physical health ($p = 0.01$), social ($p = 0.00$) and school functioning ($p = 0.00$) domains of the HRQoL, but only for respondents living with HIV. This study highlights the importance of dietary interventions to improve the HRQoL of CLHIV.

INTRODUCTION

Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) is a chronic infection that affects not only the patients' physical condition, but also their social relations, psychological health and finances (Liping et al., 2015), and the assessment of quality of life (QoL) is important to check these factors (Cronje et al., 2016). HIV/AIDS is a chronic condition with no cure, making it necessary to assess determinants of QoL and as well improve the QoL of people living with HIV/AIDS (Mutabazi-mwesigire et al., 2015).

The burden of HIV/AIDS is high in Nigeria, 29% in 2023. The majority of children in the world living with HIV live in Africa. Globally, 1.4 million children are living with HIV, with 120,000 new cases, and 76,000 who died due to AIDS-related illnesses in 2023 (UNAIDS/WHO, 2024). The situation is particularly challenging in Nigeria, which in 2023 had the highest number of new HIV infections among children globally (UNAIDS/WHO, 2024).

The WHO defines QoL as 'an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, values and concerns, while incorporating the individual's physical health, psychological state, level of independence, social relationships, personal beliefs and relationship to salient features of the environment' (Folasire et al., 2015; Freire and Ferreira, 2018; Wallander and Koot, 2016). Measurement of QoL is considered an indicator of overall well-being, of satisfaction with life as a whole (Freire

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and Ferreira, 2018). Health-related quality of life (HRQoL) on the other hand reflects an individual's perception on how a disease or treatment affects the physical, psychological and social aspects of their health (Andrinopoulos et al., 2011; Mafirakureva et al., 2016).

With the advent of antiretroviral therapy (ART) and other advancements in HIV care, there has been a significant change in the paediatric HIV epidemic (Das et al., 2010). ART has transformed HIV in countries where treatment is widely available from a terminal disease to a chronic condition (Cooper et al., 2017; Ghayomzadeh et al., 2019; Nobre et al., 2017). Nevertheless, chronic disease and the toxicities of long-term therapy can impair QoL (Fuster-ruizdeapodaca et al., 2019; Mekuria et al., 2015; Sackey et al., 2018). In other words, as HIV patients live longer, their QoL can be adversely affected by the disease progression, associated issues with ART and the ageing process (George et al., 2016).

Several other factors have been found to be associated with QoL which include depression, age, sex, religion, level of education, CD4 count, marital status, opportunistic infections and socio-economic status (Anand et al., 2012; Gebremichael et al., 2018; Mutabazi-mwesigire et al., 2015). Nutritional status of HIV patients is also a very important factor that impacts QoL (Carvalho et al., 2017). Because children are not capable of addressing their own needs (Wallander and Koot, 2016), CLHIV are more likely to be malnourished as a result of limited or uncertain availability of nutritionally adequate foods (Tesfaye et al., 2016) and this may reduce adherence to ART. (Carvalho et al., 2017). In contrast, receiving appropriate nutrition can help improve antiretroviral absorption and tolerance as well as QoL of people living with HIV/AIDS (Thapa et al., 2015).

From the moment a chronic illness is diagnosed in childhood, there is significant psychological impact on the QoL of the patients and their relatives (Buczynski et al., 2015). It becomes important to know what factors contribute to adolescents' health and well-being in order to promote positive development (Freire and Ferreira, 2018). Therefore, assessment of HRQoL has become an important outcome measure in the management of HIV/AIDS and reflects improvement or otherwise health experience and satisfaction with care among patients living with HIV/AIDS (Osei-Yeboah et al., 2017).

Little research has been conducted to assess the QoL of CLHIV, especially in Nigeria. The present study thus explored relevant issues, comparing diet quality, HRQoL and anthropometric status of children with or without HIV, and investigating the relationship between HRQoL, diet and anthropometric status of children with or without HIV.

MATERIALS AND METHODS

This study is a cross-sectional group comparison of cases, CLHIV, and controls, children living negative (both groups living in the same area, recruited at the same time, and aged 8-19 years). Sample size was determined using G-power version 3.1.9.2 software. Effect size was 0.5, α err probability of 0.05, Power (1-β err prob) of 0.95.

SAMPLING TECHNIQUE

T tests - Means: Difference between two independent means (two groups)

Analysis:	A priori: Compute required sample size		
Input:	Tail(s)	=	Two
	Effect size d	=	0.5
	α err prob	=	0.05
	Power (1-β err prob)	=	0.95
	Allocation ratio N2/N1	=	1
Output:	Noncentrality parameter δ	=	3.6228442
	Critical t	=	1.9714347
	Df	=	208
	Sample size group 1	=	105
	Sample size group 2	=	105

The estimated required sample size for this study was thus 210 (105 for cases and 105 for control).

Participants were recruited from the paediatric HIV outpatient clinic at the State Hospital, Ijaiye. The healthcare providers managing the children's ART assisted in identifying potentially eligible participants. The researchers then approached the parents or legal caregivers of these children to explain the study and obtain informed consent. Recruitment was done between February and April, 2022. Every child presenting during the period of data collection who met the inclusion criteria was included in the study.

INCLUSION CRITERIA:

Case Group (HIV-Infected Children):

- Documented HIV infection confirmed by virological or serological testing, as appropriate for age.
- Currently receiving ART at the State Hospital, Ijaiye.
- Age between 8 and 19 years, inclusive.
- Parent or legal caregiver provides written informed consent.

Control Group (Children with No HIV Infection):

- No known or documented HIV infection.
- Age between 8 and 19 years, inclusive.
- Residing in a household located in the immediate vicinity (nearest neighbour) of a participating HIV-infected child's household.
- Parent or legal caregiver provides written informed consent.

EXCLUSION CRITERIA:

Both Case and Control Groups:

- Children with a documented history of chronic illnesses that, in the opinion of the researchers or healthcare providers, could confound the study's outcomes.
- Children with acute illnesses at the time of recruitment that would inhibit their participation.
- Children who have moved into their current residence within the last 6 months. (This helps to ensure the neighbour effect is more valid).

Case Group Only:

Children who are not currently receiving their ART at the state hospital, Ijaiye.

METHOD OF DATA COLLECTION:

DEMOGRAPHIC INFORMATION

Caregivers' and children demographic information were obtained using a semi-structured interviewer-administered questionnaire.

DIET QUALITY AND DIETARY HABITS

A 24-hour dietary recall of respondent's intakes of food and drink was taken with the support of their caregiver using a validated interviewer-administered 24-hour dietary recall questionnaire (FAO, 2018). Data on intakes of food and drink was converted to nutrient intake using total dietary assessment software (version 3) and the Nigerian food composition database (Sanusi et al., 2017). Diet quality was determined by comparing dietary intake with the optimum intake of the Global Burden of Diseases Dietary Risk Factors and Estimated Average Requirement (Abbafati et al., 2020).

The dietary habits questionnaire is a 17-item validated questionnaire based on a 4-point Likert scale. Respondents' responses were categorized into < 3 times per week, and ≥ 3 times per week (Pauh, 2005).

ANTHROPOMETRIC STATUS

Respondents' body weight (kg) and height (m) were measured using a digital weighing scale and a heightometer as described by WHO (2008). Body mass index-for-age of respondents were analysed using WHO Anthro Plus. Respondents' BMI-for-age was categorized as severe thinness (<-3SD), thinness (<-2SD), normal weight (-2SD to +1SD), overweight (>+1SD) and obesity (>+2SD) (World Health Organization, 2025).

HEALTH-RELATED QUALITY OF LIFE

HRQoL was assessed using a validated 23-item PedsQLTM 4.0 Generic Core Scales questionnaire (Varni, 2017) which contains the core domains for paediatric HRQoL measurement which are: Physical functioning (8 items), Emotional functioning (5 items), Social functioning (5 items) and School functioning (5 items). The questionnaire consists of items for child self-report and parent proxy-report for each domain of QoL for ages 8-12, 13-18 and 19 years on a 5-point response scale (0-4). Items were scored in reverse order and transformed to a 0-100 scale (0 = 100, 1 = 75, 2 = 50, 3 = 25, 4 = 0). Higher scores on the 100-point scale indicate better HRQoL. The Physical Health Summary score (8 items) is the same as the Physical Functioning subscale, and the Psychosocial Health Summary score (15 items) is calculated as the sum of the items in the Emotional, Social, and School Functioning subscales divided by the number of items answered. Consent was obtained from Mapi Research Trust, Lyon, France prior to using the questionnaires.

ETHICAL APPROVAL:

Ethical approval was obtained from the Institutional Review Board (IRB) and Research Ethics Committee of State Hospital, Ijaiye, Sokenu, Abeokuta, Ogun State, Nigeria (SHHA/338/REC/Vol.1/9). Written consent of all respondents was obtained before the administration of questionnaires.

STATISTICAL ANALYSIS

Data were analysed with the Statistical Package for the Social Sciences software version 25 using frequencies, percentages and means. Chi-square and t-test were used to test for association and significant differences between the variables of respondents with and without HIV.

RESULTS

Table 1 shows the socio-demographic characteristics of respondents living positive and negative for HIV. There was no relationship between the HIV status of the children and socio-demographic characteristics of respondents.

Table 1. Socio-demographic characteristics of respondents

Variable	Case n (%)	Control n (%)	Total n (%)	P-Value
Total	105 (100)	105 (100)	210 (100)	
Children				
Mean age ± SD[a]	14.6± 3.21	14.4 ± 2.98	14.5 ± 3.09	
Age Range (Years)				
8-12	25 (23.8)	25 (23.8)	50 (23.8)	0.63
13-18	68 (64.8)	72 (68.6)	140 (66.7)	
19	12 (11.4)	8 (7.6)	20 (9.5)	
Gender				
Male	53 (50.5)	47 (44.8)	100 (47.6)	0.40
Female	52 (49.5)	58 (55.2)	110 (52.4)	
Educational Level				
Dropped out	7 (6.7)	7 (6.7)	14 (6.7)	0.48
Primary	18 (17.1)	19 (18.1)	37 (17.6)	
Secondary	54 (51.4)	62 (59.0)	116 (55.2)	
Tertiary	26 (24.8)	17 (16.2)	43 (20.5)	
Caregiver				
Mean age ± SD	44.2 ± 11.1	43.3 ± 10.4	43.7 ±10.8	
Age range (Years)				
0-29	5 (4.8)	5 (4.8)	10 (4.8)	1.00
30-59	93 (88.6)	93 (88.6)	186 (88.6)	
60 and above	7 (6.7)	7 (6.7)	14 (6.7)	
Gender				
Male	41 (39.0)	42 (40.0)	83 (39.5)	0.88
Female	64 (61.0)	63 (60.0)	127 (60.5)	
Educational Level				
Primary	12 (11.4)	14 (13.3)	26 (12.4)	0.70
Secondary	29 (27.6)	32 (30.5)	61 (29.0)	
Tertiary	46 (43.8)	38 (36.2)	84 (40.0)	
No formal Education	18 (17.1)	21 (20)	39 (18.6)	
Relationship of the Caregiver to the Child				
Parent	69 (65.7)	70 (66.7)	139 (66.2)	0.80
Grandparent	6 (5.7)	6 (5.7)	12 (5.7)	
Relative	18 (17.1)	15 (14.3)	33 (15.7)	
Sibling	11 (10.5)	14 (13.3)	25 (11.9)	
Nanny	1 (1.0)	0 (0.0)	1 (0.5)	
Marital Status				
Single	13 (12.4)	11 (10.5)	24 (11.4)	0.31
Married	79 (75.2)	87 (82.9)	166 (79.0)	
Divorced	13 (12.4)	7 (6.7)	20 (9.5)	
Employment Status				
Employed	102 (97.1)	99 (94.3)	201 (95.7)	0.31
Unemployed	3 (2.9)	6 (5.7)	9 (4.3)	
Monthly Household Income[b]				
<109, 999	96 (91.4)	100 (95.2)	196 (93.3)	0.54
110, 000 – 209,999	7 (6.7)	4 (3.8)	11 (5.2)	
>210, 000	2 (1.9)	1 (1.0)	3 (1.4)	

[a]SD = standard deviation. [b] $1 = ₦ 448

Table 2 shows the diet quality and anthropometric status of the respondents. The mean intake were below optimal for most food groups. Excess intakes of legumes and SSBs were observed. Respondents with HIV had higher intakes of nuts and seeds (p=0.04) and of SSBs (p=0.01) but lower intakes of vegetables (p=0.00), dietary fibre (p=0.04) and calcium (p=0.00). In the age groups 8-12 years (100%) and 13-18 years (20.6%) those with HIV were more often thin.

Table 2. Diet quality and anthropometric status of the respondents

Diet quality of the respondents						
S/N	**Intake of food groups/nutrients (g)**	**Optimal Intake**	**Case** Mean ± SEM	**Control** Mean ± SEM	t-score	P value
1	Fruits	250	1.74 ± 1.23	1.90 ± 1.90	-0.07	0.95
2	Vegetables	360	78.8 ± 5.99	115 ± 9.74	-0.03	0.00*
3	Legumes	60	85.5 ± 13.4	108 ± 16.1	-3.21	0.18
4	Whole grains	125	30.6 ± 21.7	35.2 ± 21.9	-3.21	0.10
5	Nut and seed	21	1.80 ± 0.90	1.60 ± 0.00	1.36	0.04*
6	Milk	435	4.88 ± 2.01	6.24 ± 2.59	-1.86	0.68
7	Red meat	23	8.27 ± 2.28	15.5 ± 3.77	-1.68	0.10
8	Processed meat	2	0.95 ± 0.95	0.00 ± 0.00	1.68	0.32
9	Sugar sweetened beverages[a]	3	50.0 ± 12.2	13.3 ± 6.41	2.00	0.01*
10	Dietary fibre	24	10.5 ± 0.96	10.2 ± 0.95	2.00	0.04*
11	Calcium	1.25	0.2 ± 0.01	1.21 ± 0.00	-0.02	0.00*

Anthropometric status of the respondents					
Age		**Case [n (%)]**	**Control [n (%)]**	**Total [n (%)]**	**P-value**
8-12 yrs.	Severe thinness	1 (4.0)	0 (0.0)	1 (2.0)	
	Thinness	24 (96.0)	0 (0.0)	24 (48.0)	
	Normal	0 (0.0)	25 (100)	25 (50.0)	
	Overweight	0 (0.0)	0 (0.0)	0 (0.0)	0.00*
	Total	25 (100)	25 (100)	50 (100)	
13-18 yrs.	Severe thinness	0 (0.0)	0 (0.0)	0 (0.0)	
	Thinness	14 (20.6)	0 (0.0)	14 (10.0)	
	Normal	54 (79.4)	71 (98.6)	125 (89.3)	
	Overweight	0 (0.0)	1 (1.4)	1 (0.7)	0.00*
	Total	68 (100)	72 (100)	140 (100)	
19 yrs.	Severe thinness	0 (0.0)	0 (0.0)	0 (0.0)	
	Thinness	2 (16.7)	0 (0.0)	2 (10.0)	
	Normal	10 (83.3)	7 (87.5)	17 (85.0)	
	Overweight	0 (0.0)	1 (12.5)	1 (5.0)	0.24
	Total	12(100)	8 (100)	20 (100)	

[a]With ⩾ 50 kcal per 226.8ml serving, optimal level of intake is defined as the level of risk exposure that minimizes the risk from all causes of death. SEM=Standard error of mean

Respondents living without HIV skipped meals more often than CLHIV at least three times a week (p = 0.02). However, respondents with HIV more often consumed three base meals per day (p = 0.01), recorded food intake (p = 0.05), consumed non-fried energy dense snacks (p = 0.00), and fried/baked energy dense snacks (p = 0.00) at least 3 times per week, more often than respondents without HIV (Table 3).

Table 4 shows the child's self-report and parent proxy-report of respondents' HRQoL by age. The table shows the mean and standard error of means for the each of the HRQoL domains.

The HRQoL of respondents reduces with increase in age in both case and control groups for total score, physical health summary score, emotional functioning, social functioning, school functioning and psychosocial summary score except in children living with HIV of ages 19 years where the total, physical health summary and emotional functioning scores were higher than those of ages 13-18 years. As Table 5 shows, parental scores were similar to the children's scores for all but two quality-of-life variable scores for 19-year-old cases.

Table 3. Dietary habits and supplement use of sample children

		Case (n=105)		Control (n=105)		
S/N	Dietary habits pattern	< 3 times/ week n (%)	≥ 3 times/week n (%)	< 3 times/week n (%)	≥ 3 times/week n (%)	P value
1	Breakfast consumption in the morning	12 (11.4)	91 (88.6)	20 (19.1)	85 (80.9)	0.13
2	Meal skipping	48 (45.7)	57 (54.3)	32 (30.5)	73 (69.5)	0.02*
3	Vitamin supplements intake	38 (36.2)	67 (63.8)	39 (37.1)	66 (62.8)	0.89
4	Mineral supplements intake	32 (30.5)	73 (69.5)	41 (39.1)	64 (55.0)	0.19
5	Three base meals consumption per day	17 (16.2)	88 (83.8)	32 (30.5)	73 (69.6)	0.01*
6	Food intake record	45 (42.9)	60 (57.2)	61(58.1)	44 (41.9)	0.05*
7	Water intake in a day	22 (20.9)	83 (79.1)	21 (20.0)	84 (80.0)	0.86
8	Carbonized beverages intake	45 (42.9)	60 (57.1)	45 (42.9)	60 (57.1)	1.00
9	Dieting	59 (56.2)	46 (43.9)	69 (65.7)	36 (34.2)	0.09
10	Intake of potatoes, cereals or cereal products	20 (19.0)	85 (81.0)	26 (24.8)	79 (75.2)	0.32
11	Intake of fruits (as apples, bananas, or oranges)	41 (39.1)	64 (61.0)	37 (35.3)	68 (64.8)	0.57
12	Intake of vegetables (tomatoes, carrots, or salad)	40 (38.1)	65 (61.9)	35 (33.3)	70 (66.7)	0.47
13	Intake of dairy products	40 (38.1)	65 (61.9)	41 (39.1)	64 (61.0)	0.89
14	Intake of energy dense snacks (not fried)	45 (42.9)	60 (57.1)	68 (74.7)	37 (35.3)	0.00*
15	Intake of energy dense snacks (fried and/baked)	41 (39.0)	64 (61.0)	62 (59.0)	43 (40.9)	0.00*
16	Intake of healthy snacks	41 (39.1)	64 (61.0)	48 (45.7)	57 (54.2)	0.33
17	Intake of fast food	33 (31.5)	72 (68.5)	41 (39.0)	64 (54.9)	0.25

Energy dense snacks include pastry, cookies, candies, or other sweets. Healthy snacks include popcorn, pretzels, or fruits. Fried snacks include: potato chips, cakes, doughnuts, soda.

Table 4. Child's Self-report and Parent Proxy-report of Respondents' Health-Related Quality of Life by Age

	CASE				CONTROL					
	8-12years	13-18 years	19years	Total	8-12years	13-18years	19 years	Total	t-score	p-value
Variables	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		
Child's report										
Total score	86.13 (9.21)	70.40 (15.58)	71.49 (10.66)	74.27 (15.27)	78.37 (11.40)	75.01 (12.11)	69.70 (15.91)	75.41 (12.33)	-0.60	0.55
Physical health summary score	84.24 (14.21)	70.36 (20.15)	76.82 (15.68)	74.40 (19.21)	82.87 (14.26)	78.75 (15.28)	76.56 (12.72)	79.57 (14.87)	-2.18*	0.03
Emotional functioning	85.60 (9.28)	70.17 (19.24)	72.50 (14.22)	74.11 (17.94)	76.97 (12.67)	71.87 (19.36)	75.62 (20.07)	73.37 (18.03)	0.30	0.77
Social functioning	93.00 (13.07)	70.96 (18.67)	67.20 (15.28)	75.77 (19.59)	79.40 (16.35)	73.79 (17.03)	61.25 (23.56)	74.17 (17.80)	0.62	0.54
School functioning	82.80 (11.82)	70.15 (18.12)	66.25 (19.32)	72.71 (17.80)	71.55 (14.05)	73.38 (20.54)	61.25 (19.41)	72.02 (19.22)	0.27	0.79
Psychosocial summary score	87.13 (9.45)	70.42 (15.99)	68.65 (13.37)	74.20 (16.04)	75.97 (11.81)	73.01 (13.48)	66.04 (18.03)	73.19 (13.57)	0.49	0.62
Parent report										
Total score	82.22 (10.99)	70.57 (14.78)	71.11 (8.82)	73.40 (14.19)	77.38 (11.64)	74.45 (12.15)	70.15 (15.60)	74.82 (12.32)	-0.77	0.44
Physical health summary score	81.22 (15.31)	70.45 (21.07)	76.56 (14.07)	73.71 (19.56)	78.31 (15.62)	78.47 (14.84)	77.34 (13.44)	78.35 (14.80)	-1.94*	0.04

Table 4. Continued

Emotional functioning	78.40 (13.12)	70.68 (19.16)	65.83 (26.00)	71.96 (19.06)	72.86 (14.94)	71.46 (18.72)	76.45 (21.68)	72.17 (18.01)	-0.08	0.94
Social functioning	89.69 (13.48)	71.94 (17.09)	72.91 (14.69)	76.28 (17.60)	82.00 (13.76)	71.81 (16.56)	62.50 (19.08)	73.52 (16.87)	1.16	0.25
School functioning	80.20 (13.34)	69.26 (17.75)	65.83 (7.64)	71.48 (16.60)	75.80 (15.65)	73.68 (18.07)	60.00 (17.11)	73.14 (17.74)	-0.70	0.48
Psychosocial summary score	82.76 (10.57)	70.63 (15.16)	68.19 (12.36)	73.24 (14.81)	76.89 (11.79)	72.31 (13.65)	66.32 (17.16)	72.94 (13.66)	0.15	0.88

Table 5. Relationship between Child's Self-report and Parent Proxy-report of Respondents' Quality of Life

	Case												Control											
	8-12 Years			13-18 Years			19 Years			Total			8-12 Years			13-18 Years			19 Years			Total		
Variables	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**
Physical Health Score	0.49*	0.24	0.01	0.51*	0.26	0.00	0.94*	0.88	0.00	0.57	0.33	0.00	0.44*	0.19	0.03	0.74*	0.55	0.00	0.99*	0.98	0.00	0.68	0.46	0.00
Psychosocial Score	0.52*	0.27	0.00	0.68*	0.46	0.00	0.78*	0.61	0.00	0.72	0.52	0.00	0.65*	0.42	0.00	0.86*	0.74	0.00	0.98*	0.96	0.00	0.84	0.71	0.00
Total Score	0.60*	0.36	0.00	0.67*	0.45	0.00	0.76*	0.58	0.00	0.71	0.51	0.00	0.61*	0.37	0.00	0.83*	0.69	0.00	0.99*	0.98	0.00	0.81	0.65	0.00
Emotional Functioning	0.48*	0.23	0.02	0.43*	0.18	0.00	0.39	0.15	0.21	0.45	0.20	0.00	0.53*	0.28	0.01	0.84*	0.71	0.00	0.99*	0.98	0.00	0.81	0.65	0.00
Social Functioning	0.43*	0.18	0.03	0.54*	0.29	0.00	0.69*	0.48	0.01	0.63	0.40	0.00	0.71*	0.50	0.00	0.90*	0.81	0.00	0.92*	0.85	0.00	0.87	0.75	0.00
School Functioning	0.48*	0.23	0.02	0.78*	0.61	0.00	0.35	0.12	0.27	0.72	0.52	0.00	0.44*	0.19	0.03	0.70*	0.49	0.00	0.99*	0.98	0.00	0.68	0.46	0.00

As Table 6 shows, among the respondents living with HIV, there was a significant ($p < 0.01$) positive relationship between the BMI-for-age and HRQoL across all domains, but the relationship was negative among the respondents living without HIV and this was statistically significant in three cases.

Table 6. Relationship between the health-related quality of life and BMI-for-age of the respondents

	Case			Control		
Variables	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**
Physical Health Score	0.25	0.06	0.01*	-0.12	0.01	0.22
Psychosocial Score	0.49	0.24	0.00*	-0.25	0.06	0.01*
Total Score	0.45	0.20	0.00*	-0.23	0.05	0.02*
Emotional Functioning	0.40	0.16	0.00*	-0.21	0.05	0.03*
Social Functioning	0.49	0.24	0.00*	-0.16	0.02	0.11
School Functioning	0.39	0.15	0.00*	-0.19	0.04	0.05

Table 7 shows the relationship between diet quality and HRQoL of the respondents. Nuts and seeds intake positively correlated with School functioning ($p = 0.02$) among the case group. Also, SSB intake was negatively correlated with psychosocial functioning ($p = 0.00$), total HRQoL score ($p = 0.01$), social functioning ($p = 0.01$), and school functioning ($p = 0.03$). Red meat intake positively correlated with physical health among the control group ($p = 0.05$).

Table 7. Relationship between diet quality and Health-related Quality of life of the respondents

Case Group	Fruits			Vegetables			Legumes			Whole grains			Nuts and Seeds			Milk			Red meat			Processed meat			Sweet beverages		
Variables	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**	**R**	**R^2**	**P-value**
Physical Health Score	-0.13	0.02	0.12	0.02	0.00	0.75	0.09	0.01	0.24	-0.07	0.00	0.34	-0.02	0.00	0.82	0.10	0.01	0.23	0.03	0.00	0.69	-0.14	0.02	0.09	-0.08	0.01	0.27
Psychosocial Score	-0.08	0.01	0.32	-0.05	0.00	0.47	0.04	0.00	0.60	-0.09	0.01	0.19	0.11	0.01	0.17	0.10	0.01	0.19	-0.07	0.01	0.35	-0.14	0.02	0.09	-0.22*	0.05	0.00
Total Score	-0.12	0.01	0.15	-0.02	0.00	0.79	0.07	0.00	0.36	-0.10	0.01	0.13	0.06	0.00	0.44	0.12	0.02	0.12	-0.04	0.00	0.62	-0.14	0.02	0.09	-0.19*	0.04	0.01
Emotional Functioning	-0.07	0.01	0.39	-0.05	0.00	0.49	0.09	0.01	0.26	-0.03	0.00	0.64	0.06	0.00	0.48	0.07	0.01	0.37	-0.02	0.00	0.77	-0.14	0.02	0.09	-0.13	0.02	0.10
Social Functioning	-0.02	0.00	0.79	-0.04	0.00	0.59	-0.01	0.00	0.88	-0.10	0.01	0.18	0.04	0.00	0.67	0.10	0.01	0.25	-0.04	0.00	0.59	-0.13	0.02	0.13	-0.21*	0.04	0.01
School Functioning	-0.11	0.01	0.18	-0.05	0.00	0.49	0.04	0.00	0.65	-0.08	0.01	0.23	0.198*	0.04	0.02	0.08	0.01	0.31	-0.10	0.01	0.24	-0.11	0.01	0.19	-0.18*	0.03	0.03
Control Group																											
Physical Health Score	-0.09	0.01	0.28	-0.08	0.01	0.27	0.08	0.01	0.27	-0.05	0.00	0.49	-	-	-	0.00	0.00	0.96	0.16*	0.02	0.05	-	-	-	0.04	0.00	0.63
Psychosocial Score	-0.08	0.05	0.31	-0.11	0.05	0.11	0.07	0.05	0.33	-0.01	0.05	0.94	-	-	-	0.00	0.05	1.00	0.07	0.05	0.36	-	-	-	0.02	0.05	0.76
Total Score	-0.10	0.04	0.22	-0.13	0.04	0.06	0.08	0.04	0.24	-0.04	0.04	0.60	-	-	-	0.00	0.04	1.00	0.13	0.04	0.10	-	-	-	0.03	0.04	0.72
Emotional Functioning	-0.10	0.02	0.23	-0.11	0.02	0.12	0.05	0.02	0.53	-0.04	0.02	0.54	-	-	-	-0.03	0.02	0.69	0.06	0.02	0.49	-	-	-	0.04	0.02	0.63
Social Functioning	0.04	0.04	0.64	-0.09	0.04	0.21	0.08	0.04	0.27	-0.05	0.04	0.51	-	-	-	-0.01	0.04	0.90	0.00	0.04	0.98	-	-	-	0.04	0.04	0.64
School Functioning	-0.11	0.03	0.18	-0.06	0.03	0.37	0.05	0.03	0.47	0.09	0.03	0.19	-	-	-	0.03	0.03	0.68	0.14	0.03	0.09	-	-	-	0.01	0.03	0.95

DISCUSSION

This study compared the diet quality, HRQoL and anthropometric status of children with or without HIV in Abeokuta, Nigeria, and investigated the relationship between their HRQoL and their diet, and anthropometric status. We recruited CLHIV and uninfected children living closest to them of the same age group. A 23-item PedsQL 4.0 Generic Core Scales questionnaire was administered to them and their caregivers.

We observed that the socio-demographic and economic status of the CLHIV with HIV was similar to that of their uninfected peers. This was similar to the findings of ter Haar et al. (2021) who conducted a study on the HRQoL of a small sample of HIV-infected young people in the Netherlands over a five-year period.

However, the HRQoL of respondents living positive with HIV was slightly lower based on both children's and parental reports, which were surprisingly similar. Among school-age/adolescent children in Uganda (Nkwata et al. 2017), in India (Das et al. 2017), and in Spain (Cuéllar-Flores et al. 2019), there were also generally lower QoL scores for HIV-infected children compared to the uninfected children. One study in the Netherlands (Cohen et al. 2015) found them to be about the same. Surprisingly, ter Haar et al. (2021) found that the HIV-infected children and adolescents in their study experienced higher HRQoL than their uninfected peers on nearly all domains. According to those authors, the most likely explanation was that only HIV-infected children and adolescents receive extra guidance from professionals that help them attain a satisfactory health status.

Thus, the lower HRQoL scores among CLHIV in our study, despite having similar socio-demographic characteristics, can imply that these children require more professional support in order guide them into living a healthier, more satisfactory life. The highest mean HRQoL score among our CLHIV was obtained in social functioning domain while the lowest was in school functioning. In contrast, Lahai et al. (2020) found that the lowest mean score from caregivers' QoL assessment was in the social domain, perhaps reflecting caregivers' expressed dissatisfaction from friends and lack of support from others.

This could suggest that CLHIV from the current study had more support from friends and others. However, in congruence with our finding, Van Opstal et al. (2021) concluded that -

children with HIV experience more problems in various areas of school functioning compared to uninfected children. This implies that monitoring of school functioning should be an important aspect of care for CLHIV.

HRQoL scores were higher across all the domains among cases than control participants within the age range 8-12 years but lower for those in the age range 13-18 years. Similar findings were observed in the study of Meade and Dowswell (2016) which showed higher QoL score among adolescents in the lower age-groups. This could be because as children start getting older, they tend to aim towards being more independent and thus get reduced care from caregivers. However, Meade and Dowswell (2016) also found, contrary to the present study, that the gap in perceptions of child and parent's report widened with age.

Gopakumar et al. (2018) wrote that they expected a greater mean value for each domain score for the parent proxy-report, considering that the caregiver's perspective might have been subjected to bias where caregivers could have given socially desirable answers pertaining to the QoL of children under their care. However, our R values comparing child and parent scores in Table 5 were significant in all but two cases.

There was a significantly higher prevalence of underweight among CLHIV than their counterparts, as has been seen in several other studies (Akintan et al., 2016; Martín-Cañavate et al., 2018; Moolasart et al., 2017; Penda et al., 2018; Rakholia et al., 2016). This was more pronounced in the 8–12-year age group. The prevalence of underweight among CLHIV appeared to decrease with increasing age. This age difference was also found by Lentoor (2018). . The observed positive association between BMI-for-age and HRQoL across all domains for the cases underscores the crucial role of nutritional status in the well-being of these children. Yet the same was not true for the controls. This demonstrates the complex interplay between physical health and overall quality of life.

Finally, the present study highlights the significant impact of diet on various aspects of HRQoL of HIV-infected children. The positive correlation between nut and seed intake and school functioning suggests a potential cognitive benefit, while the negative impact of SSBs on multiple HRQoL domains (psychosocial, social, school functioning and total quality of life) emphasizes the need for dietary interventions that promotes healthy eating and discourages SSB intake. This dietary analysis strengthens the argument for a holistic approach to care, incorporating nutritional interventions.

CONCLUSION

This study provides insights into the complex interplay between HIV status, anthropometric measures, dietary factors, and health-related quality of life (HRQoL) among children in Abeokuta, Nigeria. The consistent finding of lower HRQoL in HIV-infected children, despite similar socio-demographic backgrounds, underscores the enduring impact of the virus on overall well-being. The observed age-related differences in HRQoL highlight the need for nuanced assessments and targeted interventions throughout childhood and adolescence. Notably, the significant prevalence of underweight among HIV-infected children, and its association with HRQoL, emphasize the critical role of nutritional support. Furthermore, the dietary analysis reveals the potential benefits of nut and seed consumption for school functioning, while underscoring the detrimental effects of SSBs on various HRQoL domains. These findings collectively advocate for a comprehensive, multi-faceted approach to care that encompasses professional support, nutritional interventions, and targeted strategies to address specific HRQoL challenges.

Future research should prioritize longitudinal studies to elucidate the long-term impact of HIV on child development, explore the underlying mechanisms driving these associations, and evaluate the effectiveness of targeted interventions. Ultimately, these efforts will contribute to improving the overall health and well-being of children living with HIV.

AUTHOR CONTRIBUTIONS

OOA performed Roles/writing– original draft, conceptualization, validation, editing, visualization, formal analysis. OMA performed writing – investigation, review and editing. SAA performed writing – investigation, and review, editing and formal analysis. All the authors read through the final version and gave approval for its publication.

CONFLICT OF INTEREST

The authors declare that they have no other potential conflicts of interest.

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REFERENCES

Abbafati, C., Abbas, K. M., Abbasi-Kangevari, M., et al. (2020). Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, *396*(10258), 1223–1249. https://doi.org/10.1016/S0140-6736(20)30752-2

Akintan, P., Akinsulie, A., Temiye, E., & Esezobor, C. (2016). Anthropometric measurements of HIV-infected children aged one to five years in a tertiary hospital in Lagos Nigeria. *Nigerian Journal of Paediatrics*, *43*(1), 26. https://doi.org/10.4314/njp.v43i1.5

Anand, D., Puri, S., & Mathew, M. (2012). Assessment of quality of life of HIV-positive people receiving art: An Indian perspective. In *Indian Journal of Community Medicine* (Vol. 37, Issue 3, pp. 165–169). https://doi.org/10.4103/0970-0218.99918

Andrinopoulos, K., Clum, G., Murphy, D. A., Harper, G., Perez, L., Xu, J., Cunningham, S., & Ellen, J. M. (2011). Health related quality of life and psychosocial correlates among HIV-infected adolescent and young adult women in the US. *AIDS Education and Prevention*, *23*(4), 367–381. https://doi.org/10.1521/aeap.2011.23.4.367

Buczynski, A. K., Leao, A. T. T., & Souza, I. P. R. de. (2015). Evaluation of Quality of Life in HIV-Infected Children and Children with Cancer. *Dentistry*, *05*(01), 1–7. https://doi.org/10.4172/2161-1122.1000276

Carvalho, B. de, Policarpo, S., & Moreira, A. C. (2017). Nutrición Hospitalaria Trabajo Original Nutritional status and quality of life in HIV-infected patients. *Nutrición Hospitalaria*, *34*(4), 923–933.

Cohen, S., Ter Stege, J. A., Weijsenfeld, A. M., et al. (2015). Health-related quality of life in perinatally HIV-infected children in the Netherlands. *AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV*, *27*(10), 1279–1288. https://doi.org/10.1080/09540121.2015.1050986

Cooper, V., Clatworthy, J., Harding, R., Whetham, J., & Consortium, E. (2017). *Measuring quality of life among people living with HIV : a systematic review of reviews*. https://doi.org/10.1186/s12955-017-0778-6

Cronje, J. H., Williams, M., Steenkamp, L., et al. (2016). The quality of life of HIV-infected South African university students : Experiences with the The quality of life of HIV-infected South African university students : Experiences with the WHOQOL-HIV-Bref. *AIDS Care*, *0*(0), 1–4. https://doi.org/10.1080/09540121.2016.1234688

Cuéllar-Flores, I., Saínz, T., Velo, C., et al. (2019). Impact of HIV on the health-related quality of life in youth with perinatally acquired HIV. *World Journal of Pediatrics*, *15*(5), 492–498. https://doi.org/10.1007/s12519-019-00281-z

Das, A., Detels, R., Afifi, A. A., Javanbakht, M., Sorvillo, F. J., & Panda, S. (2017). Health-related quality of life (HRQoL) and its correlates among community-recruited children living with HIV and uninfected children born to HIV-infected parents in West Bengal, India. *Qual Life Res.*, *26*(8), 2171–2180. https://doi.org/10.1007/s11136-017-1557-x.Health-related

Das, S., Mukherjee, A., Lodha, R., & Vatsa, M. (2010). Quality of life and psychosocial functioning of HIV infected children. *Indian Journal of Pediatrics*, *77*(6), 633–637. https://doi.org/10.1007/s12098-010-0087-0

FAO. 2018. Dietary Assessment: A resource guide to method selection and application in low resource settings. Rome. 1-151

Folasire, O. F., Folasire, A. M., & Sanusi, R. A. (2015). Measures of Nutritional Status and Quality of Life in Adult People Living with HIV/AIDS at a Tertiary Hospital in Nigeria. *Food and Nutrition Sciences*, *06*(04), 412–420. https://doi.org/10.4236/fns.2015.64042

Freire, T., & Ferreira, G. (2018). Health-related quality of life of adolescents: Relations with positive and negative psychological dimensions. *International Journal of Adolescence and Youth*, *23*(1), 11–24. https://doi.org/10.1080/02673843.2016.1262268

Fuster-ruizdeapodaca, M. J., Laguía, A., Safreed-harmon, K., Lazarus, J. V, Cenoz, S., & Amo, J. (2019). *Assessing quality of life in people with HIV in Spain : psychometric testing of the Spanish version of WHOQOL-HIV-BREF*. *8*, 1–13.

Gebremichael, D. Y., Hadush, K. T., Kebede, E. M., & Zegeye, R. T. (2018). Food insecurity, nutritional status, and factors associated with malnutrition among people living with HIV/AIDS attending antiretroviral therapy at public health facilities in West Shewa Zone, Central Ethiopia. *BioMed Research International*, *2018*. https://doi.org/10.1155/2018/1913534

George, S., Bergin, C., Clarke, S., Courtney, G., & Codd, M. B. (2016). Health-related quality of life and associated factors in people with HIV: An Irish cohort study. *Health and Quality of Life Outcomes*, *14*(1), 1–12. https://doi.org/10.1186/s12955-016-0517-4

Ghayomzadeh, M., Etesami, M. S., Earnest, C. P., et al. (2019). Effect of a Short-term Lifestyle Modification Program on Quality of Life, Anthropometric Characteristics and CD4+T Cell Count of HIV Infected Patients in Tehran/Iran: A Randomized Controlled Trial. *Explore*, *15*(4), 308–315. https://doi.org/10.1016/j.explore.2019.01.004

Gopakumar, K. G., Bhat, K. G., Baliga, S., Joseph, N., Mohan, N., & Shetty, A. K. (2018). Impact of care at foster homes on the health-related quality of life of HIV-infected children and adolescents: a cross-sectional study from India. *Quality of Life Research*, *27*(4), 871–877. https://doi.org/10.1007/s11136-017-1726-y

Lahai, M., James, P. B., Wannang, N. N. M., Wurie, H. R., Conteh, S., Bah, A. J., & Samai, M. (2020). A cross-sectional study on caregivers' perspective of the quality of life and adherence of paediatric HIV patients to highly active antiretroviral therapy. *BMC Pediatrics*, *20*(1), 1–10. https://doi.org/10.1186/s12887-020-02194-7

Lentoor, A. G. (2018). Nutritional Status of Perinatally HIV-infected Children on Antiretroviral Therapy from a Resource-poor Rural South African Community. *African Journal of Medical and Health Sciences*, *17*(1), 1–6. https://doi.org/10.4103/ajmhs.ajmhs

Liping, M., Peng, X., Haijiang, L., Lahong, J., & Fan, L. (2015). *Quality of Life of People Living with HIV / AIDS : A Cross-Sectional Study in Zhejiang*. *71373008*, 1–14. https://doi.org/10.1371/journal.pone.0135705

Mafirakureva, N., Dzingirai, B., Postma, M. J., Hulst, M. Van,

& Khoza, S. (2016). Health-related quality of life in HIV / AIDS patients on antiretroviral therapy at a tertiary care facility in Zimbabwe. *AIDS Care Psychological and Socio-Medical Aspects of AIDS/HIV ISSN:*, *0121*(May), 2–10. https://doi.org/10.1080/09540121.2016.1173639

Martín-Cañavate, R., Sonego, M., Sagrado, M. J., et al. (2018). Dietary patterns and nutritional status of HIV-infected children and adolescents in El Salvador: A cross-sectional study. *PLoS ONE*, *13*(5), 1–14. https://doi.org/10.1371/journal.pone.0196380

Meade, T., & Dowswell, E. (2016). Adolescents' health-related quality of life (HRQoL) changes over time: A three year longitudinal study. *Health and Quality of Life Outcomes*, *14*(1), 1–8. https://doi.org/10.1186/s12955-016-0415-9

Mekuria, L. A., Nieuwkerk, T., Sprangers, M. A. G., Prins, J. M., Yalew, A. W., Ababa, A., & Medical, A. (2015). *AIDS Care : Psychological and Socio-medical Aspects of AIDS / HIV Health-related quality of life of HIV-infected adults receiving combination antiretroviral therapy in Addis Ababa*. *April*, 37–41. https://doi.org/10.1080/09540121.2015.1020748

Moolasart, V., Chottanapund, S., Ausavapipit, J., & Ampornareekul, S. (2017). Prevalence and Risk Factors of Malnutrition among HIV-Infected Children Aged 2-18 Years: A Cross Sectional Study. *Pediatric Infectious Diseases: Open Access*, *02*(01), 1–5. https://doi.org/10.21767/2573-0282.100036

Mutabazi-mwesigire, D., Katamba, A., Martin, F., & Seeley, J. (2015). *Factors That Affect Quality of Life among People Living with HIV Attending an Urban Clinic in Uganda : A Cohort Study*. 1–21. https://doi.org/10.1371/journal.pone.0126810

Nkwata, A. K., Zalwango, S. K., Kizza, F. N., et al. (2017). Quality of life among perinatally HIV-affected and HIV-unaffected school-aged and adolescent Ugandan children: a multi-dimensional assessment of wellbeing in the post-HAART era. *Quality of Life Research*, *26*(9), 2397–2408. https://doi.org/10.1007/s11136-017-1597-2

Nobre, N., Pereira, M., Roine, R. P., Sintonen, H., & Sutinen, J. (2017). Factors associated with the quality of life of people living with HIV in Finland. *AIDS Care*, *0*(0), 1–5. https://doi.org/10.1080/09540121.2017.1281879

Osei-Yeboah, J., Owiredu, W. K. B. A., Norgbe, G. K., et al. (2017). Quality of Life of People Living with HIV/AIDS in the Ho Municipality, Ghana: A Cross-Sectional Study. *AIDS Research and Treatment*, *2017*, 1–7. https://doi.org/10.1155/2017/6806951

Penda, C. I., Moukoko, E. C. E., Nolla, N. P., Evindi, N. O. A., & Ndombo, P. K. (2018). Malnutrition among HIV infected children under 5 years of age at the laquintinie hospital Douala, Cameroon. *Pan African Medical Journal*, *30*, 1–7. https://doi.org/10.11604/pamj.2018.30.91.15832

Rakholia, R., Bano, M., & Rawat, V. (2016). Malnutrition among HIV- infected children by anthropometric measures in poor outreach area of a developing country and its relationship with CD4 counts. *International Journal of Pediatrics*, *4*(4), 1643–1654. https://doi.org/10.22038/ijp.2016.6717

Sackey, J., Zhang, F. F., Rogers, B., Aryeetey, R., & Wanke, C. (2018). Food security and dietary diversity are associated with health related quality of life after 6 months of follow up among people living with HIV in Accra, Ghana. *AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV*, *30*(12), 1567–1571. https://doi.org/10.1080/09540121.2018.1500011

Sanusi, R. A., Akinyele, I. O., Ene-Obong, H. N., & Enujiugba, V. N. (2017). *Nigerian Food Composition Table* (Harmonized). Center of Excellence for Food Composition Studies in Nigeria, University of Ibadan, Nigeria.

ter Haar, A. M., Van den Hof, M., Scherpbier, H. J., Oostrom, K. J., Haverman, L., & Pajkrt, D. (2021). Health-related quality of life of perinatally HIV-infected young people: a longitudinal study. *AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV*, *0*(0), 1–9. https://doi.org/10.1080/09540121.2021.1909695

Tesfaye, M., Kaestel, P., Olsen, M. F., Girma, T., Yilma, D., Abdissa, A., Ritz, C., Prince, M., Friis, H., & Hanlon, C. (2016). Food insecurity, mental health and quality of life among people living with HIV commencing antiretroviral treatment in Ethiopia: A cross-sectional study. *Health and Quality of Life Outcomes*, *14*(1), 1–8. https://doi.org/10.1186/s12955-016-0440-8

Thapa, R., Amatya, A., Pahari, D. P., Bam, K., & Newman, M. S. (2015). Nutritional status and its association with quality of life among people living with HIV attending public anti-retroviral therapy sites of Kathmandu Valley, Nepal. *AIDS Research and Therapy*, *12*(1), 1–10. https://doi.org/10.1186/s12981-015-0056-9

UNAIDS/WHO. (2024). *HIV Statistics, globally and by WHO region, 2024* (Issue July). https://cdn.who.int/media/docs/default-source/hq-hiv-hepatitis-and-stis-library/j0482-who-ias-hiv-statistics_aw-1_final_ys.pdf?sfvrsn=61d39578_3

Van Opstal, S. E. M., Wagener, M. N., Miedema, H. S., et al. (2021). School functioning of children with perinatal HIV-infection in high-income countries: A systematic review. *PLoS ONE*, *16*(6 June). https://doi.org/10.1371/journal.pone.0252746

Varni, J. (2017). *The PedsQL Measurement Model for the Paediatric Quality of Life Inventory*. Mapi Research Trust. https://www.pedsql.org/about_pedsql.html

World Health Organization (WHO) (2008). *Waist Circumference and Waist-Hip Ratio Report of a WHO Expert Consultation*.

Wallander, J. L., & Koot, H. M. (2016). Quality of life in children: A critical examination of concepts, approaches, issues, and future directions. In *Clinical Psychology Review* (Vol. 45, pp. 131–143). Elsevier B.V. https://doi.org/10.1016/j.cpr.2015.11.007

World Health Organization (WHO). (2025). *Home/Tools and toolkits/Growth reference data for 5-19 years/Indicators/BMI-for-age (5-19 years)*. World Health Organization.