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Prevalence of Overnutrition and Associated Dietary and Sociodemographic Factors Among Children Aged 6–59 Months Attending Reproductive and Child Health Clinics in Tanzania: A Cross-Sectional Study of Urban Municipality

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Highlights

What are the main findings?

- Overnutrition affected 9.6% of the children attending selected reproductive and child health clinics.
- Socioeconomic characteristics, lower dietary diversity, fast or fried food consumption, and sugary snack consumption were associated with overnutrition.

What are the implications of the main findings?

- Urban reproductive and child health services offer an opportunity for age-specific counseling on diet.
- Childhood overnutrition prevention strategies should target families across socioeconomic groups, emphasizing dietary quality and reduced energy dense foods

Abstract

Background/Objectives: Childhood overnutrition is a growing problem in rapidly urbanizing settings of low- and middle-income countries. We estimated its prevalence and examined the sociodemographic and dietary factors associated with it in children aged 6–59 months attending reproductive and child health (RCH) clinics in selected health facilities in Tanzania. **Methods**: This facility-based analytical cross-sectional study included 396 children enrolled from eight randomly selected public and private health facilities. Caregivers completed a structured questionnaire covering sociodemographic characteristics, previous-day food group intake, and selected foods and beverages. Trained data collectors obtained duplicate weight and length/height measurements. Overnutrition was defined as a weight-for-length/height Z score >+2 standard deviations, on the basis of the growth standards of the World Health Organization (WHO). Multivariable logistic regression was used to estimate adjusted prevalence odds ratios (aPORs), each reported with 95% confidence intervals (CIs). Firth penalized likelihood logistic regression and age-restricted models were used for sensitivity analyses. Results: Overnutrition was found in 38 children, corresponding to a design-based prevalence of 9.6% (95% CI 5.9–15.2). Caregivers aged 25–34 years (aPOR 2.9; 95% CI: 1.10–7.51), secondary or higher education (aPOR 3.9; 95% CI: 1.45–10.22), and monthly household income above TZS 300,000 (aPOR 3.3; 95% CI: 1.50–7.29) were associated with overnutrition. Low dietary diversity (aPOR 3.7; 95% CI: 1.51–9.04), previous-day consumption of fast or fried foods (aPOR 3.0; 95% CI: 1.24–7.50),

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and sugary snacks (aPOR 3.0; 95% CI: 1.24–7.07) were also significantly associated with overnutrition. The direction of the principal associations was similar in the penalized and age-restricted sensitivity analyses. **Conclusions**: About one in ten children attending the selected clinics experienced overnutrition. Overnutrition was associated with caregiver age, higher caregiver education, higher household income, lower dietary diversity, and previous-day consumption of fast or fried foods and sugary snacks. RCH services should integrate routine monitoring of excessive weight gain with age-appropriate counseling.

Keywords: childhood; overnutrition; reproductive and child health; prevalence

1. Introduction

Childhood overweight and obesity are complex forms of malnutrition arising from interactions among biological susceptibility, early-life exposure, dietary intake, physical activity, sedentary behavior, sleep, socioeconomic conditions, and the broader food environment [1,2]. Across many low- and middle-income countries (LMICs), rapid urban growth together with shifting food systems have accelerated the nutrition transition from traditional diets toward increased availability and consumption of commercially prepared foods and drinks that are high in energy but poor in nutrients [3,4]. These changes occur alongside persistent food insecurity, micronutrient deficiencies, and child undernutrition, resulting in a double burden of malnutrition within countries, communities, households, and individual children [5,6].

Globally, approximately 35.5 million children under five years of age, corresponding to 5.5% of this population, were living with overweight in 2024 [7]. Although the global prevalence has changed relatively little in recent years, the absolute number of affected children has increased, and progress toward achieving the 2030 global nutrition target remains inadequate [7,8]. In Tanzania, nationally representative surveys indicate that the prevalence of overnutrition in children younger than five years increased from 2.8% recorded in the 2018 Tanzania National Nutrition Survey to approximately 4.0% in the 2022 Tanzania Demographic and Health Survey and Malaria Indicator Survey [9,10]. The coexistence of childhood overweight with persistent stunting, wasting, and micronutrient deficiencies presents a particular challenge for health systems because nutrition programs must prevent excessive weight gain while sustaining effective interventions against undernutrition [5,6].

Early childhood is a formative period during which food preferences, appetite regulation, and feeding behaviors develop, making it an important stage for establishing healthy dietary practices [1,11]. Excess adiposity established during childhood may persist into later life and is linked to poorer cardiometabolic health, psychosocial difficulties, and a greater likelihood of premature morbidity and mortality [1,12]. Dietary exposures associated with excessive weight gain in children include the regular intake of high-energy snacks, sugary drinks, and commercially prepared or fried foods [13,14]. The timing and quality of complementary feeding may also influence subsequent weight status; however, research findings vary according to breastfeeding history, when complementary foods are first given, the dietary assessment method, and the extent to which maternal, household, and environmental characteristics are considered [15–17]. Feeding practices should therefore be examined considering wider socioeconomic and food-environment conditions rather than being interpreted as isolated causes of childhood overnutrition.

Studies conducted across sub-Saharan Africa have identified several children, mother, household, and related correlates of overweight among children under five years of age, including child age and sex, birth size, maternal overweight, parental education, household wealth, and place of residence [18–21]. Several multicountry analyses have shown

that childhood overweight is more common in wealthier households, although the magnitude and direction of socioeconomic inequalities vary across countries and stages of the nutrition transition [18–21]. Much of this evidence has been derived from secondary analyses of demographic and health surveys, which provide robust anthropometric and sociodemographic information but comparatively limited detail on dietary quality, portion sizes, habitual food consumption, and young children's exposure to energy-dense foods. Consequently, evidence directly relating recent feeding practices to overnutrition across the full preschool age range remains limited, particularly in rapidly urbanizing sub-Saharan African settings [22,23].

An additional methodological challenge concerns the assessment of feeding practices across different preschool ages. Standard infant and young child feeding indicators developed by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), including minimum dietary diversity, minimum meal frequency, and minimum acceptable diet, were designed primarily for children aged 6–23 months [24]. Under the current definition, minimum dietary diversity is achieved when a child aged 6–23 months consumes foods or beverages from at least five of eight specified food groups during the preceding day [24]. Although these indicators provide useful population-level measures of complementary feeding, their application to children aged 24–59 months requires explicit methodological justification for this older age group [24,25]. We argue that a pooled and standardized tool for this age group may be particularly important because breastfeeding status, dietary autonomy, meal patterns, energy requirements, and exposure to foods consumed outside the home change substantially with age. In addition, some health facility educational interventions, such as health education and nutritional counseling, are generally provided at reproductive and child health services in this group during postnatal visits. This study therefore sought to determine the facility-based prevalence of overnutrition and examine its associations with selected dietary and sociodemographic factors among children aged 6–59 months receiving reproductive and child health services. By studying recent feeding practices together with caregiver and household characteristics, this study aimed to provide context-specific evidence that can guide age-appropriate nutrition assessment and counseling within urban child-health services.

2. Materials and Methods

2.1. Study Design and Setting

This was a facility-based analytical cross-sectional study, and data were collected between 25 March and 23 April 2026 among children attending RCH services at eight health centers (defined as the second formal health unit of level one health services, after dispensary, serving as a primary health facility located at the ward level to cater to approximately 50,000 people and supervise all dispensaries in its locality and provide both outpatient and inpatient services, including maternity care, laboratory testing, dispensing of medicines, and mortuary services), in Kinondoni (an urban) Municipality. Breastfeeding, dietary, and sociodemographic information and anthropometric measurements were collected concurrently. Movement behaviors (physical activity, screen time, and sleep duration) were assessed for a separate objective of the parent study. The municipality is predominantly urban and had an estimated population of 982,328 in the 2022 Population and Housing Census [26]. In 2023, approximately 187,913 residents were children younger than five years [27]. The RCH section in these health centers provides immunization, growth monitoring, nutritional assessment, education and counseling, and general pediatric care. This manuscript was prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology recommendations for cross-sectional studies (STROBE) checklist attached as Supplementary File S1 [28].

2.2. Study Population and Eligibility

The study population comprised children aged 6–59 months. The study population consisted of children attending RCH services at the selected health centers during the data collection period. Children were eligible when accompanied by a primary caregiver aged 18 years or older who was responsible for the child's feeding and care and could provide the requested sociodemographic, breastfeeding, dietary, and health information. Because the approved tool was self-administered, caregivers were also required to be able to read and write. Ethically approved self-administered questionnaires allowed caregivers to complete the questionnaire privately; thus, they were required to be able to read and write. However, given the adult literacy rate of 97.5% in the Dar es Salaam Region [26], this eligibility requirement was expected to exclude relatively few caregivers. Children were excluded if they had a known chronic illness or congenital anomaly likely to affect growth or feeding, including genetic syndromes, cleft lip or palate, neural-tube defects, or congenital heart disease. Children who presented with an acute illness requiring urgent care, including high fever, breathing difficulty, persistent vomiting, diarrhea with dehydration, or seizures, were also excluded. Only one enrollment per child was permitted.

2.3. Sample Size

The required sample size was calculated via Cochran's formula for a single population proportion, $n = Z^2p(1 - p)/d^2$, where n represents the required number of participants, p is the expected prevalence, d is the absolute margin of error, and Z is the standard normal deviate corresponding to the selected confidence level. The calculation assumed an expected prevalence of 4.0% on the basis of the 2022 Tanzania Demographic and Health Survey and Malaria Indicator Survey [10], a 95% confidence level ($Z = 1.96$), and an absolute precision of 2.5%, yielding 237 children. Applying a design effect of 1.5 increased the sample to 356. To allow for 10% nonresponse, the final sample size was 396 children.

2.4. Sampling and Recruitment

A stratified, one-stage cluster sampling approach was used. The municipality has nine public health centers and six private health centers. Health facilities were stratified by ownership as public or private. Five public health facilities and three private health facilities were selected via simple random sampling using a lottery method. The total sample was allocated proportionally to the RCH attendance recorded in the District Health Information Software (DHIS 2) during the preceding six months. Within each selected facility, all consecutive eligible caregiver–child pairs were invited to participate.

2.5. Data Collection

Data were collected using a structured, self-administered caregiver questionnaire. Sociodemographic items were adapted from the Tanzania Demographic and Health Survey (TDHS-MIS); breastfeeding and dietary questions were informed by the WHO/UNICEF infant and young child feeding guidance [24]. The tool collected information on caregiver and child characteristics, breastfeeding history, complementary feeding practices, and previous-day food and beverage consumption.

The questionnaire was developed in English, translated into Kiswahili, and independently back-translated into English to assess conceptual consistency. It was reviewed for content validity and pretested outside the selected facilities. One research assistant with a health-related background received one day of training on study procedures, informed consent, questionnaire administration, and WHO-standard anthropometric techniques. The principal investigator and research assistant approached caregivers attending RCH clinics, explained the study, obtained written informed consent, and provided the questionnaire

for independent completion. The completed questionnaires were checked immediately for completeness and internal consistency before the child's anthropometric measurements were obtained.

2.6. Anthropometric Assessment

Weight was measured using calibrated SECA infant (15 months or less) or standing digital scales, as appropriate for the child's age. The children wore light clothing and no shoes. The measurement guide specified recording to the nearest 0.01 kg. Two readings were obtained; when they differed by more than 0.1 kg, the measurement was repeated, and the mean of two acceptable readings was used. The scales were checked each day using a standard 1-kg weight. Recumbent length was measured for children younger than 24 months, and standing height was measured for children aged 24–59 months, using a standard anthropometric board. Length or height was recorded to the nearest 0.1 cm. Two readings were obtained, with a maximum acceptable difference of 0.5 cm, and their mean was used. Measurements followed WHO child-growth procedures [29,30].

Weight-for-length Z scores (WLZ) were generated for children younger than 24 months, and weight-for-height Z scores (WHZ) were generated for children aged 24–59 months, using WHO Anthro software Version 3.2.2. The primary binary outcome was overnutrition, defined as WLZ or WHZ >+2 standard deviations (SDs) from the WHO Child Growth Standards median. For mutually exclusive descriptive categories, overweight was defined as >+2 to +3 SDs, and obesity was defined as >+3 SDs. The comparison category comprised children who did not meet the overnutrition definition, including those with normal nutritional status and five children with WLZ/WHZ ≤ 2 SD. A sensitivity analysis subsequently excluded these five undernourished children.

2.7. Exposure and Covariate

Child age was calculated from the date of birth to the date of data collection, summarized using the median and interquartile range, and categorized as 6–11, 12–23, and 24–59 months. Caregiver age was recorded in completed years and grouped into 18–24, 25–34, and ≥35 years for analysis. Education was categorized into no formal/primary education and secondary/higher education. Employment status was grouped as homemaker, employed/student, or self-employed. Monthly household income was dichotomized as ≤TZS 300,000 and >TZS 300,000.

Complementary-feeding initiation was classified as early (<6 months), timely (at 6 months), or late (>6 months). The first complementary item was recorded as porridge, water, cow or goat milk, mashed banana, or commercial or processed food and was later collapsed into home-based or commercial or processed food for regression analysis. The feeding frequency was defined as the number of solid, semisolid, or soft food feeding episodes on the preceding day and was classified as ≥3 versus <3 episodes per day. Feeding frequency is the WHO/UNICEF proxy indicator of energy intake from complementary foods and was originally validated in children aged 6–23 months [24,31]. The WHO minimum meal frequency requires two feeds for breastfed infants aged 6–8 months, three for breastfed children aged 9–23 months, and four for non-breastfed children aged 6–23 months [24]. We applied a uniform threshold of three feeds across the 6–59-month age range on the basis of a study of 538 children aged 6–59 months in southern Ethiopia that assessed meal frequency against nutrient adequacy. In that study, three or more meals in the previous 24 h identified children with adequate nutrient intake, with a sensitivity of 73.0%, specificity of 47.8%, and an area under the receiver operating characteristic curve of 0.62 [32]. Because this threshold does not apply the age- and breastfeeding-specific WHO algorithm, it is described as a

study-specific feeding-frequency variable rather than the WHO minimum meal-frequency indicator [24].

Dietary diversity was assessed from caregiver-reported consumption during the preceding day across the seven food groups captured by the questionnaire: (1) grains, roots, and tubers; (2) legumes and nuts; (3) dairy products; (4) flesh foods; (5) eggs; (6) vitamin A-rich fruits and vegetables; and (7) other fruits and vegetables. Consumption from ≥4 of 7 food groups was classified as higher dietary diversity, and consumption from <4 of 7 food groups was classified as lower dietary diversity, following the earlier WHO minimum dietary diversity indicator for children aged 6–23 months [33]. We applied the same indicator and cut-off to all children aged 6–59 months. The WHO/UNICEF indicator for children aged 6–23 months has since been revised to include ≥5 of 8 groups by adding breast milk as a separate group, mainly to eliminate an advantage given to formula-fed over breastfed infants [24]. We retained the seven-food-group version because breastfeeding declines after 24 months, so an eight-food-group count would partly score older children on breastfeeding status rather than on the complementary and family diet, which was the exposure of interest across the whole age range. The seven food group scores were originally validated against micronutrient adequacy in children aged 6–23 months, with correlations of 0.21–0.76 among breastfed children and 0.26–0.50 among non-breastfed children across ten datasets [31]. When the same seven food group scores with a ≥4 cut-off was evaluated directly in 1066 children aged 24–59 months in Burkina Faso, the score was correlated with the mean probability of the adequacy of 11 micronutrients (Spearman rank correlation = 0.50), within the range reported for non-breastfed children aged 6–23 months, and the authors concluded that the indicator can be extended to children aged 24–59 months [34]. The criterion of ≥4 of 7 food groups has accordingly been used in studies of children aged 6–59 months [35–38] and 24–59 months [39]. Notably, the indicator has been validated against micronutrient adequacy but not against energy intake or adiposity.

Previous-day consumption of fast or fried foods was coded as yes when the child consumed chips, pizza, burgers, crisps, noodles, or kebabs. Sugary snack consumption included cake, candies, ice cream, biscuits, or chocolate. Sweetened beverage consumption included soda, sweetened juice, or flavored milk. Any reported consumption of an item in the relevant composite category was sufficient for classification as exposed. These variables do not measure portion size, total energy intake, or longer-term consumption frequency. They therefore assumed that recent consumption rather than habitual dietary patterns was reflected.

Validity was ensured by adapting items from the TDHS and WHO/UNICEF [10,24]; translating and back-translating the questionnaire; pretesting it outside the selected facilities; and following WHO anthropometric procedures [29,30]. Measurement reliability was strengthened through one-day standardized training, daily scale checks, duplicate weight and length/height measurements, prespecified repeat measurements, and the use of mean values.

2.8. Statistical Analysis

The data were entered into Microsoft Excel using a standard coding scheme and imported into Stata version 18 (StataCorp LLC, College Station, TX, USA). Cleaning included frequency distributions, cross-tabulations, and comparisons of questionable entries with the original questionnaires. Electronic data were stored on a password-protected computer and backed up to a password-protected external drive. Physical and electronic records were scheduled for secure storage.

Categorical variables were summarized using frequencies and percentages. The prevalence of overnutrition was calculated as the number of children with WLZ/WHZ > +2

SDs divided by the total number analyzed and was reported with a design-based 95% confidence interval accounting for stratification and clustering within the eight facilities. Overweight and obesity were also reported separately.

Bivariable binary logistic regression was used to assess associations between sociodemographic factors, breastfeeding, dietary factors and overnutrition. The results are expressed as crude prevalence odds ratios (cPORs) with 95% confidence intervals. Variables with $p < 0.20$ in the bivariable analysis were considered for the multivariable logistic regression model. Exclusive breastfeeding duration was not entered together with age at complementary-feeding initiation because of collinearity between these variables. The final model produced adjusted prevalence odds ratios (aPORs) with 95% confidence intervals. Multicollinearity was assessed with variance inflation factors. Statistical tests were two-sided, and $p < 0.05$ was used as the conventional threshold for statistical significance. Because odds ratios are not equivalent to prevalence ratios, the estimates are described throughout as prevalence odds ratios and not as relative risks [40].

A sensitivity analysis was performed to determine whether including the five undernourished children in the "no overnutrition" comparison group influenced the findings. The multivariable logistic model was repeated after excluding these children, thereby comparing overnourished children directly with normally nourished children. The direction, magnitude, and statistical significance of the adjusted associations were compared between the primary and sensitivity analyses [41]. Given that the final model was fitted with only 38 outcome events, Firth's penalized-likelihood logistic regression was used to assess the robustness of the estimates to small-sample bias. The Firth model was refitted with additional adjustment for child age and sex after the undernourished children were excluded and in children aged 6–23 months. Dietary exposure-by-age-group (6–23 vs. 24–59 months) interactions were tested with likelihood ratio tests, and the binary dietary diversity variable was replaced by a continuous score. The current WHO minimum dietary diversity indicator (≥5 of 8 groups) was examined among children aged 6–23 months [24].

2.9. Ethical Considerations

Ethical approval was granted by the Muhimbili University of Health and Allied Sciences Research Ethics Committee (Ref. No. MUHAS-REC-03-2026-3316), followed by administrative approval. Written informed consent was obtained from each caregiver before enrollment. Participation was voluntary, and caregivers were informed about the study purpose, procedures, possible discomforts, benefits, confidentiality, and their right to skip questions or withdraw without affecting services. The data used for analysis were anonymized and accessible only to authorized members of the research.

3. Results

3.1. Sociodemographic Characteristics of the Participants

This study enrolled a total of 396 caregiver-child pairs. The median child age was 14 months (interquartile range [IQR]: 9–23), and 221 children (55.8%) were male. The caregivers had a median age of 27 years (IQR: 24–31). Most caregivers were married or cohabiting (299; 75.5%), 190 (48.0%) had secondary education, and 200 (50.5%) were homemakers. A total of 117 households (29.5%) reported a monthly income above TZS 300,000 (Table 1). The prevalence of overnutrition differed significantly in caregiver age ($p = 0.019$), caregiver education level ($p = 0.009$), and monthly household income ($p = 0.001$) (Table 1).

Table 1. Sociodemographic characteristics by overnutrition status (N = 396).

Characteristic	Category	No Overnutrition, n (%)	Overnutrition, n (%)	Total, N (%)	*p* Value
Child age	6–11 months	139 (89.7)	16 (10.3)	155 (39.1)	0.923 *
	12–23 months	141 (91.0)	14 (9.0)	155 (39.1)	
	≥24 months	78 (90.7)	8 (9.3)	86 (21.7)	
Child sex	Male	203 (91.9)	18 (8.1)	221 (55.8)	0.271 *
	Female	155 (88.6)	20 (11.4)	175 (44.2)	
Caregiver age	18–24 years	110 (93.2)	8 (6.8)	118 (29.8)	0.019 *
	25–34 years	194 (87.0)	29 (13.0)	223 (56.3)	
	≥35 years	54 (98.2)	1 (1.8)	55 (13.9)	
Education level	None	28 (96.6)	1 (3.4)	29 (7.3)	0.009 **
	Primary	126 (95.5)	6 (4.5)	132 (33.3)	
	Secondary	168 (88.4)	22 (11.6)	190 (48.0)	
	Higher	36 (80.0)	9 (20.0)	45 (11.4)	
Marital status	Single	65 (92.9)	5 (7.1)	70 (17.7)	0.545 **
	Widowed	9 (100.0)	0 (0.0)	9 (2.3)	
	Married/cohabiting	269 (90.0)	30 (10.0)	299 (75.5)	
	Divorced/separated	15 (83.3)	3 (16.7)	18 (4.5)	
Employment	Homemaker	185 (92.5)	15 (7.5)	200 (50.5)	0.437 **
	Employed	45 (90.0)	5 (10.0)	50 (12.6)	
	Self-employed	125 (87.4)	18 (12.6)	143 (36.1)	
	Student	3 (100.0)	0 (0.0)	3 (0.8)	
Monthly household income	≤TZS 300,000	261 (93.5)	18 (6.5)	279 (70.5)	0.001 *
	>TZS 300,000	97 (82.9)	20 (17.1)	117 (29.5)	

Child age: median 14 months (IQR: 9–23). Caregiver age: median 27 years (IQR: 24–31). The percentages in the overnutrition columns are row percentages; the total percentages are column percentages. * *p* values were calculated using Pearson's chi-square test and are significant at $p < 0.05$. ** *p* values were calculated using Fisher's exact test and were considered significant at $p < 0.05$.

3.2. Breastfeeding and Dietary Characteristics

All the children enrolled in this study had ever been breastfed. Breastfeeding was initiated within one hour of birth for 245 children (61.9%), 298 (75.3%) were reported to have been exclusively breastfed for at least six months, and 229 (57.8%) were still breastfeeding during the study period. Complementary feeding was introduced at six months for 283 children (71.5%), and porridge was the most frequently reported first complementary food (294; 74.2%). A total of 358 children (90.4%) had at least three feeding episodes during the preceding day, and 244 (61.6%) consumed food from at least four of the seven food groups captured by the questionnaire. Previous-day consumption was reported for fast or fried foods by 90 children (22.7%), sugary snacks by 107 (27.0%), and sweetened beverages by 152 (38.4%) (Table 2). Overnutrition prevalence differed significantly with respect to the timing of complementary-feeding initiation ($p = 0.022$), dietary diversity ($p = 0.024$), and previous-day consumption of fast or fried foods ($p < 0.001$), sugary snacks ($p < 0.001$), and sweetened beverages ($p = 0.003$) (Table 2).

Table 2. Dietary characteristics by overnutrition status (N = 396).

Characteristic	Category	No, Overnutrition n (%)	Overnutrition n (%)	Total, N (%)	*p* Value
Complementary feeding initiation	Early (<6 months)	83 (84.7)	15 (15.3)	98 (24.7)	0.022 *
	At 6 months	263 (92.9)	20 (7.1)	283 (71.5)	
	Late (>6 months)	12 (80.0)	3 (20.0)	15 (3.8)	

Table 2. *Cont.*

Characteristic	Category	No, Overnutrition n (%)	Overnutrition n (%)	Total, N (%)	*p* Value
First complementary food	Porridge	268 (91.2)	26 (8.8)	294 (74.2)	0.215 **
	Water	41 (93.2)	3 (6.8)	44 (11.1)	
	Cow/goat milk	12 (75.0)	4 (25.0)	16 (4.0)	
	Mashed banana	31 (88.6)	4 (11.4)	35 (8.8)	
	Commercial/processed food	6 (85.7)	1 (14.3)	7 (1.8)	
Feeding frequency	≥3 episodes/day	325 (90.8)	33 (9.2)	358 (90.4)	0.391 **
	<3 episodes/day	33 (86.8)	5 (13.2)	38 (9.6)	
Dietary diversity	≥4 of 7 food groups	227 (93.0)	17 (7.0)	244 (61.6)	0.024 *
	<4 of 7 food groups	131 (86.2)	21 (13.8)	152 (38.4)	
Fast/fried foods	No	286 (93.5)	20 (6.5)	306 (77.3)	<0.001 *
	Yes	72 (80.0)	18 (20.0)	90 (22.7)	
Sugary snacks	No	273 (94.5)	16 (5.5)	289 (73.0)	<0.001 *
	Yes	85 (79.4)	22 (20.6)	107 (27.0)	
Sweetened beverages	No	229 (93.9)	15 (6.1)	244 (61.6)	0.003 *
	Yes	129 (84.9)	23 (15.1)	152 (38.4)	

The percentages in the overnutrition columns are row percentages; the total percentages are column percentages. * p values were calculated via Pearson's chi-square test and are significant at $p < 0.05$. ** p values were calculated using Fisher's exact test and were considered significant at $p < 0.05$.

3.3. Nutritional Status

Thirty-eight children met the study definition of overnutrition, corresponding to a design-based prevalence of 9.6% (95% CI: 5.9–15.2). This included 27 children who were overweight (6.8%) and 11 who were obese (2.8%). The remaining 358 children (90.4%) did not meet the overnutrition definition; this comparison group included five children with weight-for-length/height Z scores below −2 standard deviations (Table 3).

Table 3. Weight-for-length/height nutritional status (N = 396).

Nutritional-Status Category	Count, n	Percent, %	95% CI
No overnutrition	358	90.4	84.8–94.1
Overweight	27	6.8	3.3–13.7
Obesity	11	2.8	1.2–6.1
Overnutrition	38	9.6	5.9–15.2

CI, confidence interval.

3.4. Sociodemographic Factors Associated with Overnutrition

In the bivariable logistic regression, having a caregiver with secondary or higher education was associated with greater odds of overnutrition than having a caregiver with no formal or primary education (cPOR 3.3; 95% CI: 1.43–7.79). Compared with a lower household income, a monthly household income > TZS 300,000 was associated with greater odds of overnutrition (cPOR 3.0; 95% CI: 1.52–5.89) (Table 4).

Table 4. Bivariable analysis of sociodemographic characteristics and overnutrition status (N = 396).

Variable	Category	cPOR	95% CI	*p* Value
Child age	6–11 months	Reference		
	12–23 months	0.9	0.41–1.83	0.701
	≥24 months	0.9	0.36–2.17	0.800

Table 4. *Cont.*

Variable	Category	cPOR	95% CI	*p* Value
Child sex	Male	Reference		
	Female	1.5	0.74–2.84	0.273
Caregiver age	18–24 years	Reference		
	25–34 years	2.1	0.91–4.65	0.084
	≥35 years	0.3	0.03–2.09	0.203
Education	No formal/primary	Reference		
	Secondary/higher	3.3 *	1.43–7.79	0.005
Marital status	Single	Reference		
	Married/cohabiting	1.5	0.54–3.88	0.460
	Widowed/divorced/separated	1.6	0.36–7.32	0.527
Employment	Housewife	Reference		
	Employed/student	1.3	0.44–3.71	0.643
	Self-employed	1.8	0.86–3.65	0.119
Monthly household income	≤TZS 300,000	Reference		
	>TZS 300,000	3.0 *	1.52–5.89	0.002

cPOR, crude prevalence odds ratio; CI, confidence interval; TZS, Tanzanian shilling. cPORs, 95% CIs, and *p* values were estimated using bivariable binary logistic regression. Overnutrition was defined as a weight-for-length/height Z score > +2 standard deviations. $p < 0.05$ was considered statistically significant. * $p < 0.05$.

3.5. Breastfeeding and Dietary Factors Associated with Overnutrition

Exclusive breastfeeding for <6 months was associated with increased odds of overnutrition in the bivariable analysis (cPOR 2.2; 95% CI: 1.08–4.33). Among the dietary variables, early complementary feeding (cPOR 2.4; 95% CI: 1.16–4.85), lower dietary diversity (cPOR 2.1; 95% CI: 1.09–4.20), previous-day consumption of fast or fried foods (cPOR 3.6; 95% CI: 1.80–7.11), sugary snacks (cPOR 4.4; 95% CI: 2.22–8.79), and sweetened beverages (cPOR 2.7; 95% CI: 1.37–5.40) were associated with overnutrition (Table 5).

Table 5. Bivariable analysis between selected feeding and dietary factors and overnutrition status (N = 396).

Variable	Category	cPOR	95% CI	*p* Value
Exclusive breastfeeding	≥6 months	Reference		
	<6 months	2.2 *	1.08–4.33	0.030
Complementary feeding initiation	At 6 months	Reference		
	Early (<6 months)	2.4 *	1.16–4.85	0.017
	Late (>6 months)	3.3	0.86–12.61	0.083
First complementary food	Home-based	Reference		
	Commercial/processed	1.6	0.19–13.53	0.673
Feeding frequency	≥3 episodes/day	Reference		
	<3 episodes/day	1.5	0.55–4.08	0.436
Dietary diversity	≥4 food groups	Reference		
	<4 food groups	2.1 *	1.09–4.20	0.027
Fast/fried foods	No	Reference		
	Yes	3.6 *	1.80–7.11	<0.001
Sugary snacks	No	Reference		
	Yes	4.4 *	2.22–8.79	<0.001

Table 5. *Cont.*

Variable	Category	cPOR	95% CI	*p* Value
Sweetened beverages	No	Reference		
	Yes	2.7 *	1.37–5.40	0.004

cPOR, crude prevalence odds ratio; CI, confidence interval. cPORs, 95% CIs, and *p* values were estimated using bivariable binary logistic regression. $p < 0.05$ was considered statistically significant. * $p < 0.05$.

3.6. Multivariable Regression Analysis

Caregivers' age of 25–34 years (aPOR 2.9; 95% CI: 1.10–7.51), having secondary or higher education (aPOR 3.9; 95% CI: 1.45–10.22), and monthly household income > TZS 300,000 (aPOR 3.3; 95% CI: 1.50–7.29) were significantly associated with increased odds of overnutrition. Similarly, lower dietary diversity (aPOR 3.7; 95% CI: 1.51–9.04), previous-day consumption of fast or fried foods (aPOR 3.0; 95% CI: 1.24–7.50), and sugary snacks (aPOR 3.0; 95% CI: 1.24–7.07) were significantly associated with higher odds of overnutrition (Table 6).

Table 6. Crude and adjusted logistic regressions for socioeconomic and dietary factors associated with overnutrition (N = 396).

Variable	Category	cPOR	95% CI	aPOR	95% CI
Caregiver age	18–24 years	Reference		Reference	
	25–34 years	2.1	0.91–4.65	2.9 *	1.10–7.51
	≥35 years	0.3	0.03–2.09	0.6	0.06–5.36
Education	No formal/primary	Reference		Reference	
	Secondary/higher	3.3	1.43–7.79	3.9 *	1.45–10.22
Employment	Housewife	Reference		Reference	
	Employed/student	1.3	0.44–3.71	0.6	0.18–2.38
	Self-employed	1.8	0.86–3.65	1.9	0.79–4.40
Monthly household income	≤TZS 300,000	Reference		Reference	
	>TZS 300,000	3.0	1.52–5.89	3.3 *	1.50–7.29
Complementary feeding introduction	At 6 months	Reference		Reference	
	Early (<6 months)	2.4	1.16–4.85	2.0	0.81–4.71
	Late (>6 months)	3.3	0.86–12.61	4.4	1.00–19.50
Dietary diversity	≥4 food groups	Reference		Reference	
	<4 food groups	2.1	1.09–4.20	3.7 *	1.51–9.04
Fast/fried foods	No	Reference		Reference	
	Yes	3.6	1.80–7.11	3.0 *	1.24–7.50
Sugary snacks	No	Reference		Reference	
	Yes	4.4	2.22–8.79	3.0 *	1.24–7.07
Sweetened beverages	No	Reference		Reference	
	Yes	2.7	1.37–5.40	1.5	0.64–3.42

cPOR, crude prevalence odds ratio; aPOR, adjusted prevalence odds ratio; CI, confidence interval; TZS, Tanzanian shilling. The adjusted model included all the variables presented in the table. Overnutrition was defined as a weight-for-length/height Z score > +2 standard deviations. * $p < 0.05$.

Sensitivity Analyses and Clustering Effects

After the five undernourished children were excluded, the direction and magnitude of the principal estimates were similar to those in the primary analysis. For example, the adjusted prevalence odds ratio (aPOR) for monthly household income > TZS 300,000 was 3.3 (95% CI: 1.49–7.25), whereas it was 3.3 (95% CI: 1.50–7.29) in the primary analysis.

Firth-penalized likelihood estimates were modestly attenuated but remained directionally consistent with the primary results. Similar findings were observed after additional adjustment for child age and sex and after excluding the five undernourished children (Supplementary Table S2).

Among children aged 6–23 months, the estimates for caregiver education, household income, dietary diversity, fast or fried foods, and sugary snacks remained directionally consistent, although confidence intervals were wider, for example, for the caregiver-age estimate (aPOR 2.3; 95% CI: 0.92–6.67). We found no statistical evidence that the dietary associations differed between children aged 6–23 and 24–59 months (interaction p values 0.20 to 0.81), although the power was limited by the small number of children with overnutrition. Caregiver education and household income were weakly correlated (Cramér's V = 0.10), and all variance inflation factors were ≤1.4, indicating little numerical multicollinearity. In a reduced model excluding the dietary variables, the estimates for caregiver education (aPOR 3.1; 95% CI: 1.36–7.84) and household income (aPOR 3.1; 95% CI: 1.55–6.40) remained similar. In the facility-level cluster analysis, the direction and magnitude of the adjusted estimates were similar to those from the primary model (Supplementary Table S2).

4. Discussion

This facility-based study found that 9.6% of children aged 6–59 months receiving selected RCH services experienced overnutrition, with 6.8% being overweight and 2.8% being obese. In the adjusted analysis, overnutrition was significantly associated with a caregiver age of 25–34 years, secondary or higher caregiver education, a monthly household income above TZS 300,000, lower dietary diversity, and previous-day consumption of fast or fried foods and sugary snacks. Exposures and outcomes were measured at the same time; the observed associations do not establish causality. RCH services therefore provide an important opportunity to identify excessive weight gain early and deliver age-appropriate nutrition education and counseling to families across various socioeconomic groups.

The observed prevalence was numerically higher than the 4.0% national estimate reported in the 2022 Tanzania Demographic and Health Survey and Malaria Indicator Survey [10]. However, this difference should not be interpreted as evidence for a higher prevalence of overnutrition in urban settings because the present study recruited consecutive attendees from selected health facilities, whereas the national estimate was derived from a population-based household survey. Differences in sampling methods, age composition, urban dietary exposure, health service utilization, and measurement context may all contribute to the observed prevalence differences. The literacy requirement may also have introduced selection bias [19,21]. However, with high adult literacy of 97.5% in Dar es Salaam [26], the number and characteristics of otherwise eligible caregivers excluded for this reason were not recorded. The direction and magnitude of the resulting bias therefore cannot be determined but is assumed to be insignificant. The estimate nevertheless supports concerns about childhood overnutrition in rapidly urbanizing settings. A pooled prevalence of 4.6% has been reported among children younger than five years in eleven eastern African countries [19].

Higher household income was associated with overnutrition. This finding is consistent with analyses from sub-Saharan Africa showing that childhood overweight may be concentrated among wealthier households, particularly during earlier stages of the nutrition transition [19,21,42]. In urban settings, greater disposable income can increase access not only to higher-quality foods but also to commercially prepared, energy-dense foods and snacks. Furthermore, high household income may represent differences in food availability, purchasing power, neighborhood food environments, and unmeasured caregiver or household characteristics. As food consumption changes, socioeconomic gradients in individuals

with obesity can also shift; however, the direction and magnitude of this relationship may vary across locations and over time [3,4,42].

Children whose caregivers had secondary or higher education levels had greater odds of overnutrition. Although education is often expected to improve health knowledge and feeding practices, its relationship with child weight is context-dependent. In this study, education may have served as a marker of household resources, occupation, urban lifestyle, or access to commercial foods rather than nutrition knowledge alone. Empirical evidence from a study including 35 sub-Saharan African countries has shown that household wealth and maternal education are linked to inequalities in child nutritional outcomes, including overnutrition, but the patterns differ across forms of malnutrition and country contexts [42]. However, we acknowledge that residual confounding is plausible because maternal body mass index, paternal characteristics, birth weight, household food security, and the detailed home food environment were not measured in our current study. Therefore, the observed positive associations should be interpreted with caution. In this study, education and income were weakly correlated and remained associated with overnutrition in a model excluding the dietary variables. This reduces concern about numerical collinearity but does not distinguish direct socioeconomic associations from pathways mediated through diet or other unmeasured factors.

Caregivers aged 25–34 years were associated with increased odds of overnutrition. The evidence for an independent effect of caregiver age on childhood overnutrition is inconsistent, and caregiver age may proxy parity, household resources, feeding experience, employment, or maternal nutritional status. We suggest that this estimate should be interpreted cautiously because the oldest caregiver category had few entries (participants) that produced a wide confidence interval. This was also the least stable estimate in the sensitivity analyses. Confirmation in larger population-based studies with direct measurement is warranted [18,43].

A lower dietary diversity was also associated with overnutrition. This direction may appear counterintuitive because dietary diversity is primarily an indicator of micronutrient adequacy [24,25,34]. The seven-group indicator across 6–59 months is supported by evidence that it predicts micronutrient adequacy in children aged 24–59 months, with performance within the range reported for the younger children for whom it was developed [31,34]. In our data, the dietary associations also did not differ between children aged 6–23 and 24–59 months (interaction p values 0.20–0.81), although the power of these tests was limited. The association is therefore unlikely to be explained by the indicator performing differently in older children. More plausible explanations relate to what a food group count measures. It does not capture portion size, total energy intake, preparation method, added sugar or fat, or the quality of foods within each group, and it has been validated against micronutrient adequacy rather than energy intake or adiposity [31,34]. In an urban setting, a low food group count may therefore indicate a diet dominated by staples and energy-dense foods rather than an insufficient diet. Residual confounding and chance cannot be excluded. The association was consistent when dietary diversity was analyzed as a continuous score and when the current WHO indicator (≥5 of 8 food groups) was applied to children aged 6–23 months. This finding should therefore be interpreted as an association with a previous-day food group measure, not as evidence that dietary diversity itself influences adiposity.

Previous-day consumption of fast or fried foods and sugary snacks was associated with overnutrition in this study. These findings are directionally consistent with the literature linking obesogenic dietary patterns, including processed foods, confectionery, energy-dense snacks, and fried foods, with childhood adiposity [13,14,44]. Energy-dense foods may contribute to a positive energy balance through high fat or sugar contents, palatability,

and the displacement of less energy-dense foods. Nevertheless, the present exposures represented any consumption during the previous day and did not capture quantity, habitual frequency, energy intake, food processing, or where the food was obtained. A single previous-day report reflects recent rather than habitual intake, and reverse causation is possible, for example, if caregivers modify the diets of children perceived as heavy.

This study has several strengths. Anthropometry was standardized, with duplicate measurements classified against the WHO child growth standards. Health facilities were randomly selected within ownership strata, and the prevalence was also estimated with design-adjusted models. The direction of the main associations was similar across several sensitivity analyses. The study also provides context-specific evidence from an urban Tanzanian setting, where data on dietary correlates of overnutrition in children aged 6–59 months remain limited. However, these findings should also be considered in light of important limitations. Consecutive recruitment of facility attendees and the eligibility requirement that caregivers read and write may have introduced selection bias and limited generalizability. Literacy may be associated with socioeconomic position, and restricting participation to literate caregivers may have reduced the socioeconomic heterogeneity of the study population. Dietary exposures were based on a single, caregiver-reported recall of the previous day with binary responses. This approach is appropriate for population-level feeding indicators [24] but does not capture habitual intake, portion size or energy intake. Random day-to-day misclassification would generally bias associations toward the null, whereas underreporting of energy-dense foods by caregivers of heavier children could also bias the observed findings. The WHO/UNICEF dietary diversity indicator is formally defined only for children aged 6–23 months. The evidence supporting its use in children aged 24–59 months comes mainly from a single direct validation study in a rural setting, which focused on micronutrient adequacy only [34]. Its performance has not been tested in urban Tanzanian children, and a single cut-off may not fully reflect age-related differences in diet. The evidence supporting the use of a threshold of three feeding episodes per day across children aged 6–59 months remains limited. The indicator has shown moderate accuracy but has been evaluated against nutrient adequacy rather than energy intake and has not been assessed separately among children aged 24–59 months. Nevertheless, feeding frequency was not significantly associated with overnutrition in the bivariable analysis and was therefore not included in the adjusted model. Thus, this limitation did not directly affect the study's adjusted findings or conclusions. The small number of outcome events (38 of 396 children had overnutrition) limited model complexity. Maternal body mass index, childbirth weight, household food security and other potential confounders were not comprehensively assessed. Maternal overweight and higher birth weight may be more prevalent in better-off households and are associated with child overweight [18]. Their omission may therefore have inflated the observed socioeconomic associations, although the Firth penalized estimates were consistent with the primary results.

These findings have practical implications for RCH services but should be applied proportionately. Nutrition education and counseling in urban clinics should address the double burden of malnutrition and include age-appropriate guidance on complementary feeding and food-group quality and limiting energy-dense fried foods and sugary snacks. Population-based longitudinal studies with repeated quantitative dietary assessments, maternal and early-life measures, and appropriate accounting for facility or community clustering are warranted.

5. Conclusions

This study revealed that the prevalence of overnutrition among children aged 6–59 months receiving RCH services was 9.6% (95% CI 5.9–15.2). Overnutrition was associ-

ated with caregiver age, higher caregiver education, higher household income, lower dietary diversity, and previous-day consumption of fast or fried foods and sugary snacks. RCH services should integrate routine monitoring of excessive weight gain with age-appropriate counseling on dietary quality and limiting energy-dense fried foods and sugary snacks. Counseling should include families from all socioeconomic groups. Population-based longitudinal studies using validated age-specific dietary measures and comprehensive maternal, household, and early-life information are warranted to inform childhood overnutrition prevention strategies in urban Tanzania.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/children13111606/s1, File S1: STROBE Statement—Checklist of items that should be included in reports of cross-sectional studies. Table S2: Sensitivity analyses of adjusted associations with overnutrition.

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Abbreviations

The following abbreviations are used in this manuscript:

aPOR	Adjusted prevalence odds ratio
CI	Confidence interval
cPOR	Crude prevalence odds ratio
DHIS2	District Health Information Software 2
IQR	Interquartile range
IYCF	Infant and young child feeding
LMICs	Low- and middle-income countries
MUHAS	Muhimbili University of Health and Allied Sciences
RCH	Reproductive and child health
SD	Standard deviation
SSA	Sub-Saharan Africa
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
TDHS-MIS	Tanzania Demographic and Health Survey and Malaria Indicator Survey
TZS	Tanzanian shilling
UNICEF	United Nations Children's Fund
WHO	World Health Organization
WHZ	Weight-for-height Z score
WLZ	Weight-for-length Z score

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