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Consumption frequency of ultra-processed foods and beverages among 6- to 36-month-olds in Kampala, Uganda

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Abstract

The nutrition transition in sub-Saharan Africa has led to increased consumption of ultra-processed foods in infancy, especially sweet foods. This has heightened the risk for nutrition-related non-communicable diseases, including dental caries and overweight/obesity, and promotes poor food choices later in life. The present study used a cross-sectional design to investigate the consumption frequency of ultra-processed foods and beverages among urban 6- to 36-month-olds attending four selected health facilities in Kampala using a standardised questionnaire and 24-h diet recall record. The primary outcome was the consumption of at least one ultra-processed food or beverage (UPFB) the previous day, and frequency of UPFB consumption of the week before was the secondary outcome. Four hundred and ten caregiver–child pairs were randomly recruited, 94% of caregivers being mothers with a mean age of 30.7 (±5.3) years. Fifty-nine per cent of mothers and 73% of fathers had attained a college education. The median age of children was 18 months and 51% were female. Most children (57%) consumed at least one UPFB the previous day. In the week before, 69% had consumed UPFB frequently (4–7 days) which was significantly positively associated with maternal education (odds ratio [OR] = 2.85, 95% confidence interval [CI]: 1.02–7.96, $p = 0.045$) and child's age ([OR = 2.87, 95% CI: 1.62–5.08, $p < 0.001$], [OR = 3.68, 95% CI: 1.88–7.20, $p < 0.001$]). In conclusion, the dietary habits of the surveyed Ugandan population were unhealthy, characterised by the frequent consumption of UPFB with added sugar. There is an urgent need to re-enforce existing Ugandan food regulation guidelines and policies and to build strong nutritional education programmes to enhance health-promoting environments in early childhood.

KEYWORDS

added sugar, commercial complementary foods, complementary feeding, nutrition transition, snacks, sugar-sweetened beverages, Uganda, ultra-processed foods, unhealthy diet

1 | INTRODUCTION

There is a worldwide increase in the use of highly processed foods (ultra-processed), especially in low- and middle-income countries (LMIC) (Fanzo et al., 2019). Commercial food products are a significant contributor to the total dietary energy among infants and young children (IYC) in high-income countries and are often sweetened (Theurich et al., 2020). In sub-Saharan Africa (SSA), consumption is primarily driven by a general nutritional transition in the region where people of all age groups are gradually changing from consuming traditional diets rich in fibre and micronutrients as they switch to the ultra-processed 'westernised diets', high in sugar, fat and salt and low in fibre and nutrients (Tschirley et al., 2015). The transition is also currently taking place in Uganda especially in urban dwellings (Auma et al., 2019). In early childhood, this includes processed foods during early childhood is characterised by commercially available complementary foods (CACFs), formula (Baker et al., 2016), commercially produced snacks, beverages and a concomitant reduced consumption of home-prepared complementary foods (Pries et al., 2017). Inadvertently, this transition is influenced by commercial determinants of health—actions of the private sector intended for their profiteering that are affecting public health negatively (de Lacy-Vawdon & Livingstone, 2020; Kearns & Watt, 2019).

A high consumption of sugar-containing ultra-processed foods during early childhood is associated with an increase in the likelihood of nutrition-related non-communicable diseases (NR-NCDs), for example, dental caries, as well as early childhood caries (ECC) among children (American Academy of Pediatrics, 2020; Gupta et al., 2013) and overweight or obesity (OWO) (Danquah et al., 2020; Popkin, 2002). OWO in early childhood is a strong predictor of adult obesity, morbidity (other NCDs) and mortality (Zhang et al., 2013). Additionally, early childhood is an important period for getting accustomed to various tastes and textures that determine food choices later in life. The intake of sugar or sweeteners in infancy and early childhood influences the acquisition of taste patterns which establish sweet preferences in later life (Mennella, 2014). However, studies have also shown that there is no nutritional requirement for free sugars (Sheiham & James, 2014); instead, free sugars provide significant energy without specific nutrients (WHO and FAO, 2003). Due to such concerns, the WHO provided evidence-based guidelines for free sugar consumption to be limited to 10% of the total energy intake and preferably a further reduction to less than 5% for dental health (WHO, 2015).

In most SSA, there is a double burden of malnutrition, namely the highly prevalent undernutrition and micronutrient deficiencies among IYC and a gradual increase in over-nutrition as evidenced by an increase in OWO among children in SSA (Steyn & McHiza, 2014). This increase in obesity has been reported over the last decades in richer African countries like South Africa (Popkin & Ng, 2022) but with fewer national figures from Uganda. About 5% of children under 5 years were OWO compared to 28% who were undernourished (Sserwanja et al., 2021). Nevertheless, going by the adult reports of greater proportions of over-nutrition among urban than rural females (Yaya & Ghose, 2019), this can be used to infer that, similarly, this could be happening among younger children. Therefore, it is possible for urban, affluent populations to have a bigger burden of this condition (Ngaruiya et al., 2017). Given these changing trends in diet, especially among urban populations, if no public health interventions are taken, Uganda might soon be faced with similar challenges of increasing over-nutrition among children and an established double burden of malnutrition.

Primarily, most of the efforts in Uganda, including research, nutritional interventions and policies, have focussed on undernutrition. This has consequently left a gap in addressing a public health challenge of other nutrition-related NCDs like dental decay and over-nutrition that is steadily increasing and insidiously affecting the population in early childhood. The present study, therefore, investigated consumption frequency of ultra-processed foods and beverages (UPFBs) among urban/peri-urban aged 6–36 months.

Key messages

- The frequent consumption of ultra-processed food or beverage (UPFB) in a Ugandan urban population during the complementary feeding period is an indication of an established nutrition transition.
- The frequent consumption of UPFB is characterised by a high sugar content and sweetened diet and therefore the potentially has health detriments in young children.
- There is an urgent need to promote traditional diets and minimally processed foods for complementary feeding and introduce policies that discourage consumption of UPFB in early childhood.

2 | METHODS

A cross-sectional descriptive survey was carried out from October to December 2021 in Kampala, the capital city of Uganda. Kampala district is fully urbanised. The neighbouring district urbanisation rates are 40%–50% (Uganda Bureau of Statistics [UBOS], 2016). Most of the working population travels from neighbouring peri-urban areas to the capital city for work and to access services, including seeking health care. Kampala metropolitan has a heterogeneous population comprising several ethnic groups, but English is the official language of communication, while the majority of the indigenous population speaks Luganda. Kampala city population is about 1.7 million and 6.7 million when the neighbouring population is included (Kampala City Council Authority (KCCA) and UBOS, 2019). There are approximately 906 facilities that provide maternal and child services, 6 of which are paediatric specialist centres. The study target population was the caregivers and children aged 6–36 months, attending selected health facilities. The target age group was 6–36 months, aligning with WHO recommendations to start complementary feeding at 6 months

(WHO, 2005). This range also follows the 'Codex Guidelines on formulated complementary foods for older infants and young children', which considers young children as up to 3 years old (FAO and WHO, 1981).

2.1 | Definition of ultra-processed food and beverages

UPFBs were defined as industrial formulations and prepackaged typically with several ingredients such as sugar, oils, fats, salt, antioxidants, flavourings and colourants. They are usually ready to eat or drink or require brief heating before consumption (Monteiro et al., 2017). This definition excluded the locally minimally processed cereals (without additives and require boiling during preparation), commonly used for porridge. Since the study was targeting the complementary period, the UPFB definition excluded formula because it is a breast milk substitute intended to supplement breastfeeding rather than complement it. UPFBs were further categorised as CACFs defined as processed packaged products with a label or image indicating that the product is intended for young children less than 3 years old (Sweet et al., 2016). The other category was industrially manufactured foods intended for the general population which included snacks, sugar-sweetened beverages (SSB) and any other ultra-processed foods commonly fed to IYC in Uganda. Snacks included sweets, ice cream, biscuits, breakfast cereals, grain snacks and sweetened baked products or confectionary like bread, cakes, cookies, doughnuts and buns. The SSB included prepackaged fruit drinks, soft drinks, sweetened/flavoured yoghurt or milk, artificially sweetened beverages and sweetened purees.

2.2 | Sample size and sampling

Using the formula for calculating survey proportions, the following were used $Z = 1.96$ (95% confidence), expected proportion, $p = 0.23$ (from prevalence of snack consumption of 23.1% reported in Dar-es-Salaam (Vitta et al., 2016), precision, $d = 0.06$. A factor of 2 was used as a multiplier to adjust for the design effect due to multi-stage cluster sampling. Additionally, 10% was added to cater for non-response, giving a final sample size of 416. A multi-stage cluster sampling technique was used to select the primary sampling unit. Random sampling of 3/5 divisions in Kampala and thereafter purposive selection of one health facility based on the type, size and utilisation rates of child health services. The different types (private, public or private-not-for-profit) serve different categories of populations based on socioeconomic class. The bigger private facilities serve higher income groups (Uganda Bureau of Statistics [UBOS] ICF, TDP, 2018; UBOS, The DHS Program (ICF), 2018). Additionally, a private paediatric clinic from a neighbouring district was selected to represent the more urbanised Kampala metropolitan population. The average monthly utilisation rates were used to allocate clusters using probability proportional to size for each child age category (6–11.9, 12–17.9, 18–23.9) from each of the selected four facilities. The 24–36 months' age group had an additional 20% to cater for its broader age range. The number (n) of caregiver–child pairs was selected using systematic random sampling which was the primary sampling unit. The sampling interval at this stage was determined by dividing the monthly average utilisation rate by the required number of caregiver–child pairs. Caregivers younger than 18 years, those with limited communication in English or Luganda and very ill children were excluded.

2.2.1 | Data collection

The recruitment procedures and the research tools were translated into Luganda, piloted and tested at a nearby government health facility not selected for the main study. A researcher-administered standardised structured questionnaire was used in an electronic data collection form (Open Data Kit Collect). Additionally, a paper-based data collection form for the qualitative 24-h diet recall without portion sizes was used. A pictorial food chart determined through piloting of common foods was used to aid recall. The questionnaire was adopted from previous studies (Olatona et al., 2017; Pries et al., 2019) with additional questions on the source of nutritional information and contextual socioeconomic measures (UBOS, ICF, TDP, 2018; UBOS, The DHS Program (ICF), 2018). All quantitative variables child age, maternal age and sibling number were collected in a raw, unaltered format. The marital status, parental education and occupation and regularity of income variables were listed and the respondent selected one. The respondents were interviewed on all days of the week to avoid bias with the 24-h recall due to the day-of-the-week effect at the group level (Tarasuk & Beaton, 1992). The 24-h recall data were a list of itemised foods, snacks and drinks, including breastfeeding throughout the morning of the previous day and the night till the morning of the interview. For nontraditional meals, research assistants obtained further descriptions including asking about the details of brands and flavourings of specific items, preparation, for example, instant cereal, packaged juice, flavoured packaged milk or yoghurt. UPFBs were later established using the study definition after the principal researcher reviewed the product packaging images for label information to confirm the content and level of processing based on the study definition. Data on food frequency the previous week were through a list of items and the frequency with five choices: everyday, at least 4 days, 1–3 days, less than once a week and never. This list included processed food items.

2.2.2 | Data management and analysis

Study data were checked daily for accuracy and completeness. All data were merged in Stata. Continuous variables were summarised at univariate analysis using means and standard deviations or medians and interquartile ranges. Categorical variables were described using

frequencies and proportions. One of the variables, socioeconomic status, was derived with tertiles (three equal groups: first/lowest, middle and the highest) using principal component analysis of six household characteristics (UBOS, ICF, TDP, 2018; UBOS, The DHS Program (ICF), 2018). Maternal age was categorised into young mothers (≤25 years), adult mothers (26–30 and 31–35) and advanced mothers (≥36 years) based on expert knowledge. The primary outcome variable—consumption of at least one commercial baby food item on the preceding day—was measured as a binary outcome (Yes or No). Children who were sick on the day in question were eliminated to from this analysis. The secondary outcome was the consumption frequency of ultra-processed baby foods the week before the interview, an ordinal outcome categorised as frequently (4–7 days a week), moderately (1–3 days a week) or never, and ordinal logistic regression was used for both bivariate and multivariate analyses to assess the associated factors. The analysis included checking for collinearity and outliers, and the chunk test was used to check for interaction. Stratified analysis was used to control for confounding; if a variable had a percentage difference of 10 or more between the crude and adjusted odds ratios, it was considered to confound the relationship. Overall, 95% confidence intervals were used to determine their statistical significance.

3 | RESULTS

A total of 410 children aged 6–36 months were randomly recruited for the study. Just over half (51.2%) were female and 42.7% were aged between 13 and 23 months with a median age of 18 months. Table 1 summarises their socio-demographic characteristics.

3.1 | The proportion of children aged 6–36 months that consumed ultra-processed foods the previous day (UPFB) in Kampala

Only 403 children's results were included in the analysis of UPFB consumption as seven were very sick the day after recruitment. Overall, 56.6% (n = 228/403) of caregivers reported using at least one UPFB and 54.1% (n = 153/286) among 6- to 23-month-olds. Almost a quarter (24.8%) of children fed on two or more items. Table 2 summarises the use of UPFB by parental and child characteristics. Among these were commercially available complementary food (CACF) like infant/baby cereals consumed by 26.1% and 26.6% overall and by 6- to 23-month-olds, respectively, with ease of preparation being the commonest reason (77.9%) for their use.

Over a third (35.2%) of children and 35.7% of 6- to 23-month-olds had consumed at least one SSB like soda, juice drinks and sweetened dairy products. The most commonly consumed SSB was sweetened yoghurt (29%, n = 118). Reasons given by caregivers for

TABLE 1 Socio-demographic characteristics of parents and their children aged 6–36 months and other maternal characteristics (n = 410).

Variable	n	%
Child characteristics		
Child's sex		
Female	210	51.2
Male	200	48.8
Child's age (n = 410) (months)		
6–12 (infants)	116	28.3
13–23	175	42.7
24–36	119	29.0
Sibling number (n = 410)		
No sibling	135	32.9
1 sibling	144	35.2
2 or more siblings	131	31.9
Parental characteristics		
Maternal education level (n = 394)		
None/primary level	45	11.4
O levels completed	54	13.7
A levels/Technical/Vocational	62	15.7
College/University	233	59.1
Paternal occupation (n = 361)		
Unemployed	20	5.5
Business	97	26.9
Skilled, sales, services	38	10.5
Professional	206	57.1
Paternal education level (n = 358)		
O levels or less completed	61	17.0
A levels/Technical/Vocational	35	9.8
College/University	262	73.2
Parental income (n = 285)		
Irregular	37	13.0
Regular	248	87.0
Socioeconomic status (n = 395)		
1st (lowest)	133	33.7
2nd (middle)	147	37.2
3rd (highest)	115	29.1
Maternal health care and nutritional education-related characteristics		
Mother ever attended antenatal care (ANC) (n = 385)		
No	49	12.7
Yes	336	87.3

TABLE 1 (Continued)

Variable	*n*	%
Mother ever attended a nutritional class during ANC (*n* = 336)		
No	215	64.0
Yes	121	36.0

Note: SES was derived from a principal component analysis of home ownership, floor type, drinking water source, fuel type, toilet type and land ownership with initial categorisation similar to those used to describe household characteristics by Uganda National Bureau of Statistics (UNBS) in demographic health surveys (Uganda Bureau of Statistics [UBOS], ICF, TDP, 2018; UBOS, The DHS Program (ICF), 2018).

using yoghurt included the child's preference (72.9%), perceived healthiness (58.9%) and suitability for children with poor appetite (28%).

Thirty-two per cent and 24.8% of all children and 6- to 23-month-olds consumed snacks, respectively. Confectionery like bread, buns and doughnuts was consumed by 23.3% of all children. Other snacks included biscuits, breakfast cereals, chocolate, sweets and potato crisps.

More than half of the children (53%) had been fed formula food since birth; however, notably, the current consumption of formula was by only 4.9% (*n* = 20).

3.2 | Consumption frequency of UPFBs among 6- to 36-month-old children in Kampala

Among the 410 children, 83.9% consumed at least one ultra-processed food and beverage (UPFB) at least once a week. Further breakdown showed that 79.3%, 63.9% and 71.2% consumed CACF, snacks and SSB at least once, respectively. Among the 291 children aged 6–23 months, the corresponding percentages were 82.8%, 36.8% and 49.8%, respectively. Table 3 summarises the weekly consumption frequency of UPFBs with respect to sociodemographic and health-related characteristics.

When considering consumption frequency, 69.0% of caregivers reported that children consumed at least one UPFB frequently (4–7 days a week). Confectionery was the most frequently consumed snack, followed by breakfast cereal (Figure 1a). SSB consumption was also notable, with nearly two-thirds of children consuming at least one SSB once or more within the week (Figure 1b).

On the other hand, nearly two-thirds (65.2%, *n* = 260/399) consumed at least one SSB once or more within the week, and almost half of these (45%, *n* = 117/260) consumed them daily. Although the least consumed SSB was soft drinks (13.3%, *n* = 53/398), a more significant proportion (64.2%, *n* = 34/53) consumed it daily (Figure 1b). The frequent consumption of UPFB was highest among children whose fathers had higher education or were professionals, as well as those who had ever been formula-fed.

3.3 | Association between family/child characteristics and weekly frequency of consumption of UPFBs among 6- to 36-month-old children in Kampala

Bivariate analysis was conducted to identify variables with a $p \leq 0.2$, which were then included in the multivariable model. Variables such as mothers' age, mothers' and fathers' education levels, socioeconomic status, child's age and sibling number were considered. Table 4 summarises the independent associations of these factors.

Using multivariate analysis, it was found that 13- to 23-month-olds and 24- to 36-month-olds had significantly higher odds of more frequent UPFB consumption (2.87 and 3.68 times, respectively) compared to 6- to 12-month-olds ([OR = 2.87, 95% CI: 1.62–5.08, $p < 0.001$] and [OR = 3.68, 95% CI: 1.88–7.20, $p < 0.001$]). Children whose mothers had a college education also had higher odds of more frequent UPFB consumption. The relationship between maternal education level, sibling number and UPFB consumption was confounded by socioeconomic score, while paternal education level confounded the association between maternal education level and UPFB consumption.

4 | DISCUSSION

In the present study, 57% of children had consumed UPFB the previous day. Among children aged 6–23 months, 27% consumed CACF, 36% consumed SSB and 25% consumed snacks. These findings concurred with one from Nepal where 25% of 6- to 23-month-olds consumed CACF (Pries et al., 2016) but much higher than in other LMIC studies (3%–5%) (Pries et al., 2016; Vitta et al., 2016). The difference in findings with another East African population, Zanzibar, at 3% (Vitta et al., 2016) might be due to social and cultural differences in feeding practices (Batalha et al., 2017), with some populations, like urban Ugandans, probably being more adaptable to CACF.

CACF, when appropriately formulated, improves nutritional status by providing essential micronutrients like iron, calcium, zinc and vitamins during the complementary period (PAHO and WHO, 2003; Phu et al., 2012; Pries et al., 2016). However, high consumption of nutritionally unsuitable CACF with high sugar content is concerning (Hutchinson et al., 2021; Maalouf et al., 2017; Marais, 2016). CACF can sometimes be nutrient poor, especially cereals for porridge (Dimaria et al., 2018). Most commonly used CACF in low-income countries are cereal based (Aryeetey & Tay, 2015; Pries et al., 2017) and used ubiquitously (Theurich et al., 2022). If lacking in essential micro-nutrients, they will hamper a child's diet from meeting the nutrient requirements. Thus, the high consumption of CACF among urban Ugandans highlights the need for guidelines and regulation of their nutritional composition.

The present study found that 36% consumed SSB, consistent with studies from Cambodia (Pries et al., 2016) and Indonesia (Green et al., 2019). Sweetened yoghurts were the most consumed SSB at

TABLE 2 Proportion of ultra-processed food and beverage consumption within 24 h among 6- to 36-month-olds from selected health facilities in Kampala ($n = 403$[a]).

Variable overall	No (n/%) 77 (19.1)	Yes (n/%) 326 (80.9)	95% CI: 76.7–84.4	Chi-square p value
Marital status ($n = 392$)				
Unmarried	20 (48.8)	21 (51.2)	36.0–66.2	0.482
Married	151 (43.0)	200 (57.0)	51.7–62.1	
Maternal age ($n = 387$), years				
≤25	32 (50.0)	32 (50.0)	37.9–62.1	0.069[b]
26–30	67 (50.4)	66 (49.6)	41.2–58.1	
31–35	44 (36.7)	76 (63.3)	54.3–71.5	
≥36	26 (37.1)	44 (62.9)	50.9–73.4	
Maternal education level ($n = 387$)				
None/primary level	86 (37.4)	144 (62.6)	56.1–68.6	0.021[b]
O levels completed	29 (56.9)	22 (43.1)	30.2–57.1	
A levels/Technical/Vocational	30 (49.2)	31 (50.8)	38.3–63.2	
College/University	24 (53.3)	21 (46.7)	32.6–61.3	
Paternal education level ($n = 352$)				
O levels or less completed	35 (58.3)	25 (41.7)	29.8–54.5	0.006[b] ©
A levels/Technical/Vocational	16 (45.7)	19 (54.3)	37.6–70.0	
College/University	93 (36.2)	16 (63.8)	57.7–69.5	
Paternal occupation ($n = 354$)				
Unemployed	11 (55.0)	9 (45.0)	24.8–66.9	0.027[b]
Business	48 (50.0)	48 (50.0)	40.0–60.0	
Skilled, sales, services	17 (44.7)	21 (55.3)	39.2–70.3	
Professional	68 (34.0)	132 (66.0)	59.1–72.3	
Parent's income ($n = 281$)				0.461
Irregular	18 (48.7)	19 (51.3)	35.4–67.0	
Regular	103 (42.2)	141 (57.8)	51.5–63.9	
Socioeconomic status ($n = 395$)				
First (lowest)	67 (51.5)	63 (48.5)	39.9–57.0	0.056[b]
Second (middle)	56 (38.9)	88 (61.1)	52.8–68.8	
Third (highest)	44 (38.6)	70 (61.4)	52.1–69.9	
Child's sex ($n = 403$)				
Female	91 (44.2)	115 (55.8)	48.9–62.5	0.756
Male	84 (42.6)	113 (57.4)	50.3–64.1	
Child's age ($n = 403$) (months)				
6–12 (infants)	66 (54.9)	48 (42.1)	33.3–51.4	0.001[b]
13–23	67 (39.0)	105 (61.1)	53.5–68.1	
24–36	42 (35.9)	75 (64.1)	55.0–72.3	
Sibling number ($n = 403$)				
No sibling	60 (44.4)	75 (55.6)	47.0–63.8	0.792

TABLE 2 (Continued)

Variable overall	No (*n*/%) 77 (19.1)	Yes (*n*/%) 326 (80.9)	95% CI: 76.7–84.4	Chi-square *p* value
1 sibling	63 (44.7)	78 (55.3)	47.0–63.4	
2 or more siblings	52 (35.9)	75 (59.1)	50.2–67.3	
Ever used formula (*n* = 400)				
No	89 (48.1)	96 (51.9)	44.7–59.0	0.069[b]
Yes	84 (39.1)	131 (60.9)	54.2–67.2	
Baby breastfed last night (*n* = 403)				
No	79 (39.3)	122 (60.7)	53.7–67.2	0.096[b]
Yes	96 (47.5)	106 (52.5)	45.5–59.3	
Attended antenatal care (*n* = 379)				
No	25 (51.0)	24 (49.0)	35.2–62.9	0.257
Yes	140 (42.4)	190 (57.6)	52.1–62.8	
Mother's past nutritional class attendance (*n* = 330)				
No	86 (40.6)	126 (59.4)	52.6–65.9	0.360
Yes	54 (45.8)	64 (54.2)	45.1–63.1	

[a]Seven children were excluded from analysis because they were sick or changed their regular feeding.
[b]$p \leq 0.2$©Fischer's exact test.

32%. Only 6% consumed other beverages, which is surprisingly low compared to other low-income countries (Pries et al., 2017). Minimally processed yoghurt (made from milk and culture) is healthy in the diet (Marco et al., 2017; Salis et al., 2021), but sweetened yoghurts are considered ultra-processed when additives like sugar, flavour and colour are added (Fangupo et al., 2021; Monteiro et al., 2016). Caregivers in the study considered sweetened yoghurt a 'healthy' alternative, especially for picky eaters, but this perception poses challenges as children develop a preference for sweet flavours. High sugar content in SSB poses risks of consuming energy-dense beverages with minimal nutritional benefits and development of dental caries early in life.

Caregivers often purchase commercial food products based on children's preferences (Pries et al., 2016). Most snacks consumed in the present study were sweet, emphasising the importance of taste development for nutrition and health. Therefore, interventions should promote health-promoting tastes, including early exposure to bitter vegetables and bland flavours, limited exposure to sweet tastes at home (Mennella, 2014) and intentional introduction of traditional foods and varied vegetable tastes, even if initially unpleasant.

4.1 | Frequency of the consumption of UPFBs in the previous week

On the question of consumption in the previous week, the present study found that over 84% had consumed an UPFB at least once and 69% had consumed them frequently. Snacks were consumed by 64% and SSB by 71% at least once the week before the interview. These findings differed from an Indonesian population that consumed snacks more than SSB, 90% versus 56% (Green et al., 2019). Nevertheless, higher consumption of SSB than sweet snacks remains consistent even within the 24-h consumption in this Ugandan study population.

The only similarity between the Ugandan and Indonesian populations is that the majority consumed sweetened dairy. However, the frequency of consumption of more than 3 days a week was far higher in the present study, with four-tenths compared to a fifth in Indonesia (Green et al., 2019). Additionally, the Ugandan study shows a much higher frequent soft drink consumption of 13%, indicating that this is also of public health concern in the Ugandan urban population.

The data from the present study suggest that the frequent consumption of breakfast cereals is a unique finding in Uganda. Moreover, breakfast cereals were consumed by all age groups. This food item was not reported in studies from other LICs. Apart from a Brazilian study in Montes Claros, where 86% of the 415 children aged 6–24 months consumed breakfast cereals within the last 24 h (Lopes et al., 2020), hardly any other studies reported breakfast cereal intake in this age group. In the Ugandan population, breakfast cereal represents foods meant for the general population, which are used because they are ready to eat and, thus, very convenient.

However, the concerns surrounding the use of breakfast cereals are partly due to the high sugar content in some of the cereals and their low energy density when they contain high-fibre content, which is too complex to be digested. These cereals will satiate the young child because of their bulkiness but provide very little energy or

TABLE 3 Frequency of weekly consumption of ultra-processed foods and beverages among 6- to 36-month-old children that attended selected health facilities in Kampala ($n = 410$).

Variable	Never, *n* (%)	Moderate, *n* (%)	Frequently, *n* (%)
Overall	66 (16.1)	61 (14.9)	283 (69.0)
Marital status ($n = 399$)			
Unmarried	12.2 (11.9–31.6)	14.6 (6.6–29.2)	73.2 (57.7–84.6)
Married	16.6 (13.2–21.0)	15.1 (11.7–19.2)	68.1 (63.1–72.8)
Maternal age ($n = 394$), years			
≤25	20.0 (11.9–31.6)	15.4 (8.4–26.4)	64.6 (52.2–75.3)
26–30	17.8 (12.2–25.2)	20.7 (14.7–28.5)	61.5 (52.9–69.3)
31–35	15.4 (10.0–23.0)	13.0 (8.1–20.2)	71.5 (62.9–78.8)
≥36	7.0 (2.9–15.9)	7.0 (2.9–15.9)	80.3 (69.3–88.0)
Maternal education level ($n = 394$)			
None/primary level	33.3 (21.0–48.4)	24.4 (13.9–39.2)	14.2 (28.6–57.1)
O levels completed	22.2 (12.9–35.4)	18.5 (10.2–31.3)	59.2 (45.6–71.6)
A levels/Technical/Vocational	17.7 (10.0–29.4)	12.9 (6.5–23.9)	69.3 (56.7–79.6)
College/University	11.6 (8.1–16.4)	12.9 (9.1–17.8)	75.5 (69.6–80.6)
Paternal education level ($n = 358$)			
O levels or less completed	27.9 (17.9–40)	21.3 (12.7–33.5)	50.8 (38.3–63.2)
A levels/Technical/Vocational	14.3 (5.9–30.4)	25.7 (13.8–42.8)	60.0 (42.9–74.9)
College/University	12.9 (9.4–17.6)	12.9 (9.4–17.6)	74.1 (68.4–79.0)
Paternal occupation ($n = 361$)			
Unemployed	20.0 (7.5–43.6)	35.0 (17.3–58.1)	45.0 (24.8–66.9)
Business	16.5 (10.3–25.3)	18.5 (11.9–27.6)	64.9 (54.9–73.8)
Skilled, sales, services	21.0 (10.8–37.1)	26.3 (14.6–42.7)	52.6 (36.7–67.9)
Professional	14.1 (9.9–19.5)	11.6 (7.9–16.8)	74.3 (67.8–79.8)
Parent income regularity ($n = 285$)			
Irregular	13.5 (5.6–28.9)	10.8 (4.0–25.8)	75.7 (59.1–86.9)
Regular	14.9 (10.9–19.9)	14.9 (10.9–19.9)	70.2 (64.1–75.5)
Socioeconomic status ($n = 395$)			
First (lowest)	24.8 (18.2–32.9)	21.1 (14.9–28.9)	54.1 (45.5–62.3)
Second(middle)	12.2 (7.8–18.6)	13.6 (8.9–20.2)	74.1 (66.4–80.6)
Third (highest)	12.2 (7.3–19.6)	6.9 (3.4–13.3)	80.9 (72.6–87.1)
Child's sex ($n = 410$)			
Female	14.3 (10.1–19.7)	13.3 (9.3–18.7)	72.4 (65.9–78.0)
Male	18.0 (13.2–23.9)	16.5 (11.9–22.3)	65.5 (58.6–71.8)
Child's age ($n = 410$), months			
6–12 (infants)	31.9 (24.0–40.9)	17.2 (11.4–25.3)	50.9 (41.87–59.9)
13–23	10.9 (7.0–16.4)	14.3 (9.8–20.3)	74.8 (67.9–80.8)
24–36	8.4 (4.5–15.0)	13.4 (8.4–20.9)	78.1 (69.8–84.7)
Sibling number ($n = 410$)			
No sibling	19.2 (13.4–26.8)	14.1 (9.1–21.1)	66.7 (58.2–74.1)

TABLE 3 (Continued)

Variable	Never, *n* (%)	Moderate, *n* (%)	Frequently, *n* (%)
1 sibling	6.9 (3.7–12.5)	15.9 (10.8–22.9)	77.1 (69.5–83.2)
2 or more siblings	22.9 (16.5–30.9)	14.5 (9.4–21.8)	62.5 (53.9–70.5)
Ever used formula (*n* = 407)			
No	20.5 (15.3–26.9)	16.3 (11.7–22.3)	63.2 (56.0–69.7)
Yes	11.5 (7.9–16.5)	13.4 (9.4–18.6)	75.1 (68.9–80.4)
Baby breastfed last night (*n* = 410)			
No	6.9 (4.1–11.4)	16.3 (11.8–22.1)	76.7 (70.4–82.1)
Yes	25.0 (19.6–31.4)	13.5 (9.4–18.8)	61.5 (54.7–67.9)
Attended antenatal care (*n* = 385)			
No	16.3 (8.3–29.6)	10.2 (4.3–22.5)	73.5 (59.3–84.0)
Yes	16.7 (13.0–21.0)	16.1 (12.5–20.4)	67.2 (62.0–72.1)
Mother's past nutritional class attendance (*n* = 336)			
No	15.3 (11.1–20.8)	16.7 (12.3–22.4)	67.9 (61.3–73.8)
Yes	19.0 (12.9–27.0)	14.9 (9.5–22.4)	66.1 (57.2–74.0)

Note: Descriptive statistics: frequency (*n*) and proportions (%) and confidence intervals of proportions.

nutrients for the IYC. It was observed that all age groups consumed breakfast cereals, and this is an even more significant concern among infants because their energy needs are greater than at any other time of development (Dewey & Brown, 2003).

Furthermore, wholegrain cereals contain phytate, which binds to iron and zinc, inhibiting their absorption (Van Der Merwe et al., 2007). Unless they are fortified with zinc and iron, unsweetened or with low fibre, when mixed with fresh milk, this meal will not meet the nutritional needs of IYC. Although ready-to-eat breakfast cereals meant for older children and adults may have health benefits for these age groups (Fayet-Moore et al., 2017; Panagiotakos et al., 2008), these are generally discouraged from use in IYC (Van Der Merwe et al., 2007).

Additionally, even the one-tenth that frequently consumed soft drinks and the other tenth who consumed fruit drinks, although few, are also a subpopulation of concern. This finding also calls for other population-wide interventions that promote optimal IYC feeding practices and discourage the intake of unhealthy drinks (WHO, 2017, 2019). Such interventions in other countries, including those within Africa, have included strict label guidelines that include age recommendations and front-of-pack labelling that which indicates the sugar content of an item in a format that is easily understood (Erzse et al., 2019). Other recommendations have been to restrict the promotion and marketing of such products in places that young children frequent (WHO, 2017).

These findings also reveal that frequency measures from the week before the interview might be a more practical measure for infant and young child diets because these show habits rather than the occasional infrequent consumption of items represented in the 24-h diet recall. This is especially useful for studies that are not conducted in the community, like the present study, where participants were recruited from facilities. When the frequency is measured, it better reflects at-risk groups for which targeted interventions can be specifically designed. The 24-h diet recall was modified with a 3-day diet recall in European studies, and this, too, captured the dietary patterns better rather than the 24-h recall that represents a single day's meals.

4.2 | Factors associated with frequency of consumption of UPFBs among children aged 6–36 months

The results of the present study show that maternal education (OR = 2.85, 95% CI: 1.02–7.96, $p = 0.045$) and the child's age (13–23 months [OR = 2.87, 95% CI: 1.62–5.08, $p < 0.001$) and 24–36 months (OR = 3.68, 95% CI: 1.88–7.20, $p < 0.001$)] were significantly associated with UPFB consumption.

Frequency of consumption in the week prior was an ordinal outcome with three tertiles: 1—never, 2—moderate (1–3 days) and 3—very frequent (4–7 days), considered to provide additional information and determine if there were parental or child characteristics that were associated with consumption of ultra-processed foods. However, this outcome has not yet been used in published studies. As such, comparison with other studies is a challenge.

Other studies, mostly from different Brazilian populations, quantified consumption using several methods including count data on the number of products consumed in 24 h (Lopes et al., 2020), energy contribution using three 24-h recalls (Soares et al., 2022) or the frequency-related

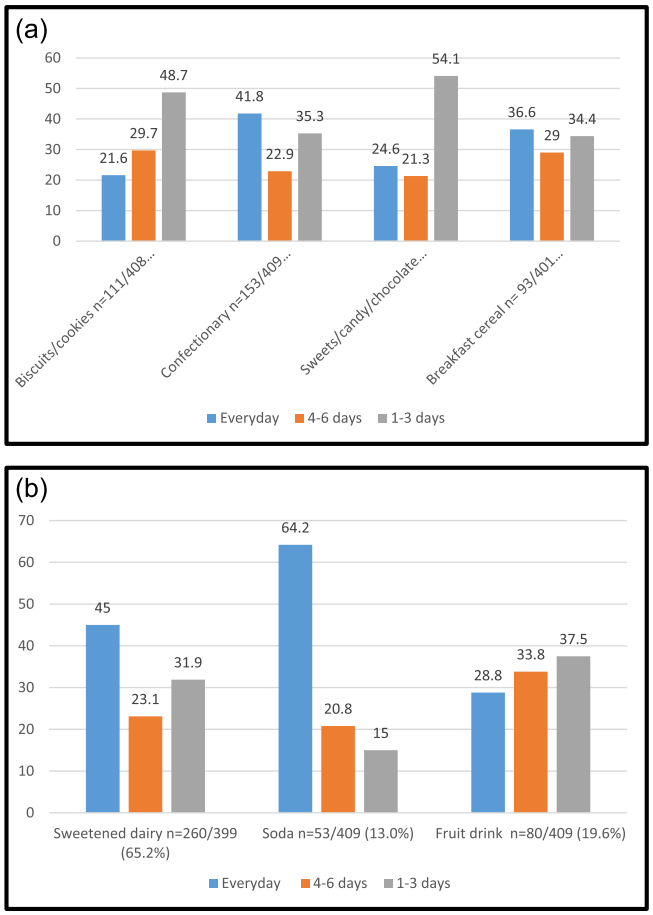

FIGURE 1 Frequency of snack and sugar-sweetened beverages (SSB) in the week before the interview. (a) Frequency of snacks consumption in the week before the interview. (b) Frequency of SSB consumption in the week before the interview.

quantitative methods (Batalha et al., 2017) or actual amounts of foods consumed were measured (Sparrenberger et al., 2015).

Consistent with the literature, the present study found that older children were more likely to consume UPFB frequently (Batalha et al., 2017; Soares et al., 2021). The frequency of consumption of all UPFB increased with age except for breakfast cereals and infant cereals. Some reasons that were gleaned from a qualitative study were that with increasing age, there is a more relaxed approach to feeding, hence, the introduction and frequent use of snacks. Snacks and beverages meant for adult consumption become more permissible with increasing age (Reynolds, 2022). It is also probable that as children grow older and become more verbally expressive and proactive in having their needs met, they can communicate their preferences. Given that most caregivers reported that they feed their children foods and beverages because 'they like them', it is expected that even as the children grow older, they reinforce this behaviour from their caregivers. As expected, these items are sweet or with other pleasant tastes and thus preferred by young children.

Ideally, IYC should become accustomed to healthy traditional family foods and their array of flavours and textures during the complementary period to promote healthier diets in future (Mennella, 2014). Moreover, the traditional cooking methods and different techniques of food preparation conferred improved nutritional composition, promoted digestion and absorption and provided additional health benefits (Salis et al., 2021). Therefore, it is of great concern that there is an increase in exposure to unhealthy UPFB instead. This sets IYC on a trajectory of poor food choices as they grow older and later in life.

In contrast to earlier findings, the maternal education level was significantly positively associated with frequent UPFB consumption. Other studies that have some form of quantification reported that fewer maternal years of schooling were associated with higher or more frequent consumption of UPFB (Batalha et al., 2017; Giesta et al., 2019; Pereira et al., 2022). Generally, low socioeconomic characteristics in high- and middle-income countries are correlated with poor feeding practices, including high consumption of UPF.

However, this trend of increasing maternal education as an associated factor cannot be dismissed as a coincidental finding. It reiterates the postulation derived in the present study that favourable socioeconomic characteristics in the urban Ugandan setting influence unhealthy dietary habits of IYC related to ultra-processed foods. This is further demonstrated by the positive association with other socioeconomic indicators in the present study at bivariate analysis: maternal age, paternal education, paternal occupation and socioeconomic score.

In high- and middle-income countries, increased schooling and other socioeconomic characteristics are believed to present greater opportunities for caregivers to access information on healthy eating practices in such countries (Giesta et al., 2019), as well as higher socioeconomic characteristics like education can be correlated with higher family income. Income increases access and affordability to healthier but more expensive foods like fruits, vegetables and meat (Relvas et al., 2019). On the contrary, in the present study, the most frequently consumed UPFBs—sweetened yoghurt, infant cereals (instant), breakfast cereals and confectionery—are more expensive items that might not be affordable for lower socioeconomic populations.

Therefore, as highlighted by several authors concerning the nutrition transition in LICs, their economic growth has greatly influenced the transition, especially income per capita. This has led to increased affordability of a variety of processed and ultra-processed foods, which has inevitably led to increased consumption of foods that contain high amounts of fat and sugar, and edible oils as opposed to the local staple foods (Popkin et al., 2012; Vorster et al., 2011). This is further demonstrated by African (Adamo et al., 2011) and Ugandan (Nakaggwa, 2019; Nawangi, 2013) data from older age groups where children and adolescents in private schools—a proxy for higher socioeconomic status—are likely to be overweight and obesity (OWO) compared to those from public schools.

4.3 | Use of formula

While initially favouring formula, most individuals in low-income countries like Uganda ultimately opt for cheaper alternatives such

TABLE 4 Factors associated with weekly consumption frequency of ultra-processed foods and beverages among 6- to 36-month-old children attending selected health facilities in Kampala ($n = 410$).

Variable overall	Unadjusted OR	95% CI	*p* Value	Adjusted OR	95% CI	*p* Value
Marital status ($n = 399$)						
Unmarried	Ref	Ref				
Married	0.77	0.38–1.57	0.473			
Maternal age ($n = 394$), years						
≤25	Ref	Ref	Ref			
26–30	0.93	0.51–1.70	0.821			
31–35	1.38	0.73–2.59	0.315			
≥36	2.18	1.01–4.69	0.047*			
Maternal education level ($n = 394$)						
No education/primary level completed	Ref	Ref	Ref	Ref	Ref	Ref
O levels completed	1.90	0.88–3.99	0.09*	2.37	0.90–6.23	0.079
A levels/Technical/Vocational	2.84	1.33–6.07	0.007*	2.50	0.85–7.37	0.096
College/University completed	4.02	2.16–7.44	<0.001*	2.85	1.02–7.96	0.045**
Paternal occupation ($n = 361$)						
Unemployed	Ref	Ref	Ref			
Business	1.85	0.76–4.50	0.173*			
Skilled, sales, services	1.19	0.14–3.19	0.731			
Professional	2.77	1.18–6.46	0.018*			
Parent income regularity ($n = 285$)						
Irregular	Ref	Ref	Ref			
Regular	0.77	0.35–1.77	0.527			
Paternal education level ($n = 358$)						
O levels or less completed	Ref	Ref	Ref	Ref	Ref	Ref
A levels/Technical/Vocational	1.61	0.72–3.58	0.246	1.21	0.49–3.03	0.669
College/University	2.74	1.58–4.75	<0.001*	1.23	0.54–2.82	0.624
Socioeconomic status ($n = 395$)						
First (lowest)	Ref	Ref	Ref	Ref	Ref	Ref
Second (middle)	2.38	1.45–3.88	0.001*	1.25	0.62–2.51	0.525
Third (highest	3.34	1.89–5.90	<0.001*	1.80	0.80–4.03	0.155
Child's sex ($n = 410$)						
Female	Ref	Ref	Ref			
Male	0.73	0.48–1.10	0.137*			
Child's age ($n = 410$), months						
6–12 (infants)	Ref	Ref	Ref	Ref	Ref	Ref
13–23	3.13	1.92–5.09	<0.001**	1.62–5.08	<0.001**	1.62-5.08
24–36	3.78	2.16–6.60	<0.001**	1.88–7.20	<0.001**	1.88-7.20
Sibling number ($n = 410$)						
No sibling	Ref	Ref	Ref	Ref	Ref	Ref
1 sibling	1.82	1.08–3.06	0.024*	1.81	0.94–3.47	0.074
2 or more siblings	0.82	0.50–1.34	0.441	0.83	0.45–1.51	0.549

(Continues)

TABLE 4 (Continued)

Variable overall	Unadjusted OR	95% CI	*p* Value	Adjusted OR	95% CI	*p* Value
Ever used formula						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.80	1.18–2.74	0.006*	1.58	0.9–2.7	0.098
Baby breastfed last night						
No	Ref	Ref	Ref			
Yes	0.43	0.28–0.66	<0.001*			
Attended antenatal care (*n* = 379)						
No	Ref	Ref	Ref			
Yes	0.78	0.40–1.52	0.462			
Mother's attendance of nutritional class (*n* = 336)						
No	Ref	Ref	Ref			
Yes	0.89	0.56–1.41	0.620			

Note: Ref is the baseline comparative group whose unadjusted or adjusted OR is '1'.

*$p \leq 0.2$.

**$p \leq .\ 0.05$.

as fresh milk or yogurt probably due to the high cost of formula (Sewannonda et al., 2022). Surveys consistently show low formula usage in Uganda, with only 12% of infants in Wakiso consuming it compared to 40% consuming cow's milk before 6 months (Ssemukasa & Kearney, 2014). National data indicate just 1% reliance on formula (UBOS, ICF, TDP, 2018; UBOS, The DHS Program (ICF), 2018).

Given the widespread preference for non-formula dairy substitutes, IYC policy must promote safe and adequate dairy product use during complementary feeding. This requires collaboration with multi-sectoral policy frameworks to ensure optimal nutrition practices. Efforts should encourage consumption of minimally processed, nutritionally suitable dairy products while discouraging unhealthy alternatives.

4.4 | Commercial determinants of health

In the overall considerations of the nutrition transition, the role of 'commercial determinants of health' (CDoH) cannot be ignored. Big corporations, many of these transnational, have fuelled the transition by their active role in adversely influencing health due to their profit motives (de Lacy-Vawdon & Livingstone, 2020). Among the strategies, the sugar industry has employed include preventing the sugar policy by counteracting any efforts by public health advocates to describe public health problems and thereby promoting unhealthy diets—the overconsumption of UPFBs. Such actions go as far as providing contradicting statistics, downplaying the severity of health conditions, and when solutions are proposed, they claim they are too costly and impractical (Kearns & Watt, 2019). Thus, as far as the drivers of NCDs like caries and OWO (sometimes known as industrial epidemics) are concerned, the manufacturers are the 'vectors', and the unhealthy commodities that is UPFBs act as the 'agents' while the individuals are the 'hosts' (Jahiel & Babor, 2007).

To address these CDoH, international guidelines specific for baby foods have indicated that any foods with added sugar should not be marketed or promoted by labelling them as appropriate for younger age groups (WHO, 2019).

4.5 | Study limitations

This facility-based study was chosen over a community-based approach due to challenges accessing participants during the COVID-19 lockdown and afterward. However, facility-based studies may bias towards those seeking regular health services, and purposive selection may not ensure a representative sample. To address this, efforts were made to include various urban populations across different service contexts and geographic locations, enhancing the external validity of the findings for Uganda's urban infant and young child population.

5 | CONCLUSION

The present study reveals a high consumption of UPFBs during the complementary period which could potentially increase the risk of malnutrition, such as overweight/obesity or micronutrient deficiencies, displacing more nutritious foods, as demonstrated in a study from another LMIC setting (Pries et al., 2019). UPFBs contribute significantly to energy intake among IYC, often containing added sugar. Sugar poses risks for ECC, a chronic condition, and also sets up

these children on a life course for poor food choices because of the adaptation to sweet and palatable foods. The popular use of sweetened dairy products as a milk substitute highlights the issue of 'hidden sugars' and the low awareness of nutritious foods for children's needs and possibly the potential health effects of consuming unhealthy products.

These findings provide baseline evidence on consumption of UPFBs for researchers, health workers, policymakers and stakeholders concerned about urban infant and young child (IYC) nutrition in Uganda. The findings highlight the need for LMICs to acknowledge the nutrition transition paradigm and develop guidelines and policies to address current health promotion needs and challenges in complementary feeding.

However, there is need for further research in such urban populations on the health effects of overconsumption of these UPFBs as well as interventions that could promote better food choices for optimum IYC nutrition. Future research should also consider using quantitative food frequency questionnaires as part of the dietary assessments in this subpopulation.

Finally, there is great urgency to address the role of commercial determinants of health in Uganda. Policies that discourage the overconsumption of UPFBs in the youngest population are urgently required and could include the use of warning labels (Ares et al., 2023) and clear messages on their inappropriateness for the younger children (WHO, 2019) so as to increase consumer awareness and fiscal policies to reduce purchases (Ahaibwe et al., 2021).

AUTHOR CONTRIBUTIONS

Catherine L. Mwesigwa conceived and refined the research idea, drafted the initial proposal and was involved in the whole research process, drafting the manuscript and all revisions. Sudeshni Naidoo guided the entire research process from the conception of the research idea, contributed to the drafting of the manuscript and critically analysed it for publication. Both authors gave the final approval of the version to be published.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

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

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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