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Determinants of nutrition status in children aged 6-59 months, in kiandutu informal settlement, Thika, Kenya

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Abstract
Introduction: Globally, more than 80% of countries face different forms of malnutrition which attribute to about 45% of deaths in children. The 2019 Global Nutrition Report indicated that under-five malnutrition rates remain high. Under-five undernutrition is the most common form of malnutrition in low- and middle-income countries, and Africa experiences high levels (36%). The majority of the undernutrition cases in Africa are concentrated in Sub-Saharan Africa, including Kenya.
Objective: This study aimed to assess determinants of nutritional status of children aged 6-59 months in Kiandutu informal settlement; Thika, Kenya.
Design: A community-based cross-sectional study was used. Multi staged stratified sampling followed by systematic random sampling was used to reach caregiver-child pairs from different households. A structured questionnaire was used to collect data. Anthropometric measurements were performed using standardized tools and methods. Data was analyzed using WHO-Anthro Analyzer, and IBM SPSS version 26.0.
Setting: Kiandutu Informal settlement, Thika; Kiambu County, Kenya
Participants: 170 children aged 6-59 months living in Kiandutu.
Results: The results of this study revealed that 18.8% and 34.7%children were underweight and stunted. The prevalence of wasting using WHZ was 15.3% and 9% using MUAC. Child immunization (p<0.01) and breast feeding (p<0.05) were significantly associated with underweight. Stunting was significantly associated with the house household decision maker (p<0.05), type of food feed first (p<0.05) and child well clinic visits (p<0.05). Child wasting (WHZ) was significantly associated with the house hold decision maker (p<0.01), and wasting (MUAC) was significantly associated with child age group (p<0.001), child breast feeding (p<0.05), reports of diarrhea during the last two weeks' prior the survey (p<0.01) and child wellness clinic visit (p=0.05).
Conclusion: Our results reveals that childhood malnutrition remains an important public health nutrition concern in the informal settlements. There is need to address access to sustainable diets, nutrition education and improving livelihoods of populations in informal settlements.

Keywords: nutritional status, under five, underweight, informal settlement

Introduction

Optimal nutrition in children is the cornerstone of good health [1]. About a third of the world's population lives in informal settlements, and the population is rapidly growing every year [2, 3]. Poor livelihoods in informal settlements have been linked with poor nutrition and ill-health in children [3, 4]. Childhood malnutrition is an underlying cause of the increased risk of infections, reduced quality of life, and impaired physical and cognitive development [4]. Even though poor nutrition affects the general population, children living in informal settlements have been reported to be more vulnerable to undernutrition, attributed to lack of basic needs and limited social infrastructures [5, 6, 7].

Globally, more than 80% of countries face different forms of malnutrition which attribute to about 45% of deaths in children. The 2019 Global Nutrition Report indicated that under-five malnutrition rates remain high with 149.0 million cases of stunting, 49.5 million cases of wasting, and 40.1 million cases of overweight [8]. Under-five undernutrition is the most common form of malnutrition in low- and middle-income countries, and Africa experiences high levels (36%). Stunting has declined at a global level, though the numbers in Africa have gradually increased [8] attributable to high urban poverty in informal settlements [3-7].

The majority of the undernutrition cases in Africa are concentrated in Sub-Saharan Africa, including Kenya. Despite existing interventions to address malnutrition in children in low-and middle-income countries, more than 7.5 million under-fives die every year due to infectious diseases related to malnutrition [8]. Recently Kenya has experienced episodes of severe food insecurity that exposed about 3.4 million people to acute food insecurity, resulting in 1.87 million under-fives (26%) suffered from chronic malnutrition [9-11].

In Kenya, one in five households in informal settlements is food insecure limiting their access to sufficient, safe nutritious food to meet their nutritional needs to lead a healthy and active life [12]. Urban informal settlements present challenging conditions that impact child health, nutrition, and survival [2, 3, 12]. With the steady growth of the urban poor population, the health and development of children is a key public health concern. Other health-related studies have highlighted the nutrition status of under-five children, with little focus on the determinants of nutritional status. This study aimed to assess determinants of nutritional status among children aged 6-59 months in Kiandutu Urban

informal settlement in Kiambu County, Kenya.

Methodology

Study design and setting

A community-based cross-sectional study was conducted from July–September 2019 in Kiandutu Urban Informal settlement located in Thika town, Kiambu County, Kenya. The population of the area is about 18,000 inhabitants. Children under five years of age comprise 13.3% of the total population.

Selection and recruitment of study participants

The sample size was computed using the Open Epi Source version 3.01 statistical software with the following assumptions: population size of under 5 children in Kiandutu in July 2019 was 2,395. Kiandutu settlement was stratified into 10 villages. A list of households in each village with children under five was generated through the County Health Extension Worker Housing registration. A systematic random sampling method was used to select households with children under-five. Households with more than one child aged 6-59 months, a child was selected using simple random sampling.

Data Collection

Data were collected from all eligible and consenting caregivers using the researcher administered a structured questionnaire to collect data on socio-economic, feeding practices, caregivers' health-seeking behaviors, and children's anthropometry.

Anthropometry

Children's length/height and weight were measured using standard techniques to calculate their height-for-age, weight-for-age, weight-for-height Z-scores. Weight was measured using a portable baby scale to the nearest 0.1kg, with heavy clothing and shoes removed. The length was measured using a portable horizontal wooden length board in a recumbent position and read to the nearest 0.1cm for children aged 6-23 months. Height was measured using a portable stadiometer with 0.1cm precision, with participants standing in an upright position in the middle of the board. Mid Upper Arm Circumference (MUAC) was measured by the pediatric MUAC tape and recorded to the nearest 0.1cm. Height and weight Z-scores were calculated using the WHO Anthro Survey Analyzer. Nutritional status was classified according to the WHO Growth Standards.

The anthropometric measures were interpreted using the WHO Standards for 0-59 months' children. A child whose HAZ less than -2 Standard Deviation (SD) from the reference population was defined as stunted, while a child with WHZ less than -2 SD from the reference population was classified as wasted. WAZ less than -2SD from the reference population was classified as underweight.

Statistical analysis

The anthropometric measures were computed using the WHO-Anthro survey analyzer. The statistical software package IBM SPSS version 26.0 was used to conduct data analysis. The quantitative data were summarized using descriptive statistics. Descriptive analysis was used to describe the proportions and frequencies of the respondents to summarize the study variables. Bivariate analyses were conducted for the four outcome variables: underweight, stunting, and wasting (using both WHZ WHO and MUAC) separately. Multinomial logistic regression was used to identify determinants of underweight, stunting, and wasting. Association with a p-value < 0.05 were considered statistically significant.

Results

Socio-demographic and economic characteristics

A total of 170 children aged 6-59 months from 170 households were included in the study, consisting of 97 (57.1%) males, 73 (42.9%) females, with the mean age of 32.41 months (+/-14.15 months). The caregivers' age was in the age range of 18 to 95 years, and 123 (72.4%) were married. The majority of the caregivers had primary education 99 (58.2%) and 73 (42.9%) were unemployed (Table 1).

Table 1: Socio-demographic and economic characteristics of participants

Characteristic	N	%
Sex of the Child		
Male	97	57.1
Female	73	42.9
Age of child (months)		
06-11	12	7.1
12-23	39	22.9
24-35	39	22.9
36-47	44	25.9
48-59	36	21.2
Size of the child at birth		
Smaller than average < 2.5kg	33	19.4
Average (2.5-3.9kg)	131	77.1
Larger than average (≥ 4.0kg)	6	3.5
Length of exclusive breastfeeding		
Less than 6 months	66	38.8
6 months	91	53.5
More than 6 months	5	2.9
Initiation of complementary feeding		
Less than 6 months	36	21.2
At 6 months	88	51.8
After 6 months	46	27.1

Caregiver's age		
18 years	4	2.4
19-30 years	108	63.5
31-40 years	43	25.3
> 40 years	15	8.8
Caregiver's Education		
No formal Education	6	3.5
Primary	99	58.2
Secondary	60	35.3
Post-secondary	5	2.9
Caregiver's occupation		
Housewives	73	42.9
Self employed	67	39.4
Employed	30	17.6
Number of under five children in the household		
0 or 1	105	61.8
2 or 3	59	34.7
More than 3	6	3.5
Decision Maker		
Father	82	48.2
Mother	46	27.1
Both parents	35	20.6
Other Family Member	7	4.1
Household Monthly Income		
Less than KES 10,000	110	64.7
KES 10,001-20,000	54	31.8
More than KES 20,001	6	3.5

Child Feeding practices, morbidity status, and health-seeking behaviors

More than half 96 (59.3%) of the caregivers exclusively breastfed their children for at least 6 months, of which the majority were housewives and self-employed. About 21.2% of the children were introduced to other foods and fluids before the age of 6 months, the majority belonging to the employed caregivers. Thirty-one (31.8%) percent of the caregivers said that their child had experienced fever, 55.3% reported cough, and 28.8% reported diarrhea in the last two weeks preceding this survey. Nearly all of the children (97.6%) in this study had received expected immunization according to their ages. A third (37.1%) of the caregivers attended the child well clinic every month while 42.9% only attended when a child is unwell (Table 1).

Measures of Child Nutritional Status

Height-for-age

The overall mean of Height Z-score of -1.58 (95% CI –1.91 - – 1.29). Table 2 present the children's nutritional status by age group and sex. Overall, 34.7 percent of children are stunted, while 17.6 percent are severely stunted. Age group analysis shows that stunting is highest in children age 12 – 23 months, and 24 -35 months (each 43.6%). Similarly, children age 12 - 23 months were the most affected by severe stunting (28.2 percent). Boys are more likely (39.2 percent) to be affected by stunting than girls (28.8 percent).

Age group 06-11 months had a higher median height Z-score of -0.45 (95% CI–1.95 - 0.31) which was statistically different than other age groups. After evaluating the distribution of stunting by age group, a statistically significant difference was observed (p<0.05). Children aged 24-35 months were significantly associated with stunting (p<0.05).

Table 4 further shows stunting slightly reduces with the caregivers' education. Children of caregivers who have no formal education (33.3 percent) or caregivers with primary education (37.4 percent) are likely to be stunted than children of caregivers with secondary education (33.0) or post-secondary education (0.0 percent). The analysis also shows a slight decrease in stunting as the monthly household income increases.

Weight-for-height

The general mean of weight-for-height Z-score is 0.17 (95% CI -0.17 – 0.49). Table 2 shows wasting levels as measured by weight-for-height Z-scores. Overall, 15.3 percent of children are wasted, while 6.5 percent are severely wasted. Children in the age groups 12 – 23 months (17.9%) and 24 – 35 months (23.1%) are the most affected with wasting, and children aged 24 – 35 months are the most affected (12.8%) with severe wasting. Boys wasting levels are slightly higher (16.5 percent) than girls (13.7 percent).

Weight-for-age

Overall, the mean_Weight Z-score was -0.78 (95% CI –1.01 - – 0.60). Table 2 shows that 18.8% of children are underweight, and 8.2% are severely underweight. Underweight levels are highest among children in the age groups 12 – 23 months (25.6%) and 24 – 35 months (20.5%). Similar results are observed for severely underweight children; children age 24 – 35 months are the most affected (12.8%). Underweight levels are higher among boys (22.7 percent) than girls (13.7 percent).

Mid-Upper Arm Circumference

Overall, the mean MUAC measure of 14.62cm (95% CI 14.34-14.88). The MUAC measurement also indicated that 9% of the children were undernourished (< 12.5 cm), and 2.9% of them were severely undernourished (<11.5 cm) (Table 2).

Table 3: Nutritional status of children

Variable	Total Number of children	Height-for-age			Weight-for-height				Weight-for-age			Mid-Upper Arm Circumference			
		Severely stunted	Stunted	Normal Height	Severely Wasted	Wasted	Normal weight-for-height	Over weight	Severely Under weight	Under weight	Normal Weight	SAM	MAM	At the risk of Malnutrition	Well Nourished
All	170	17.6	34.7	65.3	6.5	15.3	71.2	13.5	8.2	18.8	81.2 7.1	2.9	2.4	19.4	75.3
Age Group in months															
06 – 11	12	8.3	16.6	83.3	0.0	8.3	66.7	25.0	0.0	16.7	83.3	0.0	8.3	33.3	58.3
12 – 23	39	28.2	43.6	56.4	5.1	17.9	66.7	15.4	10.3	25.6	74.4	5.1	5.1	38.5	51.3
24 – 35	39	20.5	43.6	56.4	12.8	23.1	64.1	12.8	12.8	20.5	79.5	5.1	2.6	10.3	82.1
36 – 47	44	18.2	34.1	65.9	0.0	9.1	75.0	15.9	2.3	11.4	88.6	0.0	0.0	18.2	81.8
48 – 59	36	5.6	22.2	77.8	11.1	13.9	80.6	5.6	11.1	19.4	80.5	2.8	0.0	5.6	91.7
Sex															
Male	97	20.6	39.2	60.8	7.2	16.5	69.1	14.4	9.3	22.7	77.3	4.1	2.1	19.6	74.2
Female	73	13.7	28.8	71.2	5.5	13.7	74.0	12.3	6.8	13.7	86.3	1.4	2.7	19.2	76.7

Determinants of Nutrition Status

Associations of social and demographic factors with nutritional status

Bivariate analysis revealed an association between nutrition variables and social and demographic factors (Table 4). Height-for-age was significantly associated with the house household decision-maker (p<0.05). Wasting (WHZ) was significantly associated with the household decision-maker (p<0.01), and wasting (MUAC) was significantly associated with child age group (p<0.001). The caregiver's age was not correlated with stunting, underweight, and stunting.

Further multinomial regression to explain the relationship between nutritional variables and categorical independent variables was done. The analysis revealed that the child age group (24 -35 months) was significantly associated with stunting (p<0.05). The care giver's occupation (Housewives p<0.05) and caregiver's education (secondary level p<0.05) was associated with a child's low weight for their age. The number of under-five children in households was associated with wasting (p<0.0001). The household gross monthly income (less than KES 10,000/$100) was correlated with both underweight (WAZ) and stunting (HAZ) (p<0.0001).

Associations of child feeding practices and nutritional status

Bivariate analysis revealed a correlation between nutrition variables and child feeding practices and nutritional status (Table 4). When factors associated with stunting were analyzed, stunting (HAZ) was significantly associated with the type of food fed to the child when complementary feeding was initiated (p<0.05). Stunting was not statistically associated with the initiation of complementary feeding, mode of feeding, and frequency of feeding per day. Child feeding practices were not associated with underweight (WAZ) and wasting (WHZ). Multinomial regression further revealed that children who were exclusively breastfed for less than 6 months were associated with being underweight and stunted (p<0.0001).

Associations of morbidity status and health-seeking behavior and nutritional status

Bivariate analysis revealed an association between child morbidity, health-seeking behavior, and nutrition variables. Weight-for-age was statistically correlated with child immunization (p<0.01) and reported acute respiratory infection two weeks preceding this survey (p<0.05). Weight-for-height and height-for-age Z-scores were significantly associated with child wellness clinic visits for monthly check-ups (p<0.05). MUAC scores were associated with reports of the presence of diarrhea within two weeks preceding this survey (p<0.01) and child wellness clinic visits (p<0.05). All the nutrition variables were not significantly correlated with the distance to the health facility.

Table 4: Determinants of childhood undernutrition in Kiandutu Informal Settlement

Variable	Total sample	Underweight	Stunted	Wasted
	N (%)	N (%)	N (%)	N (%)
Outcome Variables Childhood undernutrition	170 (100)	32 (18.8)	59 (34.7)	26 (15.3)
Individual-level factors				
Sex of the Child				
Male	97 (57.1)	22 (22.7)	38 (39.2)	16 (16.5)
Female	73 (42.9)	10 (13.7)	21 (28.8)	10 (13.7)
Age of child (months)				
06 – 11	12 (7.1)	2 (16.7)	2 (16.7)	1 (8.3)
12 – 23	39 (22.9)	10 (25.6)	17 (43.6)	7 (17.9)
24 – 35	39 (22.9)	8 (20.5)	17 (43.6) [c]	9 (23.1)
36 – 47	44 (25.9)	5 (11.4)	15 (34.1)	4 (9.1)
48 – 59	36 (21.2)	7 (19.4)	8 (22.2)	5 (13.9)
Size of the child at birth				
Smaller than average	33 (19.4)	7 (21.2)	13 (39.4)	6 (18.2)
Average	131 (77.1)	24 (18.3)	45 (34.4)	18 (13.7)
Larger than average	6 (3.5)	1 (16.7)	1 (16.7)	2 (33.3)
Immunization				
No	4	3 (75.0) [c]	3 (75.0)	1 (25.0)

Yes	166	29 (17.5)	56 (33.7)	25 (15.1)
Fever in the last 2 weeks				
No	116 (68.2)	18 (15.5)	41 (35.3)	16 (13.8)
Yes	54 (31.8)	14 (25.9)	18 (33.3)	10 (18.5)
Recent diarrheal disease				
No	122 (71.8)	22 (18.0)	43 (35.2)	18 (14.8)
Yes	48 (28.2)	10 (20.8)	16 (33.3)	8 (16.7)
Acute respiratory infection				
No	76 (44.7)	20 (26.3)	27 (35.5)	18 (23.7) [c]
Yes	94 (55.3)	12 (12.8) [c]	32 (34.0)	8 (8.5)
Length of exclusive breastfeeding				
Less than 6 Months	66 (38.8)	14 (21.2) [a]	26 (39.4) [a]	10 (15.2)
6 months	91 (53.5)	17 (18.7)	30 (33.0)	15 (16.5)
More than 6 months	5 (2.9)	0 (0.0)	0 (0.0)	0 (0.0)
Initiation of Complementary feeding				
Less than 6 months	36 (21.2)	8 (22.2)	14 (38.9)	7 (19.4)
At 6 months	88 (51.8)	14 (15.9)	30 (34.1)	9 (10.2)
After 6 months	46 (27.1)	10 (21.7)	15 (32.6)	10 (21.7)
Form of complementary food				
Liquid	85 (50.0)	17 (20.0)	36 (42.4)	17 (20.0)
Semi-Solid	79 (46.5)	12 (15.2)	22 (27.8)	8 (10.1)
Solid	6 (3.5)	3 (50.0)	1 (16.7)	1 (16.7)
Number of times fed in a day				
Less than 3 times	35 (20.6)	10 (28.6)	11 (31.4)	7 (20.0)
Three times	68 (40.0)	9 (13.2)	21 (30.9)	8 (11.8)
More than 3 times	67 (39.4)	13 (19.4)	27 (40.3)	11 (16.4)
Maternal-level factors Caregiver's age (years)				
18 and younger	4 (2.4)	2 (50.0)	3 (75.0)	0 (0.0)
19 – 30	108 (63.5)	20 (18.5)	34 (31.5)	19 (17.6)
31 – 40	43 (25.3)	5 (11.6)	15 (34.9)	6 (14.0)
Above 40	15 (8.8)	5 (33.3)	7 (46.7)	1 (6.7)
Caregiver's Education				
No formal education	6 (3.5)	3 (50.0)	2 (33.3)	2 (33.3)
Primary	99 (58.2)	22 (22.2)	37 (37.4)	14 (14.1)
Secondary	60 (35.3)	7 (11.7) [c]	20 (33.3)	10 (16.7)
Post-secondary	5 (2.9)	0 (0.0)	0 (0.0)	0 (0.0)
Caregiver's Occupation				
Housewives	73 (42.9)	18 (24.7) [c]	28 (38.4)	13 (17.8)
Self Employed	67 (39.4)	6 (9.0)	22 (32.8)	8 (11.9)
Employed	30 (17.6)	8 (26.7)	9 (30.0)	5 (16.7)
Number of under in the HH				
0 or 1	105 (61.8)	19 (18.1)	36 (34.3)	15 (14.3) [a]
2 or 3	59 (34.7)	12 (20.3)	19 (32.2)	10 (16.9) [a]
More than 3	6 (3.5)	1 (16.7)	4 (66.7)	1 (16.7)
Decision Maker				
Father	82 (48.2)	15 (18.3)	23 (28.0)	14 (17.1) [a]
Mother	46 (27.1)	11 (23.9)	18 (39.1)	8 (17.4) [a]
Both Parents	35 (20.6)	6 (17.1)	14 (40.0)	4 (11.4)
Other Family Member	7 (4.1)	0 (0.0)	4 (57.1)	0 (0.0)
Household Monthly Income				
Less than KES 10,000	110 (64.7)	20 (18.2) [a]	41 (37.3) [a]	15 (13.6)
KES 10,001-20,000	54 (31.8)	12 (22.2)	18 (33.3)	11 (20.4)
More than KES 20,001	6 (3.5)	0 (0.0)	0 (0.0)	0 (0.0)
Visits to Child Well Clinic				
Monthly	63 (37.1)	13 (20.6)	17 (27.0) [c]	11 (17.5)
Once in 3 months	8 (4.7)	0 (0.0)	2 (25.0)	1 (12.5)
Only when sick	73 (42.9)	17 (23.3)	32 (43.8)	13 (17.8)
Not at all	26 (15.3)	2 (7.7)	8 (30.8)	1 (3.8)
Distance to the health facility				
Low	111 (65.3)	19 (17.1)	39 (35.1)	15 (13.5)
Middle	57 (33.5)	12 (21.1)	20 (35.1)	10 (17.5)
High	2 (1.2)	1 (50.0)	0 (0.0)	1 (50.0)

Note: [a]$P<0.0001$; [b]$P<0.001$; [c]$P<0.05$; HH Household; KES – Kenyan Shillings

Discussion

This study aimed to assess the determinants of the nutrition status of 6-59 months old children in Kiandutu, an informal settlement located in Thika Town, Kiambu County, Kenya. Overall, 34.7% of the children were stunted, 18.8% were underweight, and 13.5% overweight and 15.3% were wasted. According to the new prevalence thresholds for wasting, overweight, and stunting established by the WHO-

UNICEF Technical Advisory Group on Nutrition Monitoring (TEAM) in 2018, the prevalence of stunting was "very high", the prevalence of underweight was "medium", the prevalence of overweight was "medium", and the prevalence of wasting indicated as "very high".

Our findings though higher than the national levels obtained by the Kenya Demographic and Health Survey (KDHS) in 2014, with a national prevalence of stunting at 26%, underweight at 11%, and wasting at 4% [13]. The KDHS confirms the magnitudes of the different forms of malnutrition as revealed in this study. The prevalence of stunting, underweight, and wasting in this study was also higher than the overall prevalence rates for Kiambu County, with a stunting rate of 15.7%, underweight 5.1%, overweight 7.9%, and wasting at 2.3%, as revealed by the national KDHS survey [13]. Populations in the informal settlements seem to be vulnerable to economic constraints impacting their ability to meet the nutritional needs of the households. These predispose the vulnerable groups in informal settlements to poor nutritional status in comparison to the general population in the county and national level.

The prevalence of stunting, underweight, and wasting in this study agreed with studies conducted in Nairobi, where Korogocho informal settlement had stunting levels of 31.8% and underweight levels at 18.8%. Surveys in Kiambio and Majengo informal settlements reported wasting rates of 9.6% and 9.2% respectively [14]. Our findings are also comparable to other informal settlements in other regions in the world. Studies in Urban informal settlements in Mumbai (India), Gondar city (Ethiopia), Dhaka and Bangladesh [15-18].

Children living in households whose decision-maker was the father had a higher likelihood to develop wasting and stunting than those living households whose decision-makers was the mother, both parents, and other family members. Our results, similar to earlier studies [19, 20] highlighted that in households where fathers are the main decision-makers, mothers lack autonomy on food budget allocations, much more if the caregivers are housewives or unemployed. For this reason, their influence on dietary diversity in the household eventually impacting on child's nutrition [21-23].

In the current study, reported episodes of diarrhea occurring within the two weeks preceding the survey were statistically associated as a risk factor for wasting. This is consistent with the findings of studies conducted in Ethiopia [24-26]. It is documented that a child with diarrhea loses weight and can quickly become malnourished [24]. This could be due to the relationship of diarrhea to nutrient losses, increases the nutritional demands, which in turn predisposes one to malnutrition. However, diarrhea and cough within the two weeks preceding the survey were not associated with stunting. This was in agreement with other studies [27-28]. This could be because stunting is as a result of chronic malnutrition.

Underweight in the current study was statistically associated with the presence of illness (cough) within two weeks before the survey. Our findings were in line with other studies that reported an association between acute illness and underweight [29-31]. This could be since underweight is associated with macro and micronutrient loss, the stress of the immune system, thus making the child more vulnerable to infections [32].

In this study, the children's age group was associated with wasting as classified by MUAC. Children in the age group of 12-23 and 24 – 35 months were more likely to wasted (WHZ & MUAC). This finding is consistent with other surveys in Nigeria [33] and Ghana [34]. Wasting in these age groups could be a result of a deficit in proper complementary feeding and the presence of progressive diseases [13, 35].

Child well clinic visits were associated with stunting and wasting. Children attending child well clinic visits 'only when sick' constituted the higher proportions of the children who were wasted and stunted. It is documented that adequate child well clinic visits could effectively enhance child-caring practices including health-seeking behaviors and child feeding practices that could translate to better child growth outcomes [36].

Although this survey contributes to current information in the study area, it is not free from limitations. The cross-sectional design, neither represents the seasonal variation of nutritional outcomes nor establishes causality. Social desirability and memory recall bias cannot be ruled out, such as feeding practices, child's history of illness, and health-seeking behaviors. The sample is only from an informal settlement and is hence difficult to generalize.

Conclusion

In conclusion, our results reveal that child undernutrition remains a public health nutrition concern in informal settlements. Children age 12 - 35 months are the most affected, with all forms of undernutrition assessed in this study; underweight, wasting, and stunting. Interventions focusing on undernutrition in informal settlements should consider age groups specific for under-five nutrition to enable addressing health related determinants across all age groups under five years. Additionally, there is need to address access to sustainable diets, nutritional education and improving livelihoods in informal settlements.

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Authorship: RI formulated the research question and designed the study, analyzed the data, and wrote the first draft of the article. NA contributed to the conception, design, and data analysis of the current study. AN, MM, JN, & SK provided a critical review of initial drafts. All the authors read and approved the final version of the manuscript. IR has the primary responsibility for the final content.

Ethics of human subject participation: This study was conducted by following the guidelines laid down in the Declaration of Helsinki research ethics and guidelines. All procedures involving research study participants were approved by the Ethical Review Committee of Kenya Medical Training College, the National Commission of Science and Technology (NACOSTI/P/19/72173/30433), and the County Director of Health Services in Kiambu County (KIAMBU/HRDU/AUTHO/2019/07/15/IRERIRW) Written informed consent was obtained from all

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