Maternal Nutritional Knowledge in Association with the Dietary Intake and Nutritional Status of their School-Going Children: A case of Kayole-Soweto Informal Settlement, Nairobi County, Kenya

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Abstract

Introduction: School age is a period during which dynamic growth and development occur; therefore, good nutrition during this time is crucial. Mothers have been known to play a central role in their children's nutritional status, and their knowledge of nutrition affects their children's nutritional outcomes. The study sought to assess the association of maternal nutritional knowledge with the nutritional status and dietary intake of protein, energy, vitamin A, iron and zinc among school children (7-11 years) in Kayole-Soweto informal settlement, Nairobi County, Kenya.

Methods: A cross-sectional survey was conducted among 224 mother-child pairs, comprising of mothers and their school-going children (7-11 years) living in Kayole-Soweto informal settlement, in Nairobi, Kenya. A pre-tested structured questionnaire was used to collect data, while SPSS version 20 was used for analysis. Associations between variables were tested using ANOVA, Chi-square tests **(χ^2)** and Correlation coefficient (r).

Results: About 98.7% of mothers had some level of education, and 62.5%, 22.3%, and 15.2% of them had low, moderate and high nutritional knowledge, respectively. Dietary intake was generally inadequate, and no significant differences were observed between maternal nutritional knowledge and the children's dietary intakes of protein (ANOVA F=0.98, p=0.38), energy (ANOVA F=0.45, p=0.64), vitamin A (ANOVA F=0.31, p=0.74), iron (ANOVA F=0.42, p=0.66) and zinc (ANOVA F=0.92, p=0.41). The prevalence of underweight, stunting, and wasting among children was 5.9%, 8.9%, and 5.3%, respectively, with overweight and obesity at 6.7% and 1.3%, respectively. No significant differences were observed between maternal nutritional knowledge and the weight for age (χ^2=0.31, df=2, p=0.07), height for age (χ^2=5.26, df=4, p=0.50) and BMI for age z-scores (χ^2=9.86, df=8, p=0.19) of their children.

Conclusion: Even though mothers of school children had low nutritional knowledge, malnutrition was not widespread among school children in the study area. However, dietary intake for most nutrients was low, an indication of the lack of diversified diets for these children. Therefore, it is recommended that nutrition education programmes be targeted to mothers to improve dietary intake of the various micronutrients key during this growth phase.

Keywords*: Dietary Intake, Nutritional Status, Nutritional Knowledge, School Children, RDA*

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Introduction

Malnutrition, as defined by the World Health Organisation (WHO), involves deficiencies or imbalances in energy and nutrient intake, and remains a significant health issue in underdeveloped countries, affecting children's physical, mental, social, and spiritual well-being (1). It occurs in both poor and affluent populations and presents in two distinct forms: undernutrition and overnutrition. Undernutrition, prevalent in Kenya, results from inadequate consumption of safe and quality food, leading to underweight, stunting, and wasting in children, while overnutrition

involves excessive fat accumulation from overeating, resulting in overweight and obesity (2). Despite Kenya's economic growth, undernutrition persists due to poverty and food scarcity, with nearly half of the population living below the poverty line (3). Children in urban informal settlements are particularly vulnerable to malnutrition and related health issues (4, 5).

Micronutrient deficiencies, caused by monotonous and poor-quality diets, significantly impact children's growth and nutritional status (6). In Kenya, malnutrition rates among school children are alarmingly high, negatively impacting their health and academic performance (9). The Kenya Micro-Nutrient Survey reported high prevalence rates of anaemia, iron deficiency anaemia, and zinc deficiency among school-aged children, highlighting the critical need for proper nutrition during childhood (7, 8). A lack of access to food, rather than its availability, is a primary issue in Nairobi's informal settlements (10).

Maternal knowledge of nutrition plays a significant role in children's dietary habits, influencing their health outcomes (11, 12). Recent studies have emphasised the importance of maternal nutritional knowledge in influencing children's health outcomes. A systematic review reported that behaviour change interventions significantly improved maternal and child nutrition outcomes in sub-Saharan Africa, including reduced prevalence of wasting, underweight, and stunting, and improved dietary diversity (13).

A study in Marsabit County, Kenya, highlighted that maternal knowledge of complementary feeding practices positively impacted children's nutritional outcomes. Mothers who received nutrition education were better able to provide diverse and adequate diets for their children, leading to improvements in weight-for-height and height-for-age z-scores (14). However, data on the nutritional status and nutrient intake of school children in relation to maternal nutritional knowledge remains limited (15).

This research aimed to fill this gap, providing valuable data for the Ministries of Health and Education as well as NGOs to develop targeted nutrition programs, thereby contributing to the achievement of Sustainable Development Goal 3: ensuring healthy lives and promoting well-being at all ages. The study evaluated maternal nutritional knowledge and its association with the nutritional status and dietary intake of protein, energy, vitamin A, iron, and zinc among school-age children (7-11 years) in Kayole-Soweto informal settlement, Nairobi County, Kenya.

Materials and Methods

Study setting

The study was conducted in Kayole-Soweto, Embakasi East Constituency, Nairobi County.

Kayole-Soweto is located in the Lower Savannah location of Embakasi East Constituency. It is situated 8 km from Nairobi's city centre and covers an area of 1.9 sq. kms (17). The settlement is divided into eight administrative zones.

Study design

A cross-sectional survey, descriptive and analytical in nature, was conducted in July 2020. The design involved the collection of quantitative data done through home visits, where data on mothers' demographics, socio-economic status, maternal nutritional knowledge, children's dietary intake and anthropometry were collected.

Study population

The study population consisted of mother-child pairs, comprising of mothers and their school-going children (7-11 years) living in Kayole-Soweto informal settlement, in Nairobi, Kenya.

Inclusion criteria. Mothers with school-going children aged 7-11 years, residing in Kayole-Soweto informal settlement, and consenting to participate in the study.

Exclusion criteria. Mother–child pairs were excluded if the child had a known chronic or acute illness at the time of data collection that

could affect dietary intake or growth assessment.

Children with physical disabilities that interfered with accurate anthropometric measurements were also excluded

Sample size determination

The national prevalence of anaemia among school-age children is 16.5% (10), and assuming a standard error of 5% at a 95% Confidence Interval, the sample size was calculated using Fisher's formula (18).

$$n = \frac{Z^2 pq}{d^2}$$

Where;

n= the desired sample size if the target population is > 10,000

Z= the standard normal deviate (1.96)

p= prevalence of anaemia set at 16.5%

q= 1-p

d= the desired level of precision

$$n = \frac{1.96^2 \times 0.165 \times 0.835}{0.05^2}$$

$$n = 212$$

An attrition of 5% was added, yielding 224 mothers and their children.

Sampling procedure

The study site was purposely selected. Three zones in the settlement were selected through simple random sampling. Within the selected zones, households with eligible school-going children (7-11 years) were identified with the assistance of community guides.

At the household level, purposive selection was applied to recruit eligible mother–child pairs that met the inclusion criteria. To minimise selection bias, recruitment was conducted across multiple zones and only one child per household was randomly selected where more than one eligible child was present, to avoid clustering at the household level.

Data collection

Data collection tools consisted of a semi-structured questionnaire, which was divided into 6 sections: socio-demographic and socio-economic characteristics, child characteristics, mothers' nutritional knowledge and child anthropometric measurements and a single 24-hour recall was used as detailed in (19).

Piloting

The questionnaire was piloted among 20 respondents (approximately 9% of the total sample) to assess clarity and reliability. Internal consistency was evaluated using Cronbach's alpha, which yielded a coefficient of 0.82, indicating good reliability (20). Based on the pilot, minor adjustments were made to improve clarity.

Data analysis

SPSS version 20, Microsoft Excel, WHO AnthroPlus and Python version 3.7.3 were used for analysis. Numerical data was categorised and expressed as mean ± SD, range and frequencies. Associations between variables were tested using ANOVA, Chi-square tests (χ^2) and Correlation coefficient (r), and the p-value (probability) <0.05 was deemed as significant.

Anthropometry was analysed using WHO AnthroPlus software version 1.0.4 using the 2007 reference values for individuals aged 5-19 years to compute the z-scores for weight for age, height for age and BMI for age. Children aged 7-10 (up to 120 completed months) years whose weight for age z-score was <-3SD and <-2SD were categorised as severely and moderately underweight, respectively. Children whose height for age z-score was <-3SD and <-2SD were categorised as severely and moderately stunted, respectively. Children whose BMI for age z-scores were <-3SD and <-2SD were categorised as severely wasted and wasted, respectively. Those whose z-score was >+1SD and >+2SD were categorised as overweight and obese, respectively. Further analysis was done using SPSS.

Ethical considerations

A research permit (Licence No: NACOSTI/P/20/5254) was obtained from the National Commission for Science, Technology and Innovation, and permission was also obtained from the Deputy County

Commissioner's office, Embakasi Sub-County, and the chief of the Savannah location. Participants were fully informed about the voluntary nature of their participation and were free to withdraw at any stage. Informed consent was obtained while confidentiality was ensured by anonymising participants' data in reporting.

Results

Characteristics of the mothers

The ages of the mothers ranged from 21 to 54 years, and a majority of them were married (78.1%). Their educational attainment was fair, with a majority (54%) of them having attained primary education, as shown in Table 1. Nearly all (92.9%) of the mothers had a low socio-economic status.

Since a proportion of the mothers were either housewives or unemployed, the income reported came from their spouses and other family members.

Nutritional knowledge of the mothers

Approximately 62.5% of the mothers had low nutritional knowledge, 22.3% had moderate knowledge, and 15.2% had high knowledge. The mean knowledge score was 5.75 (± 2.47). The proportion of mothers who gave correct responses to the various questions is presented in Table 2. Based on correlation tests, positive statistical significance was observed between the mothers' educational attainment and their nutritional knowledge levels (r= 0.25, p= 0.01). The proportion of mothers with high nutritional knowledge levels increased with an increase in educational attainment (Figure 1).

Table 1

Socio-Demographic and Socio-Economic Characteristics of the Mothers

Variables		Frequency (N=224)	Percentage (%)
Age (Years)	21-30	117	52.2
	31-40	86	38.4
	41-50	19	8.5
	51-60	2	0.9
Marital status	Single	36	16.1
	Married	175	78.1
	Separated	11	4.9
	Widowed	1	0.4
	Divorced	1	0.4
Educational attainment	Illiterate	3	1.3
	Formal education	121	54.0
	Secondary education	82	34.6
	Tertiary education	18	8.0
Occupation	Self-employed	77	34.3
	Casual labourer	33	14.7
	Unemployed	14	6.3
	Formal employed	14	6.3
	Housewife	86	38.3
Socio-economic status	Low income (≤KES. 23,670)	208	92.9
	Middle income (KES. 23,671 - 119,999)	16	7.1
	High Income (≥KES. 120,000)	1	0.0

Characteristics of children included in the study

Out of 224, 106 (47.3%) were boys, and 118 (52.7%) were girls, with a mean age of 8.50 (± 1.33) years.

Dietary intake of the study children

A 24-hr recall was conducted on a sub-sample of 53 children. Almost all of the children (90.6%) had consumed three meals a day, while 5.7% and 1.9% had consumed two meals and one meal, respectively. The average protein intake among boys and girls contributed to 136.1% and 151.9% of their Recommended Dietary Intake (RDAs), respectively. The RDAs for protein were met by 74.2% of the boys and 63.6% of the girls.

Table 2

Nutritional Knowledge of the Mothers

Variables		Frequency (N=224)	Percentage (%)
Knowledge levels	Low knowledge (≤50%)	140	62.5
	Moderate knowledge (51-69%)	50	22.3
	High knowledge (≥70%)	34	15.2
Correct responses	Number of glasses of water in a day	144	64.3
	Food group that gives you energy	141	62.9
	Food group that helps build the body	97	43.3
	Food group that helps fight diseases	151	67.4
	Food group to eat most everyday	117	52.2
	Most important meal of the day	79	35.3
	Composition of a balanced diet	110	49.1
	Food sources of iron	158	70.5
	Food sources of vitamin A	111	49.6
	Food sources of zinc	29	12.9
	Sources of good fats	115	51.3
	Which one provides more energy	37	16.5

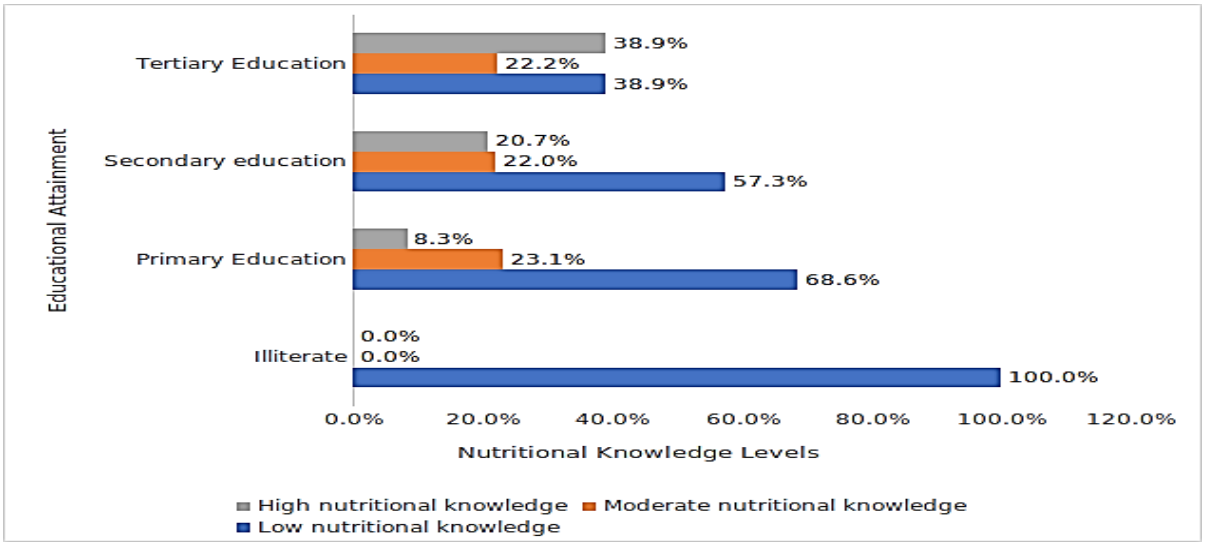

Figure 1

Association between Mother's Educational Attainment and Level of Nutritional Knowledge

The average energy intake for boys and girls contributed to 83.4% and 83.8% of their RDAs, respectively. Less than half, 41.9% of the boys and 31.8% of the girls, met their RDAs for energy. The average vitamin A (retinol equivalent) intake for boys and girls contributed to 42.7% and 36.2% of their RDAs, respectively. Only 4.5% of the girls and 3.2% of the boys met their RDA for vitamin A.

The average iron intake for boys and girls contributed to 148.5% and 124.6% of their RDAs, respectively. The RDAs for iron were met by 54.8% of the boys and 54.5% of the girls. The average zinc intake for boys and girls contributed to 41.2% and 36.9% of their RDAs, respectively. The zinc intakes represented proportions lower than the RDA, with only 19.4% of the boys and 13.6% of the girls meeting their RDAs for zinc. No significant differences were observed between the nutrient intakes for boys and girls across all ages ($p>0.05$).

Based on the ANOVA tests, no significant differences were observed between the mothers' nutritional knowledge and the children's dietary intakes of protein (ANOVA $F(2,50) = 0.98$, $p=0.38$), energy (ANOVA $F(2,50) = 0.45$, $p=0.64$), vitamin A (ANOVA $F(2,50) = 0.31$, $p=0.74$), iron (ANOVA $F(2,50) = 0.42$, $p=0.66$) and zinc (ANOVA $F(2,50) = 0.92$, $p=0.41$).

Table 3
Proportion of Children Meeting the Recommended Dietary Intake (RDAs)

Nutrients	Percentage meeting RDA		Total (N=53)	p-value (χ^2, df)
	Boys(n=31)	Girls(n=22)		
Protein	74.2%	63.6%	69.8%	0.44(53.00,52)
Energy	41.9%	31.8%	37.7%	
Vitamin A	3.2%	4.5%	3.8%	
Iron	54.8%	54.5%	54.7%	
Zinc	19.4%	13.6%	17.0%	

Table 4
Distribution of children by underweight

Underweight	Gender		Total (N=170)	p-value (χ^2, df)
	Boys(n=84)	Girls(n=86)		
Moderately underweight	7 (8.3%)	3 (3.5%)	10 (5.9%	0.18 (1.80, 1)
Normal	77 (91.7%	83 (96.5%)	160 (94.1%)	

Table 5:
Nutritional Status of the Study Children

Nutritional status		Boys (n=106)	Girls (n=118)	Total (N=224)	p-value (χ^2, df)
Stunting	Severely stunted	0.9%	0.8%	0.9%	0.76 (0.54,2)
	Moderately stunted	9.4%	6.8%	8.0%	
	Normal	89.6%	92.4%	91.1%	
BMI for Age	Severely wasted	2.8%	0.0%	1.3%	0.27 (5.23,4)
	Wasted	4.7%	3.4%	4.0%	
	Normal	85.8%	87.3%	86.6%	
	Overweight	4.7%	8.5	6.7%	
	Obese	1.9%	0.8	1.3%	

Nutritional status of the study children

The prevalence of moderate underweight was 5.9% among the children. There was no significant difference in the prevalence of underweight across gender (Table 4). The prevalence of stunting was 8.9%. Based on the chi-square tests, significance was observed where more children between the ages of 7-9 years (5.4%) were stunted compared to those aged 10-11 years (3.6%) (χ^2=6.24, df=2, p=0.04).

The BMI for age z-scores were compared to the WHO reference values. The study results revealed that 1.3% of the children were severely wasted, 4.0% were wasted, 6.7% were overweight, and 1.3% were obese. There was no significant difference between the genders and the BMI classes of the children (Table 5). No significant differences were observed between the mother's nutritional knowledge and the weight for age z-scores (χ^2=0.31, df=2, p=0.07), height for age z-scores (χ^2=5.26, df=4, p=0.50), as well as BMI for age z-scores (χ^2=9.86, df=8, p=0.19) of their children.

Discussion

Nutritional knowledge was observed to significantly increase with an increase in educational attainment; an indication that an increase in educational attainment translated to higher levels of nutritional knowledge, similar to findings reported in Ethiopia, where respondents with better nutritional knowledge had significantly higher educational attainment (21). The average dietary intakes for protein among the children were higher than the recommended levels for children aged 7-10 years, but lower among those aged 11 years. Some of the children had inadequate protein intake, contrary to the findings of (22), who stated that protein intake is adequate for school children in this region.

The average dietary intakes for energy among the children were lower than their respective RDAs. Adequate energy intake was reported in less than half of the children. No significant differences in the mean energy and protein intakes across genders were observed. These findings were in contrast to a study conducted in Dakar, Senegal, where both protein and energy intakes for children 10-17 years were significantly higher among boys compared to girls (23).

The average vitamin A intake was lower than the RDAs for both genders. This was in contrast to studies conducted in Jordan and in urban day primary schools in Nairobi (24, 25). There was no significant difference in the vitamin A intake across genders, similar to the findings reported in Senegal (26).

The proportion of children who had adequate iron intake was lower than the findings of a study conducted in urban day primary schools in Nairobi (25). The inadequate intake among some children could be because most animal sources are out of reach due to cost or because plant sources have a lower bioavailability due to the presence of anti-nutrients (27).

Inadequate zinc intake was evident among these children. High levels of inadequate zinc intake were also reported in multiple studies conducted in Senegal, Urban Cameroon and rural Ghana (26, 28, 29).

Foods rich in protein, such as meat and meat products and legumes, are rich in vitamin A, iron and zinc; thus, dietary inadequacy of these foods shouldn't be overlooked since they lead to poor protein, iron and zinc status (30, 25). The fact that most of these children came from households within the low socio-economic status could explain why there was an inadequate intake of micronutrients, which are easily obtained from animal sources, but their consumption was low since mothers couldn't afford them.

There was no significant association between maternal nutritional knowledge and dietary intake, contrary to a study conducted in Oman (31). The study results imply that nutrition education may be more effective if targeted directly towards these school children rather than their mothers (32).

The prevalence of underweight among children was lower than the findings from previous studies conducted in Dagoretti, Kibwezi and Zambia (33, 35, 35). Underweight among these children is a reflection of prenatal undernutrition, macro and micronutrient deficiencies, infections, and insufficient caregiver attention (36, 34). Weight-for-age reference data for children over 10 years old is unavailable because this measure does not differentiate between height and body mass during puberty, a time when children may appear overweight by this metric when they are simply tall (37).

The most common form of malnutrition in the study was stunting. These findings were similar to studies conducted in Kawangware informal settlement and Kilifi district (38, 39). Stunting levels in this study were lower than the findings reported by (40), which could be an indication that the majority of the children gain their linear growth during this phase (34).

Younger children (7-9 years) were more stunted than the older children (10-11 years), contrary to a study conducted by (38) where stunting was observed to be higher in older children (10-12 years) compared to younger ones (6-9 years). The persistent lack of adequate micronutrients for these children could be the reason why higher stunting levels were observed compared to the other forms of malnutrition, as observed in this study. School-age children who are stunted are likely to have experienced poor nutrition since early childhood, with the severity of stunting increasing as they grow older (41, 34).

The prevalence of wasting in the study was similar to the findings of a previous study conducted in Mangalore city (42). The similarities may be because the children from both studies were from urban backgrounds. The cumulative prevalence of overweight and obesity was higher than the findings reported in South India (43) but lower than those of Dar es Salaam (44). The difference could be attributed to the differences in culture, structure and ecology of the environment of the study population (45).

No significant association was observed between the gender and the nutritional status of the study children. The findings were similar to the results of a study conducted in Kilifi district (38) but in contrast to the findings of a study conducted in Kibwezi district, which reported that boys were more likely to have poor nutritional status than girls (34). No statistical association was observed between maternal nutritional knowledge and the nutritional status of their children; similar to the findings of a study conducted among children aged 4-6 years, where no relationship was observed between the mothers' nutritional knowledge and the children's nutritional status (46). This may be attributable to the fact that nutritional knowledge alone isn't sufficient in ensuring children's nutritional security (47).

Study Limitations

The study's focus on participants within Kayole-Soweto may limit the generalizability of the findings to other informal settlements. The 24-hour recall may not have fully represented the children's habitual diets due to the COVID-19 pandemic, which altered their normal routines. Future research should consider community-based studies with varied locations to provide more comprehensive insights.

Conclusion

Mothers of school-age children have low nutritional knowledge, and the level of knowledge increases with an increase in educational attainment. Protein RDA is met by approximately two-thirds of the children. Less than half of the children have adequate energy intake. The mean dietary intakes of vitamin A and zinc are lower than the RDAs across all ages, indicating the presence of hidden hunger among the study population.

Slightly over half of the children have adequate iron intake. Dietary intake is not dependent on age and gender in these children. Dietary intake is also not associated with mothers' nutritional knowledge. Malnutrition in

the forms of stunting, underweight, overweight and obesity among school children is low. Stunting is dependent on the child's age. Nutritional status is not dependent on gender and is also not associated with their mothers' nutritional knowledge. The dietary intakes of these children are not associated with their nutritional status.

Recommendations

Emphasis should be laid on identifying, developing, customising and implementing nutritional education programmes for mothers by the Ministry of Health and NGOs in order to improve the dietary intake for their children. Moreover, the poor dietary intake evidenced by the data should be of concern, and interventions should be put in place to reverse and prevent micronutrient deficiencies.

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Authors' contribution

All listed authors contributed to the conceptualisation, revisions and approved the final version of the manuscript.

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