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Multilevel analysis of prevalence and associated factors of minimum dietary diversity among children 6–23 months in Somaliland: evidence from Somaliland demographic and health survey (2020)

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Abstract

Background Inadequate feeding practices during infancy and early childhood have profound and often irreversible consequences for child nutrition, with devastating impacts particularly prevalent in low- and middle-income countries. These suboptimal practices contribute significantly to elevated mortality rates and heightened global disease burden. Alarmingly, more than 3.4 million children under the age of five lose their lives each year due to inappropriate feeding practices, underscoring the urgent need for targeted interventions to address this critical public health challenge. In Somaliland, little is known about how the dietary diversity of children aged 6–23 months aligns with the recommendations and factors that shape it, whether individual, community-based, or both.

Methods This study used data from the Somaliland Demographic and Health Survey 2020 (SLDHS 2020). SLDHS2020 represents the nationwide household survey gathering demographic and health information across all six primary regions of Somaliland. The survey participants were women aged between 15 and 49 years.

Results The prevalence of infants and young children who met the recommended minimum dietary diversity was only 9.3%. Mothers aged 35 years and older were 2.75 times more likely to have MDD in their children compared to those aged 15–24 years (AOR = 2.75, 95% CI: 1.00–7.12). Similarly, mothers with formal education had 2.45 times higher odds of ensuring MDD for their children than those without formal education (AOR = 2.45, 95% CI: 1.26–4.77). Mothers without media exposure were 85% less likely to provide diverse diets to their children than those with media exposure (AOR = 0.15, 95% CI: 0.045–0.502). Older children (12–23 months) had nearly five times higher odds of meeting MDD than younger children (6–8 months) (AOR = 4.95, 95% CI: 1.59–15.3).

Conclusion *The study found that only 9.3% of children aged 6–23 months in Somaliland met the Minimum Dietary Diversity (MDD) criteria. Significant variations were observed in relation to the mother's educational attainment, with those*

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possessing formal education exhibiting 2.45 times higher odds of their children achieving MDD (AOR = 2.45, 95%CI:1.26–4.77). Additionally, maternal age was a factor, as mothers aged 35 and above had 2.75 times higher odds (AOR = 2.75, 95%CI:1.00–7.12). Household wealth also played a critical role, with children from wealthier families having 6.78 times higher odds (AOR = 6.78, 95%CI:1.82–25.1). Geographic disparities were evident, as children residing in Togdheer had 95% lower odds (AOR = 0.05, 95%CI:0.00–0.299) than those in Awdal, and those in rural or nomadic settings experienced diminished access (AOR = 0.28–0.48). Given that 80.8% of mothers lack formal education and 97.7% have no media exposure, it is imperative to prioritise maternal literacy programs, region-specific agricultural support, and expanded media outreach to address these disparities.

Keywords Children, Dietary diversity, Demographic and health survey, Somaliland

Background

Appropriate feeding practices for infants and children are essential for optimal growth and development. On a global scale, merely 28·2% of children between 6 and 23 months of age receive the recommended level of dietary diversity. This issue is particularly acute in low- and middle-income countries (LMICs), especially in regions such as South Asia and Eastern, West Southern, and Central Africa [1, 2].

Minimum Dietary Diversity (MDD) for children aged 6–23 months is defined as the consumption of foods from at least five out of eight defined food groups within a 24-hour period, as per the World Health Organization (WHO) and UNICEF guidelines. The eight food groups include (1) grains, roots, and tubers; (2) legumes and nuts; (3) dairy products; (4) fresh foods (meat, fish, poultry, and organ meat); (5) eggs; (6) vitamin A-rich fruits and vegetables; (7) other fruits and vegetables; and (8) breast milk (counted as an additional group for breastfed children) [3, 4].

The United Nations Children's Fund (UNICEF) reports that undernutrition claims the lives of approximately 3.1 million children annually. Globally, the prevalence of stunting in children under five years of age decreased from 203.6 million to 149.2 million between 2000 and 2020. In contrast, Sub-Saharan Africa (SSA) experienced a concerning rise in these figures during the same period, with numbers escalating from 22.8 million to 29.3 million [5, 6].

Adopting key Infant and Young Child Feeding (IYCF) practices can substantially reduce child mortality and morbidity. These practices include commencing breastfeeding within one hour of birth, maintaining exclusive breastfeeding for the first six months of life, introducing complementary foods at six months, sustaining breastfeeding until the child reaches one year of age, and ensuring the consumption of foods rich in iron or fortified with iron. The implementation of these core IYCF indicators plays a crucial role in improving child health outcomes [7].

Insufficient dietary variety in infants and young children can lead to malnutrition, recurrent illnesses, and suboptimal micronutrient intake. These repercussions may extend beyond childhood, potentially resulting in stunted growth and development, compromised immune function, and an elevated risk of developing cancer and diabetes later in life [8].

Malnutrition is a major contributing factor to childhood morbidity and mortality in Somaliland, with recent estimates showing 21% of children under-five are stunted, 13% are wasted and 14% are underweight [9, 10].

In the internally displaced persons (IDP) camps of Somalia, approximately 15% of children achieved minimum dietary diversity. In Somaliland, the introduction of solid foods and attainment of adequate dietary diversity are frequently suboptimal. Although over two-thirds of children aged 6–8 months consumed complementary foods on the day preceding the survey, less than 20% met the required dietary diversity standard [11, 12].

The Somaliland Demographic and Health Survey (SLDHS 2020) revealed that merely 12% of children were fed in accordance with IYCF guidelines. Irrespective of their breastfeeding status, approximately 6% of children aged 6–23 months received food that met the three IYCF practices during the day or night before the survey. For children in this age group, 27% consumed grain-based foods, while 34% ate vitamin A-rich fruits and vegetables the night prior to the survey. Among non-breastfeeding children aged 6–23 months, 25% were given grain-based foods, and 40% consumed vitamin A-rich fruits and vegetables on the night preceding the survey [9].

Prior research has indicated that various sociodemographic and economic factors may influence Minimum Dietary Diversity (MDD) among children aged 6–23 months in low-and middle-income countries (LMICs), including those in Sub-Saharan Africa (SSA). These factors encompass the household wealth index, maternal age, education, and employment status, as well as access to healthcare facilities, residential location, and exposure to mass media such as radio. Furthermore, child-specific factors, particularly age, have also been linked to MDD in SSA [13–20].

As the first study to examine minimum dietary diversity and its determinants among children aged 6–23 months in Somaliland, these findings provide critical baseline evidence to inform targeted nutrition interventions and

policies aimed at improving child feeding practices in this vulnerable population.

Methods

Study setting, data source, and study design

This study constitutes a secondary examination of data from the Somaliland Demographic and Health Survey 2020 (SLDHS 2020). SLDHS2020 represents the inaugural nationwide household survey gathering demographic and health information across all six primary regions of Somaliland. The survey participants were women aged between 15 and 49 years. The sampling methodology employed a multistage probability approach, with each region categorised into urban, rural, and nomadic residential areas. Ultimately, 18 equal strata were created based on the six regions and their residential urbanicity levels. In urban and rural areas, the initial stage involved randomly selecting 35 primary sampling units (PSUs) per stratum, whereas 10 PSUs were randomly chosen from nomadic areas. The second stage saw the random selection of 10 secondary sampling units (SSUs) from 35 listed PSUs, but only in the urban and rural strata. The final stage entailed randomly choosing 30 households from each designated PSU, with women of reproductive age (15–49 years) eligible for participation. Data on maternal and child (under five years old) health were collected from all women. Trained interviewers conducted the data collection process using validated questionnaires in face-to-face interviews [9].

Study population

All eligible children aged 6–23 months in the selected clusters in Somaliland.

Study variables

Dependent variable

This study's outcome measure was minimum dietary diversity, categorised as either (inadequate/adequate). was then coded if the child did not fulfil the minimum dietary diversity score, coded as 0, and 1 for those who fulfilled the criteria. Based on the updated criteria, this outcome variable was categorised as Adequate MDD if the children received foods from five food groups from a total of eight food groups and Inadequate if less than five food groups were consumed during the previous day of the survey [3, 4].

Independent variables

Individual and household factors Maternal age, Maternal education, Place of delivery, Distance to health centre, Media exposure, Child age, Child sex, Birth order, Number of children under five years, Wealth index, Household members, Household head, Father occupation, and Source of water.

Community-related factors Region and place of residence.

Data management and analysis

Data processing, including cleaning, recoding, and analysis, was performed in STATA version 16 using variables extracted from the Kids Record (KR) files. Participants with missing outcome variables were excluded from the analysis. The analysis used sample weights to adjust for potential biases introduced by sampling errors and non-responses. Descriptive statistics provided an overview of individual, community-level, and combined levels using frequency distributions, tables, and charts. Given the hierarchical structure of the DHS data– children nested within households and households within geographic clusters– a standard logistic regression was unsuitable because of the likely correlation of outcomes within clusters. To address the clustering effect inherent to the data, we employed a three-level multilevel mixed-effects logistic regression model. This approach estimates the effects of predictor variables while accounting for community-level clustering through random effects. The magnitude of clustering was quantified using the intraclass correlation coefficient (ICC), which was used to assess the contribution of community-level factors in explaining variance. Model selection was based on deviance, with the model exhibiting the lowest deviance considered the best fit. Variables demonstrating a p-value below 0.25 in bivariable analyses were subsequently included in the multivariable model.

This multivariable analysis involved a series of four models: (1) a null model (Model 0) without explanatory variables to determine the variation between clusters and calculate the ICC, and (2) Model I with individual-level variables only to evaluate their effect. (3) Model II with community-level factors only to evaluate their effects and (4) Model III with both individual and community-level variables to assess their combined fixed and random effects. Variables with $p < 0.05$ in the multivariable analysis were considered significant predictors of complementary feeding among infants and young children, and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported.

Operational definitions of terms

Minimum dietary diversity

This proportion of children who are 6–23 months of age and who are living with the mother who were fed five out of eight food groups during the previous day or night [3, 4].

Minimum meal frequency

For proportion of breastfed and non-breastfed children who are 6–23 months of age and who receive solid,

semisolid, or soft foods (but also including milk feeds for non-breastfed children), the minimum frequency is defined as 2 times for breastfed infants aged 6–8 months and 3 times for breastfed children aged 9–23 months [3, 4].

Results

Prevalence of minimum dietary diversity

The prevalence of infants and young children meeting the recommended minimum dietary diversity was only 9.3% (Fig. 1). Grain, roots, and tubers (37·4%), followed by nuts (33.7%) were the most consumed food items 24 h preceding the survey. However, only 12·9, 6.4, and 4% of the children, respectively, had consumed dairy foods, flesh foods, and eggs in the past 24 h preceding the survey. In addition, only 3·3 and 1.9% of children 6–23 months consumed vitamin A-rich foods and other fruits and vegetables, respectively (Fig. 2).

Sociodemographic characteristics of the study participants

To assess the minimum dietary diversity intake, a total of 1516 secondary data were included in this study (Table 1). Slightly more than half of the mothers were 25–34 years old (53.03%). A large proportion (80.75%) of mothers had no formal education. Most deliveries occurred at home (79.71%). The majority (67.89%) of the respondents perceived distance to the health centre as a problem, and only (2.3%) have media exposure.

Regarding child characteristics, 66.21% of the children were 12-23 month of age. A small majority of the study participants were male (53.97%). Most children are first born (85.77%), and most of the households have less than or equal to five children under five (60.98%).

The wealth quintile was dominated by poorer families (58.26%). The largest segment of the population resided in nomadic settings (44.98%), followed by rural areas (33.16%). Sanaag and Sool regions have the highest representation in the sample (28.03% and 26.88%,

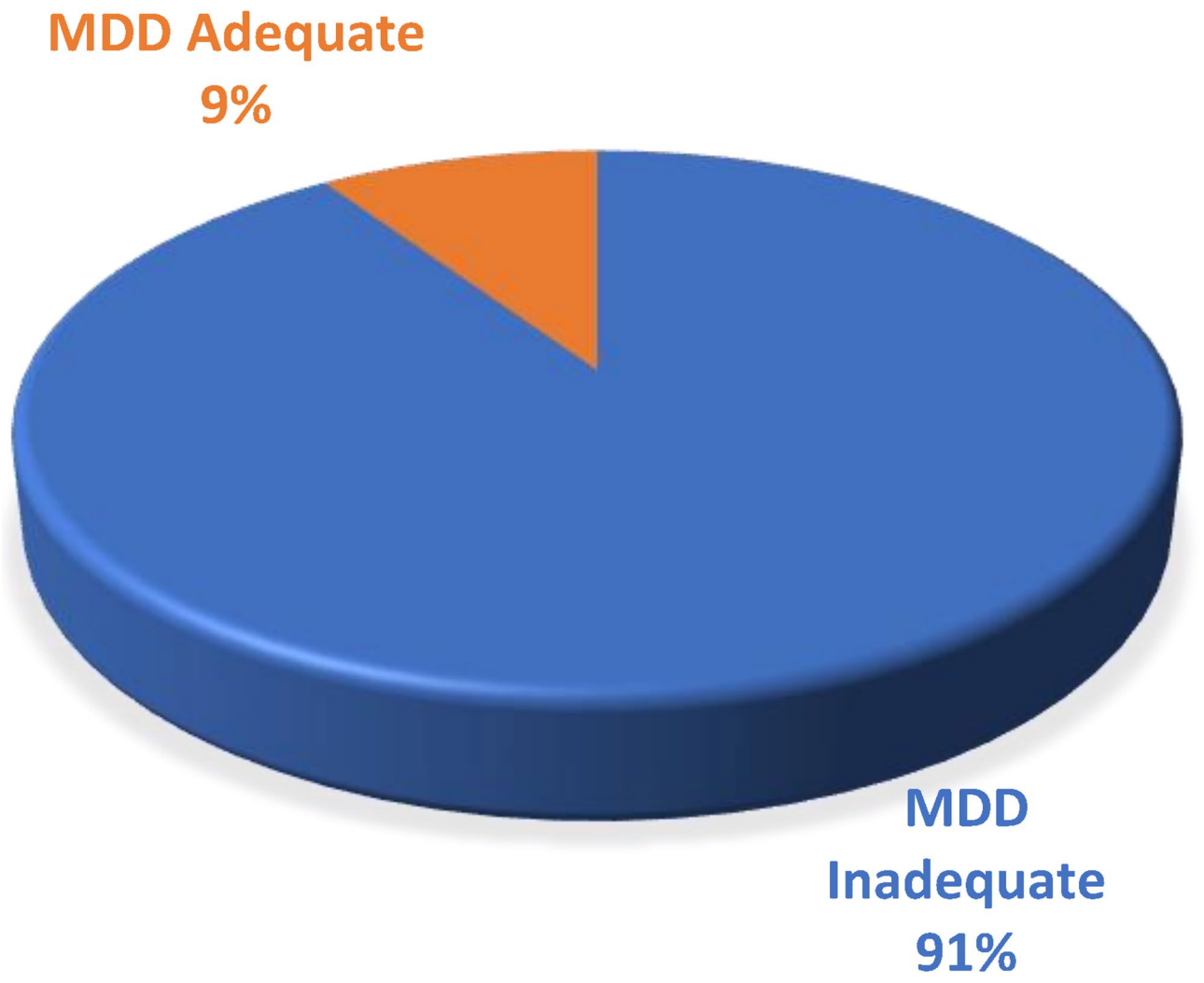

Fig. 1 Prevalence of Minimum Dietary Diversity Among Children Aged 6–23 Months (SLDHS, 2020)

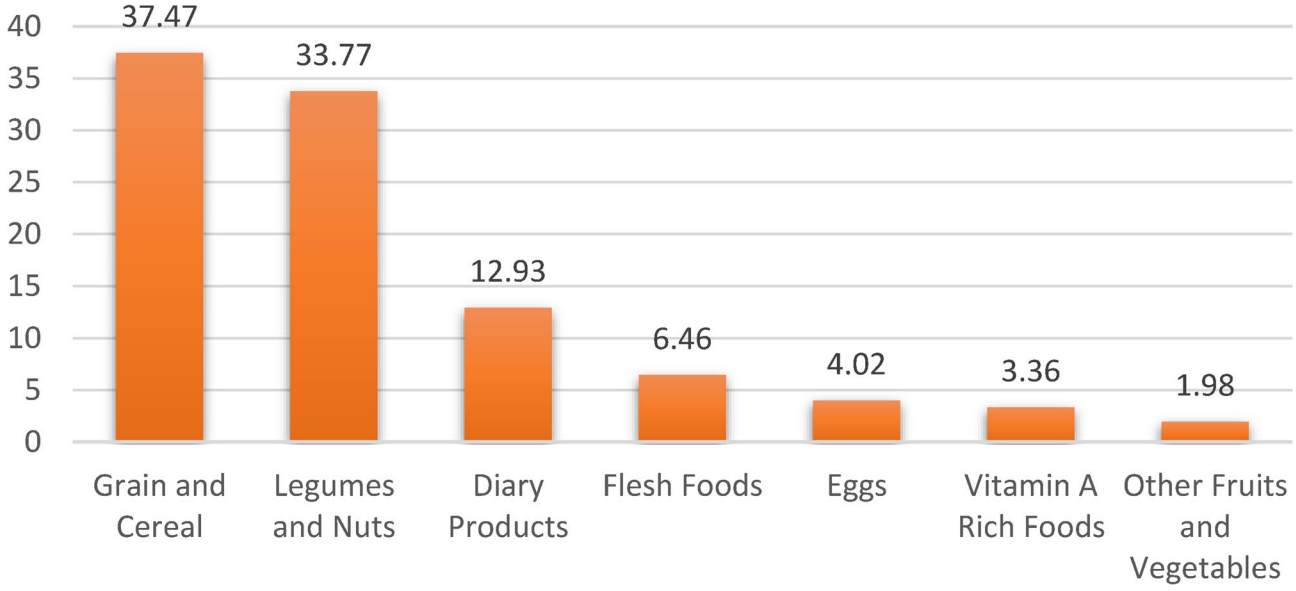

Fig. 2 Proportion of Food Groups Consumed by Children Aged 6–23 Months (SLDHS, 2020)

respectively). Almost half of the households have between 4 and 6 members (43.1%). More than two-thirds of households are headed by males (60.88%). Most of the fathers did not have an occupation (64.02%), and a large majority (84.83%) relied on non-improved water sources.

Bivariate and multivariate analysis of factors associated with minimum dietary diversity among children aged 6 to 23 months

In Table 2, bivariate and multivariate logistic regression analyses reveal that maternal age, maternal education, media exposure, the child's age, birth order, region, and wealth index remained statistically significant at $p < 0.05$.

Mothers whose age are 35 years or more were more than two times feed their children with minimum dietary diversity compared to mothers aged 15–24 years old (AOR = 2.75, 95% CI (1.0-7.12). Caregivers who have attended formal education were about two times more likely to meet minimum dietary diversity for their children than mothers who had no formal education (AOR = 2.45, 95%CI, 1.26–4.77). Compared to mothers who had exposure to media, those who had no exposure to media were less likely to meet children's minimum dietary diversity (AOR = 0.15, 95% CI, 0.045-0.502).

The odds of meeting minimum dietary diversity were significantly associated and higher among children aged 12–23 months, with an adjusted odds ratio of (AOR = 4.95, 95% CI, 1.59–15.3) compared to children aged 6–8 months. Meeting minimum dietary diversity is less likely to be practiced among families with a birth order of two or more children, with an adjusted odds ratio of (AOR = 0.34, 95% CI, 0.126-0.937). Compared to Awdal, children in the Togdheer, Sool, Sanaag were less likely to meet minimum dietary diversity with odd ratio of (AOR = 0.05, 95% CI, 0.00-0.299), (AOR = 0.30, 95% CI, 0.107-0.863) and (AOR = 0.30, 95% CI, 0.109-0.838) respectively. Children from rich families were six times more likely to meet minimum dietary diversity with an odd ratio of (AOR = 6.78, 95% CI, 1.82–25.1) compared with children from poor families. Finally, factors such as place of delivery, household size, and water source did not show significant associations in the adjusted model.

Multilevel analysis of factors associated with feeding minimum dietary diversity among children aged 6–23 months

In Table 3, multilevel analysis demonstrates that maternal age, educational status, media exposure, child's age, birth order, wealth index, region, and place of residence were significantly associated with achieving Minimum Dietary Diversity (MDD) among children aged 6–23 months. Mothers aged 35 years and older were 2.75 times more likely to have MDD in their children compared to those aged 15–24 years (AOR = 2.75, 95% CI: 1.00–7.12). Similarly, mothers with formal education had 2.45 times higher odds of ensuring MDD for their children than those without formal education (AOR = 2.45, 95% CI: 1.26–4.77). In contrast, mothers without media exposure were 85% less likely to provide diverse diets to their children than those with media exposure (AOR = 0.15, 95% CI: 0.045–0.502). Older children (12–23 months) had nearly five times higher odds of developing MDD than younger children (6–8 months) (AOR = 4.95, 95% CI: 1.59–15.3). Additionally, children who were not firstborn had significantly lower odds of meeting MDD than firstborn children (AOR = 0.34, 95% CI: 0.12–0.937). Regional

Table 1 Socio-demographic and environmental characteristics of mothers and study children: insights from Somaliland demographic and health survey, 2020 ($n = 1516$)

Variable	Category	Frequency	Percentage
Maternal Age (Years)	15–24 Years	271	28.35
	25–34 Years	507	53.03
	=>35 Years	178	18.62
Educational Status	No Formal Education	772	80.75
	Formal Education	184	19.25
Place Of Delivery	Home	762	79.71
	Health Institution	194	20.29
Distance Of Health Center	Problem	649	67.89
	Not Problem	307	32.11
Media Exposure	Yes	22	2.3
	No	934	97.7
Child Age	6–8 months	179	18.72
	9–11 months	144	15.06
	12–23 months	633	66.21
Child Sex	Male	516	53.97
	Female	440	46.03
Birth Order	1	820	85.77
	2 or More	136	14.23
Children Under5	=<5	583	60.98
	=>5	373	39.02
Region	Awdal	89	9.31
	Marodijeh	83	8.68
	Sahil	112	11.72
	Togdheer	147	15.38
	Sool	257	26.88
	Sanaag	268	28.03
Residence Place	Urban	209	21.86
	Rural	317	33.16
	Nomadic	430	44.98
Wealth Index	Poor	557	58.26
	Middle	88	9.21
	Rich	311	32.53
House-hold Members	1—3	204	21.34
	4—6	412	43.1
	7—9	340	35.56
House Hold Head	Male	582	60.88
	Female	374	39.12
Father occupation	Yes	344	35.98
	No	612	64.02
Water Source	Improved	145	15.17
	Non-Improved	811	84.83

disparities were evident, with children in Togdheer (AOR = 0.05, 95% CI: 0.00–0.299), Sool (AOR = 0.30, 95% CI: 0.107–0.863), and Sanaag (AOR = 0.30, 95% CI: 0.109–0.838) being significantly less likely to have MDD than those in Awdal. Furthermore, children in rural (AOR = 0.28, 95% CI: 0.145–0.561) and nomadic settings (AOR = 0.48, 95% CI: 0.109–2.16) had lower odds of achieving MDD than urban residents. These findings underscore the influence of maternal, socioeconomic, and geographic factors on children's dietary diversity.

Random effect analysis and model comparison

In Table 4, multilevel analysis shows key insights into the determinants of minimum dietary diversity (MDD) among children in Somaliland. The null (empty) model showed a high intraclass correlation coefficient (ICC = 0.298), indicating that nearly 30% of the variation in MDD was attributable to community-level factors, highlighting the importance of geographic and contextual influences. The progressive reduction in ICC values across Model I (individual-level factors, ICC = 0.0523) and Model II (community-level factors, ICC = 0.0291) suggests that individual characteristics such as maternal education and media exposure explained most of the variance, whereas community factors further refined the model. Model III, which combined both levels, demonstrated the best fit with the lowest Akaike Information Criterion (AIC = 391.3924) and negligible residual clustering (ICC = 3.68E-35), reinforcing the need for integrated interventions to address both household and regional disparities. The likelihood ratio (LR) tests confirmed the significance of each model ($p < 0.001$), with Model III's superior performance supporting the discussion's emphasis on multifaceted strategies to improve dietary diversity.

Discussion

Multilevel analysis revealed that nearly 30% of dietary diversity variation stemmed from community-level factors (ICC = 0.298), underscoring the importance of geographic targeting. The combined model (Model III) with the lowest AIC (391.39) confirmed that interventions must simultaneously address maternal education (individual level) and regional disparities (community level). The prevalence of infants and young children who met the recommended minimum dietary diversity was very low, indicating that only 9.3% met DD. The findings of this study are lower than those of other studies conducted in Ethiopia 47.6%, 10.8% [15, 21], sub-Saharan Africa 25.1% [22], East Africa 10% [23], and Gambia 20.22% [24]. Findings were higher (7%) in South Wollo, Amhara region, Ethiopia [25]. The difference can be explained by disparities in socioeconomic status, access to diverse foods, and maternal education levels. The study design, sample size, or measurement tools could contribute to this variation.

The study suggests that a maternal age ≥ 30 years is associated with a higher likelihood of children meeting the Minimum Dietary Diversity (MDD) requirement among children aged 6–23 months. These findings are similar to those of studies conducted in three sub-Saharan countries [26] and in Malawi [16]. This could be attributed to older mothers potentially having more

Table 2 Bivariate and multivariate analysis of factors associated with feeding minimum dietary diversity among children age 6–23 months: insights from Somaliland demographic and health survey, 2020

Variable	Category	Inadequate	Adequate	COR(95%CI)	AOR(95%CI)
Maternal Age	15–24 Years	260(95.94%)	11(4.06%)	REF	REF
	25–34 Years	468(92.31%)	39(7.69%)	1.96(0.991 – 3.91)	1.55(0.711 – 3.41)
	=>35 Years	161(90.45%)	17(9.55%)	2.49(1.14–5.46)**	2.75(1.0-7.12)**
Educational Status	No Formal Education	738(95.60%)	34(4.40%)	REF	REF
	Formal Education	151(82.07%)	33(17.93%)	4.74(2.84–7.89)**	2.45(1.264.77)**
Place Of Delivery	Home	724(95.01%)	38(4.99%)	REF	REF
	Health Institution	165(85.05%)	29(14.95%)	3.34(2.00-5.58)**	0.66(0.316 – 1.38)
Distance Of Health Center	Problem	614(94.61%)	35(5.39%)	REF	REF
	Not Problem	275(89.58%)	35(10.42%)	2.04(1.23–3.36)**	1.0(0.578 – 1.88)
Media Exposure	Yes	14(63.64%)	8(36.36%)	REF	REF
	No	875(93.68%)	59(6.32%)	0.11(0.047-0.292)**	0.15(0.045.502)**
Child Age	6–8 months	175(97.77%)	4(2.23%)	REF	REF
	9–11 months	135(93.75%)	9(6.25%)	2.91(0.879 – 9.67)	2.82(0.743-10.72)
	12–23 months	579(91.47%)	54(8.53%)	4.08(1.45–11.4)**	4.95(1.5915.3)**
Child Sex	Male	481(93.22%)	35(6.78%)	REF	REF
	Female	408(92.73%)	32(7.27%)	1.07(0.655 – 1.77)	1.10(0.617 – 1.96)
Birth Order	1	759(92.56%)	61(7.44%)	REF	REF
	2 or More	130(95.59%)	6(4.41%)	0.57(0.243 – 1.35)	0.34(0.126.937)**
Children Under5	=<5	540(92.62%)	43(7.38%)	REF	REF
	=>5	349(93.57%)	24(6.43%)	0.86(0.514 – 1.44)	0.67(0.358 – 1.27)
Region	Awdal	77(86.52%)	12(13.48%)	REF	REF
	Marodijeh	77(92.77%)	6(7.23%)	0.49(0.178 – 1.40)	0.48(0.136 – 1.70)
	Sahil	100(89.29%)	12(10.71%)	0.76(0.327 – 1.80)	0.59(0.206 – 1.70)
	Togdheer	145(98.64%)	2(1.36%)	0.08(0.019-0.405)**	0.05(0.00-0.299)**
	Sool	244(94.94%)	13(5.06%)	0.34(0.149-0.780)**	0.30(0.107.863)**
	Sanaag	246(91.79%)	22(8.21%)	0.57(0.271 – 1.21)	0.30(0.109-0.838)*
Residence Place	Urban	167(79.90%)	42(20.10%)	REF	REF
	Rural	298(94.01%)	19(5.99%)	0.25(0.142-0.450)	0.28(0.145-0.561)
	Nomadic	424(98.60%)	6(1.40%)	0.05(0.023-0.134)	0.48(0.109 – 2.16)
Wealth Index	Poor	549(98.56%)	8(1.44%)	REF	REF
	Middle	81(92.05%)	7(7.95%)	5.93(2.09–16.7)**	3.94(0.914 – 17.0)
	Rich	259(83.28%)	52(16.72%)	13.7(6.45–29.4)**	6.78(1.82–25.1)*
House-hold Members	1–3	186(91.18%)	18(8.82%)	REF	REF
	4–6	390(94.66%)	22(5.34%)	0.58(0.305 – 1.11)	0.48(0.227 – 1.04)
	7–9	313(92.06%)	27(7.94%)	0.89(0.477 – 1.66)	0.59(0.275 – 1.29)
House Hold Head	Male	540(92.78%)	42(7.22%)	REF	REF
	Female	349(93.32%)	25(6.68%)	0.92(0.551 – 1.53)	1.0(0.522 – 1.93)
Father occupation	Yes	298(86.63%)	46(13.37%)	REF	REF
	No	591(96.57%)	21(3.43%)	0.23(0.134-0.392)**	0.58(0.294 – 1.14)
Water Source	Improved	134(92.41%)	11(7.59%)	REF	REF
	Non-Improved	755(93.09%)	56(6.91%)	0.90(0.461 – 1.76)	0.90(0.399 – 2.06)

* COR = crude odds ratio *AOR = adjusted odds ratio *CI = confidence interval

experience, confidence, better access to nutritional knowledge, and greater financial stability, enabling them to provide a more diverse and nutritious diet for their children aged 6–23 months [27–30].

According to the findings of this study maternal education positively influences the Minimum Dietary Diversity (MDD) of children. This study is supported by studies conducted in Ethiopia [31] and pooled analyses of Indonesian DHS [14] and Malawi [16]. This can be justified by the fact that mothers with formal education are more likely to have better knowledge of nutrition, health, and childcare practices. Educated mothers are often more aware of the importance of diverse diets and are better equipped to access and utilise health information, leading to improved feeding practices [32, 33]. This results in a higher likelihood of their children meeting MDD requirements compared to the children of mothers without formal education [34, 35]. The study findings

Table 3 Multilevel analysis of feeding minimum dietary diversity among children aged 6–23 months: insights from Somaliland demographic and health survey, 2020

AOR(95%CI)					
Variable	**Category**	**Null Model (Empty)**	**Model I**	**Model II**	**Model III**
Maternal Age	15–24 Years		REF		REF
	25–34 Years		1.65(0.77 – 3.5)		1.55(0.711 – 3.41)
	=>35 Years		3.21(1.2-8.0)**		2.75(1.067.12)**
Educational Status	No Formal Education		REF		REF
	Formal Education		2.27(1.19–4.3)**		2.45(1.264.77)**
Place Of Delivery	Home		REF		REF
	Health Institution		1.12(0.60 – 2.0)		0.66(0.316 – 1.38)
Distance Of Health Center	Problem		REF		REF
	Not Problem		1.22(0.68 – 2.1)		1.04(0.578 – 1.88)
Media Exposure	Yes		REF		REF
	No		0.241(0.079.733)**		0.151(0.045.502)**
Child Age	6–8 months		REF		REF
	9–11 months		2.54(0.70–9.2)		2.82(0.743-10.72)
	12–23 months		4.86(1.6–14.5)***		4.95(1.5915.39)**
Child Sex	Male		REF		REF
	Female		1.06(0.60–1.87)		1.10(0.617 – 1.96)
Birth Order	1		REF		REF
	2 or More		0.31(0.120-0.836)**		0.34(0.126-0.937)**
Children Under5	=<5		REF		REF
	=>5		0.72(0.393 – 1.33)		0.67(0.358 – 1.27)
Wealth Index	Poor		REF		REF
	Middle		3.94(1.24–12.5)**		3.94(0.914 – 17.0)
	Rich		6.85(2.71–17.2)**		6.78(1.8225.19)**
House-hold Members	1–3		REF		REF
	4–6		0.497(0.237 – 1.04)		0.48(0.227 – 1.04)
	7–9		0.684(0.324 – 1.44)		0.59(0.275 – 1.29)
House Hold Head	Male		REF		REF
	Female		1.02(0.553 – 1.89)		1.0(0.522 – 1.93)
Father occupation	Yes		REF		REF
	No		0.526(0.274 – 1.01)		0.58(0.294 – 1.14)
Water Source	Improved		REF		REF
	Non-Improved		0.859(0.388 – 1.90)		0.90(0.399 – 2.06)
Region	Awdal			REF	REF
	Marodijeh			0.75(0.245 – 2.35)	0.48(0.136 – 1.70)
	Sahil			0.90(0.351 – 2.34)	0.59(0.206 – 1.70)
	Togdheer			0.08(0.017.412)**	0.053(0.009.299)**
	Sool			0.38(0.156-0.964)	0.030(0.107-0.863)*
	Sanaag			0.56(0.245 – 1.31)	0.30(0.109-0.838)
Residence Place	Urban			REF	REF
	Rural			0.24(0.123.491)**	0.28(0.145-0.561)**
	Nomadic			0.053(0.021.131)**	0.48(0.109 – 2.16)

indicate that media exposure has a positive impact on meeting the Minimum Dietary Diversity (MDD) requirements for children. Children whose mothers have no media exposure are less likely to meet Minimum Dietary Diversity (MDD), as their mothers may have limited awareness or access to resources necessary for ensuring a varied and nutritious diet. Access to such information enables mothers to make informed decisions, adopt better dietary practices, and provide a more diverse and nutritious diet for their children, ultimately improving dietary outcomes [36, 37]. This finding is reinforced by similar studies conducted in Nepal [38], India [39], and three sub-Saharan countries [26]. The results of this study indicate that older children are more likely to achieve Minimum Dietary Diversity (MDD). Specifically, children aged 12–23 months have higher odds of developing MDD. Our findings align with prior studies, which also found a significant positive relationship between a

Table 4 Random effect analysis and model comparison

Random effect	Null Model (Empty)	Model I	Model II	Model III
AOR	0.0467(0.0259-0.0843)			
P-Value	***	***	***	***
ICC	0.298	0.0523	0.0291	3.68E-35
LR test	12.73	0.84	0.55	0.01
Model Fit Statistics				
AIC	476.6367	407.2806	415.2985	391.3924
BIC	486.3623	504.5357	459.0633	517.8241
DIC(2loglikelyhood)	-236.31837	-183.64028	-198.64923	-169.6962

*ICC = Intra class correlation coefficient *LR test = likelihood ratio test*DIC = deviance information criterion *AIC = Akaike's information criterion * BIC = Bayesian information criterion

child's age and the likelihood of meeting dietary diversity requirements [16, 40], and [24]. This can be justified by the fact that, as children grow older, their dietary needs and intake tend to become more varied, increasing the chances of achieving Minimum Dietary Diversity (MDD). Additionally, older children develop better chewing and digestion abilities, making it easier for them to consume a broader range of foods. Increased awareness and experience of caregivers in feeding practices also contribute to better meal diversity, ensuring that children aged 12–23 months have higher odds of developing MDD. This study also showed that there is a positive association between wealth index and MDD. The observed positive relationship between wealthier households and meeting Minimum Dietary Diversity (MDD) this study is in line with findings from previous research conducted in Ethiopia [13] Indonesia [14]. This can be attributed to families with higher socioeconomic status having better access to diverse and nutritious foods. Wealthier households can afford a variety of food groups, including protein-rich, vitamin-dense, and fortified foods that contribute to a balanced diet. Community-level region and place of residence were significantly associated with MDD in children [32, 41]. Children living in Togdher and Sool regions were less likely to meet Minimum Dietary Diversity (MDD) compared to those in Awdal region, which can be justified by differences in food availability, economic conditions, and agricultural productivity. Awdal, being a more agriculturally productive region, may have better access to diverse food groups, whereas Togdher and Sool, which are more arid, may face challenges in terms of food production and supply [42, 43]. Additionally, the remoteness of Sool disparities in infrastructure, market accessibility, and household income levels could contribute to reduced dietary diversity in these regions. Limited awareness of optimal child feeding practices and lower exposure to nutrition-related information may further exacerbate these differences, making children in Togdher and Sool less likely to achieve MDD [44–46].

Children living in nomadic and rural areas are less likely to meet Minimum Dietary Diversity (MDD) compared to those in urban areas, which can be due to limited access to diverse food sources, markets, and healthcare services [47]. Urban areas typically offer better economic opportunities, greater market accessibility, and improved infrastructure, allowing families to obtain a variety of nutrient-rich foods [14, 48].

Conclusion

This study highlights a notably low prevalence of minimum dietary diversity (MDD) among young children, with only 9.3% meeting the standard, which is significantly below both the regional and sub-Saharan African averages. The research emphasises that inadequate dietary diversity is a multifaceted issue influenced by a combination of individual and community factors, with multilevel analysis indicating that the geographic context accounts for nearly one-third of the variation. Key determinants for achieving MDD include individual factors such as older maternal age (≥ 30 years), formal maternal education, media exposure, and higher household wealth, as well as the child's age, with older children (12–23 months) demonstrating better outcomes. At the community level, there are pronounced disparities, as children in rural and nomadic areas, particularly in the Togdher and Sool regions, are significantly disadvantaged compared to those in urban areas, such as the Awdal region. However, the cross-sectional design of the study limits the ability to infer causality, and its reliance on maternal 24-hour dietary recall may introduce recall and social desirability biases. Additionally, this study did not account for potential cultural or contextual barriers that could influence feeding practices. A comprehensive approach is strongly recommended to improve dietary diversity in children. Interventions should target individuals by promoting maternal education and utilising the media to disseminate nutritional information, while also addressing household poverty through economic empowerment initiatives. Concurrently, public health strategies should employ geographic targeting to address significant regional and rural-urban disparities, focusing on enhancing market access, agricultural productivity, and infrastructure in disadvantaged areas such as the Togdher and Sool regions to ensure equitable access to a variety of foods.

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Author contributions
O. M. O. and H.A. were responsible for composing the primary sections of the manuscript, encompassing the introduction, methodology, results, and discussion. They provided a comprehensive overview of the subject matter,

delineated the research methods, and presented data analysis. A. M. and H.A. conducted the data analysis, performing statistical evaluations of the collected data using appropriate methodologies to investigate the relationships between variables and calculate the odds ratios. Their analysis substantiated the findings of this study. A. M. O. authored the conclusion section of the manuscript, summarising the principal findings, discussing their implications, and offering recommendations based on the results. A.H: reviewed the manuscript. In their capacity as peer reviewers or editors, they critically assessed the manuscript, provided feedback, and suggested enhancements to ensure the quality and rigor of the research. All authors have reviewed and approved the final manuscript.

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Data availability
Data is available online using this link on free access. Somalia - Somali Health and Demographic Survey 2020 (nbs.gov.so).

Declarations

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There is no competing interest between the Authors.

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