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Review Article

Factors Influencing Under Five Children Dietary Diversity Score: A Cross-Sectional Study in Enset-Based Farming Systems of Sidama Regional State, Ethiopia

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Abstract

Introduction: Ensuring access to various nutrient-dense foods from different food groups is crucial for optimal growth, development, and resilience against health issues. Inadequate dietary diversity increases the risk of nutrient deficiencies, physical development, and other health problems.

Objective: The study aims to identify the factors influencing children's dietary diversity in the Enset-based farming systems of the Sidama Regional State, Ethiopia.

Methods: Data was collected from 620 mother-child pairs using a survey questionnaire. The study employed a cross-sectional design to gather information on various factors related to maternal education, household size, birth interval, enset dominance, and asset index. SPSS version 26 was utilized for data analysis.

Results: The educational status of the mothers was found to be a significant factor, with higher education levels associated with increased dietary diversity (OR = 1.22 (1.03, 1.44)). Another influential factor was the total household size, where larger household sizes were associated with reduced dietary diversity (OR = 0.89 (0.80, 0.98)). Furthermore, the birth interval was identified as a significant factor, indicating that longer intervals between births were positively associated with higher dietary diversity scores for children (OR = 1.80 (1.30, 2.50)). The dominance of enset, a locally grown food staple, negatively influenced dietary diversity (OR = 0.40 (0.27, 0.60)). Lastly, the asset index, which reflects household wealth, positively impacts dietary diversity (OR = 1.24 (1.06, 1.45)).

Conclusion: The study concludes that maternal education, household size, birth interval, enset dominance, and household wealth (as measured by the asset index) play crucial roles in determining the dietary diversity of under-five children in the Enset-based farming systems of the Sidama Regional State, Ethiopia. The findings emphasize the importance of targeted interventions to improve these factors to enhance the nutritional status of children in the region.

BACKGROUND

Dietary diversity is an important indicator of the quality of a household's diet and is associated with improved health outcomes. However, achieving a diverse diet can be challenging, particularly in low-income countries where food insecurity and limited access to diverse food sources are prevalent. According to the World Health Organization, more than two billion people worldwide suffer from one or more micronutrient deficiencies, including vitamin A, iron, and zinc [1]. Lack of dietary diversity is a major contributor to this problem, especially in developing countries where diets are often limited to staple foods [2].

Sub-Saharan Africa is particularly vulnerable to food insecurity, with an estimated 239 million people experiencing hunger and malnutrition. The region has the highest prevalence of stunted growth and underweight children globally. Dietary diversity is crucial to addressing these issues, but many households in the region have limited access to diverse food sources due to poverty, climate change, and other factors [3].

Ethiopia has a high prevalence of food insecurity and malnutrition. According to the 2019 Ethiopia mini Demographic and Health Survey, 37% of children under five are stunted, and 21% are underweight. Dietary diversity is low in many parts of the country, particularly in rural areas where most households rely on subsistence farming [4].

Sidama region is one of the youngest region of Ethiopia, which is located in the southern part of the country. The region is known for its unique enset-based agricultural system, which involves the cultivation of a staple crop called ensetalong with other crops such as maize, sorghum, and beans [5]. The enset-based system has been shown to have the potential to improve dietary diversity and food security. However, little is known about the factors influencing household dietary diversity in this context. Therefore, this study aimed to fill this knowledge gap by investigating the factors that influence household dietary diversity in the enset-based systems of Sidama Regional State, Ethiopia [6] This study's findings can inform policies and programs to improve dietary diversity and promote better health outcomes in the region and beyond.

RESEARCH METHODS

Study area and population

The study was conducted in Sidama regional state [6]. It was established in June 2020 after the Sidama people voted in a referendum to form their regional state. The region is located in the South of the Oromia Region (except for a brief section in the middle where it shares a border with the Gedeo zone), the Bilate River on the West, which divides it from the Wolayita zone, and the Oromia Region on the North and East. Sidama Regional State [6], is governed by a regional council responsible for the region's administration. The capital of the region is Hawassa, which is also the biggest city in the region. The region is divided into 19 districts (woredas) and one town administration, with each district being further divided into Kebeles (sub-districts).

The Sidama people are one of the most prominent ethnic groups in Ethiopia and are known for their rich cultural heritage, including their music, dance, and traditional dress. In 2017, about 3.2 million people were living in Sidama. With 879 km of all-weather roads and 213 km of dry-weather highways, Sidama has an average road density of 161 km per 1,000 km2. Agriculture is the leading economic activity in the region, with coffee being the most important crop. The region also has significant potential for tourism due to its natural beauty, including its highlands, lakes, and waterfalls.

Also abundant and underdeveloped in the area are water resources. The absence of access to safe drinking water, poor sanitation, and general knowledge about personal hygiene and environmental health are the leading causes of sickness and mortality in the region. The Sidama place a high importance on livestock, and those without cattle are not seen as fully-grown members of society but as outcasts. Cattle numbers are a solid indicator of prosperity and provide the farmer with the most livestock in more significant popularity. The population of this study includes households, Kebele administrators, Development Agents (DAs), health extension workers, Woreda administrators, and heads of relevant Woreda offices in Sidama Woredas.

OPERATIONAL DEFINITION

Household Dietary Diversity Score

The score is often used as a proxy indicator to capture the functional quality of diets, since a variety of food in the diet is required to ensure sufficient intake of essential nutrients. The number of diverse food groups consumed by household members over a given reference period (usually 24 hours), is one of the most widely used proxy indicators for dietary quality.

Even though, there is no universally agreed-upon cutoff point for dietary diversity score (DDS) in the literature, the authors suggest that it should be defined based on the local food systems and dietary patterns. For example, Holt et al., used six as the cutoff point to classify households into two categories based on their dietary diversity scores. Faber et al., used four as the cutoff point and classified households with DDS less than or equal to four as having low dietary diversity (food insecurity) and households with DDS greater than four as having high dietary diversity (food secure).

On the other hand, Getachew et al., categorized households into three groups based on their DDS scores: DDS ≤ 5 (low dietary diversity), DDS 6-7 (moderate dietary diversity), and DDS ≥ 8 (high dietary diversity, food secure). To contextualize the results, the authors used the cutoff points based on minimum dietary diversity for women and children recommended by FAO [7]: DD <5 (Low Dietary Diversity) and GDD ≥ 5 (Good Dietary Diversity).

Enset dominant

Enset dominant refers to a state or condition in which the cultivation and utilization of the enset plant (Enseteventricosum) play a significant role in a particular geographical area or community. It implies that enset is the primary crop or plant species in terms of cultivation, consumption, and economic importance within that specific context.

Non-enset dominant

Non-enset dominant describes a state or condition in which the cultivation and utilization of the enset plant (Enseteventricosum) have a lesser significance or presence compared to other crops or plant species within a specific geographical area or community. It implies that enset is not the primary crop or plant species in terms of cultivation, consumption, and economic importance within that particular context.

Asset index

An asset index is assessment tool used to evaluate and compare the wealth or economic status of households. It typically takes into account various tangible and intangible assets, such as land, livestock, housing, savings, education, and access to basic services. The index assigns a numerical value or score to each asset, and the cumulative scores are used to rank or categorize households into different wealth categories (Very poor, Poor, Middle, Rich, and Very rich)

SAMPLE SELECTION

In total, 620 respondents were included in the study from households in woredas of the Sidama regional state [6]. Using the formula proposed by the UN Economic Division (2005), the sample size was established as follows:

$$n = (z^2)(r)(1-r)(f)(k)/(p)(n_h)(e^2)$$

Where, n = is number of sample, = is the upper points of standard normal distribution at = 0.05, r is anticipated prevalence, f = is the sample design effect (deff), the study design effect is assumed to be (1.5), k is a multiplier to account for the anticipated rate of non-response. It is taken as 1.1, which is the recommended value for the household survey, p is the proportion of the target population over total population, which is 0.15, nh is the average household size (5). The margin of error (e) is 5%, the maximum recommended value.

Multi-stage sampling was employed for representative sampling. In the first stage, due to the local staple diet, six enset-producing and non-enset-producing Woredas were selected using purposive sampling technique. Wondogenet, shebedino, Hawassazuria, Malga, Goricha, and Boricha were the selected Woredas. In the second stage one representative Kebele from each Woreda was selected using simple random sampling. Thirdly, Kebele households were proportionally selected. Finally, using systematic sampling technique, 620 respondents were randomly picked from the list of respondents, a complete list of households in each Kebeles obtained from the Woredas Administration, and Kebeles offices in the selected Kebeles.

Data collection and measurements

The data was gathered through the use of a survey questionnaire. To collect the necessary data, closed ended questions were constructed. Following the development of all questions for the household survey, a pre-test was conducted prior to the survey to refine the questions in terms of language usage and topic clarity and to capture adequate data/ information from the sampled respondents during the survey.

This study used ten sets of food groups to examine dietary diversity as a subset of the household's dietary variety. Mothers were asked to recall all the foods and beverages the child consumed in previous 24 hrs (yesterday during the day and night), whether at home or outside. Underline the corresponding foods in the list under the appropriate food group and write "1" in the column next to the food group if at least one food in this group has been reported being consumed. Once the recall is finished, the data collectors probed the mothers for food groups where no food was underlined. The study focused on the number of different food groups consumed rather than the number of food items consumed from each group.

Data processing and analysis

The data collected through the questionnaire was edited, coded, and entered into computer software using SPSS version 26. The analysis techniques were performed using descriptive statistics such as frequency, percentage, mean, and standard deviation. Furthermore, inferential statistics in the form of binary logistic regression analysis was employed to identify the factors that influence the dietary diversity score of sample households in the study area.

RESULTS

The relationship between of maternal education and child dietary diversity are reported in Table 1. According to the results, 56.1% of the children whose mothers received no education had low dietary diversity (LDD), while only 34.6% had good dietary diversity (GDD). Additionally, the results of the Chi-square test (= 33.71, p < 0.001) indicate a statistically significant association between maternal education and childhood dietary diversity. This suggests that a higher proportion of children with uneducated mothers have low dietary diversity, compared to those whose mothers have some level of education.

Children with mothers who are categorized as "housewives" have a higher percentage of good dietary diversity (GDD) at 23.5%, compared to the percentage of low dietary diversity (LDD) at 14.8%. Furthermore, the variable of mothers' occupation shows a statistically significant association with childhood dietary diversity (= 7.63, p-value = 0.006). This suggests that a higher proportion of children with housewife mothers have high dietary diversity, compared to those whose mothers have occupation (Table 2).

Findings from the study reveal that children living under a house with a corrugated iron sheet housing have a higher proportion of good dietary diversity (GDD) at 58.1%, relative to children with thatch/grass housing, which reported a lower proportion of GDD at 41.9%. Importantly, the results of the statistical analysis reveal a statistically significant association between the housing condition variable and child dietary diversity score (= 7.63, p-value < 0.001) (Table 3).

According to the percentage values obtained from the study, children with birth intervals of more than two years have shown a higher percentage of good dietary diversity (61.0%) as opposed to those with birth intervals of 1-2 years (35.2%). The statistical analysis has revealed a significant relationship between the birth interval variable and child dietary diversity score (= 10.74, p-value = 0.005).

The results of the analysis indicate that within the non-enset dominant group, 36.7% of children were associated with LDD, whereas 66.3% were associated with GDD. In contrast, within the enset dominant group, 63.3% of children were associated with LDD, while 33.7% were associated with GDD. The association between "Enset dominance" and child dietary diversity score was found to be statistically significant (= 54.48, p-value < 0.001), suggesting that the enset dominant group exhibits a higher proportion of observations with LDD, while the non-enset dominant group shows a higher proportion of children with GDD.

The percentage values indicate that children from a very rich asset index households have the highest percentage of good dietary diversity (27.3%), while children from a very poor asset

Table 1: The Descriptive Summary of Respondents Characteristics (n = 620)

Variables	HDDS				Total		x^2 (p-value)
	LDD		GDD				
	n	%	n	%	n	%	
Mothers' Education							
No Education	171	56.1	109	34.6	280	45.2	33.71 (0.000)
Able to read and write	71	23.3	90	28.6	161	26.0	
Only primary education	30	9.8	42	13.3	72	11.6	
Secondary education	25	8.2	59	18.7	84	13.5	
College diploma and above	8	2.6	15	4.8	23	3.7	
Total	305	100	315	100	620	100	
Mother occupation[a]							
House wife	45	14.8	74	23.5	119	19.2	7.63 (0.006)
Others	260	85.2	241	76.5	501	80.8	
Total	305	100	315	100	620	100	
Housing condition							
Corrugated iron sheet	120	39.3	183	58.1	303	48.9	21.81 (0.000)
Thatch/grass	185	60.7	132	41.9	317	51.1	
Total	305	100	315	100	620	100	
Birth interval							
First birth	10	3.3	12	3.8	22	3.5	10.74 (0.005)
1-2 years	147	48.2	111	35.2	258	41.6	
>2 years	148	48.5	192	61.0	340	54.8	
Total	305	100	315	100	620	100	
Enset dominance							
Non-enset dominant	112	36.7	209	66.3	321	51.8	54.48 (0.000)
Enset dominant	193	63.3	106	33.7	299	48.2	
Total	305	100	315	100	620	100	
Asset index							
Very poor	84	27.5	43	13.7	127	20.5	50.21 (0.000)
Poor	78	25.6	43	13.7	121	19.5	
Middle	63	20.7	72	22.9	135	21.8	
Rich	43	14.1	71	22.5	114	18.4	
Very rich	37	12.1	86	27.3	123	19.8	
Total	305	100	315	100	620	100	

[++]Chi-square tests were used for categorical variables, LDD= Low Dietray Diversity, GDD= Good Dietray Diversity
[b]Mother occupation includes farmer, civil servant, petty trader, and cleaner

Table 2: Mean Comparison of Continuous Variables*

Variables	HDDS				t-test	p-value
	LDD (n=305)		GDD (n=315)			
	Mean	SD	Mean	SD		
Age of mother (in years)	31.5	4.8	30.7	5.13	2.07	0.039
Household monthly income (in birr)	7.1	1.42	7.5	1.22	-4.11	0.000
Total household size (in number)	5.4	1.75	5.1	1.81	2.49	0.013
Land size in hectare	1.2	0.99	1.5	1.03	-3.57	0.000
TLU (Tropical Livestock Unit)	5.7	6.73	8.1	6.80	-4.25	0.000

* Independent Samples t-tests (sig 2-tailed) were used to compare means of variables between Low Dietary Diversity and Good Dietary Diversity households.

Table 3: Factors Influencing Children's Dietary Diversity

Variables	B	S.E.	Wald	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Lower
Educational status	0.20	0.09	5.29	0.021	1.22	1.03	1.44
Mother occupation	0.10	0.24	0.19	0.661	1.11	0.70	1.77
Monthly income	0.08	0.08	1.06	0.304	1.08	0.93	1.25
Total Household Size	-0.12	0.05	5.30	0.021	0.89	0.80	0.98
Housing condition	0.08	0.21	0.16	0.693	1.09	0.72	1.65
Land size	0.12	0.09	1.55	0.213	1.12	0.94	1.35
Birth interval	0.59	0.17	12.48	0.000	1.80	1.30	2.50
TLU	0.02	0.01	2.78	0.095	1.02	1.00	1.05
Enset dominant	-0.92	0.20	20.33	0.000	0.40	0.27	0.60
Asset index	0.22	0.08	7.38	0.007	1.24	1.06	1.45
Chi-square	110.91						
Sig.	0.000						

index households have the highest percentage of low dietary diversity (27.5%). The Chi-square result shows a statistically significant relationship with children dietary diversity score (= 50.21, p-value < 0.001). The result indicated that children from higher levels of assets household have better access to diverse food choices, whereas children with lower levels of asset household face greater challenges in accessing a diverse diet.

The study shows that children from rich households (based on asset index) have a high percentage (49.8%) of healthy eating habits, while those from poor households are more likely to have a low dietary diversity percentage (53.1%). The Chi-square result found out that there is a significant relationship between the child dietary diversity and their family's assets (= 50.21, p-value < 0.001). This means that wealthier families provide their children with more diverse food options than poorer families.

The mean age of mothers in households with LDD was 31.5 years, which was significantly different than the mean age of mothers in households with GDD (30.7 years) with a t-test value of 2.07 and a p-value of 0.039. These results suggest that there is a difference in maternal age between households with LDD and GDD, with households with LDD having slightly older mothers.

The mean monthly income of households with LDD was 7.1, which was significantly different than the mean income of households with GDD (7.5) with a t-test value of -4.11 and a p-value of 0.000. These findings indicate that there is a significant difference in income between households with LDD and GDD, with households with GDD having higher incomes.

The mean household size was 5.4 for households with LDD, which was significantly different than the mean household size of 5.1 for households with GDD with a t-test value of 2.49 and a p-value of 0.013. These results suggest that there is a difference in household size between households with LDD and GDD, with households with LDD having larger family sizes.

The mean land size in hectare was 1.2 for households with LDD, which was significantly different than the mean land size of 1.5 for households with GDD with a t-test value of -3.57 and a p-value of 0.000. These findings indicate that there is a significant difference in land size between households with LDD and GDD, with households with GDD having larger land sizes.

Livestock ownership is measured by the number of Tropical Livestock Unit (TLU). Livestock serves as a means of income, traction power and nutrition. The mean TLU was 5.7 for households with LDD, which was significantly different than the mean TLU of 8.1 for households with GDD with a t-test value of -4.25 and a p-value of 0.000. These results suggest that there is a difference in TLU between households with LDD and GDD, with households with GDD having higher TLU.

The results of the regression analysis indicate that the educational status of a mother has a positive and statistically significant effect on the dietary diversity of children (B = 0.0021, p = 0.007). This revealed that as the educational status of a mother increases by one unit, the odds of the dietary diversity of children variable increase by a factor of 1.22, while holding all other variables constant. In other words, higher levels of education among mothers are associated with an increased likelihood of children having a more diverse diet.

Children's dietary diversity is inversely proportional to the number of people in the family, as shown by regression analysis (B = -0.12, p = 0.021). This means that, holding other factors constant, the likelihood of a child's diet being diverse decreases by a factor of 0.89 for every additional member of the household. To put it another way, when families are larger, children are less likely to eat a wide variety of foods.

Birth interval has a positive effect on the dietary diversity of children (B = 0.59, p = 0.000). The odds ratio of 1.80 means that for every one-unit increase in the birth interval, the odds of the dietary diversity of children increase by a factor of 1.80, holding all other variables constant. This indicates that longer birth intervals are associated with a higher likelihood of children having a diverse diet.

Enset dominant is a significant predictor of dietary diversity of children (B= -0.92, p = 0.000). The odds ratio is reported as 0.40, which suggests that the odds of good dietary diversity of children is 0.4 times lower for enset dominant compared to non-enset dominant households. In other words, children with enset dominant are less likely to have good dietary diversity as compared to those who do not have enset dominance.

The asset index is associated with child's dietary diversity score (B= 0.22, p = 0.007) showed that the relationship between asset index and the dietary diversity of children is statistically significant. The odds ratio is reported as 1.24, which suggests that for every one-unit increase in asset index, the odds of the dietary diversity of children increase by a factor of 1.24, after controlling for other variables in the model.

DISCUSSION

The main factors that significantly influence the dietary diversity of children were mother's educational status, total household size, birth interval, enset dominance, and asset index. Specifically, the study found that education level positively affects the dietary diversity of children in the household. In line with this finding, QuezadaSánchez et al. [8], found that maternal education has positive impact on various aspects of child development, including nutrition. Higher levels of education often correlate with better knowledge and awareness of healthy dietary practices, as educated mothers are more likely to have access to information about nutrition and understand the importance of a diverse diet for their children's health. The finding also consistent with the results of Scaglioni et al. [9], indicating that educated mothers are more likely to have the skills and resources to make informed decisions about their children's nutrition, such as choosing a variety of foods from different food groups, incorporating fruits and vegetables, and understanding the importance of balanced meals. Moreover, educated mothers tend to have greater financial resources and access to healthcare, which can further support their ability to provide a diverse diet for their children.

Additionally, other researchers such as Lokossou et al. [10], have explored the socio-cultural factors associated with maternal education and child nutrition. Higher levels of education are often linked to socio-economic advantages, including better employment opportunities and income levels. These factors can contribute to increased food security, access to quality food, and the ability to afford a diverse range of food options.

As revealed by regression analysis, the findings of this study suggest that the number of people living in a household has a negative correlation with the variety of foods consumed by children. The likelihood that a child will have a varied diet is reduced by a factor of 0.89 for every additional member of the household that is present in the home. The findings of the current study are consistent with the findings of studies carried out by Molla et al. [11], which suggest that as the number of family members' increases, the household food distribution is affected, and food may become more limited, which in turn would limit access to different food groups.

Birth interval has a positive effect on the dietary diversity of children. This indicates that longer birth intervals are associated with a higher likelihood of children to consume the recommended minimum dietary diversity than those who had short birth interval. This finding aligns with the findings of Woldegebriel et al. [12], which shown that shorter birth intervals can increase the risk of adverse health outcomes for both the mother and the child. In terms of child nutrition, shorter birth intervals may limit the mother's ability to fully recover and replenish her nutritional stores between pregnancies, which can impact the quality and quantity of breast milk and the ability to provide adequate nutrition to the newborn. Chungkham [13], also indicated that closely spaced pregnancies may strain family resources, including time, energy, and financial means, which can impact the availability and diversity of food options for the entire family, including the children. Conversely, longer birth intervals allow mothers to have more time for physical recovery, replenishing their nutrient stores, and providing optimal care for their infants. This increased recovery time and improved maternal health can positively influence the quality and availability of breast milk, ensuring better nutrition for the child. Furthermore, longer birth intervals may also allow families to better plan and allocate resources, including food, for each child, resulting in a higher likelihood of providing a diverse and balanced diet.

Children with enset dominant households are less likely to have good dietary diversity as compared to those who do not have enset dominance. In connection to this finding, Borko et al. [14], demonstrated that more number of children become wasted and underweight in wet season before green maize harvest in enset cultivating areas of southern Ethiopia. Jacobsen et al. [15], also added that enset is a starchy staple crop, but low in vitamins and protein content. When enough enset plants are available on a farm, poor households do not go hungry, but their diets lack some essential nutrients. In general, most enset-based households can have a balanced diet, if they are able to supplement enset with protein from legumes and/or animal products. However, the very poor households tend to fall back on kocho, bean sauce, cabbage and taro, with little daily variation and low dietary diversity throughout the year.

This study found that the household asset has association with children's dietary diversity score. Children from rich families were 1.24 times more likely to eat diverse meals compared to those from poor families. In connection to this finding Molla et al. [11], argued that household asset directly affects how much diverse food is available at home. It means that families with more money can afford to buy different types of food, while families with less money may struggle to afford a variety of foods. This link between wealth and food diversity highlights the inequality in nutrition caused by differences in income. Children from poorer families often face challenges in accessing a range of healthy foods, which can impact their health in the long run. Similar result also found by Seboka et al., and indicated that family asset has a direct association with children dietary diversity, since food consumption is believed to be heavily influenced by income of the household.

CONCLUSION

The positive association between a mother's educational status and children's dietary diversity suggests that maternal education plays an important role in improving the nutritional status of children. On the other hand, total household size and enset dominance have a negative impact on dietary diversity, highlighting that families with more members and enset dominant households should focus on promoting a diverse diet. Additionally, the study indicates that longer birth intervals have a positive effect on dietary diversity, and policymakers should focus on programs that promote family planning to improve child health outcomes. Finally, the asset index has a positive association with children's dietary diversity, which suggests that increasing household assets can enhance access to diverse food options for children.

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