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Livelihood Diversification and Multidimensional Child Poverty: Insight from Negele, Oromia Region, Ethiopia

Bogale Gemede[1], Bamlaku Alamirew[2], Bezabih Emana[3]

Abstract

The objective of this study is to examine the relationship between household livelihood diversification and child poverty. Using a multistage sampling method, 401 respondents were selected from four kebeles based on probability proportional to size. Data were collected from the sample households through enumerator-administered interview schedules and analyzed using descriptive statistics and probit model. A multidimensional approach was employed to analyze child poverty, considering indicators such as nutrition, health, education, water, sanitation, housing conditions, information, and fuel and energy. Descriptive analysis revealed that approximately 85% of children in the study area are multidimensionally poor. Additionally, significant differences in child poverty were observed across different child age and sex categories, the sex of household heads, and household socioeconomic status. The Simpson diversity index was used to measure the extent of livelihood diversification. Results indicated that nearly 56% of households have highly diversified livelihoods, while 25% have moderately diversified livelihoods. The study found that most livelihood diversification activities have a positive and significant effect on reducing child poverty. The findings suggest that interventions tailored to the child's age and sex, as well as the sex and socioeconomic status of the household, are necessary to effectively address child poverty in the study area.

Keywords: *diversification of livelihoods, multidimensional childhood poverty, Probit model, household dietary diversity score, poverty.*

[1] Wolaita Sodo University, Department of Rural Development and Agricultural Extension, Ethiopia; Email: bgboge@gmail.com
[2] Yom Institute of Economic Development, Addis Ababa P.O. Box 62539, Ethiopia; bamlakalamirew@gmail.com
[3] General Manager HEDBEZ Business & Consultancy PLC P.O. Box 15805, Addis Ababa, Ethiopia; emana_b@yahoo.com

Introduction

Livelihood diversification is a complex concept and is understood differently. The term diversification implies the processes of economic activities undertaken by a household to increase livelihood benefits such as increasing household income and reducing livelihood risks. Following this assumption, Ellis defined livelihood diversification as a process by which households undertake a diversified set of activities (Ellis, 2000). Others have also defined livelihood diversification as "*attempts by individuals and households to find new ways to raise income and to reduce income risks*" (Hussein and Nelson, 1998). As a result, various studies have shown that the association between livelihood diversification and household poverty is significant. However, very few studies have ascertained the relationship between livelihood diversification at the household level and the poverty level of children. Dirksen and Alkire (2021) have indicated that a lack of an adult's decent employment can affect children in a household. However, as far as child poverty is multidimensional, such an assumption can no longer be comprehensive.

Poverty remains to be conceived differently across the globe. Different people understand and define it in various ways. The most commonly utilized definition is that defined poverty is "a pronounced deprivation in well-being". There are numerous studies linking livelihood diversification as a major strategy for household poverty reduction (Olsson *et al*., 2014; Shanta *et al*., 2017; Gautam and Andersen, 2016). However, there is very little evidence of the relationship between the livelihood diversification of households and the reduction in the poverty status of children. There is no evidence on how much children's needs are at the center of household livelihood diversification strategies as they are in overall household well-being. Some researchers (Singh and Sarkar, 2014) believe that child poverty analysis must be based on child living conditions but not on family conditions. According to Feeny and Boyden (2003), cited in Singh and Sarkar (2014), child poverty embraces three domains, namely, deprivation, exclusion, and vulnerability. Children have more probability of falling into high levels of deprivation, exclusion, and vulnerability than adults. The child deprivation dimension assesses whether children within a household lack access to material resources that are essential for child development to their full potential. On the other hand, the exclusion dimension assesses whether a child's rights are denied, whereas the vulnerability dimension assesses whether children are at risk of exposure to

environmental threats. A lack of addressing these potential children's needs will put them into difficult future conditions, such as a lack of hope, aspiration, confidence, and dependency.

Even though global poverty is declining, disparities in rates of poverty reduction across countries continue to remain a policy concern. Among all the people living in poverty, children comprise the majority. Half of the globally multidimensional poor are still children. According to Alkire *et al.* (2017), as many as 689 million children live in extreme poverty of multidimensional nature in South Asia and sub-Saharan Africa. Of these, 87% reside in South Asia (44%) and Sub-Saharan Africa (43%). Other evidence from sub-Saharan Africa showed that approximately 47.5% of their population was living below the poverty line of USD 1.25 per day per person during 2008 (World Bank, 2012). Ethiopia is one of the African countries that have made significant strides toward poverty reduction because of impressive economic growth (Ajakaiye *et al*., 2014). However, the outcome of economic growth did not benefit equally, especially for vulnerable groups. According to UNICEF Ethiopia's 2016 report, around 13 million children in Ethiopia are living in poverty, with 2 million of them in extreme poverty. More than half of those experiencing extreme multidimensional poverty are children. According to UNICEF (2015) and Alkire *et al.* (2017), the highest multidimensional child deprivation rate was reported in the country, with 90% of children being multidimensionally deprived. Child deprivation in multiple indicators is very high in Ethiopia. Approximately 95 percent of children in the country are deprived of two or more indicators of multidimensional poverty (UNICEF, 2016). According to a report by CSA and UNICEF Ethiopia (2018), 88 percent of all Ethiopian children. This means that equivalent to 36.2 million live in multidimensional poverty. The situation is defined as deprivation in 3 to 6 dimensions concerning the fulfillment of rights or needs for basic goods and services. Additionally, there are significant disparities in deprivation intensity across different areas and regions of residence.

Apart from adults, children understand and describe differently what poverty means to them. A review of multiple children's experiences with poverty revealed that children describe poverty differently based on their socioeconomic conditions. For example, Crowley and Vulliamy (2007), as cited in Tess (2009), have documented various pieces of evidence on how families and childhood experience poverty. They show a good understanding of what poverty means to

children. For example, some children perceive that they are poor when they "lack the right clothes and right friends", others perceive that they are poor when they are unable to get "what they want for their Christmas or birthday party", likewise others feel poor when they have a bed but cannot have good things for their birthday, and still again others feel poor when their mother cannot pay off her gas and electricity bills. This indicates that poverty is a dynamic concept and that different people perceive it differently. Many previous studies on poverty primarily focus on unidimensional poverty measurements, which are mainly based on household income and expenditure indicators at a specific point in time (Dieden and Gustafsson, 2003). Such an approach mostly excludes children as the key unit of analysis. Some of the other studies on child poverty treated children separately from household livelihood activities by taking key indicators. Therefore, there is little evidence linking household livelihood activities with child poverty. Moreover, the causes of child poverty are multiple, and the income approach alone cannot sufficiently address child poverty. The study examines how child poverty varies across different age groups, as children's needs and vulnerabilities may change throughout their development. The research also explores the potential gender-based differences in child poverty, as girls and boys may face distinct challenges and deprivations. Therefore, this study aims to uncover the linkages between household livelihood diversification and the multidimensional aspects of child poverty in the Negele Arsi *woreda*.

Methods of the Study

Techniques used for Sampling and sample size determination

In this research, a multistage sampling technique was employed. In the first stage, the Arsi Negele woreda in the West Arsi zone was purposively selected based on the researcher's experience, the convenience of accessing relevant information, and the area's potential for diversified livelihood activities. In the second stage, stratified random sampling techniques were used. Kebeles were stratified based on the dominant livelihood activities (diversification options) using background information obtained from the Woreda Office of Agriculture. From each stratum, sample households were selected through simple random sampling techniques. Finally, within the stratified kebeles, households with children were selected using purposive sampling techniques. The sample size was determined based on Yamane's formula for sample size determination (Yamane, 1967).

$$n = \frac{N}{1+N(e)^2} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots . (1)$$

Where N is the population size and e is the level of precision. The population of the woreda is 394,020. With the level of precision e set at 5%, the calculated total sample size is 400. However, in our study, the sample size is 401. An additional questionnaire was distributed to an enumerator, and since the minimum representative sample as per the calculation was 400, the inclusion of one additional sample did not significantly affect the estimation. Therefore, it was retained in the sample.

Data sources and data collection methods

The primary data were collected from the sample respondents using interview schedules. Well-trained enumerators were used to gather data from the target *kebeles*. Study area *kebeles* were selected purposively based on researcher experience. Interview schedules consisted of relevant household information in terms of livelihood activities, socio-demographic characteristics, and other factors, such as institutional and infrastructural factors were developed to collect data. Interview schedules comprising subsections with questions on food frequency and dietary diversity questionnaire-based multiple-pass 24-hour recall were used specifically to collect food consumption data on children aged 6–59 months. Similarly, some sections of the schedule comprised questions on access to information, education, health, shelter, water and sanitation, and income level of households to assess child poverty indicators were included.

Methods of data analysis

Data was processed using STATA version 16, Microsoft Excel, and SPSS version 25. Descriptive statistics such as the mean and percentage were used to describe the socioeconomic and demographic characteristics of the sample households. The Probit model was also used to examine the contribution of livelihood diversification to multidimensional child poverty reduction.

We applied the Simpson diversity index to determine the diversification level of livelihoods of households. In this study, the major sources of livelihood activities are on-farm activities, off-farm activities, and non-farm activities. Most rural households practice combinations of the abovementioned livelihood activities following the expected risks and returns.

Therefore, every livelihood activity assessed in this study was carefully identified and categorized as on-farm activities, off-farm activities, and non-farm activities based on some empirical literature (Bryceson, 2005). The extent of livelihood diversification is determined by Simpson's diversity index and is specified as follows:

$$\text{Diversity Index (DI)} = 1 - \sum_{i=1}^{s} (\frac{n_i}{N})^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

where S is the number of income sources or activities that are present; n_i (for i = 1 to S) is the income value of individuals in the i-th income sources and N $(= \sum n_i)$ is the total income of all income sources. The value of SID ranges from 0 to 1, and for a household with no diversity (i.e., having only a single income source or activity so that S = 1 and $n_1 = N$), DI is zero, and as income diversity increases, DI approaches unity. The level of diversification was specified as follows: SID is less than or equal to 0.01 (undiversified), SID is equal to 0.011-0.25 (less diversified), SID is equal to 0.26–0.50 (moderately diversified), and SID is 0.51-0.74 (highly diversified), and SID is greater than or equal to 0.75 (very highly diversified). In alignment with the objective of this study, we also measured child poverty using multidimensional poverty measurement techniques.

Multidimensional child poverty

The multidimensional poverty index (MPI) is constructed considering eighteen indicators that span three dimensions. In this study, the unit of analysis is children. Multidimensional child-poor poverty was determined based on these indicators set to identify child poverty. A set of indicators such as nutrition, health, education, water, sanitation, information, shelter (housing condition), fuel, and energy were used to estimate child deprivation. Average annual household income was separately used to see child deprivation in the income aspect; however, it was not included in the multidimensional child poverty estimation index.

Deprivation cutoffs: The MPI first identifies whether a child is deprived in each of the 18 indicators. The indicators, cutoffs, and weights are summarized in Table 1 below.

Poverty Cutoff:

Once it has been identified who is deprived in each indicator, the next step is to determine who is multidimensionally poor. Following Alkire et al. (2015), the second cutoff called the 'poverty cutoff' k (in this case 33%), is set across the weighted sum of a child's deprivations. For the MPI, a child is identified as multidimensionally poor if and only if they are deprived in at least one-third of the weighted indicators.

Specifically, the indicators under each dimension are multiplied by $^1/_3$. Ultimately, children who are jointly deprived in 33% (in this case) of dimensions namely health, education, and living standard, were determined to be multidimensionally poor.

The following table shows the dimensions of multidimensional child poverty along with the indicators, deprivation conditions, and weights used in this study to determine child poverty.

Table 1: Dimensions of child poverty and indicators

Dimensions	**Indicators**	**Deprived if…**	**Related to…**	**Relative weight**
Health	Meal frequency	A child is feeding < 4 times per day	SDG 2	1/15
	Meal diversity	A child is feeding < 4 food groups per day	SDG 2	1/15
	Skilled birth	A mother didn't attend antennal care before giving a newborn	SDG 3	1/15
	Measles vaccination	A child has not been vaccinated	SDG 3	1/15
	BCG vaccination	A child has not been vaccinated	SDG 3	1/15
Education	Years of schooling	A child aged above 14 years of age has not completed primary school	SDG 4	1/6
	School attendance	A child aged 5-14 not attending primary school	SDG 4	1/6
Standard of living	Radio	No access to radio	SDG 1	1/33
	Television	No access to television	SDG 1	1/33
	Phone	No access to mobile phone	SDG 1	1/33
	Computer	No access to computer services	SDG 1	1/33
	Room crowded	A child is living with ≥4 people in a room	SDG 11	1/33
	Flooring	A floor is made of wood, and covered by grass	SDG 11	1/33
	Access to protected water	A child has no access to protected water	SDG 6	1/33
	Distance to protected water	Child travel ≥30 minutes on a round trip to collect water	SDG 6	1/33
	Access to flush toilet	The sanitation facility is not improved or it is improved but shared with other households.	SDG 6	1/33
	Electricity	Has no access to electricity	SDG 7	1/33
	Cooking fuel	Households are using charcoal, wood, or dung for cooking meal	SDG 7	1/33
Household income	Average annual income	The average annual household income is <7,184 Ethiopian birr	CSA and UNICEF (2020)	

Source: Adopted from UNICEF (2015).

Multidimensional headcount ratio (H)

According to Alkire *et al*. (2015), the multidimensional deprivation headcount assesses the number of children experiencing deprivation contingent on the selected cutoff point for identifying the deprived. Specifically, a child *i* is deemed deprived if the number of dimensions in which they are deprived (D_i) is equal to or larger than the cutoff point *K*:

$y_k = 1 \; if \; D_i \geq k, y_k = 0 \; if \; D_i < k$

The multidimensional deprivation headcount ratio is calculated as follows:

$$H = \frac{q_k}{n}, with \; q_k = \sum_{i=1}^{n} y_k \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ldots (3)$$

where

q_k = number of children affected by at least K deprivations;

n = total number of children included in the analysis;

y_k= deprivation status of child *i* depending on the cutoff point K;

Di = number of deprivations each child *i* experiences;

K = cutoff point.

Average deprivation intensity among the deprived (A)

The average intensity of multidimensional deprivation is calculated by dividing the total number of deprivations experienced by all deprived children by the total number of possible deprivations for those children.

$$A = \frac{\sum_{1}^{q_k} c_k}{q_k \times d}, with \; c_k = D_i \times y_k \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . (4)$$

where

q_k = number of children affected by at least K deprivations;

d = total number of dimensions considered per child;

c_K = number of deprivations each multidimensionally deprived child *i* experiences

Adjusted multidimensional child deprivation headcount ratio (M_0)

The adjusted deprivation headcount ratio is used to capture both the number of deprived children (H) and their deprivation intensity (A).

$$M_0 = H \times A \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ldots (5)$$

A child is classified as poor or non-poor based on their overall deprivation score relative to the multidimensional poverty cutoff. If the score is below the cutoff, the child is considered non-poor; if the score meets or exceeds the cutoff, the child is considered poor.

The contribution of livelihood diversification to child poverty reduction

The contribution of livelihood diversification to child poverty reduction was analyzed using the probit model. The probit model, introduced by Chester Bliss in 1934, and further developed with a fast method for computing maximum likelihood estimates (Bliss, 1935), is used when the dependent variable is binary, meaning it can have only two possible outcomes, denoted as 1 and 0. It is used when the dependent variable is binary that is it can have only two possible outcomes which we will denote as 1 and 0. When the dependent variable y_i is binary, P_i is expressed: The following is adopted from Gujarati (2009).

$$Pi = (y = 1|xi) = \phi(xi\beta) \ldots\ldots\ldots (6)$$

where Pi denotes probability, ϕ is the cumulative distribution function and β maximum likelihood coefficient of the standard normal distribution. The probit model assumes that the dependent variable follows a normal distribution, while the dependent variable y is derived from this underlying normal distribution.

It is also possible to motivate the probit model as a latent variable model. Suppose there exists an auxiliary random variable.

$$Y^* = X'\beta + \varepsilon, \ldots\ldots\ldots (7)$$

Where $\varepsilon \sim N(0,1)$. Then Y can be viewed as an indicator of whether this latent variable is positive:

$$Y = 1_{\{Y^*>0\}} = \begin{cases} 1\ if\ Y^* > 0\ i.e. -\varepsilon X'\beta, \\ 0\ otherwise. \end{cases} \ldots\ldots\ldots (8)$$

The use of the standard normal distribution does not cause any loss of generality compared to using an arbitrary mean and standard deviation. This is because adding a fixed amount to the mean can be offset by subtracting the same amount from the intercept and multiplying the standard deviation

by a fixed amount can be offset by multiplying the weights by the same amount. The independent variables were specified as follows:

X1 = Sex of household head (male=0, Female =1)
X2 = Age of household head (in years)
X3 = Education status of household head (able to read and write =1, illiterate =0)
X4 = Household size (number of individuals in a household)
X5 = Marital status of household head (married=1; unmarried =0)
X6 = Health status of household head (excellent =1, very good =2, good =3, fair =4, poor =5)
X7 =Total land holding in hectares (ha)
X8 = Number of plot lands owned at different locations (number)
X9 = Participation on off-farm for harvest share (yes = 1, no =0)
X10 = Laboring on other's farm (yes = 1, no =0)
X11 = Frequency of extension contact per month (number of extension contacts)
X12 = Distance to the nearest market (km)
X13 = Total number of livestock in TLU (in Tropical Livestock Unit)
X14 = Participation in petty trading (yes = 1, no =0)
X15 = Charcoal production (yes = 1, no =0)
X16 = Incidence of household poverty (poor =1, non-poor =0)
β = vector of Probit maximum likelihood esstimates
e_i = independently distributed error term

The association between child poverty and household poverty was also examined through simple statistical methods. The income approach was used to measure household poverty. The percentage of poor households in sampled population was estimated by headcount index, and specified as:

$$P_0 = \frac{N_p}{N} \ldots \quad (9)$$

Where N_p is the number of poor and N is the total population (or sample). Considering a poverty line in the measurement, we can rewrite the headcount ratio as:

$$P_0 = \frac{1}{N}\sum_{i=1}^{N} I(y_i < Z) \ldots \quad (10)$$

Here, I (·) is a function indicating that it takes on a value of 1 if the expression in the bracket is true, and 0 otherwise. So, if the average annual income (y_i) is less than the poverty line (z), then I (·) equals 1 and the household would be counted as poor. In our case, the poverty line is 7,184.00 birr, based on CSA and UNICEF (2020). Therefore, a household is poor if the average annual income is less than 7,184.00 birr.

Results and discussion

The extent of livelihood diversification

The extent of livelihood diversification was computed using the Simpson diversity index. The percentage distribution of the extent of income-based livelihood diversification indicates that more than half (56%) of respondents are engaged in highly diversified livelihoods. The second highest level of diversification is observed as a medium level of diversification. This implies that most households in the study area are engaging in activities providing medium to high levels of income. Similarly, the activity-based diversification index also showed that most households are practicing a diversified livelihood activity to generate income. The percentage distribution for livelihood activities shows that more than half (52%) of respondents are engaged in very high-level diversification of livelihood activities. Livelihood diversification is very common in the study area, which is why only 2% of households are not diversifying their livelihoods.

Table 2: Summary statistics of the extent of livelihood diversification

	The extent of livelihood diversification		
	Intervals	Freq.	Percent
Undiversified	≤0.01	58	14.46
Less diversified	0.011-0.25	13	3.24
Moderately diversified	0.26-0.50	101	25.19
Highly diversified	0.51-0.74	224	55.86
Very highly diversified	≥0.75	5	1.25

Source: Computed from our survey data, 2020

Household socioeconomic characteristics

Table 3 shows that the percentage distribution of household characteristics shows that the majority of sample household heads are males. Of the sampled households, approximately 87% of respondents are male-headed. The education status of respondents in this study was conceptualized as literate and illiterate. The former stands for those all who can read and write, mostly those who attended a certain level of schooling, while the latter stands for those all who cannot read and write. The results show that approximately 79% of sample respondents are literate, showing that they can

read, write, and understand written information. This is very important for easily adopting new agricultural technologies and being easily aware of available alternative livelihood activities in their locality. The descriptive results show that most of the respondents are married (nearly 88%), followed by divorced (6.5%), and widowed (4.7%).

Table 3: The percentage distribution of sampled households' characteristics

Characteristics	**Frequency**	**Percent**
Sex of household head		
Male	350	87.3
Female	51	12.7
Education status		
Illiterate	83	20.7
Literate	318	79.3
Marital status		
Single	5	1.2
Married	351	87.5
Divorced	26	6.5
Widowed	19	4.7
Health status		
Excellent	101	25.2
Very good	132	32.9
Good	129	32.2
Fair	37	9.2
Poor	2	.5
Irrigation practices		
No	370	92.3
Yes	31	7.7
Laboring on other's farm		
No	358	89.3
Yes	43	10.7
Participation in off-farm for harvest share		
No	302	75.3
Yes	99	24.7
Participation in petty trading		
No	382	95.3
Yes	19	4.7
Engagement in carpentry activities		
No	390	97.3
Yes	11	2.7
Charcoal production and selling		
No	388	96.8
Yes	13	3.2

Source: Computed from our survey data, 2020

Based on Wu (2003), health status is categorized using a self-reported Likert scale ranging from 1 to 5: excellent, very good, good, fair, and poor. This scale is used to assess the health condition of the household head by asking the question, "How would you describe your health status?" Following Drever *et al*. (2001) "people are good judges of their state of health"; we raised the question to each respondent to report their health condition. Most respondents are in good health conditions. The results show that only 9% of respondents said that their health condition was fair, while less than 1% of respondents reported that they were in poor health condition. Irrigation practices are not common in the study area. Most agricultural production is rain-fed, and only 8% of respondents were practicing irrigation. Agriculture is the dominant livelihood activity in the study area, and both off-farm and non-farm activities are practiced by a few households. In this study, off-farm activities include agricultural laboring and off-farm participation for harvest share. The percentages of households participating in off-farm and non-farm activities are 11% and 25%, respectively. Most households participate in other people's farms for harvest share rather than agricultural laboring. We have defined non-farm activities as all livelihood activities other than primarily farming (plowing, weeding, harvesting or trashing, and/or keeping livestock) activities regardless of spatial difference (either on own farm or another person's farm). However, it may include marketing agricultural products such as retailing farm products. Some of the non-farm activities included in this study are petty trading, carpentry works, and charcoal production and selling. The percentage distribution of households participating in non-farm activities shows that only 4.7%, 2.7%, and 3.2% of households participate in petty trading, carpentry works, and charcoal production and selling, respectively. The result implies that non-farm activities are the lowest contributor to households' livelihoods in the study area.

Household assets and opportunities

Livelihood diversification refers to individuals and households seeking new ways to increase income and reduce environmental risks (Hussein and Nelson, 1999). It can also be defined as "the process by which rural families build a diverse portfolio of activities and social support capabilities in their struggle for survival and to improve their standards of living" (Ellis, 1997). Additionally, it is seen as an ongoing process where households or rural poor add new activities to their existing ones or switch between them to maintain diverse and evolving livelihood strategies (Ellis, 1997). Typically, livelihood diversification includes a range of activities such as on-farm activities (crop production and animal husbandry), non-farm activities (non-agricultural activities like petty

trading and remittances), and off-farm activities (agricultural labor and harvest sharing) (Ellis, 1999). The level of diversification is assessed using the Simpson diversity index (SDI). The diversity levels are categorized based on the SDI value as undiversified (UD), less diversified (LD), moderately diversified (MD), highly diversified (HD), and very highly diversified (VHD) (Equation 2).

Table 4: Summary statistics of continuous variables by the extent of livelihood diversification

Variables	**The extent of livelihood diversification (mean)**					**Total mean**	**F value**
	UD	**LD**	**MD**	**HD**	**VHD**		
Age of household head	40.23	35.69	38.78	42.81	45.20	41.22	4.693***
Household size	3.71	3.52	4.03	4.85	4.85	4.43	10.184***
Economically active labor	2.50	2.41	2.50	3.36	3.66	2.99	11.354***
Total land holding	.761	1.14	1.32	1.90	2.05	1.57	17.073***
Livestock owned	1.52	2.16	2.95	5.74	3.30	4.28	17.752***
Frequency of extension contact	1.41	2.23	1.76	2.97	3.40	2.42	30.923***
Farming experience in years	19.79	15.77	16.74	22.77	22.20	20.60	7.061***
Number of plot lands owned	1.53	1.46	1.62	2.01	2.60	1.83	8.268***
Distance to the nearest market	11.11	17.54	14.43	9.12	11.30	11.04	10.384***
Total annual income	12821.55	28053.85	33095.54	68220.38	111180.0	50594.12	34.202***

Source: Computed from our survey data, 2020

We used a one-way analysis of variance (F test) to analyze the existence of significant differences among the average scores of continuous explanatory variables across the livelihood diversification groups. To make multiple comparisons among the livelihood groups, we used a post hoc test. The comparison of F test results showed the existence of a statistically significant mean difference

between rural households falling in the five levels of livelihood diversification. Age of household head, total land holding size, household active labor, farming experiences, number of plots of land owned at different locations, livestock ownership, distance to the nearest market, frequency to extension contact, and total annual income are significant at less than 1% levels (Table 4). The overall mean age of the sample households is 41.22 years. Similarly, the average age of household heads falling into different extents of livelihood diversification is 40.23, 35.69, 38.78, 42.81, and 45.20 for undiversified, less diversified, moderately diversified, highly diversified, and very highly diversified livelihoods, respectively. Studies on the association of household head age and livelihood diversification indicated that there is an inverse relationship (Abera *et al*., 2021). In the current study, it is identified that there is a significant mean difference in the age of household heads across levels of livelihood diversification.

Household size is measured as adult equivalent. The overall mean and standard deviation are 4.43 across the extent of livelihood diversification and ±1.61, respectively. When household size increases, there is a tendency for household members to participate in various livelihood activities. This might be due to structural transformation in livelihood activities, especially in SSA, as some evidence has shown. For example, McMillan and Harttgen (2014) found that between 2000 and 2010, the share of the labor force in the agriculture sector declined by about 10 percentage points. The mean of households falling in the moderately, highly, and very highly diversified livelihood diversification categories is higher than that of undiversified and less diversified households. There are various reasons why households diversify their livelihoods. For example, Alobo (2015) concludes that while the advantage of diversification into non-farm income sources primarily benefits the more affluent, diversification still offers a safety net for the rural poor and can sometimes offer a path to upward mobility. Similarly, findings from other studies also came up with findings that substantiate these arguments indicating that dwindling farm sizes and the growing landlessness in rural areas compel unskilled farm labor to look for alternatives, often low-return non-farm sectors (Haggblade, Hazell, & Reardon, 2007; Headey & Jayne, 2014). The argument for household size as a better 'opportunity for livelihood diversification' makes sense when the members of a household can participate in income-generating activities, which is what we call economically active labor. Economically active labor, which is the number of people available in the age range of 15-64 years, is higher than the age dependency ratio on average. As seen in Table (4), the mean of economically active labor is nearly 3, implying that on average, a

household has three people aged between 15 and 64 years. This implies that on average, each household has three people who can engage in income-generating activities. The results of this study revealed that a household with more economically active labor falls in the highly and very highly diversified livelihood diversification categories.

Land is one of the most needed assets, especially in the rural agrarian community. Since the majority of rural people in Ethiopia depend on agriculture for their livelihoods, land is the most commonly demanded and crucial household asset. In the study area, on average, households own 1.57 hectares of land with ±1.1 standard deviation (see Annex Table 1). The maximum and minimum land holdings are 9 and 0.13 hectares, respectively. In addition to land size, the number of plots of land owned by household heads in different agroecosystems is essential for farm-based livelihood diversification. Under unpredictable and uncertain agro-climatic conditions, owning more than one plot of land, especially under varying agroecological conditions, is assumed to be a risk diversion mechanism. Households in the study area on average possess nearly two plots of land with standard deviation, maximum and minimum of ±0.83, 4, and 1 at different locations, respectively.

The frequency of extension contact is the number of visits a farmer makes to contact extension agents per month. Farmers contact extension agents for various purposes to obtain advisory services on their production systems and to obtain market information for their production and agricultural inputs. Various studies have confirmed that extension contacts have a significant contribution to livelihood diversification. The number of extension visits per year has a significant and positive effect on income diversification (Teshome and Edriss, 2013), but other studies have shown that extension contact harms livelihood diversification (Tamerat, 2016; Asfir, 2016). Extension contact with a relevant message has contributed to pastoral livelihood diversification practices (Samuel, 2001; Dinku, 2018). In the current study, the mean frequency of extension contact is 2.42, implying that households in the study area contact extension agents on average more than twice per month. The minimum extension contact is zero, implying that there are households that do not contact the extension agents. The maximum is eight extension contacts per month. The results indicate that households in the study area have a good awareness of the importance of extension information which increases the level of livelihood diversification moving parallel with an increase in the frequency of extension contact. This also creates a good opportunity to practice diversified livelihood activities.

Farming experience is the number of years a household head practiced farming activities. Very little evidence has reported the relationship between farming experience and livelihood diversification. According to Isaac (2016), farming experience has a significant and negative association with livelihood diversification. This implies that more experienced farmers prefer specialization to diversification. In the current study, households had many years of farming experience. The mean years of farming experience are nearly 21 (Table 4), with a standard deviation, minimum, and maximum of ±10.46, 1, and 70 years, respectively (see Annex Table 1). Distance to the nearest market also affects the level of livelihood diversification. Farm households visit the market for various purposes such as seeking chemical fertilizers, crop seeds, and livestock, and to sell their farm production. As the distance to the nearest market increases, farmers prefer to stay in limited livelihood activities. The result from one-way ANOVA revealed that there is a statistically significant mean difference in distance to the nearest market across the extent of livelihood diversification in Negele Arsi *Woreda*.

Disaggregation of child poverty by age group and sex category (child poverty profile)

This section highlights the disaggregated state of child poverty by age and sex of children in the study area. The descriptive results demonstrate the nature of child poverty across the age and sex categories of children. From the rough observation, we can understand that child poverty is highly concentrated in children aged between 6 and 18 years, and female children are poorer than male children for both age categories. Some studies showed that the burden of poverty is unequally accumulated by age and gender (Feeny and Boyden, 2003). In our study, we have shown the features of child poverty in terms of the age and gender of children.

$$\%\ \text{of under} - \text{five poor children} = \frac{\text{poor children}}{\text{total under} - \text{five children}} * 100 = \frac{385}{477} * 100 = 81\%$$

From the sampled households, the total number of children under-five age is 477, among which 385 of them are multidimensionally poor, comprising approximately 81% of the children of the same age. In this approach, when we treat the poverty rate separately for different age categories, it is roughly higher for children aged between six and eighteen years than for children under the age of five years in the study area.

$$\%\ \text{of } 6 - 18 \text{ age poor children} = \frac{\text{poor children}}{\text{total } 6 - 18 \text{ Children}} * 100 = \frac{1061}{1289} * 100 = 82.3\%$$

The total number of poor children is 1412 and the overall child poverty is approximately 82%.

$$\%\ \text{of poor children}\frac{1446}{1766} * 100 = 81.87{\sim}82\%$$

Disaggregating poverty rate by the sex of children we can find that the percentage of poor female children under the age of five and children aged between 6 to 18 years are poorer than male children for the same age category. The following is the calculated child poverty rate for both age and sex categories.

Percentage of female children under the age of five poor:

$$\%\ \text{of female poor children} = \frac{\text{poor female children}}{\text{all under 5 children}} * 100 = \frac{203}{477} * 100 = 43\%$$

Percentage of male children under the age of five poor:

$$\%\ \text{of male poor children} = \frac{\text{poor male children}}{\text{all under 5 children}} = \frac{182}{477} = 38\%$$

Percentage of male poor children between 6-18 ages:

$$\%\ \text{of male poor children between } 6-18 \text{ ages} = \frac{\text{poor children}}{\text{all children } 6-18 \text{ ages}} * 100$$

$$= \frac{523}{1289} * 100 = 41\%$$

Percentage of poor female children aged 6-18 years:

$$\%\ \text{of female poor children between } 6-18 \text{ ages} = \frac{\text{poor children}}{\text{all children } 6-18 \text{ ages}} * 100$$

$$= \frac{538}{1289} * 100 = 42\%$$

The total number of children from 401 households is 1766, among which 869 are males and 897 are females. The overall poverty estimates showed that female children are poorer than male children in the study area. From the total poor children, (i.e., under five years of age and between 6-18 years of age), 741 (51.2%) female children are multidimensionally poor, while for similar age groups, 705 (49%) male children are multidimensionally poor. This figure shows that female children are poorer than male children in the study area. On the other hand, child poverty is significantly higher for children aged between 6 and 18 years. A total of 1061 children between 6 and 18 years old are poor, while 385 children under the age of five are poor. This implies that from the total of 85% of the child poverty rate in the study area, 73.4% of child poverty is concentrated in children aged between 6 and 18 years, while only 26.6% of child poverty comes from children under the age of five. Multidimensional poverty is an outcome of multiple indicators aggregated

to indicate an average deprivation in the dimensions considered for poverty measurement. Various studies from different countries indicated that child poverty disproportionally exists between boys and girls and their ages. For example, in Afghanistan and Pakistan, more girls are out of school than boys. In Afghanistan, while 44.0% of girls are out of school, the corresponding figure for boys stands at 24.8%. In the same vein, 27.2% of the former and 19.7% of the latter are out of school in Pakistan. Similarly, in Bangladesh, fewer girls than boys (7.2% vs. 12.1%) are multidimensionally poor and out of school (Dirksen and Alkire, 2021).

The features of child poverty deprivation in the study area

This section of the study examines the nature of child deprivation across multidimensional poverty indicators. We used descriptive results to portray the deprivation status of children in the study area. The analysis revealed that the incidence (headcount ratio) of multidimensional poverty (H) is 0.85, meaning that 85% of children in the study area experience multidimensional poverty. The intensity of multidimensional poverty (A) is 0.456, indicating, on average, multidimensionally poor children are deprived in 45.6% of poverty dimensions.

In the study area, the incidence of multidimensional poverty is also higher but below the national average. The following figure illustrates the percentage share of each indicator of child poverty deprivation. The maximum deprivation was observed in computers, fuel, and energy, each comprising 10% of overall deprivation. Most children live in households that use firewood, charcoal, and dung for cooking meals. This has an impact on children in that most of the time children are responsible for collecting firewood in rural areas. Therefore, they might be forced to drop out of school to carry out these activities.

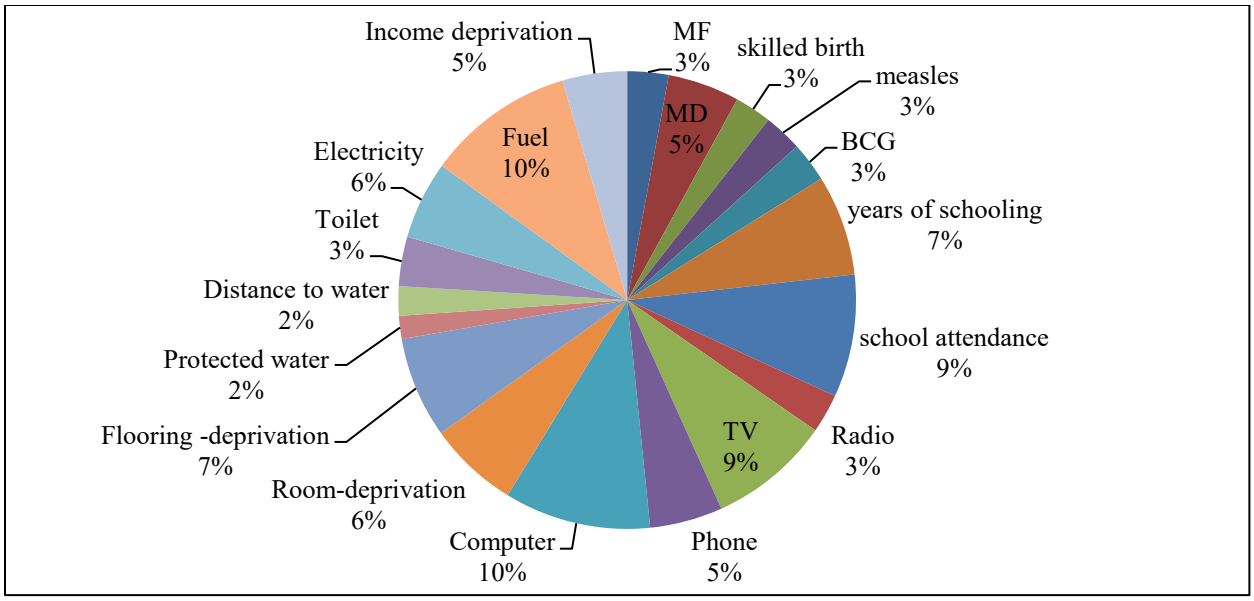

Figure 1: The percentage distribution of indicators of child poverty

Education deprivation comprises 16% of aggregated results of the disenrollment of school-aged children; and whether the children at the age of 14 years have not completed primary school. The result indicates that children in the study area are deprived of the lack of enrollment and lack of completing primary school at the age when they would have completed it. The below figure shows that children in the study area are highly deprived of other indicators, such as shelter, sanitation, income, nutrition, and health. A low deprivation rate is observed for access to protected water, and distance to access protected water implying water deprivation contributes 4% to multidimensional child poverty in the study area.

Multidimensional child poverty and deprivation status

Child deprivation in multiple indicators is very high in Ethiopia, as reported by the CSA and UNICEF (2018). Reports showed that the multidimensionally deprived children residing in Addis Ababa are, on average, deprived of 3.2 dimensions, while their counterparts in Afar and Somalia experience an average of 4.8 and 4.7 simultaneous deprivations, respectively (CSA and UNICEF Ethiopia, 2018). The current study assesses child deprivation using three dimensions (Table 5). The table compares the patterns of multidimensional child poverty and deprivation across different indicators. The results showed that multidimensionally poor children are highly deprived in all dimensions compared to multidimensionally non-poor children.

The percentage of child deprivation in meal frequency is higher for the poor than the non-poor. Multidimensionally poor children deprived in meal frequency are two times higher than multidimensionally non-poor children in the study area (see Table 5). Similarly, poor children are highly deprived of meal diversity compared to non-poor children. On the other hand, no non-poor children were deprived of skilled birth, measles, and BCG immunization. Nutrition status reports of children indicated that there is a serious problem of malnutrition in Ethiopia. According to the CSA (2016) report, 38% of children under age 5 in the country are stunted (short for their age), 10% are wasted (thin for their height), 24% are underweight (thin for their age), and 1% are overweight (heavy for their height).

The FDRE developed the National Nutrition Strategy and the National Nutrition Programs (NNP) in 2008. The second NNP, which covers the period from 2016 to 2020, addresses the multisectoral and multidimensional nature of nutrition (FDRE, 2008). However, there is a slight improvement in child dietary intake, leaving plenty of work remaining to satisfy at least the minimum dietary recommendation (EPHI, 2021). The percentage of children deprived in years of schooling is 19 and 76% for non-poor and poor respectively. This implies that the rate of children above the age of 14 years who have not completed primary school is higher for the poor than the non-poor. Similarly, the percentage of non-poor and poor children aged between 5-14 years but not attending primary school is 46 and 89 respectively. Schooling, especially for rural poor children, is very difficult in Ethiopia. The Young Lives study showed that the enrollment rate for poor children was lower (89%) than for non-poor children (92%) during the academic year of 2009, as cited in Yisak (2012). Likewise, the dropout rate is higher for poor children in the same year.

Table 5: Status of Child deprivation

Dimension	**Indicators**	**Poverty status**	**Deprivation status**			
			Not deprived		Deprived	
			Freq.	%	Freq.	%
Health	Meal frequency	Non-poor	50	85	9	15
		Poor	240	70	102	30
	Meal diversity	Non-poor	46	78	13	22
		Poor	162	47	180	53
	Skilled birth	Non-poor	59	100	0	0
		Poor	243	71	99	29
	Measles immunization	Non-poor	59	100	0	0
		Poor	239	70	103	30
	BCG immunization	Non-poor	59	100	0	0
		Poor	235	69	107	31
Education	Years of schooling	Non-poor	48	81	11	19
		Poor	82	24	260	76
	School attendance	Non-poor	32	54	27	46
		Poor	39	11	303	89
Living standard	Access to radio	Non-poor	47	80	12	20
		Poor	249	73	93	27
	Access to TV	Non-poor	17	29	42	71
		Poor	56	16	286	84
	Access to telephone	Non-poor	40	68	19	32
		Poor	165	48	177	52
	Access to computer	Non-poor	2	3	57	97
		Poor	5	2	337	98
	Overcrowding	Non-poor	38	64	21	36
		Poor	120	35	222	65
	Floor quality	Non-poor	28	47	31	53
		Poor	101	30	241	70
	Access to safe drinking water	Non-poor	58	98	1	2
		Poor	281	82	61	18
	Distance to water source	Non-poor	53	90	6	10
		Poor	269	79	73	21
	Access to improved sanitation	Non-poor	41	69	18	31
		Poor	227	66	115	34
	Access to electricity	Non-poor	42	71	17	29
		Poor	149	44	193	56
	Cooking fuel	Non-poor	1	2	58	98
		Poor	2	1	340	99
	Income deprivation	Non-poor	29	49	30	51
		Poor	198	57	144	43

Source: Computed from our survey data, 2020

In the study area, the majority of the children are deprived of information from different sources. About 27% of poor and 20% of non-poor children have no access to radio. Similarly, access to television is difficult for poor and non-poor children. The percentage deprivation of television shows that about 84% of poor children and 71% of non-poor children are deprived. The percentage of poor children deprived of telephone access is also higher than that of non-poor. Extreme information deprivation for both poor and non-poor children was observed in access to computers. A report of trend analysis of multidimensional child deprivation shows that the majority of children in Ethiopia live in households that have access to information from the media (Plavgo *et al*., 2013). Similarly, the result of this study also showed that accessing information for rural children in the study area is difficult.

Housing conditions are one of the most important indicators of multidimensional poverty. A house is considered to provide sufficient living space if three or fewer people share the same room. If 4 or more people live in one room, their risk of loss of dignity increases further resulting in more likelihood of catching an infectious disease and domestic violence. Against this background, the current survey showed that about 65% of poor children and 36% of non-poor children live with more than four individuals in a room. Living with four or more people in one room increases the risk of loss of dignity, infectious diseases, and domestic violence. Additionally, children's development may suffer due to the inability to do homework in a quiet space, poor sleep, illness, abuse, and violence. Furthermore, the quality of roof and floor materials is also poor in the study area. According to the World Health Organization (WHO, 2010), a house is considered safe if it can protect from weather extremes such as heat and cold, as well as wind and rain. In the study area, 70% of poor children and 53% of non-poor children are deprived of roof and floor-quality housing conditions.

According to SDG 6, improved sources of drinking water include piped water into dwellings, yards, or plots; protected dug wells; public taps or standpipes; protected springs; boreholes or tubewells; and rainwater. These sources should be located on the premises, available when needed, and free of fecal and priority chemical contamination. In the study area, piped water into dwellings and standpipes are the main sources of drinking water. The Central Statistical Agency (2011) reported that approximately 54% of households in Ethiopia have access to improved sources of

drinking water. However, accessing these water sources is challenging due to population pressure on the limited resources. Fetching water often involves significant time and effort, especially for women and children. Data indicates that 18% of poor children are deprived of access to protected water, while only 2% of non-poor children face the same deprivation. Additionally, 21% of poor children live more than 30 minutes round trip away from a protected water source, compared to 10% of non-poor children. Children in the study area are also deprived of access to improved sanitation. Improved sanitation facilities include flush or pour-flush toilets connected to sewer systems, septic tanks or pit latrines, ventilated improved pit latrines, pit latrines with a slab, and composting toilets (WHO and UNICEF, 2017). About 34% of poor children and 31% of non-poor children lack access to these facilities. An earlier report by the CSA (2011) indicated that approximately 81% of urban households and 91% of rural households in Ethiopia use unimproved sanitation facilities. This issue is partly due to a lack of access to water sources.

The majority of children live in households, which use traditional sources of energy for cooking such as coal, wood, charcoal, dung, crop residues, or kerosene. As a result, they are exposed to different problems, as they are deprived of access to clean energy sources. Accordingly, the percentage of children deprived of fuel and energy in the study areas is high. Findings revealed that about 56% of poor children and 29% of children who are designated to be non-poor have no access to electricity. Similarly, almost all children in the study area are living with households using firewood, charcoal, dung, or crop residue to cook meals. Deprivation in income is also high for both poor and non-poor children. Exceptionally non-poor children are more deprived than children who are poor based on income indicators.

Dietary diversity and multidimensional child poverty

This section of the study examines the relationship between multidimensional child poverty and food consumption patterns. We used the Food Consumption Score (FCS) method to measure dietary diversity. Data were gathered on different food groups consumed by children during the seven days before the survey (Kennedy *et al*., 2011). The chi-square test was used to describe whether food consumption has a significant association with child poverty. Dietary diversity refers to the number of different food groups consumed by an individual or a household over a given period used as a reference. It is also a measure used to qualitatively gauge the amount of food

consumed serving as a proxy for the adequacy of nutrients in the diet of an individual (FAO, 2013).

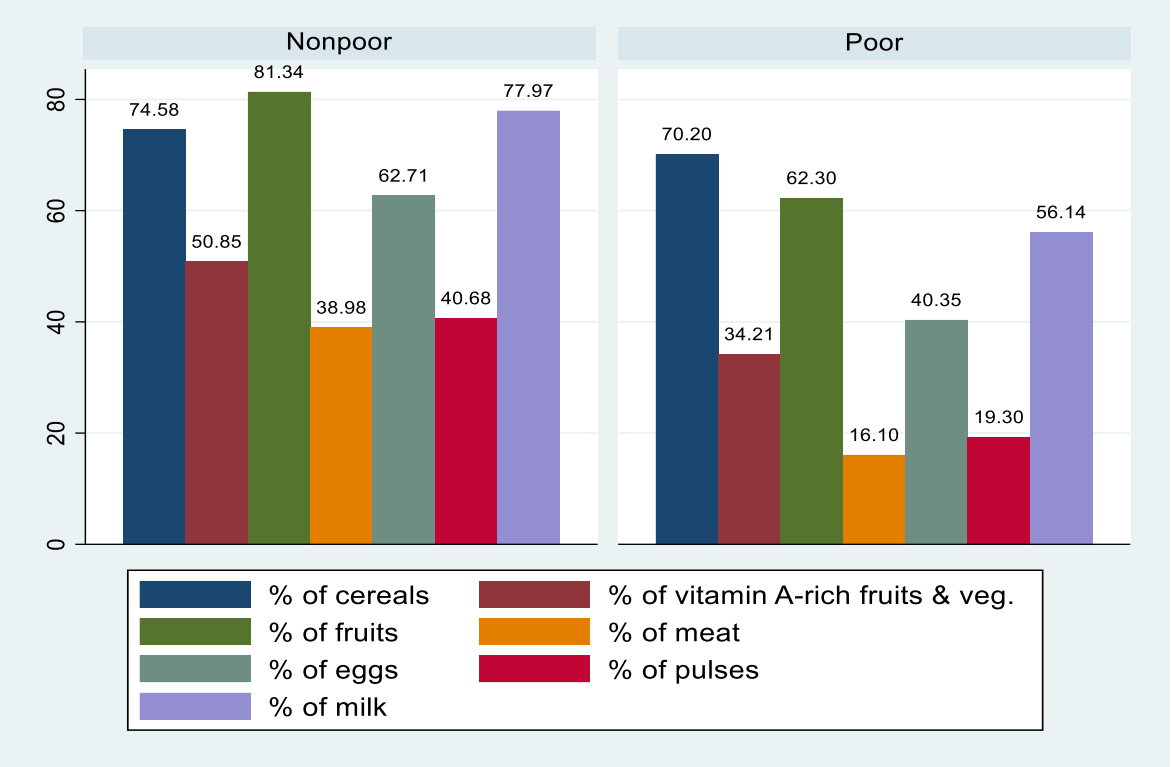

Figure 2: Percentage distribution of child dietary intake

Cereals form the major components of the diet in the study area. The above Figure 2 shows that 74.58% of non-poor children receive their diet from cereal sources while nearly 70% of poor children rely on cereal food sources (Figure 2). The result shows that poor children acquiring their diet from cereal sources are slightly lower than non-poor children. The graph clearly shows that there is observable variation in vitamin A-rich fruits and vegetable consumption between poor and non-poor children in the study area. Poor children have less access to vitamin A-rich foods than non-poor children. Most of the sample households feed on food from other fruits and vegetable crops. More than 81% of non-poor children receive other fruit and vegetable food sources compared with poor children receiving nearly 62%. Milk and milk products such as cheese, butter, and yogurt are some of the most commonly consumed diets in the study area. Nearly 78% of non-poor and above 56% of poor children get milk and milk products in their diet.

Livelihood diversification and multidimensional child poverty

A Probit regression model was used to estimate the contribution of livelihood diversification to multidimensional child poverty reduction in the study area. The result in Table (6) below shows that χ^2 is significant at the 1% level of probability ($p<0.001$), which shows the overall significance of the model. The results revealed that total land holding, number of plots of land, off-farm laboring, distance to the nearest market, petty trading, charcoal production and selling, and incidence of household poverty significantly affected the multidimensional child poverty in the study area. The total landholding negatively and significantly affects child poverty. For a unit increase of total land holding in hectares, the probability of children being multidimensionally poor decreases by 6.2%; other factors remain constant.

Table 6: Livelihood diversification and child poverty

Variables	**dy/dx**	**Std. Err.**	**P>z**
Sex of household head	0.031	0.064	0.628
Age of household head	0.001	0.002	0.510
Education status of household head	-0.034	0.051	0.508
Household size	-0.015	0.009	0.100
Marital status of household head	-0.042	0.038	0.277
Health status of household head	0.018	0.021	0.397
Total land holding in hectares	-0.062	0.023	0.006***
Number of plot lands owned at different locations	0.068	0.027	0.011**
Participation on off-farm for harvest share	-0.016	0.040	0.683
Laboring on other's farm	0.158	0.087	0.070*
Frequency of extension contact per month	-0.015	0.014	0.308
Distance to the nearest market	-0.005	0.002	0.040**
Total number of livestock in TLU	-0.002	0.005	0.640
Participation in petty trading	-0.185	0.058	0.002***
Charcoal production	-0.151	0.079	0.055*
Incidence of household poverty	-0.126	0.042	0.003***
LR chi2(16) = 65.83 Log likelihood = -134.58445 Prob > chi2 = 0.0000 Pseudo R2 = 0.1965			

Source: Computed from our survey data, 2020

The marginal effect of the number of plots of land owned by a household at a different location is found to be positive and significantly associated with multidimensional child poverty (p=0.011). The result implies that a unit increase in the number of plots of land brings a 6.8% increase in multidimensional child poverty. The result is consistent with other studies which found that owning more land and other livelihood assets, such as livestock, might have a positive contribution to child poverty because households may engage their children in tending livestock or cultivating land instead of sending them to school (Pereznieto and Jones, 2006). A study in another context, for example in the area where encroachment of wild animals exists, farming activities harm children's schooling (Wondimagegnhu *et al*., 2019). Off-farm participation as agricultural labor is an important predictor of child poverty. The marginal effect of laboring in agricultural activities is significant at the 10% probability level (p=0.070) and positively associated with multidimensional poverty. Agricultural laboring offers instant cash payment for individuals and most agricultural laborers prefer this to obtain daily income. This may offer a household to support their daily basic needs, but this might be sometimes at the expense of children's needs like attending school. When a household head is overloaded with such activities, children might be expected to undertake some of the activities at the household level. This study shows that a unit increase in agricultural labor activities increases the probability of child poverty by nearly 16%, holding other factors constant. The result further implies that child poverty is more likely to be associated with other factors than household income.

Distance to the nearest market was found to be negatively and significantly associated with multidimensional poverty. This result is consistent with Dinku (2018) which finds the probability of individuals diversifying beyond the agricultural practice is likely to be reduced as the distance to market marketplace increases from their villages. However, another study conducted by Amogne *et al*. (2017) findings showed no statistically significant relationship between access to markets measured in terms of distance to the nearest market and smallholder farmers' level of participation in non-farm economic activities. In our study, the result showed that a unit change in distance to the nearest market decreases the probability of multidimensional child poverty reduction by 0.50%. This implies that lack of access to the market limits the opportunity of a household to engage in non-farm activities, while it offers them more time to stay around their home, which might have a positive contribution to childcare; however, the result is inconclusive

in that limited studies are showing the linkage between market participation and child poverty, though, households should generate more income to satisfy their needs, including children's needs. Petty trading activity is one of the important factors found to affect multidimensional child poverty in the study area. The analysis results showed that a unit increase in the number of petty trading activities could decrease the likelihood of multidimensional child poverty by 18.5%. Household poverty is one of the determinants of child poverty in the study area. The incidence of household poverty is positive and significant at a 1% probability level ($p<0.001$). The marginal effect showed that being in a poor household decreases the probability of child poverty by 12.6%, other factors held constant. It is believed that poor households are less likely to invest in children's needs sending school, unable to provide sufficient nutritious food. A study from abroad showed that the economic condition of the household has a significant effect on a child's education; for example, children from poor households often drop out of school mainly due to economic difficulties (Thanh *et al*., 2005). On the other hand, Hegde *et al*. (2019) found that families having more income can easily spend money on children's education, health, information sources, improving housing structure, and other activities. The current study, however, showed the contrary result to these assumptions implying that child poverty is more than household income level; that is child poverty is more likely affected by other factors than household income. However, empirical evidence still stresses that it is essential to expand opportunities for the poor to diversify the business climate not only for large, formal producers but also for tiny and small entrepreneurs (UNICEF, 2012). For poor households, income generated from market participation is crucial to buffer the insufficiency of on-farm income to satisfy household needs in general and child needs in particular.

Conclusion and recommendations

This study has highlighted the importance of adopting a child-centric perspective in understanding the relationship between household livelihood diversification and child poverty. It examines how child poverty varies across different age groups, as children's needs and vulnerabilities may change throughout their development. The research also explores the potential gender-based differences in child poverty, as girls and boys may face distinct challenges and deprivations. Furthermore, the study uncovers the linkages between household livelihood diversification and the multidimensional aspects of child poverty in the Negele Arsi *woreda*.

We used the Simpson index to measure the level of diversification of livelihoods in the study area. The index was developed from different livelihood activities. Accordingly, livelihood activities were classified as on-farm, off-farm, and non-farm activities. The analysis results showed that a few households are collecting their income from single livelihood activities.

Various studies have shown a significant association between livelihood diversification and household poverty reduction. However, the relationship between households' livelihood diversification and child poverty remains underexplored, despite the multidimensional nature of child poverty. Moreover, most of the existing research has primarily focused on a unidimensional poverty measurement approach based on household income and expenditure, often excluding children as the key unit of analysis. Therefore, there is a need to better understand how household livelihood strategies impact the specific needs and experiences of children.

Although global poverty is declining, disparities in rates of poverty reduction across countries continue to remain a policy concern. Among all the people living in poverty, children comprise the majority. Empirical evidence confirmed that half of the globally multidimensionally poor are still children. This study also found that the incidence of multidimensional child poverty is high but below the national average. Among all indicators used to examine child poverty, maximum deprivation was observed in information, which comprises 27% of overall deprivation. Poor children have limited connectivity to national and international information sources transmitted through various Media like radios, television, mobile phones, and computer internet services. School-aged multidimensionally poor children are highly deprived of education attainment. About 7% of poor children could not complete primary school at the age they could have to; while 9% of the same-age poor children are not even attending school in the study area. Moreover, age disaggregated analysis results revealed that child poverty is higher for children aged between 6 to 18 years compared with children under the age of five. Similarly, female children are poorer than their counterpart male children in the study area. Therefore, age and sex-specific intervention is needed to reduce child poverty. In dietary indicators, poor children are more likely deprived than non-poor. As a result, the percentage deprivation of poor children in meal frequency and meal diversity is higher. They are also deprived of skilled birth attendants and immunizations. Meat, poultry, and fish food are among the least consumed food groups by the children in the study area. Therefore, an awareness campaign on dietary diversity for child development and health is needed.

The current study has identified that various factors affect child poverty. The Probit model results revealed that total land holding, number of plots of land owned at different locations, engagement in agricultural labor activities, proximity to the market, petty trading, charcoal production, and sale, and the incidence of household poverty have a significant effect on multidimensional child poverty. The study recommends that livelihood provision programs are needed to reduce child poverty. By considering the multidimensional nature of child poverty, the study provided insights that can inform more effective and inclusive policies and interventions to address the complex challenges faced by children in poverty. Moving forward continued research and a holistic approach are crucial to ensuring that the needs and experiences of children are at the forefront of efforts to alleviate poverty and promote sustainable development. Therefore, further research is needed to deepen the understanding of the complex linkages between household livelihood strategies and the various dimensions of child poverty, particularly in diverse cultural and socioeconomic contexts.

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Annex 1: Summary statistics of continuous variables

Variables	The extent of livelihood diversification	Mean	Std. Deviation	Minimum	Maximum
Age of household head	Undiversified	40.2586	12.78645	23.00	95.00
	Less diversified	35.6923	8.46940	22.00	50.00
	Moderately diversified	38.7822	9.28935	22.00	60.00
	Highly diversified	42.8080	8.64879	22.00	70.00
	Very highly diversified	45.2000	8.19756	35.00	57.00
	Total	41.2244	9.67649	22.00	95.00
Household size	Undiversified	3.7138	1.10095	1.70	6.10
	Less diversified	3.5231	1.30904	1.70	5.40
	Moderately diversified	4.0337	1.45652	1.50	11.00
	Highly diversified	4.8549	1.69075	1.00	11.20
	Very highly diversified	4.0400	1.47071	2.40	6.30
	Total	4.4297	1.61666	1.00	11.20
Number of economically active labor	Undiversified	2.4879	1.03603	1.70	5.90
	Less diversified	2.4077	.86454	1.70	3.80
	Moderately diversified	2.5030	1.05778	1.00	7.30
	Highly diversified	3.3621	1.46466	1.00	8.70
	Very highly diversified	3.6600	1.03827	2.40	5.20
	Total	2.9920	1.36104	1.00	8.70
Total land holding in hectares	Undiversified	.7609	.34355	.25	2.00
	Less diversified	1.1442	.76520	.13	3.00
	Moderately diversified	1.3203	.87504	.25	4.50
	Highly diversified	1.8989	1.20807	.38	9.00
	Very highly diversified	2.0500	.64711	1.25	3.00

	Total	1.5660	1.10616	.13	9.00
Frequency of extension contact per month	Undiversified	1.4138	.91832	.00	4.00
	Less diversified	2.2308	.83205	1.00	4.00
	Moderately diversified	1.7624	1.15020	.00	5.00
	Highly diversified	2.9688	1.27195	.00	8.00
	Very highly diversified	3.4000	1.67332	2.00	6.00
	Total	2.4214	1.35626	.00	8.00
Farming experience in years	Undiversified	19.7931	13.12659	1.00	70.00
	Less diversified	15.7692	11.28534	1.00	33.00
	Moderately diversified	16.7426	10.03061	1.00	40.00
	Highly diversified	22.7723	9.27250	1.00	48.00
	Very highly diversified	22.2000	8.22800	15.00	35.00
	Total	20.5885	10.46053	1.00	70.00
Number of plot lands owned at different locations	Undiversified	1.5345	.75430	1.00	4.00
	Less diversified	1.4615	.66023	1.00	3.00
	Moderately diversified	1.6238	.84678	1.00	4.00
	Highly diversified	2.0089	.80353	1.00	4.00
	Very highly diversified	2.6000	.54772	2.00	3.00
	Total	1.8329	.83037	1.00	4.00
Distance to the nearest market	Undiversified	11.1121	8.93792	4.00	27.00
	Less diversified	17.5385	9.50978	5.00	26.00
	Moderately diversified	14.4307	9.73859	4.00	26.00
	Highly diversified	9.1183	6.28352	4.00	26.00
	Very highly diversified	11.3000	8.22040	7.50	26.00
	Total	11.0449	8.17553	4.00	27.00
Total number of livestock in TLU	Undiversified	1.5195	1.75678	.00	6.30
	Less diversified	2.1646	1.55744	.00	6.40

	Moderately diversified	2.9547	3.12778	.00	19.00
	Highly diversified	5.7403	4.86509	.00	19.66
	Very highly diversified	3.3000	1.40091	1.94	5.35
	Total	4.2818	4.36734	.00	19.66
Total annual income	Undiversified	12821.5517	16057.89993	1600.00	107000.00
	Less diversified	28053.8462	13284.97681	6600.00	49000.00
	Moderately diversified	33095.5446	33997.62940	2600.00	171700.00
	Highly diversified	68220.3795	45516.40009	3400.00	236600.00
	Very highly diversified	111180.0000	45641.39568	72500.00	164000.00
	Total	50594.1771	45026.68513	1600.00	236600.00