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ORIGINAL RESEARCH

Vitamin A Supplementation Status and Determinant Factors among Children Aged 6-59 Months in Ethiopia, Data from Ethiopian Demographic and Health Survey 2019: Multilevel Analysis

Mohammed Seid Ali[1*], Tewodros Getaneh Alemu[1], Tadesse Tarik Tamir[1], Almaz Tefera Gonete[1], Berhan Tekeba[1], Enyew Getaneh Mekonen[2], Belayneh Shetie Workneh[3], Mulugeta Wassie[4], Alemneh Tadesse Kassie[5] and Alebachew Ferede Zegeye[6]

[1]Department of Pediatrics and Child Health Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[2]Department of Surgical Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[3]Department of Emergency and Critical Care Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[4]School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[5]Department of Clinical Midwifery, School of Midwifery, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[6]Department of Medical Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

***Corresponding author:** *Mohammed Seid Ali, Department of Pediatrics and Child Health Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, Tel: +251915279813*

Abstract

Introduction: Vitamin A deficiency is a severe public health problem in many countries of the world. Vitamin A supplementation reduces child morbidity and mortality. Despite interventions, vitamin A deficiency in children is a common problem in developing countries. Therefore this study was conducted to investigate vitamin A supplementation status and determinant factors among children aged 6-59 months in Ethiopia.

Methods: The total samples of 3208 children were included in this study. The data were taken from the Ethiopian Demographic and Health Survey 2019. A multilevel logistic regression model was used to identify the determinant factors of vitamin A supplementation status. STATA-14 software was used for analysis. In the multivariable multilevel analysis, the Adjusted Odds Ratio with 95% CI was used to declare significant determinants of vitamin A supplementation status.

Results: The prevalence of vitamin A supplementation status among 3208 children aged 6-59 months in Ethiopia was 38.06%. In multivariable multilevel analysis, the significant factors associated with vitamin A supplementation status were the age of child; 35-59 months (AOR = 2.12 95% CI (1.08-4.16)), institutional delivery (AOR = 1.23; 95%CI (1.01-1.56)), no antenatal care visits, (AOR 31 = 0.52; 95% CI (0.37-0.71)), middle level wealth index (AOR = 1.49; 95% CI (1.13-1.95)), and the regions; Afar, Somali, and SNNPR.

Conclusion: Vitamin A supplementation status among children in Ethiopia was low and below WHO recommendation. It is recommended for regions like Afar, Somali, SNNPR, and some areas in Addis Ababa to be considered as priority areas for reducing the burden of deficiency of vitamin A supplementation in children aged 6-59 months.

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Keywords

Vitamin A supplementation, Children, EDHS, Ethiopia

Abbreviations

AOR: Adjusted Odd Ratio; CI: Confidence Interval; EDHS: Ethiopian Demographic and Health Survey; ICC: Intra-Class Correlation Coefficient; SNNPR: South Nations Nationalities and Peoples Region; WHO: World Health Organization

Introduction

Vitamin A deficiency is a severe public health problem in many countries of the world particularly children 6-59 months of age [1]. It is the single most important cause of childhood blindness in developing countries. It also contributes to significant morbidity and mortality from common childhood infections [2]. Globally, more than 1.02 billion people were severely affected by micronutrient deficiencies, vitamin A being the most deficient nutrient in the body [3]. The impact of Vitamin A deficiency usually has long-term consequences; it can cause growth and development deficits, loss of vision, and increased risk of infection in children. In addition, inadequate Vitamin A Supplementation is a potential risk factor for childhood cognitive impairment and mental illness [4]. Micronutrient deficiencies like vitamin A are an important contributor to the global burden of disease through increasing rates of illness and death from infectious diseases [5]. The possible causes of inadequate vitamin A supplementation were place of residence far from health institution, poor attitude towards health care follow-up, economic constraints, socio-cultural limitations, insufficient dietary intake, and poor absorption leading to depleted vitamin A stores in the body have been regarded as potential determinants of the prevalence of low vitamin A supplementation particularly in developing countries [6,7]. Vitamin A supplementation reduces child morbidity and mortality and is recommended for infants and children 6-59 months when vitamin A inadequacy is a public health concern. Vitamin A supplementation given to children will not cause any significant side effects when the recommended age-specific vitamin A dose is administered [8]. The problem is more common in children who fulfill their daily requirements through plant foods alone. Consequently, vitamin A deficiency is common among children, whose families cannot afford eggs and dairy products, easing the strain on health systems and hospitals [9]. According to World Health Organization (WHO) recommendations, vitamin A is vital to child health and immune function; hence, in settings where vitamin A deficiency is a public health problem, vitamin A supplementation is recommended in infants and children aged 6-59 months as a public health intervention to reduce child morbidity and mortality [10]. Providing at least two doses of vitamin A for children 6-59 months significantly improves child survival rates. Supplementation with vitamin A is a safe, cost-effective, and efficient means for eliminating deficiency of this vitamin and improving child survival [11]. Even if programs are available to control vitamin A deficiency and associated health complications, the problem is still a public health concern in developing countries like Ethiopia. Therefore this study aimed to assess the vitamin A supplementation status and determinants factors among children aged 6-59 months in Ethiopia, Data from the Ethiopian Demographic and Health Survey (EDHS) 2019.

Methods

Study design and setting

This study was a multilevel analysis study conducted in Ethiopia using the data from EDHS 2019 to identify the determinant factors associated with vitamin A supplementation status among 6-59 month children in Ethiopia, which is situated in the horn of Africa between 3 and 15 degrees north latitude and 33 and 48 degrees east longitude (3°-15° N and 33°-48° E). It has an administrative structure of nine regional states (Tigray, Afar, Amhara, Oromiya, Somali, Benishangul-Gumuz, Southern Nations Nationalities and People (SNNP), Gambela, and Harari) and two city administrations (Addis Ababa and Dire Dawa). These are subdivided into 68 zones, and 817 administrative districts which are further divided into 16 253 Kebeles, the smallest administrative units of the country. Ethiopia had an estimated population of 114.96 million in 2020, which makes it second in Africa next to Nigeria and 12th in the world's most populous country.

Data source, extraction, sampling procedure, and study participants

The data source for this study was the mini EDHS 2019 survey which was collected in 2019. EDHS data were collected by the Ethiopian Central Statistical Agency. The data sets for EDHSs were downloaded in STATA format with permission from the Measure DHS website. The EDHS samples were collected and stratified in a two-stage cluster sampling technique. In the first stage 305 (93 urban and 212 rural) cluster areas were selected, after stratification of each region was done into urban and rural. In the second stage of selection, a fixed number of 30 households per cluster were selected with an equal probability of systematic selection from the newly created household listing. All children within 6-59 months during the surveys in Ethiopia were the source of the population for this study, whereas all 6-59 months children in the selected enumeration areas during the survey were the study population. Ultimately, a total representative sample of 3208 children 6-59 month was included in the 2019 survey. The EDHS survey data were nationally representative data, which was collected every five years.

Study variables

The dependent variable in this study is vitamin A supplementation status. It was measured as 'supplied' if the child was supplemented with vitamin A and 'not supplied' if the child was not supplemented with vitamin A in the last 6 months. The independent variables include the age of the mother, marital status, educational status of the mother, place of delivery, sex of the child, birth order, number of children in the household, the number of antenatal care visits, and geographical factors like region and place of residence were the independent variables.

Data management and analysis

To restore the survey's representativeness the sample weights were applied to compensate for the unequal probability of selection between the strata. The STATA version 14 software was used to conduct descriptive statistics and multilevel analysis. A multilevel multivariable logistic analysis was employed to identify the determinant factors associated with vitamin A supplementation status. While conducting multilevel analysis, four models were fitted: The null model (a model without explanatory variables), model I (a model with individual-level explanatory variables only), model II (a model with community-level variables only), and model III (a model with both individual- and community level variables). Both bivariable and multivariable multilevel logistic analyses were conducted. Variables with a p-value < 0.2 in the bivariable analysis were eligible for multivariable analysis. In the multivariable analysis, an Adjusted Odds Ratio (AOR) with a 95% Confidence Interval (CI) was reported and variables with a p-value < 0.05 were declared to be statistically significant factors for vitamin A supplementation status. For assessing the cluster-level variability of vitamin A supplementation status, we have employed the random effect analysis calculating the Intra-class Correlation Coefficient (ICC) and Log Likely-hood Ratio (LLR) also presented.

Results

Socio-demographic and maternal related characteristics of the participants

A total of 3208 children aged 6-59 months were included in this study. Among the total, about 51.61% of the children were males, and nearly one-fifth (19.0%) of the children were in the age category of 35-59 months. One-third (34.14%) of the children were from the poorest households. The majority (76.92%) of the children were lived in a rural residence. Regarding maternal educational status, more than half (54.74%) of the mothers had not attended any formal education. Among the total households, the majority (65.54%) of them had a size of five to one to four family members in the household (Table 1).

Table 1: Socio-demographic and maternal related characteristics of the participants with children aged 6-59 months EDHS 2019 (n = 3, 208).

Variables	Category	Frequency	Percent (%)
Sex of child	Male	2,969	51.61
	Female	2,784	48.39
Age of child	6-11m	542	9.42
	12-23m	1,068	18.56
	24-34m	1,093	19.00
	35-59m	1,093	19.00
Residence	Urban	1,328	23.08
	Rural	4,425	76.92
Age of mother	15-24 year	1,439	25.01
	25-34 year	3,097	53.83
	35-49 year	1,217	21.15
Mother educational level	No education	3,149	54.74
	Primary	1,823	31.69
	Secondary and higher	781	13.58
Marital status of mother	Unmarried	31	0.54
	Married	5,396	93.79
	Ever married	326	5.67
Birth order	First	1,261	21.92
	2-4	2,598	45.16
	> 5	1,894	32.92

Number of children in Household	No	64	1.11
	1-4	3,828	66.54
	5-9	1,836	31.91
	10 and more	25	0.43
Wealth index	Poorest	1,964	34.14
	Poorer	805	13.99
	Middle	805	13.99
	Richer	738	12.83
	Richest	1,252	21.76
Number of Antenatal carevisits	No visit	1,044	26.24
	1-4 visits	2,109	53.00
	5-8 visits	753	18.92
	9 or more visits	73	1.83
Place of delivery	Home	2,881	50.08
	Institution	2,872	49.92
Region	Tigray	454	7.89
	Afar	652	11.33
	Amhara	511	8.88
	Oromiya	719	12.50
	Somali	637	11.07
	Benishangul Gumz	530	9.21
	SNNP	660	11.47
	Gambella	450	7.82
	Harari	447	7.77
	Addis Abeba	291	5.06
	Dire Dawa	402	6.99

Table 2: Vitamin A supplementation among children aged 6-59 months in Ethiopia, EDHS 2019 (n = 3, 208).

Variable	Category	Frequency	Percent (%)
Vitamin A supplementation	No	1,987	61.94
	Yes	1,221	38.06

Vitamin A supplementation status among children aged 6-59 months in Ethiopia

In this study, the prevalence of vitamin A supplementation status was low. Only 38.06% (95% CI (36.3%-39.6) of the children aged 6-59 months were supplied with vitamin A in the last six months (Table 2).

This study presented the vitamin A supplementation status of children aged 6-59 months in Ethiopia. A low prevalence of vitamin A supplementation was observed in Afar, Somali, and SNNPR regions of the country, whereas a higher prevalence of vitamin A supplementation was observed in Amhara and Tigray and Benshangul Gumuz regions of the country (Figure 1).

Multilevel analysis of the determinant factors of vitamin A supplementation status

The total variation in vitamin A supplementation status among children aged 6-59 months in 2019 EDHS was attributable to clustering. The clustering effect is shown in the table directed to conduct multilevel analyses to identify the determinant factors associated with vitamin A supplementation among children aged 6-59 months in Ethiopia (Table 3).

In this study, the multilevel analysis was carried out to identify factors affecting vitamin A supplementation among children aged 6-59 months and presented with AOR and 95% CI.

At the individual/household level, the significant factors associated with vitamin A supplementation status were the age of 148 the child 12-23 months (AOR = 2.5; 95 CI (1.67-2.86)), 24-34 months (AOR = 2.2; 95% CI 149 (1.64-2.84)), 35-59 months (AOR = 2.3; 95% CI (1.14-4.43)), Place of delivery; institution 150 (AOR = 1.31; 95% CI (1.1-1.65)), antenatal care visits; no visits (AOR = 0.44; 95 CI ((0.32-151 0.60)).

At the community level, the significant factors associated with vitamin A supplementation status were urban residence; those children from urban residence were 1.47 times more likely to be vitamin A supplied as compared to rural children (AOR = 1.47; 95% CI (1.06-2.04)), community poverty level; middle (AOR = 155 1.54; 95% CI (1.19-1.98)), richer (AOR = 1.33 (1.03-1.72)), regions; Afar (AOR = 0.34; 95% CI 156 (0.20-

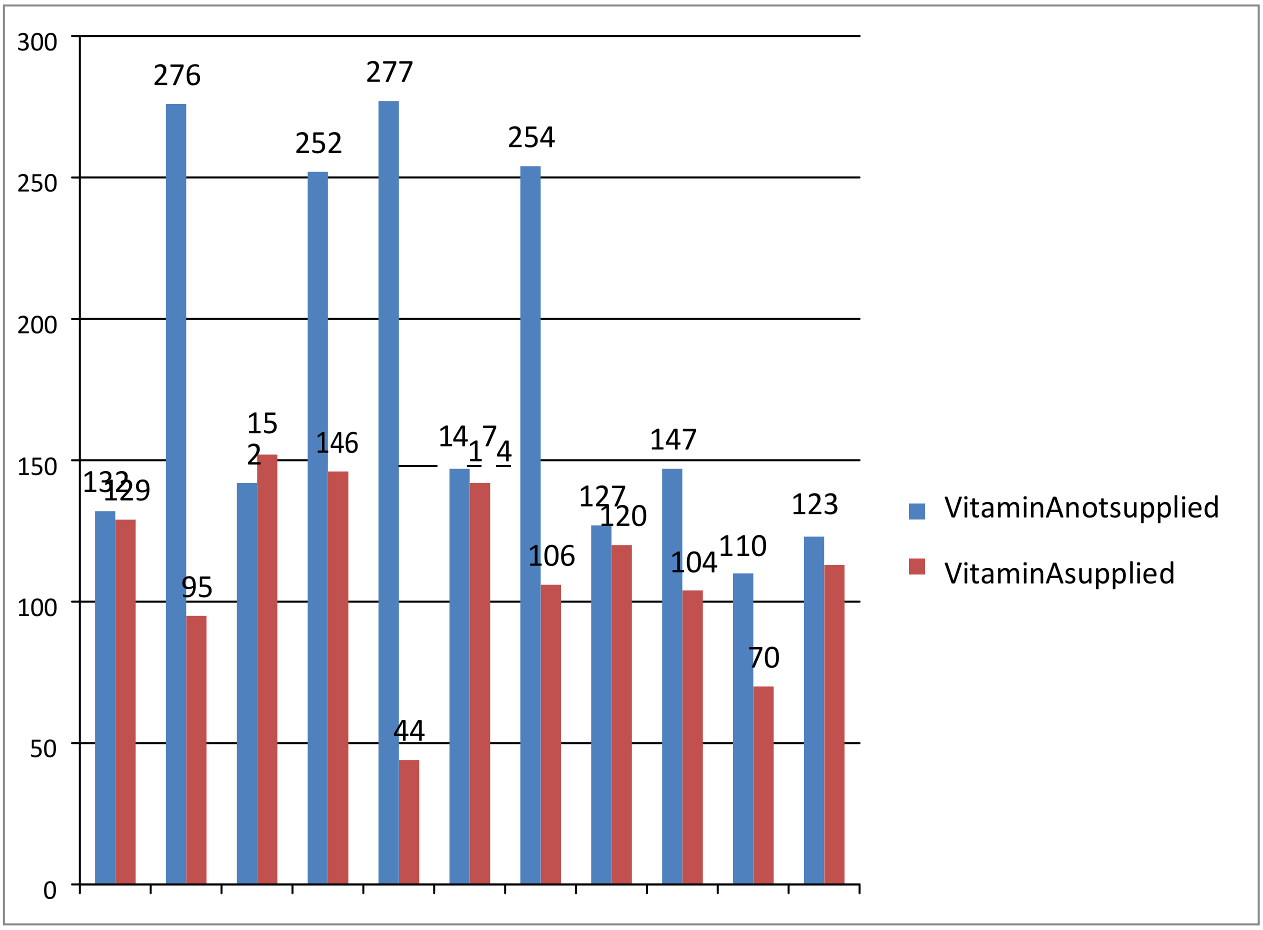

Figure 1: Regional distribution of vitamin A supplementation status among children aged 6-59 months in Ethiopia, EDHS 2019 (n = 3, 208).

Table 3: Model estimation for determinant factors associated with Vitamin A supplementation among children aged 6-59 months in Ethiopia, EDHS 2019 (n = 3, 208).

EDHS 2019	Model 0	Model I	Model II	Model III
Inter-Cluster Correlation (ICC) with 95% CI	0.85 (0.63-1.14)	0.20 (0.15-0.259)	0.11 (0.080.15)	0.16 (0.12-0.22)
Log-likelihood Ratio (LLR)	-2028.429	-1576.46	-1972.60	-1551.75

0.58)), Oromia (AOR = 0.55; 95% CI (0.34-0.89)), Somali (AOR = 0.16; 95% CI (0.09-157 0.29)), SNNP (AOR = 0.38; 95% CI (0.23-0.62)), and Addis Ababa (AOR = 0.42; 95% CI 158 (0.22-0.77)).

In multivariable multilevel analysis, the significant factors associated with vitamin A supplementation were the age of the child; 12-23 months (AOR = 2.25; 95% CI (1.69-2.84)), 24-34 months (AOR = 2.15; 95% 161 CI (1.63-2.82)), 35-59 months (AOR = 2.12 95% CI (1.08-4.16)).

Regarding the place of delivery, those mothers who deliver in the health institution were 1.23 times more likely to have vitamin A supplementation for their children as compared to home delivery (AOR = 1.23; 95%CI (1.01-1.56)). Another determinant factor for vitamin A supplementation is antenatal care visits, pregnant mothers who visit antenatal care visits have higher odds of VAS for their child, had no antenatal care visit (AOR = 0.52; 95% CI (0.37-0.71)). Among the regions, Afar (AOR = 0.46; 95% CI (0.26-0.80)), Somali (AOR = 0.28; 95% CI (0.15-0.52)), SNNPR (AOR = 0.44; 95% CI (0.26-0.73)), Children from the middle level of wealth index were about 1.5 times more likely to have vitamin A supplementation as compared to the counterparts (AOR = 1.49; 95% CI (1.13-1.95)) (Table 4).

Discussion

This study presented that the prevalence of vitamin A supplementation status among children aged 6-59 months was 38.06% with 95% CI (36.3%-39.6) in the 2019 national survey. Studying the status of vitamin A supplementation is an important indicator of health care quality and the country's socio-economic status. The current magnitude of vitamin A supplementation status was lower than other studies conducted in

Table 4: Multilevel analysis for the determinant factors associated with VAS among children aged 6-59 months in Ethiopia, EDHS2019 (n = 3, 208).

Variables	Category	Model I	Model II	Model III
Sex of child	Male	1.00 (0.84-1.18)	-	1.01 (0.85-1.19)
	Female	1.0	-	1.0
Age of child	6-11m	1.0	-	1.0
	12-23m	2.5 (1.67-2.86)*	-	2.25 (1.69-2.84)*
	24-34m	2.2 (1.64-2.84)*	-	2.15 (1.63-2.82)*
	35-59m	2.3 (1.14-4.43)*	-	2.12 (1.08-4.16)*
Wealth index	Poorest	1.0	-	1.0
	Poorer	0.8 (0.59-1.16)	-	0.97 (0.71-1.34)
	Middle	1.2 (0.87-1.71)	-	1.45 (0.52-1.66)
	Richer	1.0 (0.72-1.38)	-	1.22 (0.83-1.77)
	Richest	0.83 (0.52-1.02)	-	1.01 (0.63-1.60)
Birth order	First	1.0	-	1.0
	2-4	1.22 (0.87-1.48)	-	1.25 (0.95-1.65)
	Greater than 5	0.95 (0.57-1.61)	-	1.14 (0.64-2.03)
Delivery place	Home	1.0	-	1.0
	Institution	1.31 (1.1-1.65)*	-	1.23 (1.01-1.56)*
Number of under-five in the household	Less than 2	1.0	-	1.0
	2-4	0.91 (0.56-1.47)	-	0.88 (0.29-9.22)
	> 10	1.7 (0.35-9.03)	-	1.62 (0.52-1.49)
Marital status	Unmarried	1.0	-	1.0
	Married	1.27 (0.48-3.32)	-	1.16 (0.45-3.01)
	Ever married	1.22 (0.83-1.79)	-	1.14 (0.78-1.68)
Antenatal visits	No visit	0.44 (0.32-0.60)*	-	0.52 (0.37-0.71)*
	1-4 visits	1.0 (0.79-1.25)	-	1.0 (0.82-1.28)
	5-8 visits	1.04 (0.54-1.97)	-	1.01 (0.55-1.97)
	9 or more visits	1.0	-	1.0
Maternal education	No education	0.89 (0.66-1.2)	-	1.11 (0.89-1.39)
	Primary	1.0 (0.76-1.32)	-	1.11 (0.82-1.51)
	Secondary and higher	1.0	-	1.0
Residence	Urban	-	1.47 (1.06-2.04)*	1.32 (0.94-1.85)
	Rural	-	1.0	1.0
Community Illiteracy level	Low	-	0.95 (0.79-1.14)	-
	High	-	1.0	-
Community poverty level	Poorer	-	1.0	1.0
	Middle	-	1.54 (1.19-1.98)*	1.49 (1.13-1.95)*
	Richer	-	1.33 (1.03-1.72)*	1.21 (0.90-1.57)
Region	Tigray	-	0.97 (0.57-1.63)	0.91 (0.52-1.55)
	Afar	-	0.34 (0.20-0.58)*	0.46 (0.26-0.80)*
	Amhara	-	1.1 (0.67-1.80)	1.19 (0.716-1.97)
	Oromiya	-	0.55 (0.34-0.89)*	0.61 (0.37-1.02)
	Somali	-	0.16 (0.09-0.29)*	0.28 (0.15-0.52)*
	Benishangul Gumz	-	1.0	1.0
	SNNP	-	0.38 (0.23-0.62)*	0.44 (0.26-0.73)*
	Gambella	-	0.95 (0.55-1.58)	1.06 (0.61-1.83)
	Harari	-	0.58 (0.34-1.013)	0.67 (0.38-1.19)
	Addis Abeba	-	0.42 (0.22-0.77)*	0.43 (0.23-0.82)*
	Dire Dawa	-	0.78 (0.45-1.35)	0.85 (0.48-1.49)

Ethiopia 44.90% [12] EDHS 2016, in Sub-Sahara African Countries 59.4% [13], in Kenya 52% [14], in Bangladesh 63.6% [15], and in India 60.5% [16].

This discrepancy might be due to that studies conducted in Ethiopia EDHS 2016 might be due to sample size variation in the survey because EDHS 2019 was a mini-survey whereas EDHS 2016 was a major survey in the country with large sample size. Studies in Sub-Saharan African Countries might be conducted in many countries including those having good nutritional intervention whereas; this study includes some surveys in the regions of the country. The discrepancy between this study and India might be due to the variation of socio-demographic, economic, and lifestyle-related differences across the population. Among the determinant factors associated with vitamin A supplementation was the age of the child, those children whose age group less than twelve months was less likely to receive vitamin A supplementation as compared to those children whose age group greater than twelve months. This might be due to health extension workers provide vitamin A supplementation for older children through home to home visits whereas; infants usually supplement vitamin A in the health facility. Mothers who had antenatal care follow-ups in the health care institution were more likely to receive vitamin A supplementation for their child as compared to mothers who did not have antenatal care follow-ups in the health care facility. This finding was supported by other studies conducted in Southern Ethiopia [17]. This might be due to that mothers who had antenatal care follow-ups can access any health care service for her as well for her child starting from pregnancy and continuing up to child immunization periods. At the community level, place of residence was one of the determinant factors associated with vitamin A supplementation among children aged 6-59 months. The odds of uptake of vitamin A supplementation among children aged 6-59 months were higher among urban residences than the odds of uptake of vitamin A supplementation among children in urban areas of the country. This finding was consistent with other studies conducted in Mali [18]. This might be due to mothers who live in the urban areas being nearer to the health facility to receive vitamin A supplementation as compared to those mothers who live in rural areas. Mothers who deliver in the health care institution were more likely to receive vitamin A supplementation for their children as compared to mothers who deliver in their homes.

Place of delivery affects the vitamin A supplementation status. The reason for this situation is obvious mothers who deliver their children in the health care institution easily access vitamin A supplementation and can access information related to child care and follow-up. This study presented that the wealth index status of the households was one of the determinant factors for vitamin A supplementation in children aged 6-59 months. The odds of non-uptake of vitamin A supplementation were higher among children from the poorest and poorer households as compared to children from the richest households. This finding was supported by other studies conducted in India [19] and another study in India [20]. This might be due to that better household wealth status can access health care costs, access to transportation to the health care facility to receive vitamin A supplementation for their child, and also have better access to health-related information. The multilevel analysis in this study showed that the regions of the country were among the determinant factors among children aged 6-59 months in Ethiopia.

Children from Somali, Afar, and SNNPR regions had higher odds of non-uptake of vitamin A supplementation as compared to Amhara, Dire Dawa, and Benshangul Gumuz regions. This finding was supported by other studies conducted in Ethiopia EDHS 2016 [12]. This might be due to that Somali, Afar, and SNNPR regions have a lower uptake of vitamin A supplementation in children aged 6-59 months. Because of the desert nature of those regions; there are inadequate access to health care facility, inadequate infrastructures for transportation to access healthcare information, and healthcare seeking behaviors depends on their cultural lifestyle, whereas the regions of Amhara, Dire Dawa, and Benshangul Gumuz the population can easily access child health care services, information related to health and immunization, education and other infrastructures as compared to the population of other regions.

Conclusion

Vitamin A Supplementation status among children aged 6-59 months was low and became a major public health problem. The status of vitamin A Supplementation was below WHO recommendation. The burden of vitamin A supplementation among the regions of Ethiopia varies from region to region. The significant factors associated with vitamin A supplementation were the age of the child, place of delivery, antenatal care visits, middle-level wealth index, and the regions like Afar Somali and SNNPR. The highest odds of inadequate vitamin A supplementation were observed in Afar, Somali, and SNNPR regions. These determinant factors are an important input to develop preventive strategies of inadequate vitamin A Supplementation as well as regional-based interventions in the country.

Declarations

Ethical consideration

This study was based on secondary data analysis of publicly available national survey data from the DHS program. Ethical approval and participant's consent were not necessary for this particular study. We requested permission to download the DHS program, and it was granted. It uses data from http://www.

dhsprogram.com. The Institution Review Board-approved procedures for DHS public-use datasets do not in any way allow participants, households, or sample societies to be identified. The names of individuals or household addresses in the data file were not stated. Each enumeration area primary sampling unit has a number in the data file, but the numbers do not have any labels to indicate their names or locations.

Data sharing statement

All data are available upon request. The reader could contact the corresponding author for all data.

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Consent for publication

Not applicable.

Conflict of interest

The authors declared that no conflict of interest exists.

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