RESEARCH ARTICLE

Under nutrition and associated factors among school adolescents in Ethiopia

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Abstract

Background: Adolescence, defined as the age range of 10-19 years, is a critical period marked by significant physical and psychological growth. During this time, individuals gain approximately one-third of their adult weight and more than one-fifth of their adult height. This makes adolescents particularly vulnerable to malnutrition. This study aimed to assess the prevalence of undernutrition among school adolescents in the Wonago district, Gedeo Zone, South Ethiopia.

Methods: The study involved 443 randomly selected school adolescents from the Wonago district. Nutritional status was evaluated using body mass index for age z-score (BAZ) and height for age z-score. The prevalence of thinness, along with other anthropometric measurements and socio-economic and socio-demographic variables, was described descriptively. A multivariable logistic regression analysis was conducted to identify factors associated with undernutrition (thinness) among adolescents.

Results: The findings indicated that 11.6% of adolescents were undernourished (thin). Female adolescents had a 70% lower likelihood of being undernourished. Those whose primary source of drinking water was spring were four times more likely to experience malnutrition. Adolescents from households with medium wealth status had an 85% reduced likelihood of being undernourished. Additionally, adolescents whose families obtained food through purchase and whose fathers were merchants showed a higher risk of undernutrition. Conversely, those with mothers working as farmers had an 85% lower probability of being undernourished.

Conclusions: Our findings highlight that 11.6% of adolescents in the study were undernourished. Factors such as sex, parental occupation, household wealth, source of drinking water, and the means of obtaining food were significantly associated with the nutritional status of adolescents.

Keywords: Adolescent, Nutritional status, Thin, Wonago District

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1 Introduction

Adolescence spans the age range of 10-19 years, characterized by significant physical and psychological growth. It represents a transition from childhood to adulthood and is marked by an intense anabolic state, during which nearly one-third of adult weight and more than one-fifth of adult height are gained. This period is often described as a critical window of opportunity for growth within the human life cycle, making adequate nutrition essential for optimal development.

Nutritional recommendations for adolescents differ significantly from those for adults and children, and the consequences of nutritional deficiencies can be profound. Nutrition and physical activity are key determinants of adolescents' energy levels, influencing growth and body composition. Inadequate nutrition can delay sexual maturation, hinder linear growth, and compromise peak bone mass. Additionally, undernutrition can negatively impact cognitive development, affecting learning, concentration, and school performance.

In developing countries, adolescents are particularly vulnerable to socio-cultural maltreatment, poverty, political instability, and limited access to education and healthcare, which heightens their susceptibility to nutritional health problems. Factors such as early marriage, although declining, and low secondary school enrollment further exacerbate the risk of poor nutrition among adolescents.

A significant number of adolescents in low- and middle-income countries experience acute or chronic malnutrition, with underweight being a particular concern. In some African and Asian countries, over 10% of adolescent girls are classified as very thin for their age and height, and nearly half of all adolescents are stunted. For example, a 2014 national survey in Bangladesh indicated that more than half of adolescent girls and women consumed inadequately diverse diets, with stunting prevalence among girls aged 10–18 ranging from 23% to 32%.

Gender norms disproportionately affect girls, leaving them more vulnerable to food insecurity and malnutrition. However, a substantial number of adolescent boys are also malnourished. Adolescent girls face a higher risk of dropping out of school, marrying early, and becoming pregnant, all of which can adversely affect their nutrition and health as well as that of their children. Furthermore, adolescence is the last critical opportunity to reverse stunting, highlighting the importance of this demographic for nutritional interventions. Nutritional disorders during adolescence, including unhealthy weight status and deficiencies in energy, macronutrients, and micronutrients, contribute significantly to global morbidity and mortality and warrant focused attention.

Compared to other segments of the population, particularly children under five, the scope and severity of undernutrition among adolescents remain less well-defined. There is a lack of nutritional data on adolescents, despite their significant burden of malnutrition, especially in terms of thinness.

Adolescence represents a critical point for intervention regarding both current and future health, as well as intergenerational nutritional well-being. Healthcare providers should comprehensively screen adolescents for nutritional risks, make timely referrals, and initiate developmentally appropriate interventions. Body mass index (BMI) is recommended as a useful tool for screening nutritional health issues in adolescents and adults, particularly concerning thinness, overweight, and obesity.

Adolescents, being in a transitional phase, often miss out on the attention and care typically afforded to younger children, while also lacking the protection associated with adulthood. In Ethiopia, although there is considerable focus on adolescents' reproductive health issues, research on their nutritional status is notably limited. There is a scarcity of nutrition-related information regarding adolescent health, largely due to the misconception that this group is at low risk for poor health and nutrition.

Consequently, this study was designed to assess

the nutritional status of adolescents and identify associated factors, aiming to contribute to filling the existing evidence gap.

2   Methods

2.1   Study area and period

This study was conducted in Wonago Wereda, Gedeo Zone, South Ethiopia, from November 17 to December 3, 2018. The study area is known for its high population density, particularly among young individuals. In the district, there are 23 schools, of which 15 were randomly selected for this study.

2.2   Study Design

A facility-based cross-sectional study was conducted.

2.3   Sample size determination and sampling technique

The sample size for this study was calculated using single population proportion formula for calculating sample size $(Z_{(\alpha/2)})^2 * p(1-p)/d^2)$ assuming estimated 50% prevalence (p) of undernutrition (to maximize the possible sample size), a 95% confidence interval and a relative precision (d) of 5%. Based on the above assumptions and assuming a 15% non-response rate the total sample size used in this study was 443 adolescents.

To select the schools for this study, a simple random sampling technique was employed. The total sample was proportionally allocated to each school based on the number of eligible adolescents. Each participant was then selected through simple random sampling using the student registry from the schools.

2.4   Data collection Tools and Procedures

Data was collected using a structured questionnaire designed to capture comprehensive information relevant to our study objectives. The questionnaires, adapted from WHO nutritional survey tools, were pretested for clarity and effectiveness. Trained health extension workers served as data collectors, and the entire process was closely supervised by the investigators.

For participants who were minors, assent was obtained from their families, and the overall objectives and procedures of the study were clearly explained to all participants.

2.5   Measurement

Anthropometric Assessment: Height and weight were measured according to WHO guidelines. A battery-powered digital scale was used for weight measurement, accurate to the nearest 0.1 kg. Height was measured to the nearest 0.1 cm using a wooden height-measuring board with a sliding head bar, following standard anthropometric techniques. Body mass index for age z-score (BAZ) and height for age z-score (HAZ) were used as anthropometric indicators. Adolescents with a BAZ score less than -2 were classified as thin, while those with a HAZ score below -2 were classified as stunted.

Stool Examination: Stool examinations were conducted to assess geohelminth infections, including Strongyloidiasis, hookworm, Ascaris lumbricoides, and trichinosis. The Kato-Katz method was employed to examine the stool within one hour of staining.

2.6   Data analysis

All collected data were carefully reviewed and cleaned to ensure accuracy and completeness. The data were then processed and analyzed using appropriate statistical methods. Descriptive analyses were conducted to present socio-demographic and socio-economic information, nutritional status, and feeding practices

Bivariate associations were assessed using binary logistic regression analysis, while the independent associations of the explanatory variables with the outcome variable were evaluated using multivariable logistic regression. Adjusted odds ratios (AOR) with corresponding 95% confidence intervals were calculated for this analysis.

2.7 Ethics approval and consent to participate

Ethical clearance was obtained from the Institutional Review Board of Dilla University College of Health Sciences and Medicine. Written informed consent was secured from the parents of each student, and the purpose of the study was thoroughly explained to the participants. Confidentiality of the information collected was assured, and the privacy of the respondents was maintained throughout the study.

3 Results

3.1 Socio-Demographic Characteristics of Adolescents

This study included a total of 424 adolescents, with a higher proportion of males (247, 58.3%) compared to females (177, 41.7%). Most participants (42.4%) were in middle adolescence (14-16 years), while 40.8% were in early adolescence (10-13 years), and the remaining 16.7% were in late adolescence (17-19 years). The mean age of the participants was 13.9 ± 2.3 years.

Table 1 Socio-Demographic Characteristics of Adolescents among adolescents in Wonago district, Gedeo Zone, Southern Ethiopia, 2020

Characteristic	Category	Frequency (n)	Percentage (%)
Sex	Male	247	58.3
	Female	177	41.7
Age Group	10-13 years	173	40.8
	14-16 years	180	42.4
	17-19 years	71	16.7
Household Size	≤6 members	176	41.5
	>6 members	248	58.5
Parental Education	Literate Fathers	337	79.4
	Mothers with No Formal Education	212	50

In terms of household characteristics, 58.5% of participants came from families with more than six members, while 41.5% had six or fewer family members. The study also revealed disparities in parental education levels: nearly 50% of mothers had no formal education, whereas most fathers (79.4%) were literate.

3.2 Feeding Practices and Nutritional Status

Dietary habits and feeding programs were analyzed to assess their relationship with nutritional status. Among the participants, 27.4% reported eating two or fewer meals per day, which may contribute to inadequate nutrition.

Table 2 Feeding Practices and Nutritional Status of Adolescents among adolescents in Wonago district, Gedeo Zone, Southern Ethiopia, 2020

Feeding Practice	Category	Frequency (n)	Percentage (%)
Meal Frequency	≤2 meals/day	116	27.4
Household Food Source	Own food production	214	50.5
	Purchase food or aid	210	49.5
School Feeding Program	Present in school	245	57.8

Nearly half (50.5%) of the adolescents came from households that produced their own food, while 49.5% relied on purchasing food or receiving aid.

Additionally, about 57.8% of the adolescents attended schools with a school feeding program that had been in place for the past six months.

3.3   Prevalence of Under-nutrition

In this study, 11.6% (CI: 8.55% to 14.65%) of participants were classified as underweight/thin (BAZ < -2), and 14.6% (CI: 11.24% to 17.96%) were identified as stunted (HAZ < -2). No adolescents were found to be overweight. Stool examination results indicated that approximately 60% of the adolescents had stool parasites.
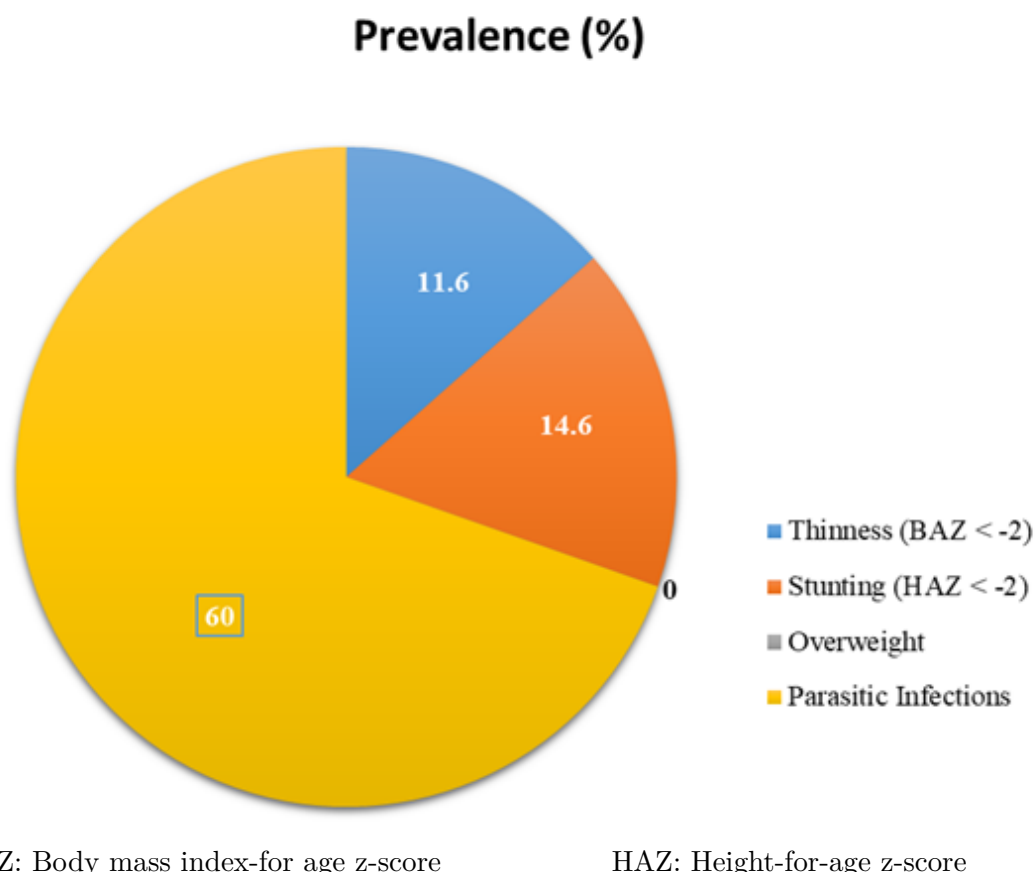

BAZ: Body mass index-for age z-score   HAZ: Height-for-age z-score

Figure 1 Prevalence of Under-nutrition among adolescents in Wonago district, Gedeo Zone, Southern Ethiopia, 2020

3.4   Factors associated with under nutrition among school adolescents

After controlling confounders using multivariable logistic regression, several factors were found to be significantly associated with undernutrition among adolescents. Specifically, the sex of the adolescents, source of drinking water, mother's occupation, father's occupation, household wealth, and source of food needs were all notable.

The likelihood of being undernourished decreased by 70% for female adolescents compared to their male counterparts [AOR: 0.30, CI: 0.12, 0.77]. Adolescents whose source of drinking water was from springs were over four times more likely to be malnourished [AOR: 4.63, CI: 1.48, 14.43].

Additionally, adolescents from households classified as medium wealth had an 85% lower likelihood of undernutrition [AOR: 0.16, CI: 0.41, 0.65] compared to those from the highest wealth households. Furthermore, adolescents who relied on purchasing food [OR: 3.33, CI: 1.55, 7.18] and those whose fathers were merchants [OR: 5.95, CI: 1.30, 27.22] showed a higher risk of being undernourished. Conversely, adolescents whose mothers were farmers had an 85% reduced probability of undernutrition [OR: 0.14, CI: 0.41, 0.65] compared to those whose mothers were housewives (Table 3).

Table 3 Determinants of undernutrition among school adolescents in Wonago district, Gedeo Zone, Southern Ethiopia, 2020

Variables		Frequency	Under nutrition (BAZ< -2)		
			Prevalence	AOR	95% CI
Age category	Early adolescence	173 (40.8)	17.3	1	Reference
	Middle adolescence	180 (42.4)	6.7	0.45	0.14, 1.40
	Late adolescence	71 (16.7)	9.8	1.63	0.45, 5.91
Sex	Male	247 (58.3)	15.4	1	Reference
	Female	177(41.7)	6.2	0.30	0.12, 0.77
Grade level	Four grade and below	101(23.8)	23.8	1	Reference
	Five to eight grade	286(67.5)	8.0	1.13	0.37, 3.50
	Nine grade and above	37(8.7)	5.4	0.60	0.08, 4.37
Live with parents	Yes	381(90.7)	10.2	1	Reference
	No	39(9.3)	25.6	4.08	1.02, 16.23
Family size	≤ 6	176 (41.5)	14.2	1	Reference
	>6	248 (58.5)	9.7	0.71	0.29,1.74
Meal frequency	Two times or below	116 (27.4)	6.0	1	Reference
	Three times or above	308 (72.6)	13.6	1.54	0.56, 4.25
Drinking water source	Tap water	291(69.8)	9.6	1	Reference
	Wells	64(15.3)	15.6	2.70	0.76, 9.62
	Spring	62(14.9)	17.7	4.63	1.48, 14.43
Stool parasite	Yes	249 (58.5)	10.7	1	Reference
	No	175 (41.5)	14.3	2.0	6 0.89, 4.77
Wealth status	Low	133 (32.8)	6.8	1.65	0.62,4.37
	Medium	138 (34.0)	14.5	0.16	0.41, 0.65
	High	135 (33.2)	10.4	1	Reference
Family food need	Grow their own	214 (50.5)	7.0	1	Reference
	Purchase/aid	210 (49.5)	16.2	3.33	1.55, 7.18
Mother occupation	Housewife	210(49.8)	17.1	1	Reference
	Farmer	73(17.3)	4.1	0.14	0.03, 0.70
	Merchant	102(24.2)	7.8	1.46	0.47, 4.57
	Other	37(8.7)	5.4	0.99	0.16, 6.30
Father occupation	Government employee	90(21.4)	7.8	1	Reference
	Farmer	213(50.7)	8.5	1.6	1 0.37,7.03
	Merchant	91(21.7)	22.0	5.95	1.30,27.22
	Other	26(6.2)	15.4	6.12	0.60, 69.96

4 Discussion

Eradicating underweight and thinness resulting from insufficient energy intake is expected to be a significant challenge for current and future global nutrition policy. Adolescents are a nutritionally critical group due to their high growth requirements, distinct eating patterns, and susceptibility to environmental influences. However, there is a lack of comprehensive data on adolescents' nutritional status.

In this study, a considerable number of adolescents were found to be stunted, with nearly twelve percent classified as underweight. These findings align with previous reports from the national nutrition baseline survey for the National Nutrition Program (NNP) of Ethiopia, which reported a 14% prevalence. Similar results were observed in a study conducted among female adolescents in northern Ethiopia, where 13.6% were found to be stunted. Comparable findings were reported in eastern Sudan, where 13.7%

of adolescent girls were stunted, and in Aligarh, Uttar Pradesh, India, where 14.6% of adolescent boys were also found to be stunted.

The prevalence of underweight among adolescents in this study is lower than findings from various regions in India. For instance, a study conducted in Wardha, India, reported that 53.8% of adolescents were classified as thin, and 50.7% were stunted. Similarly, studies from West Bengal identified a prevalence of 48.3%. These differences may be attributed to variations in study populations and geographic areas. However, the findings in this study are higher than the 6.4% prevalence reported in a study on the nutritional status of in-school adolescents in Ibadan, Nigeria. Likewise, a study from Brazil indicated a lower prevalence (7%) of underweight among adolescents in that region.

Factors associated with underweight and thinness in this study included the sex of the adolescents, source of drinking water, mother's occupation, father's occupation, household wealth, and source of food needs. Notably, female adolescents were less likely to be underweight compared to their male counterparts. This finding is consistent with results from Ibadan, Nigeria, where male adolescents were found to be at a higher risk of underweight. Similarly, the Indian National Nutrition Monitoring Bureau identified males as being at greater risk of undernutrition compared to females. This may be due to better access to food for female adolescents in developing countries, as they often engage in domestic work and may not miss meals. Additionally, adolescent males may be involved in heavier labor, which could contribute to their increased risk of undernutrition.

Among family socio-demographic characteristics, maternal working status was significantly associated with being underweight. Specifically, adolescents whose mothers were farmers were less likely to be underweight compared to those whose mothers were housewives. Mothers engaged in income-generating activities can positively impact their adolescents' nutritional status, as farming can enhance family productivity and food sources.

Conversely, adolescents whose fathers were merchants were about six times more likely to be underweight. This may be linked to differences in educational status; fathers with government jobs tend to have higher education levels, which can lead to greater awareness of nutritious foods essential for children's health. For instance, a study in Brazil found that maternal schooling was negatively associated with the likelihood of being thin.

Adolescents who sourced their drinking water from springs were four times more likely to be underweight compared to those using tap water. This increased risk may stem from a higher likelihood of repeated infections due to contaminated spring water, as many households do not treat their drinking water. Additionally, adolescents from families that purchase their food were more likely to be underweight than those who produce their own. This may be linked to better access to a variety and quantity of nutritious food in families that grow their own.

Interestingly, adolescents from households with medium economic status were less likely to be underweight compared to those from higher economic status. This finding contrasts with typical results from studies on nutritional status. The lower likelihood of underweight among adolescents in medium economic status may be due to differing nutritional characteristics between populations in medium and high economic brackets. In this study area, families in higher economic status were primarily merchants and generally less educated than those in the medium bracket, who were more often government employees and better informed about nutrition. Additionally, many families in the medium economic category were farmers, providing their own food.

This study aimed to assess the nutritional status of adolescents and identify associated factors, addressing a significant gap in literature. While we identified important risk factors for adolescent malnutrition in the study area, there are notable limitations, including a small sample size and the exclusion of out-of-school adolescents, which may have yielded different insights.

5   Conclusion and Recommendations

Our study revealed that 11.6% of adolescents were undernourished. Specifically, female adolescents, those who drank spring water, adolescents whose mothers were unemployed, and those whose families relied on purchasing food were at a higher risk of being underweight. These findings underscore the need for targeted interventions aimed at these vulnerable groups.

Stakeholders involved in nutrition programs should prioritize adolescent nutrition, particularly in developing countries, to address these disparities. Furthermore, additional studies with more robust designs are needed to accurately assess the nutritional status and its determinants among adolescents.

List of abbreviations

AOR	Adjusted Odds Ratio
BAZ	Z –Score for BMI for age
BMI	Body Mass Index
CI	Confidence Interval
COR	Crude Odds Ratio
CSA	Central Statistical Agency
HAZ	Z score for height for age
NNP	National Nutrition Program
WHO	World Health Organization

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the Institutional Review Board of Dilla University College of Health Sciences and Medicine. Written informed consent was secured from the parents of each student, and the purpose of the study was thoroughly explained to the participants. Confidentiality of the information collected was assured, and the privacy of the respondents was maintained throughout the study.

Consent for publication

Not applicable

Availability of data and material

The data underlying this study are readily available from Dryad public repository with the following link `https://datadryad.org/stash/share/yJ-DH8TMKiGdRNXlfTqXfL_IdOdqori9LjakPa2dUTE` and the preprint of this manuscript is also available on (`https://www.researchsquare.com/article/rs-117812/v1`)

Competing interests

There is no competing of interest among authors or anyone else.

References

1. Arbyn M, Weiderpass E, Bruni L, de Sanjosé S, Saraiya M, Ferlay J, et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. The Lancet Global Health. 2020;8(2):e191-e203.

2. Singh D, Vignat J, Lorenzoni V, Eslahi M, Ginsburg O, Lauby-Secretan B, et al. Global estimates of incidence and mortality of cervical cancer in 2020: a baseline analysis of the WHO Global Cervical Cancer Elimination Initiative. The lancet global health. 2023;11(2):e197-e206.

3. Mattiuzzi C, Lippi G. Cancer statistics: a comparison between World Health Organization (WHO) and Global Burden of Disease (GBD). Eur J Public Health. 2020;30(5):1026-7.

4. World Health Organization. Human papillomavirus (HPV) and cervical cancer Fact sheet 2016 [updated June 2016. Available from: `http://www.who.int/mediacentre/factsheets/fs380/en`.

5. Castle PE, Einstein MH, Sahasrabuddhe VV. Cervical cancer prevention and control in women living with human immunodeficiency virus. CA Cancer J Clin. 2021;71(6):505-26.

6. Biyazin T, Yilma A, Yetwale A, Fenta B, Dagnaw Y. Knowledge and attitude about human papillomavirus vaccine among female high school students at Jimma town, Ethiopia. Hum Vaccin Immunother. 2022;18(1):2036522.

7. Barnabas RV, Brown ER, Onono M, Bukusi EA, Njoroge B, Winer RL, et al. Single-dose HPV vaccination efficacy among adolescent girls and young women in Kenya (the KEN SHE Study): study protocol for a randomized controlled trial. Trials. 2021;22(1):661.

8. Larebo YM, Elilo LT, Abame DE, Akiso DE, Bawore SG, Anshebo AA, et al. Awareness, acceptance, and associated factors of human papillomavirus vaccine among parents of daughters in Hadiya Zone, Southern Ethiopia: a cross-sectional study. Vaccines. 2022;10(12):1988.

9. Medlineplus. Substance use 17 July 2024 [Available from: https://medlineplus.gov/ency/article/001945.htm.

10. Biyazin T, Yilma A, Yetwale A, Fenta B, Dagnaw Y. Knowledge and attitude about human papillomavirus vaccine among female high school students at Jimma town, Ethiopia. Human Vaccines & Immunotherapeutics. 2022;18(1):2036522.

11. Endale S., Delelegn K., Negash Z. Knowledge, attitude, practices, and associated factors toward cervical cancer among female health sciences students of Addis Ababa University, Addis Ababa, Ethiopia. *Therapeutic Advances in Vaccines and Immunotherapy.* 2025;13:25151355251314733.

12. Sinshaw MT, Berhe S, Ayele SG. Knowledge and attitude towards human papillomavirus vaccine and associated factors among mothers who have eligible daughters in Debre Markos Town, Northwest Ethiopia. Infection and drug resistance. 2022:781-93.

13. Yohannes E, Beyen MW, Bulto GA, Chaka EE, Debelo BT, Erena MM, et al. Knowledge and attitude toward human papillomavirus vaccination and associated factors among adolescent school girls in Ambo town, Ethiopia, 2021: A multicenter cross-sectional study. Health Science Reports. 2023;6(6):e1305.

14. Geneti HB, Hailu DA, Muleta G. Assessment of the knowledge, attitude and acceptability towards human papillomavirus and its vaccine among undergraduate female medical students. Gynecol Obstet (Sunnyvale). 2016;6(11):1-9.

15. Bulto GA, Chaka EE, Roga EY, Debelo BT, Erena MM, Tefu TL. Knowledge and Attitude of Human Papillomavirus Vaccination and associated Factors Among Adolescent School Girls in Ambo Town, Oromia Region, Ethiopia, 2021. 2021.

16. Adejuyigbe FF, Balogun BR, Sekoni AO, Adegbola AA. Cervical cancer and human papilloma virus knowledge and acceptance of vaccination among medical students in Southwest Nigeria. African journal of reproductive health. 2015;19(1):140-8.

17. Ukumo EY, Woldehawariat FG, Dessalegn SA, Minamo DM, Ukke GG. Assessment of knowledge about human papillomavirus vaccination among primary school girls in Arba Minch Town, South Ethiopia, 2020 an institution-based cross-sectional study. Cancer Management and Research. 2022:2205-14.

18. Songthap A, Pitisuttithum P, Kaewkungwal J, Fungladda W, Bussaratid V. Knowledge, attitudes, and acceptability of a human papilloma virus vaccine among students, parents and teachers in Thailand. Southeast Asian J Trop Med Public Health. 2012;43(2):340-53.

19. Voidăzan S, Tarcea M, Morariu S-H, Grigore A, Dobreanu M. Human papillomavirus vaccine-knowledge and attitudes among parents of children aged 10-14 years: a cross-sectional study, Tîrgu mureş, Romania. Central European journal of public health. 2016;24(1):29-38.

20. Cocchio S, Bertoncello C, Baldovin T, Fonzo M, Bennici SE, Buja A, et al. Awareness of HPV and drivers of HPV vaccine uptake among university students: a quantitative, cross-sectional study. Health & social care in the community. 2020;28(5):1514-24.

21. Kassa HN, Bilchut AH, Mekuria AD, Lewetie EM. Practice and associated factors of human papillomavirus vaccination among primary school students in Minjar-Shenkora district, North Shoa Zone, Amhara Regional State, Ethiopia, 2020. Cancer Management and Research. 2021:6999-7008.

22. Najafi-Sharjabad F, Rayani M. The relationship between knowledge, attitude and acceptance of Human Papilloma Virus (HPV) vaccination for cervical cancer prevention among students at Bushehr University of Medical Sciences, Iran. Journal of Research Development in Nursing and Midwifery. 2019;16(2):19-29.

23. Onowhakpor A, Omuemu V, Osagie O, Odili C. Human Papilloma Virus vaccination: knowledge, attitude and uptake among female medical and dental students in a tertiary institution in Benin-City, Nigeria. Journal of Community Medicine and Primary Health Care. 2016;28(2):101-8.

24. Trucchi C, Amicizia D, Tafuri S, Sticchi L, Durando P, Costantino C, et al. Assessment of knowledge, attitudes, and propensity towards HPV vaccine of young adult students in Italy. Vaccines. 2020;8(1):74.

25. Rashwan H, Lubis SH, Ni KA. Knowledge of cervical cancer and acceptance of HPV vaccination among secondary school students in Sarawak, Malaysia. Asian Pac J Cancer Prev. 2011;12(7):1837-41.

26. Mihretie GN, Liyeh TM, Ayele AD, Belay HG, Yimer TS, Miskr AD, et al. Female adolescents' knowledge and acceptability of human papillomavirus vaccine in Debre Tabor Town, Ethiopia: a cross-sectional study. BMJ open. 2023;13(3):e061813.