Knowledge, Attitudes, and Misconceptions About COVID-19 Prevention Practices Among High and Preparatory School Students in Dessie City, Ethiopia

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Background: Knowledge, attitudes, and misconceptions of students about COVID-19 (coronavirus disease) prevention have been examined in relatively few studies. This study aimed to assess the knowledge, attitudes and misconceptions about COVID-19 prevention practices among high and preparatory school (grades 9 to 12) students in Dessie City, Ethiopia.

Methods: This school-based cross-sectional study used a pre-tested structured questionnaire and direct observations from March 1 to 30, 2021 in 5 high and preparatory school students in Dessie City, Ethiopia. The sample size was proportionally allocated in each school based on the number of students registered in the first semester, stratified by grade level, and section. Data analysis employed 3 binary logistic regression models (Models I, II and III) with 95% CI (confidence interval). Bivariate analysis (crude odds ratio [COR]) and multivariable analysis (adjusted odds ratio [AOR]) were used. Variables with P-values <0.3 in the bivariate analysis were retained in the multivariable logistic regression analysis for each model. Variables with significance levels P<0.05 in the multivariable analysis of each model was identified as significant factors.

Results: The levels of good knowledge, positive attitudes, and low misconceptions were 74.8%, 60.2%, and 56.1%, respectively. After adjusting for the covariates, grade 12, positive attitude and living in households with more than 5 members were identified as factors significantly associated with good knowledge about COVID-19 prevention practices. Good knowledge of COVID-19 prevention practices, household size >5, infection prevention and control (IPC) training, and low level of misconceptions were factors significantly associated with positive attitudes, whereas students age ≥18 years, positive attitude, and IPC training were factors significantly associated with less misconceptions about COVID-19 prevention measures.

Conclusion: The prevalence of good knowledge, positive attitude, and low level of misconceptions of prevention practices for COVID-19 among students was relatively low. Therefore, Dessie City Health and Education Department and each high and preparatory school should implement continuous monitoring programs to ensure high prevention awareness and promote preventive behavior towards COVID-19.

Keywords: COVID-19, knowledge, attitudes, misconceptions, high and preparatory school, students, Dessie City, Ethiopia

Introduction

After more than 2 years into the COVID-19 (Coronavirus disease) pandemic, the world is still coping with its devastating impact. The transmission and spread of the coronavirus varies greatly among different communities, districts and countries with different socioeconomic, political, and infrastructural contexts. The virus is transmitted through airborne and contact routes, manifests in a wide range of symptoms, and is resulting in the deaths of many people, especially old and immunologically compromised patients.
Developing countries bear the brunt of the COVID-19 pandemic. In Ethiopia, the government declared a state of emergency after the first case of COVID-19 was confirmed in March 2020. By March 10, 2022, a total of 469,134 confirmed cases and 7,484 deaths had been reported. The increasing morbidity and mortality led to the closure of all educational institutions. While most other countries switched to online modes of teaching, this was not feasible in Ethiopia, and the Ethiopian Ministry of Education decided after 6 months into the pandemic to re-open all education institutions and mandate the universally accepted COVID-19 prevention measures of social distancing, wearing masks, and practicing respiratory hygiene. Little is known about knowledge, attitudes, and misconceptions about COVID-19 prevention measures among Ethiopian students, even though these factors are crucial in preventing and controlling COVID-19 and other acute viral diseases.

Misconceptions about disease risk and prevention can facilitate the transmission of human diseases and good knowledge, perceptions, health behaviors and attitudes can facilitate their control because all these factors influence health behavior. During the COVID-19 pandemic, a number of misconceptions led to the creation of the webpage “myth busters” by WHO.

Few studies have been carried out on knowledge, attitudes, and practices regarding of COVID-19 in schools in Ethiopia. Two studies were carried out among college students and another one among preparatory students. The latter study covered a 2-year age range of students, precluding an assessment of age in preventive behavior. Therefore, this study was designed to assess knowledge, attitudes, and misconceptions of COVID-19 prevention and control and associated factors among high and preparatory school students in Dessie City, Ethiopia.

**Methods and Materials**

**Study Area and Study Design**

This school-based cross-sectional study used an interviewer-administered questionnaire and direct observations from March 1 to 30, 2021 in 5 high and preparatory schools (students in grades 9-12) in Dessie City, Amhara Region, Ethiopia. The five high and preparatory schools (3 governmental and 2 private schools) in Dessie City Administration has accommodated a total of 9,024 students (4,341 males and 4,683 females) in March 2021.

**Source Population and Exclusion Criteria**

The source population included all students in grades 9 to 12 in Dessie City high and preparatory schools enrolled in March, 2021. Students who were absent during that study period were excluded from the study.

**Sample Size Determination**

The sample size for this study was calculated using a single population proportion formula. We assumed 50.0% prevalence (\(p\)) of good knowledge, positive attitude and less misconception levels among high and preparatory school (grades 9–12) students in Dessie City due to the scarcity of other COVID-19 studies among high and preparatory school students in Ethiopia, 5.0% margin of error (\(d\)), 95.0% CI (confidence interval), and 10.0% non-response rate. Thus using the following formula:

\[
\left[ Z_{1-\alpha/2} \right]^2 \times p \left( 1 - p \right) / d^2 = n
\]

The initial sample size (\(n\)) became 384. Then, adjusting for the 10% non-response rate gave a final sample size (\(N\)) of 422 students.

**Sampling Technique**

The sample size in each of the 5 schools studied was determined based on the number of students registered in the first academic semester who attended school by March 2021. Each school was stratified by grade level and the samples were proportionally allocated to the 9th, 10th, 11th and 12th grades. The proportionally allocated samples in each grade level were further proportionally allocated to each section of the respective grade levels. Study participants were then selected...
using simple random sampling (lottery method) based on classroom attendance at the time of the survey as the sampling frame.

**Data Collection and Quality Assurance**

The interviewer-administered, structured questionnaire was adapted from WHO COVID-19 guidelines and various reports. The questionnaire includes selected socio-demographic, knowledge, attitude, and misconception variables. The data collectors were 3 BSc. in environmental health professionals and 3 BSc. holders in nursing. One data collector was recruited for each of the 4 schools and 2 data collectors for one school, which was the largest. The questionnaire was prepared in English and then translated to Amharic (the local language) and back to English by different translators to check its consistency. The principal investigator trained the data collectors for 2 days about the contents of data collection tool, data collection procedures and ethical issues. The questionnaire was pre-tested in 1 high and preparatory school in Kombolcha town with a 5% sample (21 students) to establish the validity and reliability of the questionnaire and the questionnaire was amended based on the findings of the pre-test.

Inter-observer reliability was ensured by providing clear definitions about knowledge, attitudes, misconceptions and prevention practices regarding COVID-19. The content validity of the questionnaire was improved by using a literature review to identify relevant items; the tool was evaluated by experts in the same research field and questions that were not relevant at the critical level were eliminated.

One supervisor and principal investigator supervised data collection and supported the data collectors. Each questionnaire was checked daily for completeness and consistency was checked before data were entered.

**Outcome and Independent Variables**

The outcome variables were knowledge (good or poor), attitudes (positive or negative), and misconceptions (less or more) about COVID-19 prevention practices. Explanatory variables were socio-demographic status and source of information on COVID-19.

**Operational Definitions**

**Knowledge:** Respondents scoring equal to or above the mean value 14.0 ± 6.2 (SD, standard deviations) were considered as having good knowledge about COVID-19 prevention practices and those scoring less than the mean value 14.0 ± 6.2 were considered as having poor knowledge of COVID-19 prevention practices.

**Attitudes:** Respondents who scored equal to or above the mean value 13.6 ± 7.5 were considered as having a positive attitude towards COVID-19 prevention practices whereas scores of less than the mean value 13.6 ± 7.5 were classified as negative attitude about COVID-19 prevention practices.

**Misconceptions:** Respondents scoring equal to or below the mean misconception value 6.3 ± 3.5 were classified as having less misconceptions, and scores of more than the mean value 6.3 ± 3.5 were classified as having more misconceptions about COVID-19 prevention measures.

**Data Analysis**

All data were entered to EpiData Version 4.6 and then exported to SPSS Version 25.0 for data cleaning and analysis. To assess the overall distribution, descriptive analysis was performed on categorical data and means with standard deviations were used on continuous variables.

Associations between independent factors and the outcomes of knowledge, attitudes, and misconceptions about COVID-19 prevention practices were determined independently using a binary logistic regression model with a 95% CI (confidence interval). We employed 3 distinct logistic regression models: The first model (Model 1) identified factors associated with good knowledge of COVID-19 prevention practices, the second model (Model II) identified factors associated with positive attitudes toward COVID-19 preventive measures, and the third model (Model III) identified factors associated with less misconception about COVID-19 preventive measures.

Bivariate analysis with crude odds ratio (COR) and multivariable analysis with adjusted odds ratio (AOR) were used for each model. Variables with P-values less than 0.3 in the bivariate analysis were entered into the multivariable logistic
regression analysis. Variables with significant levels of $p$-values less than 0.05 in the multivariable analysis of each model were identified as factors significantly associated with good knowledge, positive attitude, and less misperception toward COVID-19 prevention practices.

The occurrence of multicollinearity within independent variables was investigated using standard error at a cut-off value of 2 and a maximum standard error less than 2. The Hosmer-Lemeshow test\textsuperscript{17} was used to assess model fitness for models I, II, and III, and the $p$-values were 0.897, 0.834, and 0.949, respectively, suggesting that all models fit.

Compliance with Ethical Standards
The Ethical Review Committee of the College of Medicine and Health Sciences of Wollo University gave ethical clearance for the study (Protocol number: WU/CMHS/146/03/2021). Official support letters were obtained from Wollo University for Dessie City Education Department in order to obtain support during data collection from each school. Prior to data collection, the purpose of the study was explained to each participant and informed written consent was obtained from study participants 18 years and older. For study participants below the age of 18 years, written consent was obtained from their families. Participants were informed that participation was voluntary and that they could decline to answer any of the questions during the interview and opt out of the study. They were also assured of the confidentiality of the information they provided. All study methods were performed in accordance with the ethical principles of the Declaration of Helsinki.

Results
Socio-Demographics Characteristics
Of the selected 422 students, 417 were included in the study (98.8% response rate). Two-thirds of the participants were females (256, 61.4%) and 60.9% were less than 18 years old. The mean ($\pm$SD) age of the students was 16.97 ($\pm$1.27) years. Almost all of the respondents (402, 96.4%) were single. Nearly half (204, 48.9%) of the participants’ mothers were housewives and 141 (33.8%) of the fathers were government employees (Table 1). Nearly all (94.7%) participants received updated COVID-19 information from family/friends, television (90.4%), Facebook (89.2%), and other internet sources (90.6%) (Figure 1).

Knowledge of COVID-19 Prevention Practices
Three-fourths (74.8%, 95% CI: 70.3–78.9) of the students had good knowledge and 25.2% (95% CI: 21.1–29.5) had poor knowledge of COVID-19 prevention measures. The great majority (378, 90%) of the students knew that proper washing of hands for 20 seconds or more with soap and water can prevent the transmission of COVID-19 and 383 (90.8%) stated that rubbing hands with alcohol-based sanitizer can prevent transmission. The great majority of respondents (392, 94%) knew that maintaining a 2-meter social distance can protect against COVID-19 infection; 391 (93.8%) of them knew that face masks or face coverings can reduce the transmission of the virus (Table 2).

Attitudes About COVID-19 Prevention Practices
About 60.2% (95% CI: 55.6–65.2) of the students had a positive attitude and 39.8% (95% CI: 34.8–44.4) had a negative attitude towards COVID-19 prevention practices. Of the 351 students who thought COVID-19 can be controlled in Dessie, 335 (80.3%) stated that the virus can be controlled if people follow all guidelines of the Ministry of Health, and 215 (51.6%) stated that the administration of drugs can control the epidemic. Two-fifths (39.1%) of the students thought infections were socially stigmatized. Almost three-fifths (246, 59.0%) of the participants worried about contracting COVID-19 (Table 3).

Misconceptions of COVID-19 Prevention Measures
Most students (56.1%) (95% CI: 51.6–60.4) had relatively less misconceptions and 43.9% (95% CI: 39.6–48.4) had more misconceptions about COVID-19 prevention measures. More than four-fifths (84.2%) of the students were confident that
# Table 1 Social-Demographic Characteristics and Sources of Information about COVID-19 among High and Preparatory School Students in Dessie City, Ethiopia, March 2021

| Independent Variable | Frequency (n) | Percentage (%) |
|----------------------|--------------|-----------------|
| **Age**              |              |                 |
| <18 years            | 254          | 60.9            |
| ≥18 years            | 163          | 39.1            |
| **Sex**              |              |                 |
| Male                 | 161          | 38.6            |
| Female               | 256          | 61.4            |
| **Religion**         |              |                 |
| Orthodox Christian   | 230          | 55.2            |
| Muslim               | 172          | 41.2            |
| Protestant           | 15           | 3.6             |
| **Grade**            |              |                 |
| 9th                  | 50           | 12.0            |
| 10th                 | 115          | 27.6            |
| 11th                 | 54           | 12.9            |
| 12th                 | 198          | 47.5            |
| **Marital status**   |              |                 |
| Single               | 402          | 96.4            |
| Married              | 15           | 3.6             |
| **Mother’s education status** | | |
| Unable to read and write | 16 | 3.8 |
| Able to read and write | 22 | 5.3 |
| Primary              | 105          | 25.2            |
| Secondary            | 116          | 27.8            |
| College and above    | 158          | 37.9            |
| **Father’s education status** | | |
| Unable to read and write | 18 | 4.3 |
| Able to read and write | 26 | 6.2 |
| Primary              | 58           | 13.9            |
| Secondary            | 127          | 30.5            |
| College and above    | 186          | 44.6            |
| **Mother’s occupation** | | |
| Housewife            | 204          | 48.9            |
| Student              | 25           | 6.0             |
| Daily laborer        | 20           | 4.8             |
| Government employee  | 94           | 22.5            |
| Private employee     | 18           | 4.3             |
| Merchant             | 56           | 13.4            |
the epidemic can be controlled in Dessie City. One fourths of the students (27.6%) considered eating garlic or mitmita (hot pepper) and frequently sipping water to prevent corona virus infection (Table 4).

**Bivariate and Multivariable Analysis of Factors Associated with Knowledge About COVID-19 Prevention Practices**

All variables with $P$-values < 0.3 in the bivariate analysis were entered into multivariable logistic regression analysis (Table 5). The final analysis showed that the odds of developing good knowledge about COVID-19 prevention practices among students in grades 11 and 12 were 5.45 times (AOR = 5.42, 95% CI: 2.55–11.67) higher than for lower-grade students. Similarly, the odds of developing good knowledge about COVID-19 prevention practices among students living in households with 5 or more members were 3.30 times (AOR = 3.30, 95% CI: 1.99–5.45) higher than for those who lived in smaller households. The odds of good knowledge among students who had a positive attitude were 2.69 times (AOR = 2.69, 95% CI: 1.63–4.44) higher than of those who had a negative attitude (Table 6).

![Figure 1](https://doi.org/10.2147/JMDH.S325636)

**Figure 1** Source of Information about COVID-19 Prevention Measures among High and Preparatory School students in Dessie City, Ethiopia, March 2021.
Table 2 Knowledge of High and Preparatory School Students about COVID-19 Transmission and Prevention in Dessie City, Ethiopia, March 2021

| Knowledge Question                                           | Response | Frequency (n) | Percentage (%) |
|--------------------------------------------------------------|----------|---------------|----------------|
| Is COVID-19 transmitted by air droplets between people?      | Yes      | 263           | 63.1           |
|                                                              | No       | 154           | 36.9           |
| Is COVID-19 transmitted by physical contact?                 | Yes      | 172           | 41.2           |
|                                                              | No       | 245           | 58.8           |
| Is COVID-19 transmitted by evil spirits?                     | Yes      | 61            | 14.6           |
|                                                              | No       | 356           | 85.4           |
| Are all people at risk of COVID-19?                          | Yes      | 277           | 66.4           |
|                                                              | No       | 140           | 33.6           |
| Can the virus be transferred by shaking hands?               | Yes      | 381           | 91.4           |
|                                                              | No       | 36            | 8.6            |
| Can touching your nose, mouth, eyes with un washed hands transfer the virus? | Yes | 391 | 93.8 |
|                                                              | No       | 26            | 6.2            |
| Can proper washing of hands for at-least 20 seconds with soap and water prevent COVID-19? | Yes | 378 | 90.6 |
|                                                              | No       | 39            | 9.4            |
| Can rubbing of hands with alcohol- based sanitizer prevent transmission of COVID-19 | Yes | 383 | 91.8 |
|                                                              | No       | 34            | 8.2            |
| Is there a need to wash hands before and after touching any surface using water and soap or sanitizer? | Yes | 392 | 94.0 |
|                                                              | No       | 25            | 6.0            |
| Can sneezing or coughing into your arm/elbow prevent the spread of the virus? | Yes | 394 | 94.5 |
|                                                              | No       | 23            | 5.5            |
| Can staying at home decrease the chance of getting infected? | Yes      | 386           | 92.6           |
|                                                              | No       | 31            | 7.4            |
| Can distancing 2 meters between people prevent the transmission of COVID-19? | Yes | 392 | 94 |
|                                                              | No       | 25            | 6              |
| Does wearing a face mask decrease the risk of transmission of COVID-19? | Yes | 391 | 93.8 |
|                                                              | No       | 26            | 6.2            |
| Can cloth masks be reused after washing with soap and water? | Yes | 382 | 91.6 |
|                                                              | No       | 35            | 8.4            |
| Avoiding crowded places reduces the transmission of corona virus | Yes | 381 | 91.4 |
|                                                              | No       | 36            | 8.6            |
| Does wearing gloves replace the need for hand washing or use of alcohol -based hand sanitizer? | Yes | 349 | 83.7 |
|                                                              | No       | 68            | 16.3           |
| Can isolating oneself if getting sick prevent the spread of the virus? | Yes | 389 | 93.3 |
|                                                              | No       | 28            | 6.7            |
Table 3 Attitudes of High and Preparatory School Students towards COVID-19 Prevention Practices in Dessie City, Ethiopia, March 2021

| Attitude Question                                                                 | Response | Frequency (n) | Percentage (%) |
|-----------------------------------------------------------------------------------|----------|---------------|----------------|
| Can the COVID-19 epidemic be controlled in Dessie?                                 | Yes      | 351           | 84.2           |
|                                                                                  | No       | 66            | 15.8           |
| Do you think the epidemic can be controlled by people following all guidelines by the Ministry of Health? | Yes      | 335           | 80.3           |
|                                                                                  | No       | 82            | 19.7           |
| Do you think the epidemic can be controlled with drugs?                            | Yes      | 215           | 51.6           |
|                                                                                  | No       | 202           | 48.4           |
| Do you think the government should play a role in the prevention and control of COVID-19? | Yes      | 336           | 80.6           |
|                                                                                  | No       | 81            | 19.4           |
| Do you think the schools should play a central role in the prevention and control of COVID-19? | Yes      | 390           | 93.5           |
|                                                                                  | No       | 27            | 6.5            |
| Do you think each person should play a major role in the prevention and control of COVID-19? | Yes      | 294           | 70.5           |
|                                                                                  | No       | 123           | 29.5           |
| Do you think traditional medicine should be used in the prevention and control of COVID-19? | Yes      | 44            | 10.6           |
|                                                                                  | No       | 373           | 89.4           |
| Are prayers effective in preventing COVID-19?                                      | Yes      | 312           | 74.8           |
|                                                                                  | No       | 105           | 25.2           |
| Do you think that you can contribute to preventing and controlling the COVID-19 epidemic? | Yes      | 368           | 88.2           |
|                                                                                  | No       | 49            | 11.8           |
| Do you believe that frequent hand washing damages skin and causes cracking, dryness, irritation and dermatitis? | Yes      | 212           | 50.8           |
|                                                                                  | No       | 205           | 49.2           |
| Do you believe you can protect yourself against COVID-19?                           | Yes      | 363           | 87.1           |
|                                                                                  | No       | 54            | 12.9           |
| Do you believe you have a very low risk of acquiring COVID-19 from others!         | Yes      | 202           | 48.4           |
|                                                                                  | No       | 215           | 51.6           |
| Listening and following the direction of state and local authorities reduces COVID-19 transmission? | Yes      | 368           | 88.2           |
|                                                                                  | No       | 49            | 11.6           |
| Do you worry about contracting COVID-19?                                           | Yes      | 246           | 59.0           |
|                                                                                  | No       | 171           | 41.0           |
| Do you think that the disease causes embarrassment or insult to infected persons or the relatives of students? | Yes      | 163           | 39.1           |
|                                                                                  | No       | 254           | 60.9           |
Table 4 Misconceptions of High and Preparatory School Students About COVID-19 Transmission and Prevention Practices in Dessie City, Ethiopia, March 2021

| Misconception Question                          | Response | Frequency (n) | Percentage (%) |
|------------------------------------------------|----------|---------------|----------------|
| Is traditional medicine effective for COVID-19? | Yes      | 94            | 22.5           |
|                                                | No       | 323           | 77.5           |
| Will this virus outbreak end soon?             | Yes      | 96            | 23.0           |
|                                                | No       | 321           | 77.0           |
| Can eating garlic and mitmita prevent corona virus infection? | Yes      | 115           | 27.6           |
|                                                | No       | 302           | 72.4           |
| Are females more vulnerable to COVID-19 infection than males? | Yes      | 74            | 17.7           |
|                                                | No       | 343           | 82.3           |
| Are only older adults and younger people at greater risk for COVID-19 infection? | Yes      | 74            | 17.7           |
|                                                | No       | 343           | 82.3           |
| Do you have to be with someone for 10 minutes or more to catch the virus? | Yes      | 80            | 19.2           |
|                                                | No       | 337           | 80.8           |
| Does rinsing the nose with saline protect against coronavirus? | Yes      | 64            | 15.3           |
|                                                | No       | 353           | 84.7           |
| Does frequent sipping of water protect from corona infection? | Yes      | 94            | 22.5           |
|                                                | No       | 323           | 77.5           |
| Will the coronavirus die off when temperatures rise in the spring? | Yes      | 133           | 31.9           |
|                                                | No       | 284           | 68.1           |
| Is the coronavirus the deadliest virus known to man? | Yes      | 286           | 68.6           |
|                                                | No       | 131           | 31.4           |
| Do flu and pneumonia vaccines protect against COVID-19? | Yes      | 89            | 21.3           |
|                                                | No       | 328           | 78.7           |
| Can vitamin C cure COVID-19?                   | Yes      | 88            | 21.1           |
|                                                | No       | 329           | 78.9           |
| Does gargling with warm salt water or vinegar eliminate the coronavirus? | Yes      | 83            | 19.9           |
|                                                | No       | 334           | 80.1           |

Bivariate Analysis of Factors Associated with Attitudes Towards COVID-19 Prevention Practices

Table 7 shows the results of the bivariate analysis of socio-demographic characteristics and source of information, knowledge, and misconceptions regarding COVID-19 with attitudes among high school and preparatory school students in Dessie City, Ethiopia, March 2021. The multivariable analysis showed that the odds of developing a positive attitude about COVID-19 prevention practices were 2.55 times higher (AOR = 2.55, 95% CI: 1.58–4.12) among students who had good knowledge about prevention programs than among those who had poor knowledge. The odds of developing a
Table 5 Bivariate Analysis of Knowledge of COVID-19 Associated with Socio-Demographic Characteristics, Sources of COVID-19 Information, Attitudes, and Misconceptions Among High and Preparatory School Students in Dessie City, Ethiopia, March 2021

| Variable            | Category          | Knowledge | COR (95% CI) |
|---------------------|-------------------|-----------|--------------|
|                     |                   | Good (n)  | Poor (n)     |              |
| Age                 | <18               | 182       | 72           | 1            |
|                     | ≥18               | 130       | 33           | 1.56 (0.98–2.49) |
| Sex                 | Male              | 124       | 46           | 1            |
|                     | Female            | 188       | 59           | 1.18 (0.76–1.85) |
| Religion            | Orthodox Christian| 176       | 53           | 1.51 (0.50–4.54) |
|                     | Muslim            | 125       | 47           | 1.21 (0.40–3.67) |
|                     | Protestant        | 11        | 5            | 1            |
| Grade               | 9th               | 31        | 19           | 1            |
|                     | 10th              | 81        | 34           | 1.46 (0.73–2.93) |
|                     | 11th              | 28        | 26           | 0.66 (0.30–1.44) |
|                     | 12th              | 172       | 26           | 4.06 (2.01–8.20) |
| Marital status      | Single            | 304       | 98           | 1            |
|                     | Married           | 8         | 7            | 0.37 (0.13–1.04) |
| Mother’s education status | Unable to read and write | 9 | 7 | 1 |
|                     | Able to read and write | 15 | 7 | 1.67 (0.44–6.33) |
|                     | Primary           | 75        | 30           | 1.94 (0.66–5.70) |
|                     | Secondary         | 90        | 26           | 2.69 (0.91–7.93) |
|                     | College and above | 123       | 35           | 2.73 (0.95–7.86) |
| Father’s educational status | Unable to read and write | 12 | 6 | 1 |
|                     | Able to read and write | 19 | 7 | 1.36 (0.37–5.02) |
|                     | Primary           | 46        | 12           | 1.92 (0.59–6.16) |
|                     | Secondary         | 96        | 31           | 1.55 (0.54–4.47) |
|                     | College and above | 138       | 48           | 1.44 (0.51–4.04) |
| Mother’s occupation | Housewife         | 152       | 52           | 1            |
|                     | Student           | 14        | 11           | 0.44 (0.19–1.02) |
|                     | Daily laborer     | 13        | 7            | 0.64 (0.24–1.68) |
|                     | Government employee | 71 | 24 | 0.99 (0.57–1.75) |
|                     | Private employee  | 12        | 5            | 0.89 (0.30–2.62) |
|                     | Merchant          | 50        | 6            | 2.85 (1.16–7.04) |

(Continued)
Table 5 (Continued).

| Variable                        | Category       | Knowledge | COR (95% CI) |
|---------------------------------|----------------|-----------|--------------|
|                                 |                | Good (n)  | Poor (n)     |              |
| Father’s occupation             | Daily laborer  | 28        | 5            | 1            |
|                                 | Farmer         | 21        | 11           | 0.34 (0.10–1.13) |
|                                 | Government employee | 102      | 39           | 0.47 (0.17–1.30) |
|                                 | Private employee | 84        | 21           | 0.71 (0.25–2.07) |
|                                 | Merchant       | 77        | 29           | 0.47 (0.17–1.35) |
| Household size (persons)        | ≤5             | 97        | 63           | 1            |
|                                 | >5             | 215       | 42           | 3.33 (2.1–5.26) |
| Get updated information from television | Yes          | 280       | 97           | 1.39 (0.62–3.11) |
|                                 | No             | 32        | 8            | 1            |
| Get updated information from radio | Yes         | 212       | 71           | 0.99 (0.61–1.58) |
|                                 | No             | 100       | 34           | 1            |
| Get updated information from face book | Yes        | 248       | 83           | 0.97 (0.57–1.68) |
|                                 | No             | 64        | 22           | 1            |
| Get updated information from social media | Yes       | 271       | 85           | 0.64 (0.36–1.16) |
|                                 | No             | 41        | 20           | 1            |
| Get updated information from World Health Organization | Yes  | 260       | 85           | 0.85 (0.48–1.50) |
|                                 | No             | 52        | 20           | 1            |
| Get updated information from Ethiopia Ministry of Health | Yes  | 272       | 94           | 1.26 (0.62–2.55) |
|                                 | No             | 40        | 11           | 1            |
| Get updated information from newspaper | Yes  | 127       | 41           | 0.93 (0.59–1.47) |
|                                 | No             | 185       | 64           | 1            |
| Get updated information from families/friends | Yes  | 299       | 96           | 0.83 (0.38–1.79) |
|                                 | No             | 13        | 9            | 1            |
| Received IPC training           | Yes            | 154       | 36           | 0.54 (0.34–0.85) |
|                                 | No             | 158       | 69           | 1            |
| Overall Attitudes               | Positive       | 208       | 43           | 2.88 (1.83–4.54) |
|                                 | Negative       | 104       | 62           | 1            |
| Overall Misconceptions          | Less           | 183       | 51           | 0.67 (0.43–1.04) |
|                                 | More           | 129       | 54           | 1            |

Note: 1, reference category.
positive attitude about COVID-19 prevention practices among household size of greater than five were 1.56 times (AOR = 1.56, 95% CI: 1.02–2.39) higher compared to households size 5 or fewer members. The odds of developing a positive attitude about COVID-19 prevention practices among students who obtained infection prevention and control (IPC) training were 1.64 times (AOR = 1.64, 95% CI: 1.08–2.48) higher than those who had no training (Table 8).

Multivariable Analysis of Factors Associated with Misconceptions Regarding COVID-19 Prevention Practices

Table 9 shows the results of the bivariate analysis of misconceptions and socio-demographic characteristics of grade 9–12 students regarding COVID-19 prevention practices in Dessie City, Ethiopia, March 2021. Students 18 years and older were 60% less likely to have low levels of misconceptions about COVID-19 prevention measures than their younger peers (AOR = 0.60, 95% CI: 0.40–0.90). Students who received IPC training were 67.0% less likely to have less misconceptions about COVID-19 prevention measures than those who had not received training (AOR = 0.67, 95% CI:0.44–0.99). The odds of developing less misconceptions about COVID-19 prevention practices among students who had a positive attitude were 1.58 times (AOR = 1.58, 95% CI: 1.04–2.41) fewer than those who had a negative attitude (Table 10).

Discussion

The focus of this study was on determining the prevalence of knowledge, attitudes, and misconceptions and associated factors in regard to COVID-19 prevention practices among high and preparatory school students in Dessie City. We found that the prevalence of good knowledge was 74.8% (95% CI: 70.3–79.1), positive attitude was 60.2% (95% CI: 55.6–65.2) and less misconceptions was 56.1% (95% CI: 51.6-60.4).

The rate of good knowledge in our study was lower than that reported by the only other COVID-19 study of preparatory students in Ethiopia, which was also carried out in March 2021. This difference is consistent with the lower knowledge, attitude and misconception levels of the high school students in our study. Our findings reveal that the determinant factors for good knowledge were directly related to education level, household size, and positive attitude.

The prevalence of good knowledge of prevention measures (74.8%) in our study was similar to prevalence levels reported from studies in Saudi Arabia (68.1%) and Bangladesh (61.2%) as well as in Amhara Region (69.6%) and Awi Zone (76.6%) in Ethiopia. Variations may be the result of socio-demographic differences, the effectiveness of local COVID-19 programs, and the dates of the studies. Students in grades 11 and 12 in our study were 5.45 times more knowledgeable about COVID-19 than those in grades 9 and 10; this finding is similar to results from a study of students in 4 private and public universities in Amhara Region, general populations in China and Syria, university students in Japan, and health care workers in Bangladesh.
| Variable               | Category      | Attitude | COR (95% CI) |
|------------------------|---------------|----------|--------------|
|                        |               | Positive (n) | Negative (n) |          |
| Age                    | <18           | 153      | 101          | 1          |
|                        | ≥18           | 98       | 65           | 1.00 (0.67–1.49) |
| Sex                    | Male          | 106      | 64           | 1          |
|                        | Female        | 145      | 102          | 0.86 (0.58–1.28) |
|                        | Orthodox Christian | 129  | 100          | 0.77 (0.27–2.20) |
|                        | Muslim        | 112      | 60           | 1.12 (0.39–3.23) |
|                        | Protestant    | 10       | 6            | 1          |
| Grade                  | 9th           | 33       | 17           | 1          |
|                        | 10th          | 67       | 48           | 0.72 (0.36–1.44) |
|                        | 11th          | 29       | 25           | 0.59 (0.27–1.32) |
|                        | 12th          | 122      | 76           | 0.83 (0.43–1.59) |
| Marital status         | Single        | 244      | 158          | 1          |
|                        | Married       | 7        | 8            | 0.57 (0.20–1.59) |
| Mother’s education status | Unable to read and write | 8       | 8            | 1          |
|                        | Able to read write | 16     | 6            | 2.67 (0.69–10.36) |
|                        | Primary       | 61       | 44           | 1.39 (0.48–3.98) |
|                        | Secondary     | 75       | 41           | 1.83 (0.64–5.23) |
|                        | College and above | 91  | 67           | 1.36 (0.49–3.80) |
| Father’s education status | Unable to read and write | 9       | 9            | 1          |
|                        | Able to read and write | 17     | 9            | 1.89 (0.55–6.45) |
|                        | Primary       | 36       | 22           | 1.64 (0.56–4.75) |
|                        | Secondary     | 78       | 49           | 1.59 (0.59–4.29) |
|                        | College and above | 111  | 75           | 1.48 (0.56–3.90) |
| Mother’s occupation    | Housewife     | 127      | 77           | 1          |
|                        | Student       | 16       | 9            | 1.01 (0.45–2.56) |
|                        | Daily laborer | 10       | 10           | 0.61 (0.24–1.52) |
|                        | Government employee | 52  | 43           | 0.72 (0.44–1.18) |
|                        | Private employee | 9    | 8            | 0.76 (0.29–2.00) |
|                        | Merchant      | 37       | 19           | 1.18 (0.63–2.19) |

(Continued)
Table 7 (Continued).

| Variable                                      | Category          | Attitude | COR (95% CI) |
|-----------------------------------------------|-------------------|----------|--------------|
|                                               |                   | Positive | Negative     |              |
| Father’s occupation                           | Daily laborer     | 22       | 11           | 1            |
|                                               | Farmer            | 17       | 15           | 0.57 (0.21–1.55) |
|                                               | Government employee | 76     | 65           | 0.59 (0.26–1.29) |
|                                               | Private employee  | 63       | 42           | 0.75 (0.33–1.71) |
|                                               | Merchant          | 73       | 33           | 1.11 (0.48–2.54) |
| Household size (persons)                      | ≤5                | 81       | 79           | 1            |
|                                               | >5                | 170      | 87           | 1.91 (1.27–2.85) |
| Television as a source of information         | Yes               | 230      | 147          | 0.71 (0.37–1.4) |
|                                               | No                | 21       | 19           | 1            |
| Radio as a source of information              | Yes               | 165      | 118          | 1.28 (0.84–1.96) |
|                                               | No                | 86       | 48           | 1            |
| Facebook as a source of information           | Yes               | 200      | 131          | 0.95 (0.59–1.55) |
|                                               | No                | 51       | 35           | 1            |
| Social media as a source of information       | Yes               | 216      | 140          | 0.87 (0.50–1.51) |
|                                               | No                | 35       | 26           | 1            |
| World Health Organization as a source of information | Yes           | 212      | 133          | 0.74 (0.44–1.24) |
|                                               | No                | 39       | 33           | 1            |
| Ethiopia Ministry of Health as a source of information | Yes        | 218      | 148          | 1.25 (0.68–2.29) |
|                                               | No                | 33       | 18           | 1            |
| Newspaper as a source of information          | Yes               | 98       | 70           | 1.14 (0.76–1.70) |
|                                               | No                | 153      | 96           | 1            |
| Families/friends as a source of information   | Yes               | 230      | 152          | 1.00 (0.49–2.05) |
|                                               | No                | 21       | 14           | 1            |
| Received IPC training                         | Yes               | 128      | 62           | 1.75 (1.17–2.61) |
|                                               | No                | 123      | 104          | 1            |
| Overall Knowledge                             | Good              | 208      | 104          | 2.88 (1.83–4.54) |
|                                               | Poor              | 43       | 62           | 1            |
| Overall Misconceptions                        | Less              | 134      | 100          | 1.32 (0.89–1.97) |
|                                               | More              | 117      | 66           | 1            |

Note: 1, reference category.
Students who had a positive attitude had 2.74 times more knowledge than those with a negative attitude, corroborating a study in Nepal and a study among health care workers in hospitals in Nigeria. This study showed that students living with 5 or more family members had 3.30 times better knowledge of the COVID-19 pandemic than those living in smaller families. This finding differs from results of studies of college students in Amhara Region and Debre Tabor Town in Ethiopia.

The great majority (378, 90.6%) of participants knew that proper hand washing procedures (for at least 20 seconds with soap and water) can prevent COVID-19, a result similar to findings in studies in southwestern Ethiopia (92.7%), South Wollo, Ethiopia (93.83%), in Bangladesh (93.5%), Egypt (94%), and Nepal (97%), but higher than in Addis Zemen Hospital, Gondar City, and Amhara Region, all in Ethiopia. These discrepancies may be due to differences in the socio-demographic characteristics of the study populations and the effectiveness of national and local COVID-19 prevention programs.

In our study, 391 (93.8%) of the students knew that wearing a face mask decreases the risk of transmission of COVID-19. This rate was similar to those reported from southern Ethiopia (87.3%) but higher than in South Wollo Zone (79.0%); Addis Ababa (46.1%); and Amhara Region (60%) in Ethiopia, in Malaysia (76.7%), Nigeria (86%), Bangladesh (89.4%); China (2.8%); Philippines (49% and India (36.5%). These discrepancies may be due to variations in the effectiveness of prevention programs and socio-demographic characteristics of the study populations. Three fifths (60.2%, 95% CI: 55.5–64.5) of the participants had a positive attitude towards COVID-19 prevention measures.

Studies in 8 teaching hospitals in Ethiopia (94.7%); among health care workers in Pakistan (86.5%); residents in Malaysia (86.5%); in 10 universities in China (73.8%); in Uganda (72.4%); and in India (97.3%) and in Bangladesh (78.9%) reported higher rates. These rates are similar to those in Addis Ababa (60.7%) but higher than in Pakistan (44%) and Makerere University Teaching Hospital in Uganda (21%). These discrepancies may be due to variations in study populations and the commencement dates and effectiveness of prevention programs.

In this study, the odds of having a positive attitude among students who had good knowledge about COVID-19 prevention measures were 2.69 times higher than for those with poor knowledge. Similar results were reported from Addis Ababa, Sidama Region in southern Ethiopia and Bangladesh. The odds of having a positive attitude among students living in households larger than 5 persons were 1.56 times higher than among those in households smaller than 5 persons, a finding in line with a study in Gondar, Ethiopia. Students in Dessie schools who received training about COVID-19 prevention measures had a 1.64 times higher positive attitude score than those who did not receive training, similar results in studies in South Gondar Zone hospitals.

### Table 8 Multivariable Analysis of Attitude and Socio-Demographic Characteristics among High and Preparatory School Students Towards COVID-19 Prevention Practices in Dessie City, Ethiopia, March 2021

| Variable               | Category   | COR (95% CI)    | AOR (95% CI)   |
|------------------------|------------|-----------------|----------------|
| Household size (persons) | >5         | 1.91 (1.27–2.85) | 1.56 (1.02–2.39) |
|                        | ≤5         | 1               | 1              |
| Received IPC training  | Yes        | 1.75 (1.17–2.61) | 1.64 (1.08–2.48) |
|                        | No         | 1               | 1              |
| Knowledge              | Good       | 2.88 (1.83–4.54) | 2.55 (1.58–4.12) |
|                        | Poor       | 1               | 1              |
| Misconceptions         | Less       | 1.32 (0.89–1.97) | 0.64 (0.42–0.97) |
|                        | More       | 1               | 1              |

Note: 1, reference category.
Table 9 Bivariate of Analysis of Misconceptions and Socio-Demographic Characteristics among High and Preparatory School Students Regarding COVID-19 Prevention Practices in Dessie City, Ethiopia, March 2021

| Variable                  | Category          | Misconception | COR (95% CI) |
|---------------------------|-------------------|---------------|--------------|
|                           |                   | Less (n)      | More (n)     |              |
| Age                       | <18               | 129           | 125          | 1            |
|                           | ≥18               | 105           | 58           | 0.57 (0.38–0.85) |
| Sex                       | Male              | 88            | 82           | 1            |
|                           | Female            | 146           | 101          | 0.74 (0.50–1.10) |
| Religion                  | Orthodox Christian| 123           | 106          | 1.44 (0.51–4.08) |
|                           | Muslim            | 101           | 71           | 1.17 (0.41–3.37) |
|                           | Protestant        | 10            | 6            | 1            |
| Grade                     | 9                 | 26            | 24           | 1            |
|                           | 10                | 65            | 50           | 0.83 (0.43–1.62) |
|                           | 11                | 26            | 28           | 1.17 (0.54–2.52) |
|                           | 12                | 117           | 81           | 0.75 (0.40–1.40) |
| Marital status            | Single            | 224           | 178          | 1            |
|                           | Married           | 10            | 5            | 0.63 (0.21–1.87) |
| Mother’s educational status | Unable to read and write | 10 | 6 | 1 |
|                           | Able to read and write | 11 | 11 | 1.67 (0.45–6.19) |
|                           | Primary           | 59            | 46           | 1.30 (0.44–3.84) |
|                           | Secondary         | 62            | 54           | 1.45 (0.50–4.26) |
|                           | College and above | 92            | 66           | 1.20 (0.41–3.45) |
| Father’s education status | Unable to read and write | 7 | 11 | 1 |
|                           | Able to read and write | 14 | 12 | 2.27 (0.84–6.13) |
|                           | Primary           | 32            | 26           | 1.24 (0.54–2.83) |
|                           | Secondary         | 71            | 56           | 1.18 (0.65–2.13) |
|                           | College and above | 110           | 76           | 1.14 (0.72–1.80) |
| Mother’s occupation       | Housewife         | 115           | 89           | 1            |
|                           | Student           | 14            | 11           | 1.02 (0.44–2.34) |
|                           | Daily laborer     | 11            | 9            | 1.06 (0.42–2.66) |
|                           | Government employee | 50          | 44           | 1.14 (0.69–1.86) |
|                           | Private employee  | 13            | 5            | 0.49 (0.17–1.45) |
|                           | Merchant          | 31            | 25           | 1.04 (0.58–1.89) |

(Continued)
The great majority (351, 84.2%) of participants believed COVID-19 can be controlled in Dessie City. Similarly high levels of confidence in the success of control programs were reported in Malaysia (95.9%), Nigeria (85%), Bangladesh (86.8%), and the United Arab Emirates (89.0%) but our levels were higher than in Iran (47.1%), Syria (60.1%), Tigray Region (74.3%), and Ataye District Hospital in Ethiopia (7.2%). These variations may be due to differences in the effectiveness of control programs and attitudes toward government programs.

| Variable                          | Category                  | Misconception | COR (95% CI)          |
|-----------------------------------|---------------------------|---------------|-----------------------|
|                                   |                           | Less (n)      | More (n)              |                       |
| Father’s occupation               | Daily laborer             | 14            | 19                    | 1                     |
|                                   | Farmer                    | 15            | 17                    | 0.84 (0.31–2.22)      |
|                                   | Government employee       | 81            | 60                    | 0.55 (0.25–1.18)      |
|                                   | Private employee          | 67            | 38                    | 0.42 (0.19–0.93)      |
|                                   | Merchant                  | 57            | 49                    | 0.63 (0.29–1.39)      |
| Household size (persons)          | ≤5                        | 85            | 75                    | 0.82 (0.55–1.22)      |
|                                   | >5                        | 149           | 108                   | 1                     |
| Television as a source of information | Yes                      | 211           | 166                   | 0.94 (0.49–1.82)      |
|                                   | No                        | 23            | 17                    | 1                     |
| Radio as a source of information  | Yes                       | 158           | 125                   | 0.97 (0.64–1.46)      |
|                                   | No                        | 76            | 58                    | 1                     |
| Facebook as a source of information | Yes                      | 187           | 144                   | 1.08 (0.67–1.74)      |
|                                   | No                        | 47            | 39                    | 1                     |
| Social media as a source of information (Wifi internet etc.) | Yes                      | 203           | 153                   | 1.28 (0.75–2.21)      |
|                                   | No                        | 31            | 30                    | 1                     |
| World Health Organization as a source of information | Yes                      | 197           | 148                   | 1.26 (0.76–2.10)      |
|                                   | No                        | 37            | 35                    | 1                     |
| Ethiopia Ministry of Health as a source of information | Yes                      | 207           | 159                   | 1.16 (0.64–2.08)      |
|                                   | No                        | 27            | 24                    | 1                     |
| Newspaper as a source of information | Yes                      | 97            | 71                    | 1.12 (0.75–1.66)      |
|                                   | No                        | 137           | 112                   | 1                     |
| Families/friends as a source of information | Yes                      | 215           | 167                   | 1.08 (0.54–2.17)      |
|                                   | No                        | 19            | 16                    | 1                     |
| Knowledge                         | Good                      | 183           | 129                   | 1.50 (0.43–4.04)      |
|                                   | Poor                      | 51            | 54                    | 1                     |
| Attitude                          | Positive                  | 134           | 117                   | 0.75 (0.89–1.97)      |
|                                   | Negative                  | 100           | 66                    | 1                     |
More than half (246, 59.0%) of the students worried about contracting COVID-19, a figure similar to those in studies in Nepal (70.9%), India (72%), and Nigeria (56.37%). More than half (234, 56.1%) (95% CI; 51.3–60.9%) of the students had less misconceptions about prevention measures of COVID-19 disease, this finding is similar to that from a study in Saudi Arabia (56.2%) but lower than from a research in China (98%). These discrepancies could be due to differences in data collection methods and socio-demographic characteristics of study populations and the effectiveness of prevention programs.

A small proportion (74, 17.7%) of the participants believed that females are more vulnerable to COVID-19 infection than males. This proportion was lower than in a study in Saudi Arabia (56.2%). This study reveals that students who had a positive attitude about COVID-19 prevention and control measures had 1.56 times fewer misconceptions than those who had a negative attitude, corroborating results from a study in Saudi Arabia.

Limitations of the Study
Due to the fear of being called uninformed, study participants may have provided socially acceptable answers to the knowledge and attitude questions. Another limitation is the cross-sectional study design, which did not allow assessment of the causality of the associations between knowledge, attitudes, misconceptions and preventive practices. We recommend longitudinal studies that examine the dynamics of knowledge and preventive behavior in the changing COVID-19 risk, intervention and socioeconomic environment in Ethiopia.

Another limitation is that our study was not a comparative study of the 2 groups of students (high school and preparatory school); differences in knowledge, attitudes and misconceptions between these 2 groups may be relevant in understanding age-linked and education-linked differences in COVID-19 prevention, as our study indicated, and thus may guide curriculum development.

Conclusion
The prevalence of good knowledge about COVID-19, positive attitudes, and less misconception towards preventive and control measures of COVID-19 among students in Dessie City were relatively low. After adjusting for covariates, we found positive attitude and large household size to be associated with good knowledge of COVID-19. Having good knowledge of COVID-19 prevention, living in large families, having IPC training, and having a low level of misconceptions were associated with a positive attitude. Similarly, age above 18 years, positive attitude, and IPC training were independent indicators of low misconception. Therefore, the Health and Education Department and each school in Dessie City should promote awareness and prevention practices in high schools and preparatory schools through appropriate health education programs, especially among younger students, to reduce misconceptions about and exposure risk to COVID-19.
Abbreviations
AOR, adjusted odds ratio; COR, crude odds ratio; COVID-19, coronavirus disease; IPC, infection prevention and control.

Acknowledgments
We gratefully acknowledge the Wollo University College of Medicine and Health Science Ethical Review Committee for providing the ethical clearance letter, that allowed us to do this research. We also acknowledge Dessie City Education Department and the school administrations for their cooperation during this study by providing essential information and support. Moreover, we would also like to extend our special thanks to the data collectors, supervisors, and study participants for their valuable contributions and cooperation.

Disclosure
The authors report no conflicts of interest in this work.

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