

Current Substances Use Among Students in Ethiopia: A Systematic Review and Meta-analysis of 20-years Evidence

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Abstract

Background: The use of psychoactive substances is the main cause of morbidity and becomes important public health and socio-economic issue worldwide. However, there is a lack of evidence on the magnitude of current use substances among students in Ethiopia. Therefore, this review and meta-analysis aimed to provide comprehensive views of the current prevalence of substance use among students in Ethiopia.

Methods: Literature searches were done from electronic biomedical databases; PubMed/Medline, HINARI, AJOL, Google Scholar, Science Direct and manually searched master thesis and dissertation done until 31/12/2019. Two authors autonomously selected studies, extracted data, and evaluated the quality of studies. The prevalence of current substances with 95% confidence interval (95%) estimated using the random-effects model. The results were displayed using forest plots, and Cochrane Q-test and I^2 use to measure the extents of between-study variations.

Results: A total of 1543 study articles were identified from electronic databases, and 32 of them were included in the meta-analysis. The prevalence of current use of at least one substance was 37.63% (95% CI: 33.66, 41.69; $I^2=91.2%$, $P<0.00$), alcohol 27.61% (95%CI: 22.10, 33.48; $I^2=98.08%$, $P<0.00$), khat 17.20% (95%CI: 14.03, 20.62; $I^2=97.2%$, $p<0.00$) and smoking 9.74% (95%CI: 7.17, 12.64; $I^2=95.06%$, $P<0.00$). Subgroup analysis revealed that the prevalence of any substance by high school students versus university/college students was 41.55% (95% CI: 38.83, 44.29) vs 36.24% (95% CI: 32.37, 40.20), alcohol 24.21% (95% CI: 14.05, 36.11) vs 25.27% (95% CI: 19.76, 31.20), khat 13.82% (95% CI: 8.61, 20.02) vs 17.30% (95%CI:13.75, 21.16), and cigarette 8.30% (95% CI: 1.89, 18.60) vs 9.80% (95% CI: 7.32, 12.58). Meta-regression analysis revealed publication year, sample size, female proportion, and age was not significantly associated with the current use of substances.

Conclusion: The prevalence of the current use of substances was high and highlights the extent the problem among students in Ethiopia. Overall current substance use was high for all substances use categories; any substance, alcohol, chewing khat and smoking cigarettes. Comparable to university/college students a significant proportion of high school students were already using substances before joining tertiary education. Caution is needed while interpreting the findings due to significant heterogeneity between studies. Policymakers should formulate and implement strictly binding regulations to control the pervasive use of substances around educational institution sites at the national level.

Protocol registration: The protocol has been registered on 19 August 2019 on [PROSPERO](#) (the International Prospective Register of Systematic Reviews) with ID: [CDR42019130560](#).

Introduction

Psychoactive substances such as alcohol, khat, and tobacco are widely used [1, 2]. According to the WHO Global Status Report of 2016, 2.3 billion people are current alcohol drinkers, and young people 15 to 19-years-olds account for 27% of current drinkers [3]. Alcohol and tobacco use cost more than 250 million disability-adjusted life years in 2015 [4]. Additionally, evidence showed that the use of psychoactive substances is the leading cause of morbidity and becomes essential public health and socio-economic issue worldwide [5, 6]. Recent trends demonstrated that the use of psychoactive substances has considerably increased mainly in developing countries [6], and it became a growing social problem, especially in Africa [6].

The evidence revealed that poverty increases the risk of harmful use of drugs. This demonstrated by the fact that people living in low-income countries are disproportionately affected by the high burden of substance-related morbidities and premature deaths [7]. Additionally, it is worthy to note that rapid economic, social, and cultural changes fueled the use of various substances, especially in sub-Saharan Africa countries [8].

In Ethiopia, the use of substances like khat, alcohol, and cigarette are common among the general population [9-11], and there is a growing trend of the use of these substances among high school and university students in Ethiopia [12-20]. Hence, Ethiopia is facing a mounting problem of substance use and the subsequent detrimental health and social impacts among the young population [21, 22]. Therefore, the alarming use of substance among youth, especially students designated as a serious health and social problem in Ethiopia [23].

The abundant body of evidence showed that the use of substances is linked to various health risks and poor academic performance among students. For example, studies revealed that the use of substances is associated with sexually transmitted infections and risky sexual behaviors [24], suicidal attempts [25], and risk-taking behaviors resulting in economic, social, physical, and health complications [12-20]. Additionally, a few studies also revealed the use of substance related to social withdrawal, poor academic performance, and increased the risk of concurrent lifetime use of substances among university students [26]. These indicates the use of substances have multiple negative health effects in the long run and therefore, there is a great need for researches in this area.

Since 1980s, studies conducted across different parts of Ethiopia showed that the epidemiology of the use of the various substances; either as a single or concurrent use of any substance [27-29]. These studies predominantly focused on the lifetime use of substance among students and they tends to overestimate the prevalence and this was observed in our previous meta-analysis [30]. So far one meta-analysis focused on single substance but did not specify whether the outcome was current or lifetime [31], and the other reported pooled prevalence of current khat chewing in several [32]. On the other side, the current use of substance among students showed a great disparity in the estimates. For example, the prevalence current use of any substance ranges from 28.6% to 47.9% [13, 26, 33-36], alcohol consumption ranges from 9.3% to 44.2% [12, 20], smoking cigarettes ranges from 9.3% to 22.0% [12-14, 17, 37, 38], and khat chewing ranges from 3.7% to 33.1% [12-14, 17, 18, 29, 37-40]. In general, there is lack of a comprehensive evidence on prevalence of current substance use among students in Ethiopia that warrants a systematic review and meta-analysis of abundant literature. This is very critical for developing policies at national and institutional level to address increasingly rampant use of substance in younger population.

Therefore, this review and meta-analysis aimed to provide comprehensive views of evidence over last two decades on the current prevalence 1) any substance use, 2) alcohol consumption, 3) khat chewing and 4) smoking cigarettes among secondary school and university/college students in Ethiopia. The findings of this important to inform school administrators and decision-makers to develop strategies to address public health challenges ahead related to a rampant use of substances and avert the trajectory among young population.

Methods

Registration

The protocol of this systematic review and meta-analysis has been registered on the International Prospective Register of Systematic Reviews (PROSPERO) with ID: [CDR42019130560](#)

Search strategy

A comprehensive searches of biomedical databases; PubMed/Medline, Google Scholar and HINARI. Additionally, an extensive search for unpublished study reports, including theses and dissertations, was made in Addis Ababa University's electronic library [41]. All primary studies that were available until December 31, 2019, and reporting in English were included in the review. The following search MeSH and text words were used alone or in combination:

substance, khat, alcohol, smoking, prevalence, students, university, and Ethiopia. PRISMA guideline for systematic review [42] was used to report the search results.

Inclusion and exclusion

In this systematic review and meta-analysis, we included all cross-sectional studies conducted among secondary school, college, and university students in Ethiopia between January 1, 2000, and December 31, 2010, and published in English. The main outcomes of this review and meta-analysis were the current prevalence of any substance, the current prevalence of alcohol consumption, the current prevalence of khat consumption and current prevalence of smoking cigarette. Additionally, studies with response rate $\geq 80\%$, used probability sampling procedures, reporting quality assurance methods, and quality assessment score $\geq 50\%$ were included. Review articles, studies used non-probability sampling procedure, qualitative studies, abstract and studies with unclear outcomes, and studies that were conducted among non-regular students were excluded.

Quality assessment and data extraction

For a critical appraisal of the articles, we used the Joanna Briggs Institute Meta-Analysis for Statistics Assessment and Review Instrument, checklists [43]. The checklists consisted of 9 items assessing; 1) appropriateness of target population, 2) sampling procedures, 3) adequacy of sample size, 4) the description of subject and settings, 5) adequate coverage of identified sample, 6) the use of valid method to identify the condition, 7) condition measured in a standard, reliable way for all participants, 8) appropriateness of statistical analysis and 9) adequacy of response. Two reviewers; HSR and ASB independently assessed the quality of articles using the checklists. Any disagreement which arose between the reviewers was solved by involving a third reviewer BG and HA. Data were extracted independently by both authors (HSR and ASB). We extracted information about the author(s), the study setting, study period, sample size, sampling technique, data collection method, response rate, mean age, and substances (any substance, khat, alcohol, and tobacco) on Microsoft Excel 2010.

Data analysis

Meta-analyses were conducted using the STATA version 14.0 statistical software package. All the estimates were combined using random-effects model [44] to estimate the pooled prevalence of current substances use. Forest plots were used to present the results of pooled estimates with 95% CI. The Cochran Q-test and I-squared statistic used to test heterogeneity among studies. Group analyses were conducted by region, sample size and level of educations. To conduct subgroup analysis, first, studies were grouped by regions in which school, college or university was located, sample size categorized as less than 500, 500-1000 and 1000 or higher; level of education: high school/preparatory school (referring to grade 9-12) or universities/college. Finally, meta-regression analyses were carried out to identify parameters (sample size, study year, and age of participants) associated with substances use.

Results

Search results

A total of 1543 studies were identified through electronic searches. Of these, 1532 studies were published, whereas 11 were master's thesis. After duplications were excluded, and 1196 records were screened by title and abstract. Other 1,140 records were excluded by title and abstract, and the remaining 53 articles were screened further for quality

eligibility and. From these, 21 articles were excluded since they were not eligible or failed quality criteria or contents were duplicated. Finally, 32 articles were included in the meta-analysis (**Fig 1**).

Characteristics of included studies

Overall six regions and one city administration were represented. Accordingly, 10 studies were conducted in educational institutions in Amhara Regional [20, 33, 36, 39, 45-50], 8 in Oromia Regional [13, 15, 17, 18, 40, 51-53], 5 in SNNPR [19, 26, 54-56], 2 in Addis Ababa [12, 57], 3 in Tigray Region [14, 34, 58], in Harari Region [16], 1 in Somali Region [59], and 1 study done in both SNNPR and Oromia [60]. Three studies included in the meta-analysis were unpublished, master's thesis [20, 34, 52].

There was a wide sample size difference among the studies ranging from 193 [58] to 3001 [46]. The highest prevalence of current use of any substance was 47.9% [35], 33.1% for khat consumption [40], 44.2% for alcohol [20], and 29.5% for smoking cigarettes [58]. All studies were conducted between 2002 and 2019 in high schools, preparatory schools, colleges, and Universities. Eight studies were conducted among high and preparatory schools [15, 16, 35, 49, 51, 56, 57, 60], 23 studies conducted among university students [12-14, 17-20, 26, 33, 34, 36, 39, 40, 46-48, 50, 52-55, 58, 59] and one study conducted among polytechnic college [45]. The mean age of the study participants ranges from 15.6 to 23 years (**Table 1**).

Table 1 Summary characteristics of studies included in meta-analysis of prevalence of current substance use among students in Ethiopia

Author year	Study area	Study population	Mean Age	Sample size	Khat (%)	Alcohol (%)	Smoking (%)	any prevalence (%)	QA
Gebreslassie M, et al. 2013	Tigrai; Axum	University	22.3	756	27.9	32.8	9.3	44.8	8/9
Dida, et al. 2014	Oromia; Bale	Preparatory school	18.4	603	17.1	23.6	4.6	34.8	5/9
Tsegay G & Esmael A 2014	Amhara; Debre Markos	University	21.6	800	28.1	32.5	10.0	40.0	5/9
Aklog T et al. 2013	Amhara; Debre Markos	PT college	19.8	410	6.3	35.4	4.4	38.3	7/9
Kebede Y, 2002	Amhara; Gonder, Bahir Dar	University	20.0	1103	17.5	-	8.1	-	9/9
Tesfaye G et al. 2014	Oromia; Harmaya	University	20.9	1022	23.6	20.0	10.8	-	8/9
Kassa A et al. 2014	SNNP; Hawassa	University	20.7	586	-	-	-	35.7	8/9
Kassa A et al. 2016	SNNP; Hawassa	University	20.7	586	16.3	29.5	-	-	8/9
Fufa G et al. 2017	Somale; Jijiga	University	21.2	600	28.3	-	-	40	6/9
Abrha K, 2011	Tigrai; Mekelle	University	20.4	601	25.1	41.1	11.5	32.5	9/9
Mekonen T et al. 2017	SNNP, Wolaita Sodo	University	21.18	725	10.2	24.7	5.7	28.6	5/9
Adere A et al. 2017	Amhara; Woldia	University	20.74	655	10.4	29.7	6.4	31.5	8/9
Birhanu MA et al. 2014	Amhara; Woreta	GSS & PPS	17.25	651	13.8	40.9	6.8	47.9	8/9
Teshome G, 2012	Oromia; Adamma	University	21.84	728	20.7	-	-	-	8/9
Gebrehananna E et al. 2014	Amhara; Bahr Dar	University	21.2	3001	7.7	-	-	-	8/9
Wondimu GA et al. 2017	Amhara; Gondar	University	21.0	736	16.4	-	-	-	6/9
Abdeta T et al. 2017	Oromia; Jimma	University	21.9	619	23.9	-	-	-	8/9
Astatkie A et al. 2015	SNNP; Hawassa	University	21.4	1255	11.1	-	-	-	8/9
Deressa W & Azazh A. 2011	Addis Ababa, AAU	University	20.4	622	3.7	9.3	-	-	5/9
Dachew BA	Amhara;	University	21.3	836	13.6	-	-	-	5/9

et al. 2015	Gondar								
Deresse A et al. 2014	Oromia, Haramaya	University	21.0	725	20.3	17.5	-	-	5/9
Birhanu B, 2014	Amhara, Debre Berhan	University	21.2	346	22.3	44.2	14.7	-	5/9
Dires E, et al. 2016	Oromia; Jimma	GSS	16.05	296	14.2	-	-	-	5/9
Lakew A, et al. 2014	Amhara, Ataye	GSS and PPS	17.21	332	13.25	-	-	-	5/9
Reda A, et al. 2012	Harari, Harar	GSS and PPS	16.4	1721		10.4	-	-	5/9
Meressa K et al. 2009	Oromia, Jimma	University	23.0	239	33.1	-	-	-	7/9
Teshome D & Gedif T 2013	Addis Ababa	GSS and PPS	16.93	2551	-	26.4	-	-	5/9
Dereje N, et al. 2014	Oromia and SNNPR Jimma & Hawassa	GSS and PPS	15.6	1673	-	-	17.2	-	6/9
Eticha T & Kidane F, 2014	Tigray, Mekelle	University	21.2	193	-	-	29.5	-	5/9
Alebachew W. et al. 2019	Oromia, Haramaya	University	23	251		8.0	-	-	4/9
Gebremariam et al., 2018	Amhara	University	21.6	617	5.7	16.9	3.1	-	6/9
Duko Bereket et al., 2019	SNNPR	GSS and PPS	16.8	564	6.9	15.1	-	-	6/9

Keys: AAU: Addis Ababa University, GSS: General Secondary School, PPS: Preparatory School, SNNPR: Southern Nations, Nationalities and people Region, QA: Quality assessment

The quality of assessment

The quality the studies assessed on the nine quality area. Accordingly, from the total studies, 27(84.38%) studies adequately addressed the target population and sampling was conducted in the appropriate way. In more than half, 17(53.13%) studies, the study subjects and the setting were not described in detail, 9(18.75%) studies data analysis was conducted without sufficient coverage of the identified sample or not clearly described, 14(43.75%) studies did not used a valid method to identify a current prevalence of substance use or unknown, and 28(87.5%) studies data were not collected in reliable way for all participants or not clearly described (supplementary: Table 2).

The prevalence of current use of any substance

A total of 11 studies; 10 published [14, 15, 19, 20, 36, 45, 47, 53, 59, 61], and 1 master's thesis [34] with a total of 6,638 participants were included in the meta-analysis. Concerning regional representation, 4 studies [20, 36, 45, 47] were from Amhara Region, two [19, 61] from SNNPR, two studies [14, 34] from Tigray Region, two [15, 53] from Oromia, and one [59] from Somali Region. Nine studies [14, 34, 36, 37, 45, 47, 53, 59, 61] were conducted among university students and two studies [15, 35] were conducted among high school and preparatory students. The prevalence of current use of any substance ranges from 28.6% [61] to 47.9% [20]. The pooled estimate of the current prevalence of any substance was 37.16% (95% CI: 33.39, 41.01). The analysis revealed the presence of substantial heterogeneity with ($I^2=90.55\%$, $P<0.00$) (Fig 2). However, there was no significant publication bias; Begg's test $p<1.00$ and Egger's test $p<0.560$.

The current prevalence of alcohol consumption

A total of 18 studies; 16 published [12-17, 20, 26, 36, 45, 47, 50, 53, 54, 56, 57] and two unpublished [20, 34] studies with a total of 14,206 participants were included in the analysis. From a total, six studies [20, 35, 36, 45, 47, 50] were from Amhara Region, four studies [13, 15, 17, 53] were from Oromia Region, two studies [12, 57] were from Addis Ababa, two studies [14, 34] were from Tigray Region, three studies [54, 56, 61] were from SNNP, and one study [16] was from Harari Region. The prevalence of current alcohol use ranged from 8% among Haramaya University students [53] to 44.22% among Debre Birhan University students [20]. Four studies [15, 16, 20, 57] were done among general secondary, and preparatory schools, and all of the studies were done between 2011 and 2018. The pooled prevalence of current alcohol use was 24.97% (95% CI: 20.07, 30.20). The analysis showed that there was high heterogeneity among studies ($I^2=97.96\%$, $P<0.00$) (Fig 3). The analysis showed no significant publication bias; Begg's test $p<0.733$ and Egger's test $p<0.331$.

The prevalence of current khat consumption

A total of 27 studies; 24 published studies [12-15, 17, 18, 20, 26, 33, 36, 39, 40, 45-51, 53-56, 59], and three unpublished studies [20, 34, 52] with a total of 19,679 participants were included in the analysis. From the total studies, 11 studies [20, 33, 36, 39, 45-50] were from Amhara Region, 8 studies [13, 15, 17, 18, 40, 51-53] were from Oromia Region, 4 [26, 54-56] were from SNNP, and two [14, 34] were from Tigray, one [12] was from Addis Ababa and one [59] was from the Somali Region. The prevalence of current khat consumption ranges from 4% among Addis Ababa University students [12] to 33% in a study conducted among Jimma University students [40]. Five studies [15, 20, 49, 51, 56] were conducted in general secondary and preparatory school students, and 22 were conducted in university or college students. All studies were conducted between 2002 and 2018. The pooled prevalence of current khat consumption was 16.63% (95% CI: 13.57, 19.94). Significant heterogeneity was observed among studies ($I^2=97.25\%$, $p<0.00$) (Fig 4). However, there was no publication bias with Egger's test ($p<0.240$), Begg's test $P<0.044$.

Fig 4 Forest plot of prevalence of current khat consumption among students in Ethiopia

The current prevalence of cigarette smoking

A total of 14 studies; 12 published, [13-15, 20, 26, 33, 36, 45, 47, 50, 53, 60] and two master's thesis [20, 34] with a total of 10,213 participants were included in the analysis. From the total studies, seven studies [20, 33, 35, 36, 45, 47, 50] were from Amhara Region, two [14, 34] were from Tigray Region, three studies [13, 15, 53] were from the Oromia Region, one [26] was from SNNP and one study [60] was conducted in SNNP and Oromia Regions. Three studies were done in general secondary and preparatory schools [15, 20, 60], 10 studies were conducted in university students [13, 14, 20, 26, 33, 34, 36, 47, 50, 53], and one study was done in polytechnic college [45]. The prevalence ranged from 3.1% in a study

conducted Debre Birhan University [50] to 17.2% in a study conducted among general secondary and preparatory schools in Hawassa and Jimma Towns. The pooled prevalence of current cigarettes smoking among students was 8.57% (95% CI: 6.32, 11.12). There was significant heterogeneity within studies ($I^2=94.68\%$, $P<0.00$) (Fig 5). However, there was no significant publication bias (Begg's test, $P<0.192$ and Egger's test, $P<0.743$).

Subgroup analysis for any substance, alcohol, khat and smoking cigarette

Figure 6A shows subgroup analyses of prevalence of current use of any substance, alcohol, khat and smoking cigarette by region to explore the sources of heterogeneity. Accordingly, the current prevalence any substance use was highest in the other category ($n=1$), 43.17% (95% CI: 39.16, 47.24) followed by Amhara region ($n=4$), 39.35% (95% CI: 33.64, 46.26). The current consumption of alcohol ($n=2$), khat chewing ($n=2$) and smoking cigarette ($n=3$) was highest in Tigray region 36.43% (95% CI: 33.89, 39.01), 26.66% (95% CI: 24.34, 29.05) and 15.62% (95% CI: 7.73, 25.60), respectively. There was significant between group heterogeneity for all substance use categories, $P<0.000$.

Figure 6B shows subgroup analysis of prevalence of current use of substance by sample size. The prevalence of current use of any substance was higher, 37.56% (95% CI: 33.22, 42.00) in studies with sample size range from 500 to 1000 ($n=9$). The current prevalence was highest in small sample size group (<500) for alcohol ($n=3$) 27.42% (9.18, 50.86), khat ($n=6$) 18.68% (10.89, 27.97), and cigarette smoking ($n=4$) 14.89% (6.16, 26.50).

Figure 6C reveals subgroup analysis of current use of substances by level of education. The higher prevalence of current use of any substance was observed among high school students (grade 9-12) ($n=2$), 41.55% (95% CI: 38.83, 44.29). However, higher prevalence was observed among university or college students; for alcohol ($n=13$) 25.27% (95% CI: 19.76, 31.20), khat ($n=22$) 17.30% (95% CI: 13.75, 21.16) and smoking cigarette ($n=12$) 9.80% (95% CI: 7.32, 12.58).

Meta-regression

To explore the sources of between study differences, we conducted meta-regression analysis, sample size, publication, proportion of female (%), and mean age for the use of any substance, alcohol, khat and smoking cigarettes. We found that the current use of any substance, khat and smoking cigarettes showed significant association with respective sample size. Accordingly, the prevalence of current use of any substance and khat decrease by 5.91×10^{-5} ($P<0.029$) and 5.81×10^{-5} ($P<0.037$), respectively, for unit increase in sample size. The prevalence of current smoking cigarette increases by 8.32×10^{-5} for unit increase in the sample size. However, year of study, proportion of female and the age were not associated with current use of any substance, alcohol, khat and cigarette smoking (Supplementary table: Table S3).

Discussion

In this systematic review and meta-analysis, we have tried to provide the overviews of current estimates of various substances among students in Ethiopia. We have also tried to derive the estimated that represent secondary school and tertiary education students which either considered separately or inadequately represented in the Ethiopian context. Therefore, this meta-analysis provides comprehensive views of the prevalence of current use of substances among students in secondary and above educational institutions for policymakers and concerned bodies to guide future interventions.

The current prevalence of any substance (khat, alcohol, or cigarette smoking) in this meta-analysis was 37.16% (95% CI: 33.39, 41.01), and significant regional difference was observed. This provides how young population being exposed to themselves the substances that have obvious negative health and social impacts. Although there was no comparable meta-analysis report, this finding was slightly lower than the national prevalence of single substance, alcohol consumption 41% [62]. However, the prevalence was eight times as high when compared to a prevalence of a single

substance, khat 5.3% at national level [11], and twice as high as prevalence of cigarettes smoking 19.8% among Iranian students, a result of meta-analysis [63]. The observed difference could be attributed to a difference in the study population and study settings. For instance, national prevalence of alcohol consumption was estimated from population-based study conducted among the population with wider age range, 15-64 years compared relatively younger population used in this meta-analysis.

This study showed that the current prevalence of alcohol consumption was 24.97% (95% CI: 20.07, 30.20). This shows that significant proportion of students was facing alcohol related immediate complications such as gastrointestinal upsets, injuries and long term complications such as mental disorder related dependency, withdrawal and socio-economic instabilities. The finding was lower than the national estimate of alcohol consumption in 2016, which was 41% [62], and a prevalence of alcohol consumption was 33% among young people in eastern Africa, a result of meta-analysis [64]. The observed discrepancy could be explained by a difference in study population and setting. For instance, in the national study the participants were predominantly adults and older people and it was a community based study, whereas this systematic review and meta-analysis based on an institutional based study and the participants were overwhelmingly teens and early twenties in age. Additionally, meta-analysis in Eastern Africa included studies that were conducted among secondary school students in several countries. The level of exposure to alcohol and other substances could partly explain the observed difference in the current prevalence of substances. In line with this, previous studies [11, 65] showed that existence of significant regional variation in the prevalence of alcohol consumption.

The pooled prevalence of khat consumption was 16.63% (95% CI: 13.57, 19.94). The result was consistent with the result of a national survey in Ethiopia, which was 15.8% [62]. Comparable results, 14% to 30% were also observed in a systematic review on khat chewing among adults which was done by Kasim S. et al. [66]. However, the finding was lower when compared with a result of meta-analysis of studies conducted on khat chewing among university students in Ethiopia, 23.2% [65]. The difference could be due to variation in the study population, settings, and definition of khat use. For example, unlike our systematic review and meta-analysis, the previous meta-analysis not only based on primary studies done only among university students, but also did not specify whether khat consumption was the estimate of a lifetime or current prevalence. In general, the results of this study highlighted that significant proportion of students currently chew khat are at increased risks of poor academic performance [67], sleeping disorders [68, 69], HIV and poor physical health [70], risky sexual behavior [71] and gastrointestinal disorders [69, 72, 73].

This meta-analysis showed that the current prevalence of cigarettes smoking among students was 9.74% (95% CI: 7.17, 12.64). The finding was more than twice as, 4.1% the prevalence of cigarette smoking among adults in Ethiopia [62, 74]. However, the result was lower than the prevalence estimate of meta-analysis of smoking among Iranian university students, which was 19.8% [63]. The discrepancy could be due to a difference in study population, settings and how smoking cigarettes were measured. For example, the prevalence estimate of Ethiopia was a community-based study conducted among the adult population, whereas this meta-analysis based on primary studies conducted in schools or universities/colleges which may have resulted in variation in estimates. Additionally, unlike our meta-analysis which involved both male and female in secondary school and higher education institutions, the result of the meta-analysis in Iran estimated the prevalence of smoking cigarettes among male university students. Furthermore, the meta-analysis in Iran did not specify whether the estimate represents the current or lifetime prevalence of cigarette smoking.

In subgroup analyses, where we attempted to identify the sources of heterogeneity, there were significant between study variations when the studies were grouped by the administrative regions in Ethiopia. The differences were observed for all categories of substances; current use of any substance, alcohol consumption, khat chewing and smoking cigarettes. These findings were comparable to previous studies [11, 65] that demonstrated regional variation in the epidemiology of substance use. This could be attributed to accessibility and socio-cultural influences. For example, the eastern part of Ethiopia is known for khat production and consumption that is deeply embedded in the culture whereas alcohol

consumption is relatively relaxed in the North and Northwest [21, 75]. Additionally, there is a tendency that the use of these substances co-occur which might in turn contributed the differences observed. This is supported by several studies done in Ethiopia and Middle East countries revealing high prevalence of cigarette smoking among chat chewers [10, 11, 65, 66, 76], and alcohol is also commonly consumed after khat chewing to lower high mood, commonly known as “*chabsi*”, referring to breaking high mood due to cathinone, an active ingredient in the leaf. Another study [10] revealed that majority of concurrent use of khat chewer and smokers reported having initiated khat before smoking. This calls for the need to address the challenges of substance use through societal interventions.

Limitations

The systematic review and meta-analysis had several limitations in addition to methodological limitation inherited in cross-sectional studies. The results of this study need to be interpreted with cautions because of no or under representation of the types of educational institutions, specially private institutions. Secondly, fewer regions and universities were presented in this systematic review and meta-analysis. This might have resulted in under, or overestimation of substance use estimates as production, availability, and utilization of substance varies from region to region. Therefore, the results may not be extrapolated to all education settings. Moreover, because of the variation of determinant factors across studies, we did not pool the effect size for determinant factors. Therefore, future studies should focus on substance use risk factors.

Conclusion And Recommendation

The estimates of this meta-analysis highlighted the extent of prevalence of current use of any substance, khat, alcohol, and smoking cigarettes among students in Ethiopia. Overall, the current use of any substance was highest, followed by alcohol consumption, khat chewing and smoking cigarettes. In this study, 4 in 10 high school students were current user of at least one type of substance, nearly one in four were current alcohol users, and a significant number of students were khat chewer and nearly one in ten students were current smoker and these findings were comparable to university/college students. These findings showed that the problem of substance use is common among high school students that necessitate early intervention. However, results should be interpreted with caution due to significant heterogeneity between studies. Taking social, economic, and health consequences of substances among younger population policymakers should formulate and implement strictly binding regulation to control pervasive use of substances around educational institution sites at the national level. A national survey should be conducted in educational institutions at regular interval to investigate the magnitude, trajectory, and consequences of substance use among students.

Abbreviations

AJOL: African Journal Online

CI: Confidence Interval,

GSS: General Secondary School,

HINARI: Health InterNetwork Access to Research Initiative

PPS: Preparatory School,

SNNPR: Southern Nations, Nationalities and Peoples Region,

WHO: World Health Organization.

Declarations

Ethical approval

Not applicable

Consent of publication

Not applicable

Availability of data and material

All relevant data are within this paper. If further data needed, it could be accessed from the first author upon request via e-mail: hamakiya@gmail.com

Competing interest

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Author's contribution

HSR originally designed systematic review and meta-analysis. HSR, BG, HA and ASB equally contributed to study searching and selections, quality assessment, data extraction, and analysis. HSR, BG, HA and ASB contributed to reporting writing and all authors read and approved the final manuscript.

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Figures

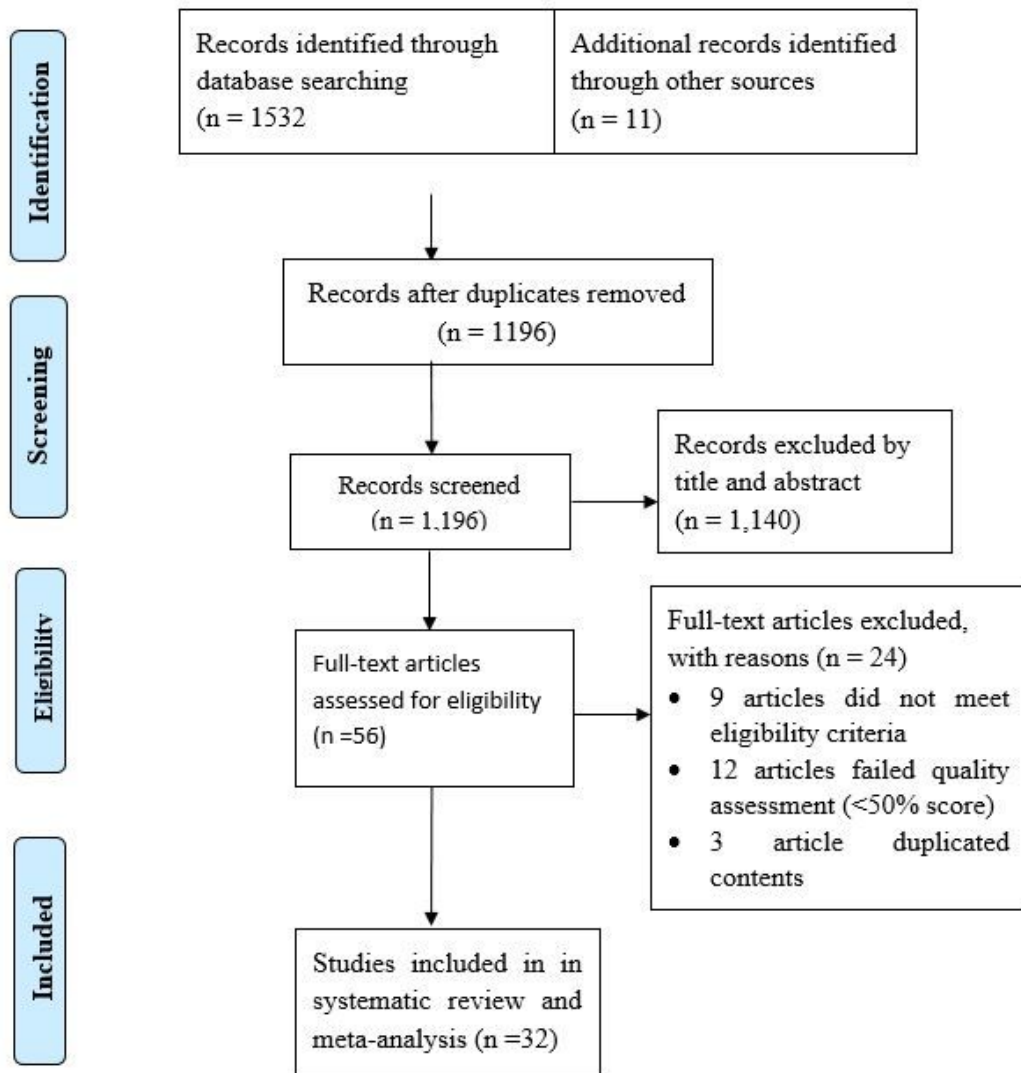


Figure 1

PRISMA flow chart diagram describing selection of studies for systematic review and meta-analysis on prevalence of current use of substances among students in Ethiopia

Prevalence of current use of any substance

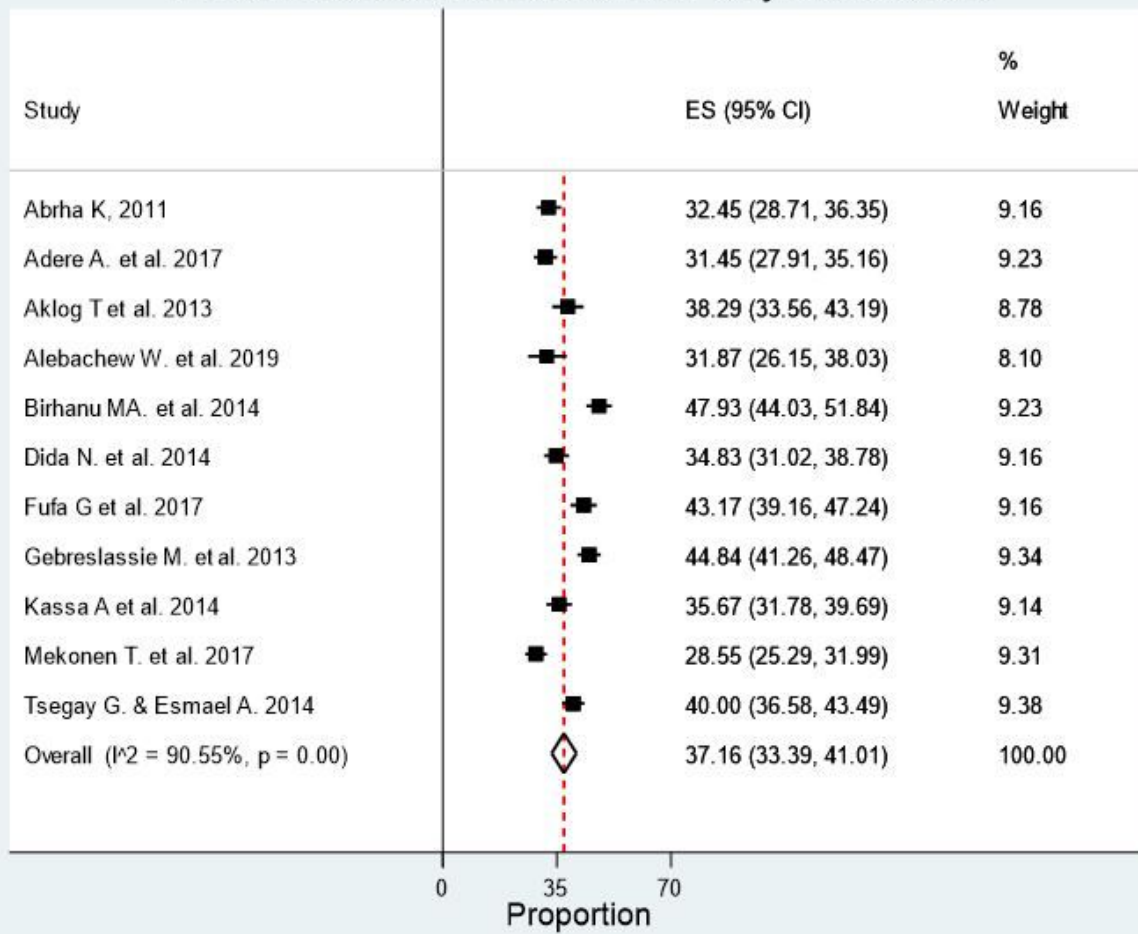


Figure 2

Forest plot of prevalence of current use of any substance among students in Ethiopia

Prevalence of current alcohol consumption

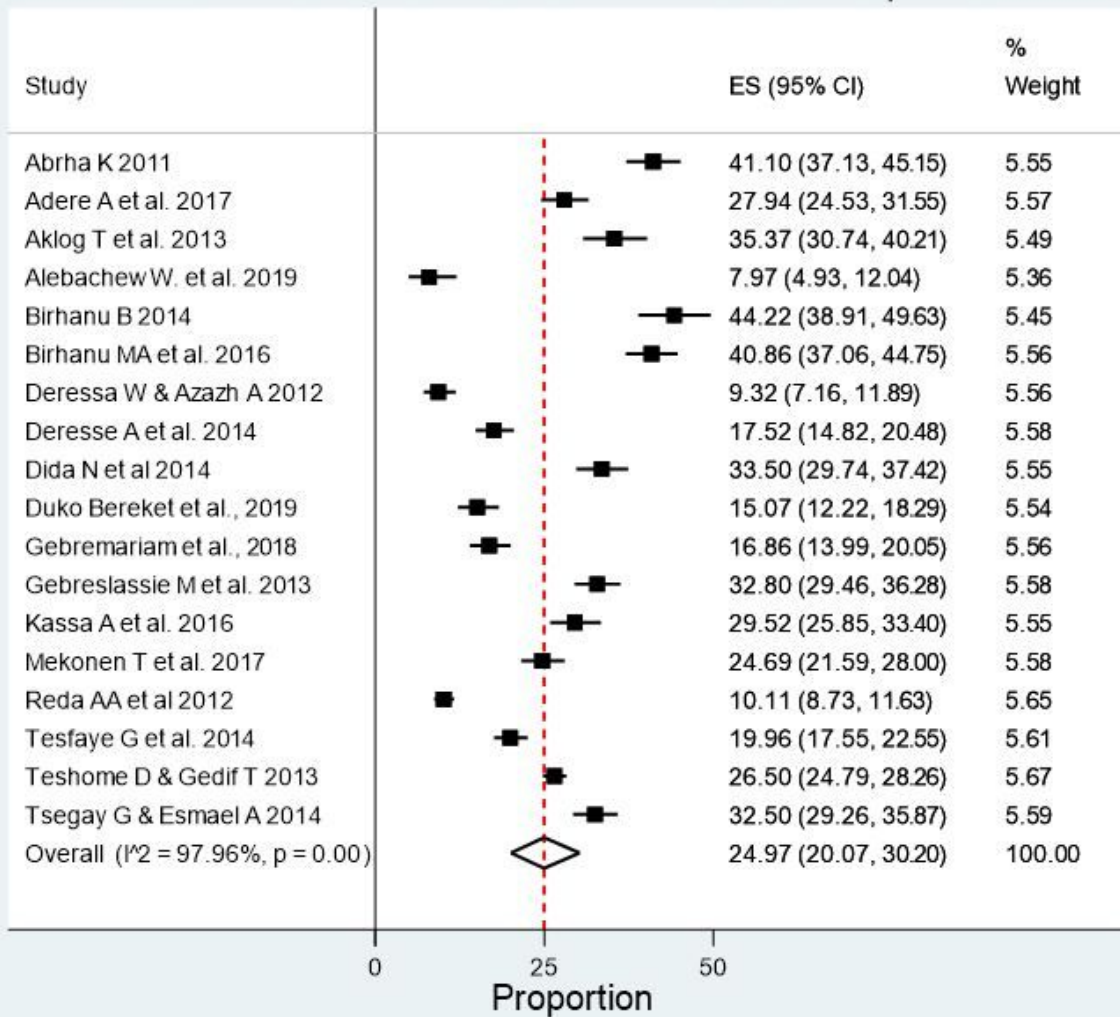


Figure 3

Forest plot of prevalence of current alcohol consumption among students in Ethiopia

Prevalence of current khat use

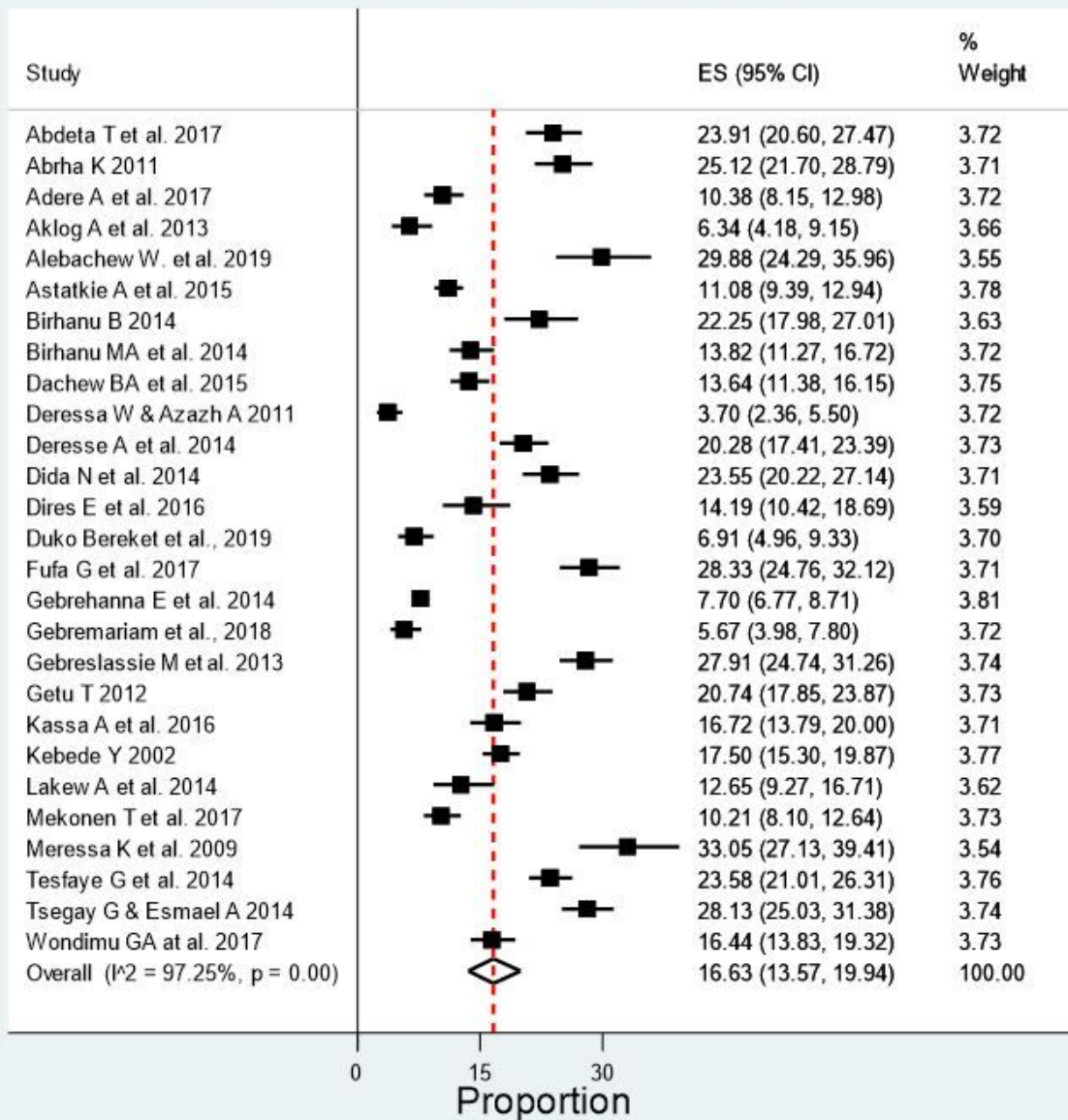


Figure 4

Forest plot of prevalence of current khat use among students in Ethiopia

Prevalence of current cigarettes smoking

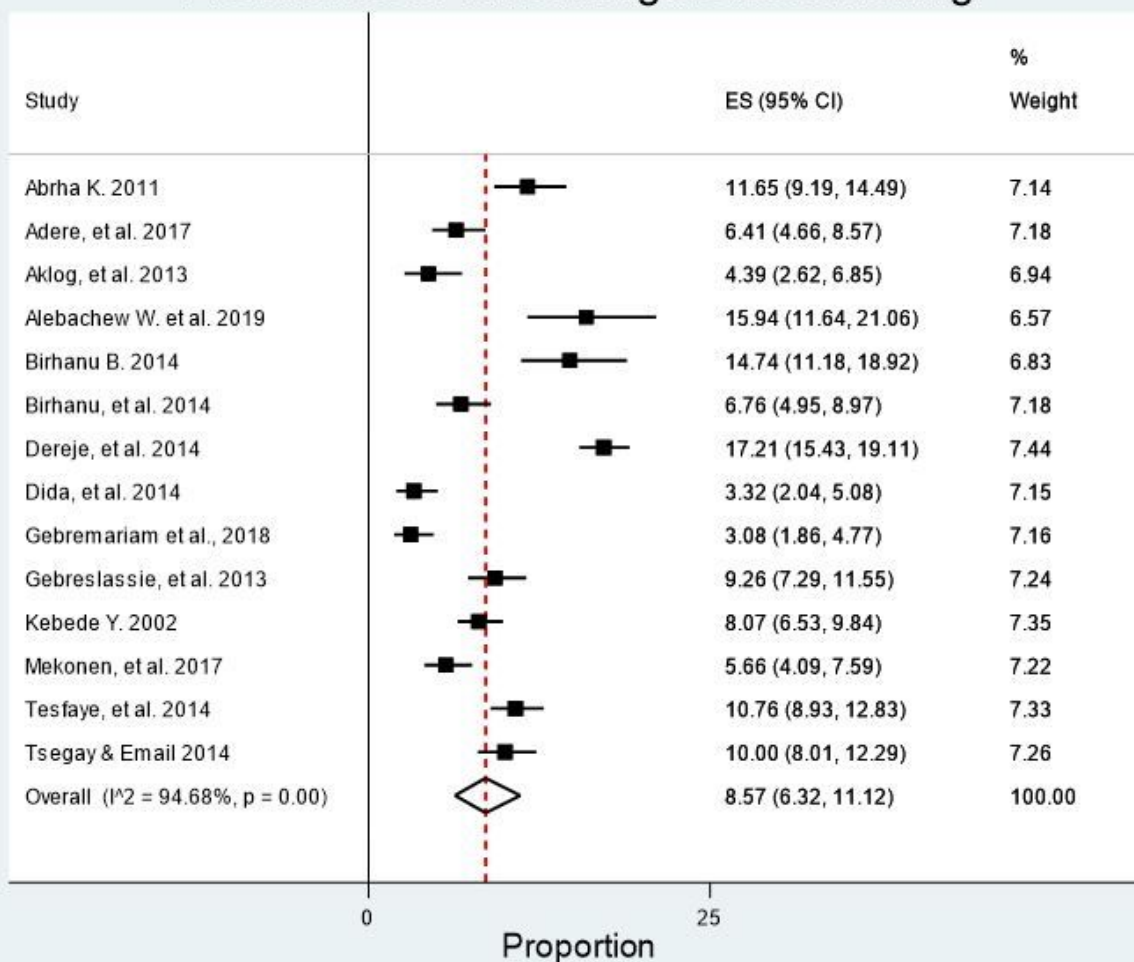


Figure 5

Forest plot of prevalence of current cigarette smoking among students in Ethiopia

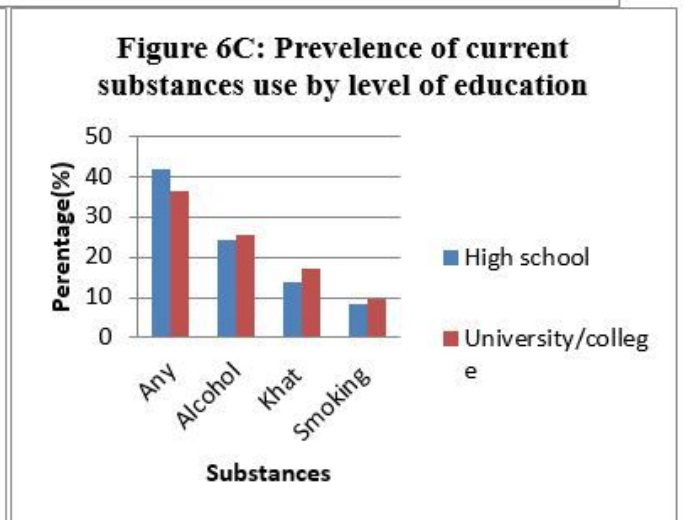
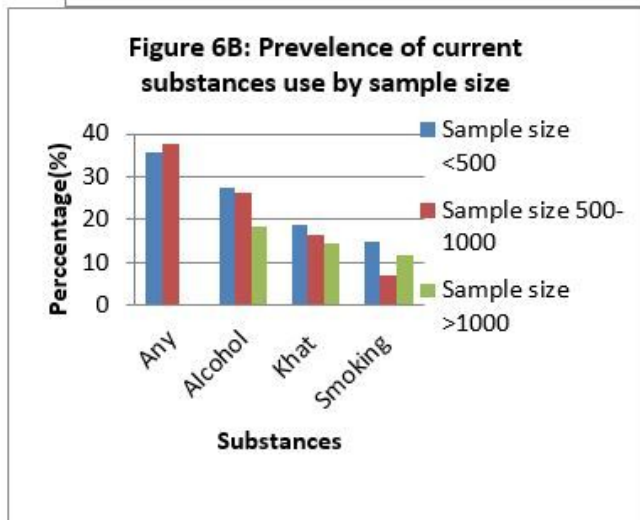
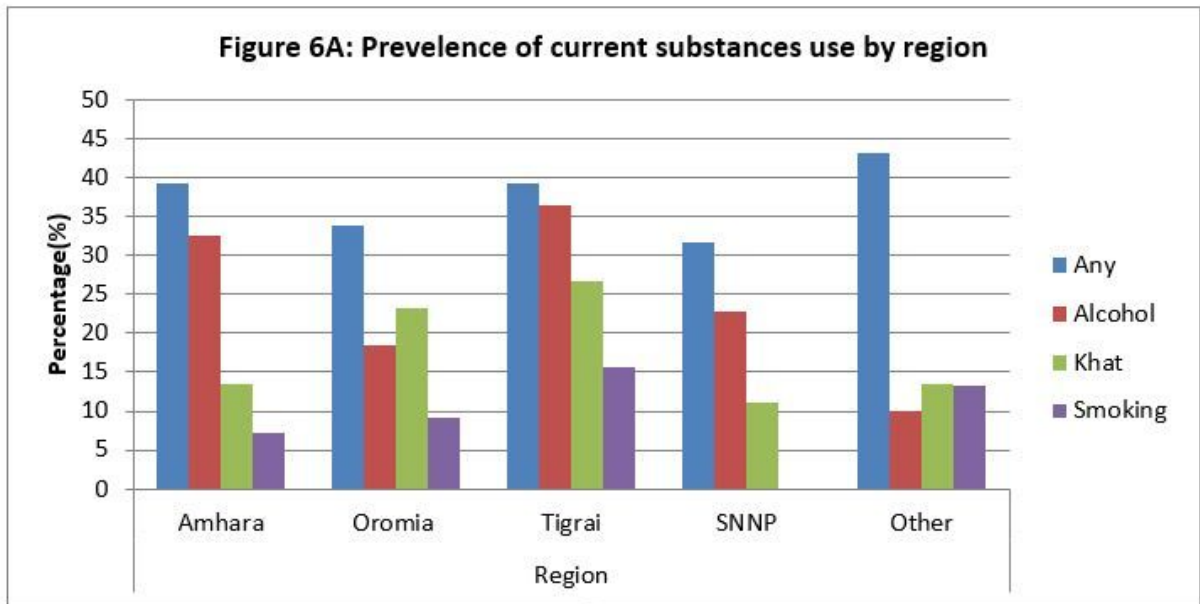


Figure 6

Prevalence of current any substance use by Regions (2A), sample size (2B), and level of education (2C) among students in Ethiopia

Supplementary Files

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