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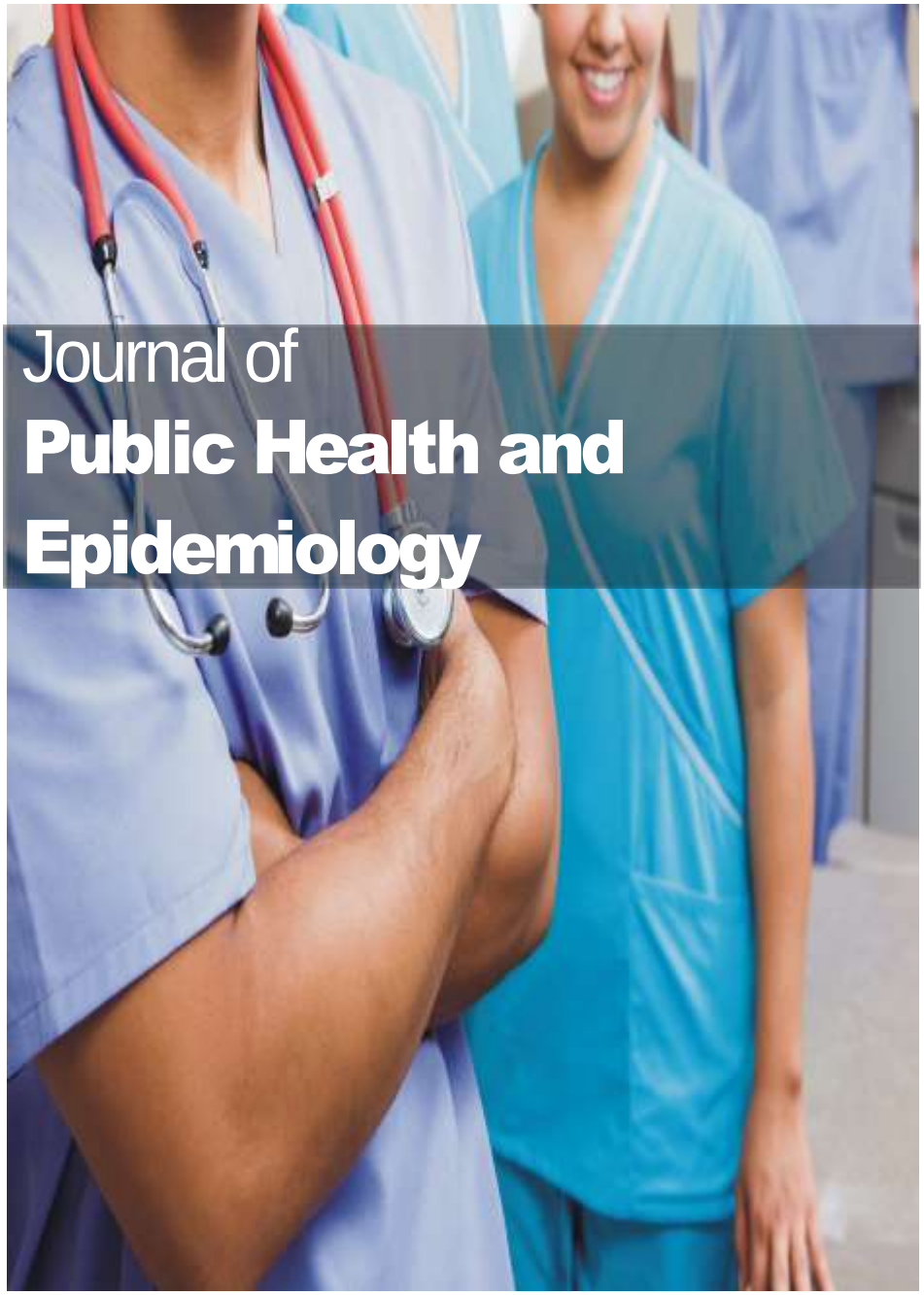

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Full Length Research Paper

The association between sugary food and drinks intake and the risk of stroke mortality in the adventist health study-2

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A high consumption of added sugar has been associated with several cardiovascular risk factors, including obesity, type 2 diabetes mellitus and dyslipidemia. The main goal was to assess the association of sugary food and drink intake on the risk of stroke mortality. The Adventist Health Study-2 (AHS-2) is a prospective study with approximately 96,000 participants from the United States and Canada. Subjects were recruited from 2002 to 2007 at which time they completed a comprehensive food frequency questionnaire including intake of sugar added sweet foods and drinks. Subjects were followed with respect to National Death Index (NDI) mortality information through 2015. This is a low sugar consuming cohort where about 50% also adhere to a vegetarian dietary pattern. After applying exclusion criteria, the final analytical sample consisted of 53,482 study subjects. Cox Proportional hazard regression was used in the analyses adjusting for important demographic, lifestyle and medical variables. Four hundred and seventy two fatal strokes occurred during an average of 9.5 years or 509, 119 person-years of follow-up. Compared to the lowest quartile of sugary food intake (0 to 1.6 times/week), the hazard ratio of fatal stroke for the highest quartile (> 7 times/week) of sugary food intake was 0.86 (95% CI: 0.65 to 1.13), after adjusting for covariates. The hazard ratios did not change significantly when stratifying on gender and race. Consumption of added sugar was not associated with fatal stroke in this low sugar consuming population. Further research is needed in populations with higher intakes of sugar-sweetened foods and with diverse backgrounds and dietary patterns.

Key words: Diet, sugar, stroke, cardiovascular diseases.

INTRODUCTION

Production and consumption of refined sugar have increased dramatically during the twentieth century nationally and internationally, to the extent that added sugar is a main component in almost every meal (Cordain et al., 2005). On average, Americans derive about 13% of their daily caloric intake from added sugars,

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which is above the governmental recommended upper limit of 10% (2015–2020 Dietary Guidelines for Americans, 2015). Sugar-sweetened beverages (SSBs), desserts and snacks account for about 70% of the daily added sugar intake (2015–2020 Dietary Guidelines for Americans, 2015). The impact of carbohydrate intake in general has recently been assessed in the ARIC study (Seidelman et al., 2018) showing that high levels are associated with increased cardiovascular mortality. High carbohydrate intake is often associated with high sugar intake and the controversy regarding the role of sugar intake on health, particularly cardiovascular health, has been thoroughly discussed by Stanhope et al (2016). The associations between increased sugar consumption and well-established risk factors for stroke (Goldstein et al., 2011) such as obesity (Malik et al., 2013), diabetes type 2 (DM2), metabolic syndrome (Di Nicolantonio et al., 2015), dyslipidemia (Vos et al., 2017) and hypertension (Malik et al., 2014). They support the hypothesis that added sugar intake may increase the risk of both cardiovascular diseases in general (Yang et al., 2014; Atkins et al., 2016) and stroke specifically (Micha et al., 2017). Increased sugar consumption has been found to induce inflammation at the vascular level (Aeberli et al., 2011), thus increasing the risk of cardiovascular diseases (Levitan et al., 2004; Ridker et al., 1997). Stroke has a substantial impact on the economy and quality of life of its victims and is among the leading causes of death and disability worldwide (CDC, 2015a; WHO, 2015). In addition, African Americans in the U.S. have a higher intake of added sugar (CDC, 2015b) and they have a higher risk of stroke mortality compared with Whites (CDC, 2016). To date, only a few epidemiological studies have evaluated the relationship between sugar intake and risk of stroke and they are included in two recent meta-analyses (Narain et al., 2016; Bechthold et al., 2017). All of these explored this association based on sugar intake only in the form of SSBs. However, some of the studies did control for other sugar-containing foods (Bernstein et al., 2012; Eshak et al., 2012; Gardener et al., 2012; Pase et al., 2017). This research sought to explore the association between a more complete measure of added sugar consumption and stroke by using total intake of sugar sweetened foods and drinks as the exposure and stroke mortality as the outcome. The Adventist Health Study-2 (AHS-2), a large cohort study of a population with varied diet patterns, was used as the study population.

MATERIALS AND METHODS

Study population

The AHS-2 (AHS-2) is a prospective-cohort study. Recruitment (2002-2007) of subjects 30 years of age or older was done through all English-speaking Black (African- and Caribbean American) and white churches in the 50 US states as well as 5 provinces of Canada. No recruitment was done in other ethnic churches and thus only a very small fraction of Latinos and Asians were recruited. Trained pastors and “health coordinators” in each church promoted the study, using various means such as presentations, brochures, announcements and TV stations. Additionally, direct mails were sent to all church members who did not respond initially to the promotion. A more detailed description of the study and recruitment methods has been published elsewhere (Butler et al., 2008).

Study participants completed a comprehensive 48-page baseline questionnaire, which included demographic information, lifestyle characteristics, medical history, a female section, and a comprehensive and validated food frequency questionnaire (FFQ) (Jaceldo-Siegl et al., 2011). Approximately 96,000 participants had completed and returned the questionnaire by the end of recruitment in 2007.

The mean age at baseline was 58 years and 65.1% of the participants were females (Jaceldo-Siegl et al., 2011). In terms of race/ethnicity distribution, 65.3% were non-Hispanic White and 26.9% were African Americans/Blacks, with small proportions of other race/ethnicities. The study population has a wide variety of dietary patterns, with 53.2% of the participants being either vegans, lacto-ovo-, pesco- or semi-vegetarians and the rest classified as non-vegetarians (Butler et al., 2008). For the present analyses, subjects who at baseline reported prevalent stroke, transient ischemic attack (TIA), carotid artery surgery, diabetes mellitus, congestive heart failure, myocardial infarction, angina pectoris, coronary bypass surgery and stent surgery as well as hypercholesterolemia/regularly taking lipid-lowering medications were excluded. The History of hypertension was not excluded as this included a large number that would significantly reduce our analytic population. Instead, prevalent hypertension was included as a covariable. Also excluded were Canadian participants and subjects with invalid and/or unrealistic data values such as a daily caloric intake of < 500 or > 4500 kcal/day and body mass index (BMI) < 14 or > 60 kg/m^2. Thus, the final study population was 53,482 subjects (18,781 men and 34,701 women).

Assessment of sugary food intake

Consumption of sugary foods was assessed at baseline utilizing a validated semi-quantitative FFQ (Jaceldo-Siegl et al., 2011) which asked about intake of more than two hundred food items during the previous 12 months. Based on this FFQ the following drinks and food items to be included in the sugary foods category were identified: Sweetened drinks (regular Coke, Pepsi and other regular soft drinks and fruit punch) and “sweets and desserts” (doughnuts, cinnamon rolls, pastries, sweet pies, store-bought cookies, home-made cookies, cake, ice cream and milk shakes). In addition, sweet foods that were reported in two open ended questions in response to whether they used any other sweets and desserts not specifically identified in the multiple-choice questions were included. Total sugary food consumption was measured as frequency of intake (times/week) and in analysis was categorized into quartiles of intake.

Ascertainment of fatal stroke cases

Stroke mortality during follow-up was obtained by linking the AHS-2 database with the National Death Index (NDI) through 2015. Any mention of stroke on the death certificate was used to identify the outcome. The research also analyzed the data restricting the outcome to stroke as the underlying cause of death, but this severely reduced the number of cases so the main analyses were

completed using any mention of stroke on the death certificate. The International Classification of Diseases and Related Health Problems 10th Revision was used for coding of fatal stroke. The following codes were used: I61: Intracerebral hemorrhage, I62: Other non-traumatic intracranial hemorrhage, I63: Cerebral infarction and I64 Stroke, not specified as hemorrhage or infarction (ICD-10, 2018).

Potential covariates

Candidate variables were selected *a priori* based on literature review and availability in our database. The final analytic models include: age (time variable), sex (male, female), race (Black, non-Black), educational level (high school graduate or less, some college/Trade-school, college graduate or higher), BMI (14 to <25, 25 to <30, 30-60 kg/m^2), physical exercise (minutes/week) (0, > 0 to 60, > 60), alcohol consumption (current, past or never), smoking (never, ever). In addition, the following dichotomous variables (yes, no) were included: history of and/or current treatment of hypertension, history of cancer, regular aspirin intake in the last 5 years, hormone replacement therapy among menopausal women (ever, never). Also, continuous variables that included the intake of the following foods (grams/day): fruits and vegetables, meats, nuts, legumes, whole grains; and total energy intake (kilocalories/day).

Statistical analyses

Descriptive analyses comparing cases and non-cases, stratified to quartiles of sugary food intake were performed using Chi-square for categorical variables, and Student-t test and analysis of variance for continuous variables after log transformation to normalize the data. Cox proportional hazard regression analyses, with attained age as the time variable, was used to assess the relationship between sugary food consumption and stroke mortality controlling for selected covariates. Energy adjustment was done using the residual method (Willett et al., 1997). Frequency of intake was first used as a continuous variable in the analyses to assess linear relationships. For the individual models, frequencies of sugary food intake (times/week) were divided into quartiles (Q) of exposure: Q1:0-1.6; Q2:>1.6-3.5; Q3:>3.5-7.0; Q4:>7.0 times/week.

The basic model included age (time variable), sex, race and educational level. The final full model included the variables in the basic model plus BMI, physical exercise, alcohol consumption, smoking, history of hypertension or current antihypertensive treatment, regular aspirin intake in the last 5 years, hormone replacement therapy among menopausal women, history of cancer; intake of the following foods: fruits and vegetables, meats, nuts, legumes, whole grains; and total energy intake. Because high blood pressure and obesity may be considered intermediates in the relationship between sugar consumption and the risk of stroke mortality, sensitivity analyses were conducted by removing hypertension and BMI from the model one at a time. Another sensitivity analysis was performed where subjects were included with non-stroke comorbidities such as prevalence of DM2, congestive heart failure, myocardial infarction, angina pectoris, bypass surgery, stent surgery and hypercholesterolemia/regularly taking lipids lowering medications in the last 5 years. Finally, stratified analyses were performed based on gender and race. For the race-stratified analyses among the Blacks, reduced models were used due to low number of stroke deaths.

The proportional hazard assumption was tested using the Schoenfeld residuals method, survival curves, and testing the time interaction term in the model, and there was no evidence that the proportionality assumption was violated. A multiple imputation method was used to replace the small number of missing values, and particularly for dietary variables, a multiple guided imputation method was used if possible (Fraser and Yan, 2007). Five imputed datasets were used to estimate the hazard ratios and the correct standard errors, using Rubin formula (Rubin, 2004). The imputation procedure was done using R statistical package, version 2. 13. 1 (Willett et al., 1997) and the Hmisc, version 3. 14-0 package (Hu et al., 2014); while the survival analyses were conducted using SAS, 9.4 (SAS Institute Inc. Cary, NC).

RESULTS

During 9.5 years of follow-up (509,119 person-years), there were 472 fatal stroke cases (186 men and 286 women). Detailed baseline characteristics of the final analytic sample are described in Tables 1 and 2. Mean age was 55 years, about 65% were females and 27% were blacks. This was a well-educated population where more than 80% had completed some college or higher, and about 46% exercised more than 60 minutes per week and only about 18% regarded themselves as physically inactive. In spite of this, 33.3% were overweight and 20.5% were obese. Among the fatal stroke cases, 322 (68.2%) were non-specific, 28 ischemic, 71 hemorrhagic and 51 were characterized as “other non-traumatic intracranial hemorrhage”. Due to low numbers, these stroke sub-types during analyses were not differentiate, but used the sum of them as our outcome. The median frequency of sweet food intake in the upper quartile was 10.5 times/week, and the median intake of SSBs was once a week in the highest quartile, which is low compared to other populations (Eshak et al., 2012; Gardener et al., 2012; Larsson et al., 2014) (Figure 1). Compared to the subjects in the lowest quartile of sugary food intake, participants in the upper quartile were more likely to have lower educational level, exercise less, and have increased body weight. They were also more likely to be past smokers and current alcohol consumers. In terms of dietary habits, subjects who had higher intake of sugar were more likely to eat more meat, but less fruits, vegetables, whole grains, nuts and legumes. However, according to Table 2, the cases ate less meat and legumes, more fruit and vegetables, more nuts and more whole grains as compared to non-cases. However, Tables 1 and 2 are not age-adjusted, and cases were 23 years older than non-cases.

After adjusting for age, gender, race and educational level (basic model), no significant association was found between the risk of stroke mortality (any mention) and increased sugar intake (Table 3). The hazard ratio (HR), comparing the highest quartile of frequency of intake with the lowest was 0.90 (95% CI: 0.70-1.16). The estimates stayed virtually unchanged in the full multivariable model (HR=0.86, 95% CI: 0.65-1.13) (Table 3). Additionally, subgroup analyses according to gender and race (Blacks, non-Blacks) did not show a significant association between sugary food intake and fatal stroke risk.

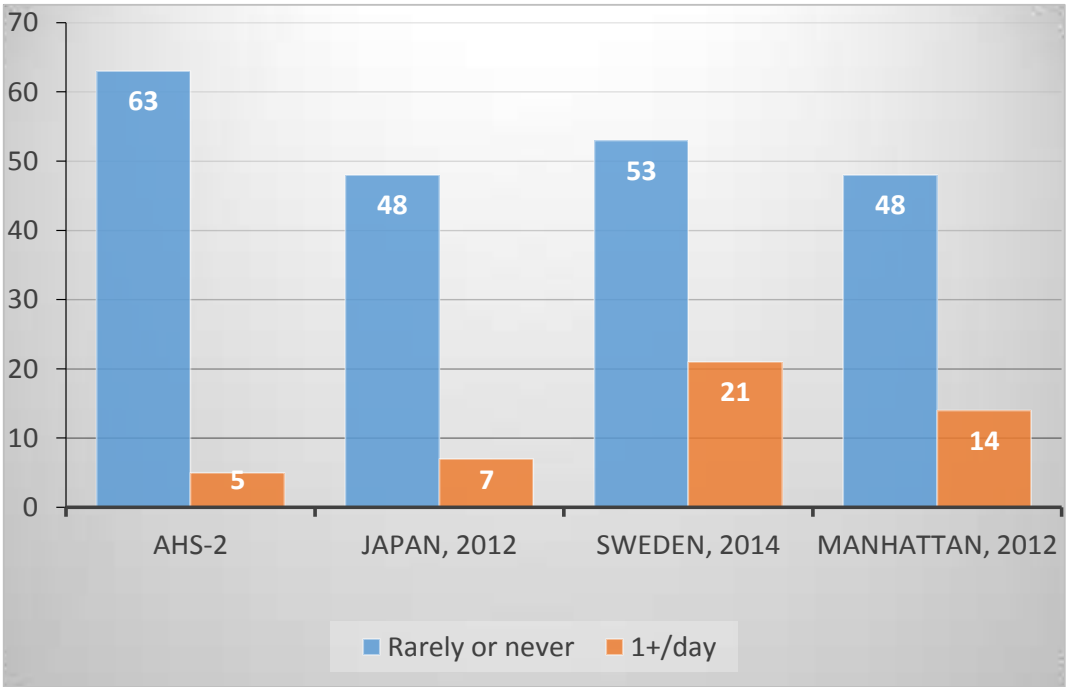

Figure 1. Percentage of populations with low or high levels of intake of sugar sweetened beverages (SSB).

Because smoking is a major risk factor for stroke and the majority (83%) of the AHS-2 subjects have never smoked, a sensitivity analysis limited to the never smoking group was performed. The estimates remained virtually unchanged compared to the estimates when including the rest of the population who were essentially all past smokers. Frequency of intake was also assessed as a continuous variable in the model after log-transformation and the HR was non-significant at 0.93 (95% CI: 0.82-1.04).

The sensitivity analyses with and without history of hypertension and BMI, respectively, in the model did not change the main effect associated with sweets intake. Likewise, when the non-stroke comorbidities were included, previously excluded, in the main analyses, the HRs stayed virtually the same as in the primary analyses.

DISCUSSION

No significant relationship between increased consumption of sugary foods and drinks and overall fatal stroke risk was found in our study. However, when stratified on race, the HR among the Blacks with in the highest quartile of sugary food intake was borderline protective with a HR=0.53 (p= 0.055). Unfortunately, our Black population was younger than the white subjects were and therefore there was only 72 cases and thus further studies among a larger and older population of Blacks are needed.

The AHS-2 is a population with relatively low sugar consumption with an average intake of 24 g/day (SD=16) of added sugar. This is low compared to the general US population who consume about 18.4 teaspoons of added sugar per day, equivalent to 77.3 grams (Bowman, 2017). There is information not only on SSB intake, but also on other foods with added sugar. Thus, to the best of our knowledge, this is the first study to assess a possible relationship between a more complete measure of added sugar consumption and risk of fatal stroke, whereas most other studies have assessed the effect of only SSB on stroke (Bernstein et al., 2012; Eshak et al., 2012; Gardener et al., 2012; Pase et al., 2017).

Results from studies on fatal stroke according to specific intakes of SSB intake are inconclusive. A cohort study in Japan (Eshak et al., 2012) found that, among women, the HR of incident ischemic stroke (fatal and non-fatal) was 1.83 (95% CI: 1.22-2.75) when comparing those who consumed SSBs every day with those who never or rarely consumed SSBs. For total stroke, however, results were not significant (HR=1.21, 95% CI: 0.88-1.68). Among men, there was a non-significant inverse association between consumption of SSBs and the risk of total and ischemic stroke with HRs at 0.76 (95% CI: 0.62-1.06) and 0.75 (95% CI: 0.53-1.03), respectively. The Framingham Heart Study Offspring

Table 1. Baseline characteristics of 53,482 AHS-2 Subjects according to sugary foods and drinks intake.

Categorical variable (%)	Sugary foods and drinks intake (frequency/week)					
	First quartile 0 to 1.6 n= 13,369	Second quartile 1.6 < to 3.5 N=13,371	Third quartile 3.5< to 7.0 N=13,372	Fourth quartile >7.0 N=13,370	Total N=53,482	P-value*
Gender						<0.01
Male	32.5	32.4	35.6	39.7	35.1	
Female	67.4	67.5	64.3	60.2	64.8	
Race						0.002
Black	27.9	26.5	25.9	26.3	26.7	
Non-Black	72.0	73.4	74.0	73.6	73.2	
Education						<0.01
High school	17.4	16.9	17.5	21.8	18.4	
Some college	38.8	38.4	39.0	40.0	39.0	
College or higher	43.7	44.6	43.4	38.1	42.4	
BMI						<0.01
<25	54.4	46.3	43.5	40.4	46.1	
25 to <30	29.6	33.7	34.3	35.3	33.2	
≥30	15.8	19.8	22.1	24.2	20.5	
Physical exercise (minutes/week)						<0.01
None	15.8	16.0	17.4	23.0	18.1	
0< to 60	31.3	36.5	37.6	37.9	35.8	
> 60	52.7	47.3	44.8	39.0	46.0	
Smoking						<0.01
Never	84.0	84.8	83.5	79.4	82.9	
Ever	15.9	15.2	16.4	20.5	17.0	
Alcohol intake						<0.01
Never	63.1	61.5	59.4	54.3	59.6	
Ever	29.2	28.6	29.7	32.5	30.0	
Current	7.6	9.7	10.8	13.1	10.3	
History of cancer						0.015
No	92.8	93.7	93.5	93.4	93.3	
Yes	7.1	6.2	6.4	6.5	6.6	
History of hypertension						<0.01
No	83.1	82.1	81.9	80.5	81.9	
Yes	16.9	17.8	18.0	19.4	18.0	
Aspirin use						<0.01
No	83.7	79.3	77.5	73.7	78.6	
Yes	16.2	20.6	22.4	26.2	21.3	

Table 1. Contd.

Hormonal replacement therapy among menopausal women					
<0.01					
No	53.4	49.6	48.1	46.5	49.5
Yes	46.5	50.4	51.8	53.4	50.4
Continuous Variables, Mean and standard deviation					
Age, years	55.9 (13.9)	54.6 (13.8)	54.8 (14.1)	55.3 (14.4)	<0.01
Total energy intake (kilocalorie/day)	1,974.2 (759.3)	1,821.2 (725.3)	1,866.7 (739.1)	2,006.8 (778.5)	<0.01
Fruits and vegetables (gram/day)	847.8 (548.5)	656.9 (412.5)	599.1 (386.3)	511.3 (341.9)	<0.01
Meat (gram/day)	18.7 (38.7)	24.5 (40.0)	29.2 (41.5)	38.9 (47.7)	<0.01
Nuts (gram/day)	22.8 (25.3)	17.6 (18.4)	16.6 (18.0)	14.6 (17.2)	<0.01
Legumes (gram/day)	63.6 (67.3)	52.2 (49.4)	49.2 (46.3)	43.1 (43.1)	<0.01
Whole grains (gram/day)	221.4 (161.6)	171.3 (135.3)	153.8 (122.2)	130.3 (112.6)	<0.01

*P-values associated with Chi-square for categorical variables and analysis of variance for continuous variables after log transformed across the quartiles of frequency of intake.

cohort found no significant association between SSBs and risk of total stroke incidence (HR=0.88, 95% CI: 0.43-1.78) when comparing SSB intake of >3 times/week to no intake (Pase et al., 2017). The Northern Manhattan Study also reported no association between consumption of SSBs and incident stroke (HR=1.00, 95% CI; 0.65-1.54) when comparing intake of SSB of ≥ 1 times/day to no intake (Gardener et al., 2012). Other studies have reported increased risk of stroke associated with high consumption of SSBs. The Health Professionals Follow-up Study and Nurses' Health Study found that consumption of ≥1 serving/day of SSBs increased the risk of total stroke (fatal and non-fatal) compared to those who did not drink SSBs, the pooled HR from the total cohort (men and women combined) was 1.16 (95% CI: 1.00-1.34). Among women the HR was 1.19 (95% CI: 1.00-1.42) whereas "a non-significant small increase" was found among the men (HR=1.08. 95% CI: 0.82-1.41) (Bernstein et al., 2012). Similarly, a study of Swedish men and women found that when comparing high SSBs intake of ≥2 servings/day with the reference of 0.1- < 0.5 servings/day, a significant increased risk of both total incident stroke (fatal and non-fatal) (19 %) and ischemic stroke (22%) was found, but no significant effect was apparent for hemorrhagic stroke (Larsson et al., 2014). Additionally, in a meta-analysis of four prospective studies with 259,176 subjects and 10,011 cases of incident stroke, the pooled relative risk (RR) for total stroke was 1.06 (95% CI: 0.97-1.15) for each serving/day increment in SSB intake. When comparing the highest level of SSB consumption to the lowest one, the summarized RR was 1.1 (95% CI: 1.00-1.20) for total stroke. The results were unstable when excluding one study at a time, and in a stratified analysis the summarized risk ratios were 1.16 (95% CI: 0.93-1.46) for ischemic stroke and 0.86 (95% CI: 0.71-1.04) for hemorrhagic stroke (Xi et al., 2015). A meta-analysis of four prospective studies reported pooled results suggesting a greater risk of stroke (RR=1.13, 95% CI: 1.02-1.24) with incremental (one serving/day) increase in SSB consumption (Narain et al., 2016). Another meta-analysis of seven prospective studies with 11,187 cases reported a RR for total stroke of 1.09 (95% CI: 1.01-1.18) comparing the highest SSB intake category with the lowest. Each additional daily 250 ml of SSB was positively associated with the risk of stroke (RR=1.07, 95% CI:1.02-1.12) (Bechthold et al., 2017). Also, when comparing data from NHANES 1999-2002 (n=8,104) and 2009-2012 (n=8,516), the reduction in stroke mortality was found to be associated with the reduction in SSB intake (Micha et al., 2017).

If intake of SSB is compared in thisstudy population with that of some of the other studies that have reported on the association between SSB and stroke risk, it is notably smaller. About 63% of the AHS-2 population never or rarely drink SSB and only 5% drink 1+ servings/day whereas the corresponding proportion of 1+ servings/day for the Swedish study (Larsson et al., 2014) and the Manhattan Study (Gardener et al., 2012) is 21 and 14%, respectively (Figure 1). Adventists are, in general, a health-conscious population (Butler et al., 2008), and compared to the average American, they tend to consume more fruits and vegetables, whole grains, legumes and nuts, but less meat, especially red meat (Fraser and Shavlik, 2001). It has been reported previously that subjects in the AHS-2 tend to become more vegetarian as they age (Martins et al., 2017) and in the AHS-1 it was discovered that subjects had the same chronic diseases as the general population, but tended to be diagnosed at an age about 10 years older than the

Table 2. Baseline characteristics of 53,482 AHS-2 subjects according to stroke cases and non-cases.

Categorical variable (%)	Non-cases N= 53,010 99.12%	Cases N=472 0.88%	Total N=53,482	P-value*
Gender				
Male	35.0	39.4	35.1	0.049
Female	64.9	60.5	64.8	
Race				<0.01
Black	26.8	15.2	26.7	
Non-Black	73.1	84.7	73.2	
Education				<0.01
High school	18.3	30.7	18.4	
Some college	39.1	36.2	39.0	
College or higher	42.5	33.0	42.4	
BMI				<0.01
<25	46.0	57.2	46.1	
25 to <30	33.3	28.3	33.2	
≥30	20.5	14.4	20.5	
Physical exercise (minutes/week)				<0.01
None	17.9	38.3	18.1	
0 < to 60	35.9	27.9	35.8	
> 60	46.1	33.6	46.0	
Smoking				0.157
Never	82.9	85.3	82.9	
Ever	17.0	14.6	17.0	
Alcohol intake				<0.01
Never	59.4	79.6	59.6	
Ever	30.1	16.7	30.0	
Current	10.4	16.7	10.3	
History of cancer				<0.01
No	93.4	83.2	93.3	
Yes	6.5	16.7	6.6	
History of hypertension				<0.01
No	82.0	67.5	81.9	
Yes	17.9	32.4	18.0	
Aspirin use				0.213
No	78.6	76.2	78.6	
Yes	21.3	23.7	21.3	

Table 2. Contd.

Hormonal replacement therapy among menopausal women				0.350
No	49.5	52.3	49.5	
Yes	50.4	47.6	50.4	
Sugary foods and drinks, frequency/wk				0.781
Quartile 1	24.9	26.4		
Quartile 2	25.0	23.7		
Quartile 3	25.0	23.9		
Quartile 4	24.9	25.8		
Continuous Variable, Mean and standard deviation				
Age, years	55.0 (13.9)	78.0 (10.8)		<0.01
Total energy intake (kilocalorie/day)	1916.7 (754.7)	1981.4 (748.5)		0.031
Fruits and vegetables (gram/day)	652.8 (446.0)	758.1 (509.8)		<0.01
Meat (gram/day)	27.9 (42.8)	16.9 (31.6)		<0.01
Nuts (gram/day)	17.8 (20.1)	23.6 (28.3)		<0.01
Legumes (gram/day)	52.1 (53.0)	43.7 (44.5)		<0.01
Whole grains (gram/day)	168.9 (138.1)	202.7 (157.6)		<0.01

*P-values associated with Chi-square for categorical variables and t-test for continuous variables after log transformed across the quartiles of sugary foods and drinks intake.

general population (Fraser, 2005). The study findings are in line with those previous reports showing an average age of 78 years for fatal stroke and that these cases tended to consume more plant-based foods than the young non-cases. This healthy diet could be a partial explanation for why the average age for fatal stroke is relatively high in this population. However, our HR did not change much even when adjusting for dietary factors. Since this population in general has a high intake of healthy foods and low meat intake, it is possible that a relatively small increase in sugary food intake does not represent an additional risk. High fruit and vegetable intake is associated with decreased risk of stroke (Hu et al., 2014) while increased consumption of red meat is associated with greater risk of total and ischemic stroke (Kaluza et al., 2012). Legumes and nuts have been found to reduce the risk of ischemic heart diseases, but the findings were inconclusive regarding stroke risk (Afshin et al., 2014). Thus, in essence, Adventists may consume foods containing adequate amounts of healthy nutrients such as antioxidants, which possess anti-inflammatory properties. Since inflammation is an essential component in the pathogenesis of cardiovascular diseases (Danesh et al., 2000; Pearson et al., 2003; Willerson and Ridker, 2004), it is reasonable to assume that a diet high in antioxidants may partially offset a potential harmful effect of sugar on fatal stroke risk (He et al., 2006; Schulze et al., 2005; Sørensen et al., 2005). The AHS-2 participants are virtually all non-smokers with about 83% never smokers, and cigarette smoking has been shown to induce an inflammatory response at the vascular level (Kangavari et al., 2004). Moreover, the AHS-2 cohort is characterized by low glycemic load (West-Write, 2018), and thus potentially lower stroke risk compared to subjects with food patterns with high glycemic load which are associated with increased stroke risk (Cai et al., 2015). It is, of course, also possible that a potential association between intake of sugar and fatal stroke is not a dose-response relationship, but a threshold effect, and that the low consumption of sugar in the AHS-2 population is below this threshold.

The present study has several strengths including the relatively large study sample size, its diversity in terms of race/ethnicities and educational status, and several well defined and validated food group intakes (Jaceldo-Siegl et al., 2011). In addition, there is a standardized method for registering mortality through linkage with the National Death Index. Nevertheless, the study is limited, first, by only having information on fatal stroke and not incident stroke. In addition, the case-fatality rate is greater for hemorrhagic stroke than for ischemic stroke (Andersen et al., 2009). In this study, most of the fatal strokes were coded as I64 (not specified as hemorrhage or infarction) and thus were unable to separate ischemic stroke from hemorrhagic stroke. This has probably attenuated the

Table 3. Hazard ratios (95% CIs) of total fatal stroke according to quartiles of sugary foods and drinks intake.

Variable	Sugary Foods and Drinks Intake (frequency/week)				
	First quartile 0 to 1.6	Second quartile 1.6 < to 3.5	Third quartile 3.5< to 7.0	Fourth quartile >7.0	P-trend
Person-years	126,785	127,489	127,738	127,107	
No. of Cases	125	112	113	122	
Model 1, HR (95% CI)	1.00 (reference)	0.97 (0.75- 1.26)	0.85 (0.63- 1.13)	0.90 (0.70-1.16)	0.28
Model 2, HR (95% CI)	1.00 (reference)	0.97 (0.75- 1.26)	0.83 (0.61 - 1.11)	0.86 (0.65-1.13)	0.17
Men					
Person-years	40,824	41,223	45,042	50,252	
No. of Cases	48	40	40	58	
Model 3, HR (95% CI)	1.00 (reference)	0.92 (0.60- 1.42)	0.85 (0.54- 1.33)	0.99 (0.67- 1.47)	0.92
Model 4, HR (95% CI)	1.00 (reference)	0.91 (0.58- 1.40)	0.82 (0.52- 1.30)	0.93 (0.60-1.43)	0.67
Women					
Person-years	85,962	86,266	82,697	76,854	
No. of Cases	77	72	73	64	
Model 3, HR (95% CI)	1.00 (reference)	1.01(0.73- 1.40)	0.85 (0.58- 1.25)	0.85 (0.61-1.18)	0.21
Model 4, HR (95% CI)	1.00 (reference)	1.02 (0.74- 1.42)	0.85 (0.57- 1.25)	0.82 (0.57-1.17)	0.18
Non-Blacks					
Person-years	91,669	93,851	94,883	93,660	
No. of Cases	104	91	94	111	
Model 3, HR (95% CI)	1.00 (reference)	0.95 (0.71- 1.27)	0.87 (0.65- 1.16)	0.95 (0.72- 1.26)	0.63
Model 4, HR (95% CI)	1.00 (reference)	0.97 (0.72- 1.30)	0.86 (0.64- 1.17)	0.94 (0.69-1.27)	0.54
Blacks					
Person-years	35,117	33,638	32,855	33,446	
No. of Cases	21	21	19	11	
Model 3, HR (95% CI)	1.00 (reference)	1.09 (0.55- 2.18)	0.75 (0.29- 1.90)	0.59 (0.29-1.20)	0.11
Model 5, HR (95% CI)	1.00 (reference)	1.02 (0.51- 2.07)	0.67 (0.27- 1.69)	0.53 (0.26-1.09)	0.055

Model 1: age, gender, race, and education
Model 2: Model 1 + BMI, physical exercise, alcohol intake, smoking, history of cancer, history of hypertension, aspirin intake in the last 5 years, hormonal replacement therapy among menopausal women, fruits and vegetable, meat, nuts, legumes, whole grains and total energy intake (kilocalorie/day).
Model 3 (subgroup analysis: men or women, Blacks or non-Black): age and education (gender or race depending on subgroup)
Model 4: Model 3 + BMI, physical exercise, alcohol intake, smoking, history of cancer, history of hypertension, aspirin intake in the last 5 years, hormonal replacement therapy among menopausal women (not in the male model), fruits and vegetable, meat, nuts, legumes, whole grains and total energy intake (kilocalorie/day).
Model 5: (subgroup analyses among Blacks): age, gender, BMI, and physical exercise.

estimates since earlier findings indicate that sugar intake may be a risk factor mostly for ischemic stroke (Bernstein et al., 2012; Eshak et al., 2012; Gardener et al., 2012; Pase et al., 2017). In addition, there are no information about atrial fibrillation and the family history of cardiovascular diseases, two important risk factors for stroke. The fact that our population overall had low sugary food intake also limits our ability to make conclusions regarding the effects of higher levels of sugar intake. It is possible that a detrimental effect of sugar intake is only evident at higher levels of intake.

Conclusions

In conclusion, the present study did not find any association between sugary food intake and fatal stroke when explored in this population with low sugar intake in the context of general healthy dietary pattern and lifestyle habits. It is possible that there is a threshold effect and

that sugar is only detrimental for stroke when taken in amounts higher than this threshold. It is also possible that a moderate intake of added sugar is not a risk factor for stroke in populations with a generally healthy lifestyle. Further studies are, therefore needed in populations with higher intake of sugar. Furthermore, additional studies using incident stroke, especially incident ischemic stroke are necessary. Lastly, the relationship between sugar intake and the risk of stroke needs further in-depth research, to explore the potential role of other dietary factors in modifying a possible effect of sugar intake on stroke risk.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Risky sexual behaviors and associated factors among preparatory school students in Arba Minch town, Southern Ethiopia

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There is growing evidence suggesting that young people in school are practicing risky sexual behaviors. Ethiopian people aged 10 to 24 years have emerged as the segments of the population most vulnerable to a broad spectrum of serious sexual health problems. Therefore, the main aim of this study was to assess risky sexual behaviors and associated factors among preparatory school students in Arba Minch, Southern Ethiopia. An institution based cross sectional study was conducted among 465 study participants from April 20 to June 2, 2018. A self-administered pre-tested questionnaire was used to collect the data. Bivariate and multivariate analysis was done using binary logistic regression. In this study, 22.4% (95%CI: 18.6%, 26.2%) of study participants had risky sexual behaviors. Marital status, education and occupational status of the father, occupation of the mother, watching pornographic movies, drinking alcohol, using hashish/shisha and knowledge about HIV/AIDS were significantly associated with odds (AOR=3.28, 95%CI: 1.24, 8.70), (AOR=5.96, 95%CI: 1.35, 26.25), (AOR=0.33, 95%CI: 0.12, 0.93), (AOR=0.22, 95%CI: 0.09, 0.51), (AOR=8.80, 95%CI: 4.04, 19.17), (AOR=2.71, 95%CI: 1.35, 5.46), (AOR=14.88, 95%CI: 4.52, 48.96) and (AOR=2.89, 95%CI: 1.42, 5.88), respectively. This finding noted that significant numbers of students were engaged in risky sexual behaviours. Those students had multiple sexual partners, used condoms inconsistently, had sex with risky individuals, and an early sexual start. Watching pornographic movies, substance abuse and a knowledge gap on HIV/AIDS were some of the significant factors. Awareness creation for youths to reduce substance abuses, HIV/AIDS and sexual and reproductive health in the school community is recommended.

Key words: Risky sexual behaviors, sexual and reproductive health problems, youths.

INTRODUCTION

There is currently no universal acceptable definition of youth. The United Nations (UN) defines the youth as persons between 15 and 24 years; WHO, 10 and 24 years; and the Ethiopian Social Security and

Development Policy, 15 and 24 years. However, youth policy of Ethiopia under minister of youth, sport and culture defines it to include parts of the society who are between 15 and 29 years of age (MYSC, 2014; UNESCO, 2013).

The world's population is young: 42% of people are under the age of 25. In South Asia and sub-Saharan Africa, the number of people aged 12 to 24 has steadily risen to 525 million in 2015, almost half the global youth population (SDGs, 2017). Ethiopia is a developing country with the youth population aged 15 to 24 years old, with the most productive force representing 20.11% of total population (CIA, 2018). Dramatic shift in sexual behavior among youths concedes with the rapid disseminations of HIV/ADIS and STIs (Yohannes et al., 2016). Many young people engage in risky sexual behavior and experiences that can result in unintended health outcomes (CDC, 2018). Risky sexual behaviors place youth at risk for HIV infection, other sexually transmitted diseases (STDs), unwanted and unintended pregnancy, abortion, and psychological distress (Cherie and Berhanie, 2015; Tadesse and Yakob, 2015; Adeomi et al., 2014; Alamrew et al., 2013; HWS, 2017). Evidences from different studies stated that, risky sexual behaviors include having more than one sexual partner, early sexual initiation, inconsistent use of condom, having sex with commercial sex workers, use of substances during sexy, and alcohol use (Cherie and Berhanie, 2015; Tadesse and Yakob, 2015; Adeomi et al., 2014; Alamrew et al., 2013; HWS, 2017; Adera et al., 2015; Asrese and Mekonnen, 2018).

AIDS is the second leading cause of death among people worldwide. An estimated 36.9 million people were living with HIV worldwide in 2017. Of these, 3.0 million were children and adolescents under 20 (UNAIDS, 2013, 2015). Adolescent girls and young women aged 15 to 24 years are at particularly high risk of HIV infection, accounting for 20% of new HIV infections among adults globally in 2015 (UNAIDS, 2016). However, AIDS is now the leading cause of death among young people in Africa. Majority of young people living with HIV are in low- and middle-income countries, with 84% in sub-Saharan Africa. In sub-Saharan Africa, adolescent girls and young women account for 25% of new HIV infections among adults, and women account for 56% of new HIV infections among adults (UNAIDS, 2013, 2015, 2016). The Ethiopian Demographic Health Survey HIV report showed that HIV prevalence is 0.3% among young women and 0.1% among young men, aged 15 to 24. Among women, HIV prevalence increases from 0.8% those with one lifetime sexual partner to 7.0% among those with 10 or more, and increases from 0.3% among men with 1 lifetime sexual partner to 2.9% among those with 10 or more. In Ethiopia, 24% of women aged 15 to 24 and 39% of men aged 15 to 24 have comprehensive knowledge of HIV (CSA, 2018). A study conducted among youth in Botswana stated that correct knowledge about prevention of HIV transmission is also low with only 16.3% (14.1-18.4) of students displaying adequate knowledge about the prevention of HIV transmission (Majelantle et al., 2014).

Sexual behaviors in high HIV/AIDS prevalence countries have generally been unfavorable over the last decade (UNAIDS, 2013). Studies conducted in developing countries showed that 75% of males aged 15 to 24 years who reported having sexual intercourse in the 12 months preceding the survey engaged in higher-risk sex. The proportion of higher-risk sex among male youth, aged 15 to 19 years was nearly 90% in 21 of the 26 countries (Berhan and Berhan, 2015).

Recent surveys in several countries in sub-Saharan Africa have detected decreases in condom use and/or an increase in the number of sexual partners. The overall proportion of condom use during youths' most recent higher-risk sexual encounter was 40 and 51% among 15 to 19 year olds and 20 to 24 year olds, respectively (UNAIDS, 2013; Berhan Yand Berhan, 2015).

Most of the risks for sexually transmitted infections (STIs) and HIV infection were identified with an attention seeking magnitudes. More than half of the students were at risk for STIs and/or HIV infection due to their varying levels of sexual behaviors such as having multiple sexual partners, regular casual sexual sex and sex with risk commercial sexual workers (CSWs) (Mengistu et al., 2013). One of the studies conducted in Ethiopia stated that more than one third of in-school youths (37.1%) reported having two or more than two lifetime sexual partners (Negeri, 2014). A considerable proportion of school youths were involved in risky sexual practice like early sexual initiation (by age 13 to 14), having multiple sexual partners and inconsistent condom use which predispose them to sexual related health (SRH) problems (Mariam et al., 2018). A study conducted in Southeast Ethiopia showed that more than half of the students were at risk for STIs and/or HIV infection. Additionally, it showed that engaging in casual sex with first sexual partner and having multiple sexual partners

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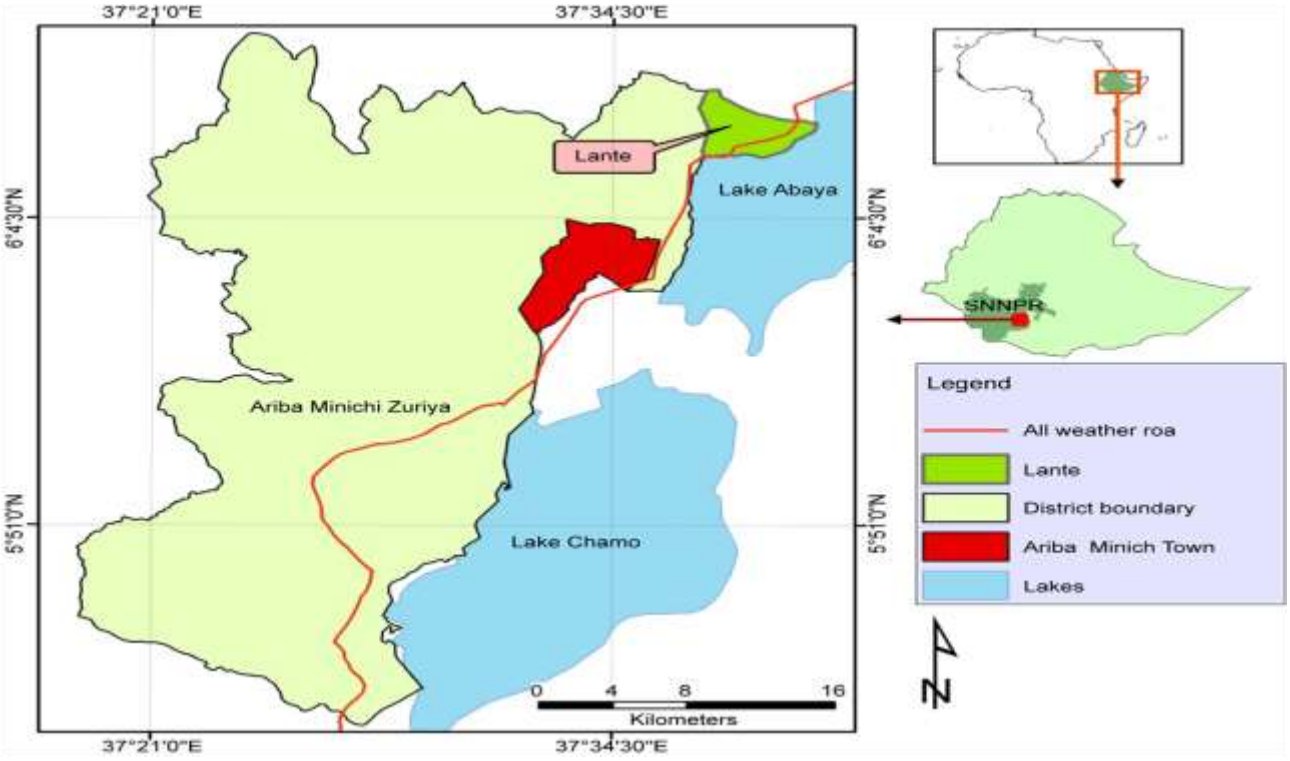

Figure 1. Map of Arba Minch town, South Nations and Nationalities and Peoples Republic, Southern Ethiopia, 2018.

in the last 12 months (four and above sexual partners) were independent risk predictors of STIs and/or HIV infections (Mengistu et al., 2013).

Peer pressure, alcohol consumption, watching pornographic materials, early sexual initiation, multiple sexual partnerships, inconsistence use of condoms, chewing 'khat' and substance use, depression, poor living arrangement, educational status of parents, family connectedness, having sex with CSWs, and poor knowledge towards HIV/AIDS are the major predictors of risky sexual behaviors among youths (Tadesse and Yakob, 2015; Alamrew et al., 2013;

Mariam et al., 2018; Nigatu et al., 2018; Fentahun and Mamo, 2014; Abebe et al., 2013; Manee and Aria, 2018; Mullu et al., 2016). Alternatively, interpersonal processes like succumbing to peer-norms, intergenerational gaps regarding beliefs about sexual behavior, the socio-economic context of students, and the interplay between desiring love. Also, included are material gain, power, and social status, HIV/AIDS messaging and programs, and the gendered nature of sex information played a great role in sexual risk-taking and exposure to risky sexual behaviors (Ndumiso et al., 2016).

Very few studies have assessed youth and particularly preparatory school student's risky sexual behavior. Most of these studies were conducted in major towns and used different categories of population. Therefore, the main aim of this study was to assess risky sexual behaviors and associated factors in Arba Minch town, Southern Ethiopia.

MATERIALS AND METHODS

Study setting and period

This study was conducted using preparatory schools students of Arba Minch town from 20th April to 2nd June, 2018. Arba Minch town is the administrative and trading center of the Gamo Gofa Zone, located at 505 km from Addis Ababa the capital city of Ethiopia and 275 km southwest of Hawassa, the regional town of South Nations Nationalities and Peoples Republic. The topography of the land is characterized by undulating feature that favors for the existence of different climatic zones. The general elevation of the zone ranges from 680 to 4207 m above sea level. Mount Gughe, the highest mountain peak in the zone as well as in the SNNPR stretches 4207 m above sea level. The climate here is tropical. In winter, there is less rainfall in Arba Minch than in summer. The climate here is classified as Aw by the Köppen-Geiger system (Figure 1). According to the 2007 Census conducted by the Central Statistical Authority (CSA), the town has a total population of 74,879, of whom 39,208 are men and 35,671 women. The annual population growth rate is found to be 4.8% with 15 years

doubling time and the population density of the town is 13 people per hectare.

Study design

An institution-based cross-sectional study design was used to address the objectives.

Study population and sample collection

All preparatory school students (grades 11 and 12) of Arba Minch town were the source population and those selected were study population for this study. Those students who were attending class during data collection period were included; whereas those who were seriously ill and unable to respond were excluded from this study. The sample size for this study was calculated using Epi info7 software Stat Cal. Sample size for each objective was determined separately. For the first objective (to determine the status of risky sexual behaviors), single population proportion and identify associated factors with two sample comparison proportion was used. The sample size used for this study was 495, after adding 10% to the larger sample size from two objectives. The calculated sample size of this study was proportionally allocated to each preparatory school based on the number of students in each school. Then, separate sampling frame (student list from director's office) was used to select the study participants from each grade (grades 11 and 12) as well as each section. Finally, study participants for this study were selected using a systematic random sampling method.

Data collection methods

A structured pretested self-administered questionnaire, adapted and modified from other similar studies was used to collect data. The tool had four main parts: socio-demographic, sexual and reproductive history, substance abuse and knowledge about HIV/AIDS. Four BSc holder nurses who are fluent in the local language, after taking informed consent, collected the data. Two MSc holder nurses supervised them. A three-day extensive training regarding the objectives of the study, ethical issues on research and data collection procedures was given for both data collectors as well as supervisors.

Measurements

Respondents have risky sexual behaviors if they had at least one of the following: multiple sexual partners; early sexual start, before the age of 18; inconsistent use of condom (incorrect use of condom or failure to use condom at least once during sexual intercourse); and sexual intercourse with commercial sex workers (Tadesse and Yakob, 2015; Alamrew et al., 2013; Mullu et al., 2016). Respondents, who mentioned three or more transmission and prevention ways of HIV/AIDS in addition to the other HIV/AIDS related questions correctly, were categorized to have good knowledge; while those who mentioned below were classified as having poor knowledge towards HIV/AIDS.

Data quality control

The questionnaires were first drafted in English then translated to the local language *"Amharic"* by a languages expert and finally before data entry again re-translated back to English in order to ensure consistency and quality. Questionnaires were pre-tested in an area with similar characteristics and possible modifications and amendments were done before actual data collection. Data were checked for completeness, accuracy, clarity and consistency at spot by data collections, after data collection by supervisors and before entry into software by principal investigator. Proper coding and categorization of data were maintained for the quality of the data to be analyzed. Double data entry was done for its validity and compared to the original data (data entered by the other data clerk).

Data processing, management and analysis

The data were coded and entered into Epi data version 3.1 in order to maintain logical errors and skipping patterns. Then, the data were exported to SPSS window version 22 for cleaning, editing and analysis. A descriptive analysis was done by computing proportions and summary statistics. The information was presented using simple frequencies, summary measures, tables and figures. Bi-variate s and multivariate analysis was done to see the association between each independent variable and the outcome variable using binary logistic regression. The goodness of fit was tested by Hosmer-Lemeshow statistic and Omnibus tests. All variables with $P<0.2$ in the bivariate analysis were included in the final model of multivariate analysis in order to control all possible confounders. In addition, variables that were significant in previous studies and from context point of view included in the final model even if the aforementioned criteria was not followed. During multivariate analysis, backward logistic regression was used. Multi co-linearity test was carried out to see the correlation between independent variables using standard error and collinearity statistics. The direction and strength of statistical association was measured by odds ratio with 95% CI. Adjusted odds ratio along with 95% CI was estimated to identify associated factors for risky sexual behaviors. In this study, P-value < 0.05 was considered to declare a result as statistically significant association.

Ethical considerations

Ethical clearance was obtained from Arba Minch University, College of Medicine and Health Sciences, Institutional Ethical Review Committee (AMU-IERC). All the study participants were informed about the purpose of the study, their right to refuse and the signed voluntary consent was obtained from all study participants prior to offering the data collection instruments. The respondents were also been told that the information obtained from them was treated with complete confidentiality and will not inflict any harm on them.

RESULTS

Socio-demographic characteristics of study participants

Of the total questionnaire, 465 participants responded with a response rate of 93.9%. From the total respondents, 255 (54.8%) were male. Regarding marital status, 421 (90.5%) were single, while 44 were married

(9.5%). The mean age of study participants was 17.92 (±1.34SD). Protestant religion followers constituted 306 (65.8%), 413 (88.8%) lived with family and 412 (88.6%) had participated in religious education. Table 1 shows the other socio-demographic characteristics.

Sexual and reproductive history of respondents

Out of the total respondents, 122 (26.2%) had sexual intercourses and 52 (42.6%) started sex for personal desire. Ninety-four (77%) of the respondents started sex before the age of 18 years, with mean age of 16.18±1.81. Ninety-three (76.2%) had first sex with their partners. From those who had sexual intercourses, 11 (9%) had sex with CSWs. Seventy two (59%) had 1 sexual partner in their lifetime and 74 (66.7%) had sex within 12 months prior to study period. Those who watched pornographic movies made up 213 (45.8%). One hundred forty seven (31.6%) had discussed about sexual intercourse with a family member, relatives and friends (Table 2).

Of the respondents who had sexual intercourse, 93 (76.2%) had used condom in lifetime and 91(82%) used condom for the sexual intercourse within 12 months prior to study period. From those who sometimes used, 45 (49.4%), 4 (4.4%) and 42 (46.2%) used often, constantly and consistently, respectively. Forty-three (62.3%) stated that using a condom decreases satisfaction (Figure 2).

Regarding family planning, 77 (16.6%) used any type of method for family planning, while 67 (87%) used condom (Figure 3). Overall, in this study, 22.4% (95% CI: 18.6, 26.2) study participants had risky sexual behaviors (Figure 4). One hundred fifty one (32.5%) had drinking alcohol (Table 3).

Knowledge about HIV/AIDS among respondents

All the study participants displayed basic knowledge about HIV/AIDS, transmission and prevention ways. As regards to testing knowledge of transmission, 447 (96.1%) stated unprotected sexual intercourse and 397 (85.4%) stated needles. Thirty three (7.1%) of the study participants had reported that HIV/AIDS is curable and 253 (54.4%) thought that healthy looking individuals may have HIV. Overall, 142 (30.5%) respondents had poor knowledge about HIV/AIDS (Table 4).

Factors associated with risky sexual behaviors among study participants

After controlling for possible cofounders in the multivariate model marital status, educational and occupational status of father, occupation of the mother, watching pornographic movies, drinking alcohol, using hashish/shisha and knowledge about HIV/AIDS were significantly associated with risky sexual behaviors. However, sex, age, grade level, educational status of mother, living with family, participation in religious education, chewing chat and smoking cigarette were not.

Married respondents were 3.28 times more likely and students with fathers with a low educational status as compared to others were 5.96 times more likely to be engaged in risky sexual behaviors (AOR=3.28, 95%CI: 1.24, 8.70) and (AOR=5.96, 95%CI: 1.35, 26.25), respectively. Students with fathers who were employed in government were 67% more likely, and those whose mother's occupational were merchants as compared to others were 78% less likely to be engaged in risky sexual behaviors. The odds of engaging in risky sexual behaviors were 8.8 among respondents who watch pornographic movies (AOR=8.80, 95%CI: 4.04, 19.17) and 2.71 among respondents consuming alcohol (AOR=2.71, 95%CI: 1.35, 5.46). Study participants who had used hashish/shisha were 14.88 times more likely to practice risky sexual behaviors. Additionally, those who had poor knowledge about HIV/AIDS were 2.89 times more likely to practice risky sexual behaviors (AOR=14.88, 95%CI: 4.52, 48.96) and (AOR=2.89, 95%CI: 1.42, 5.88), respectively (Table 5).

DISCUSSION

In this study, the prevalence of risky sexual behaviours was 22.4% (95%CI: 18.6, 26.2). Married respondents were 28% and respondents with educational status with the ability read and write were 96% to be engaged in risky sexual behaviors. The odds of practice of risky sexual behaviors were 0.33 among respondents, whose fathers were employed by the government and 0.22 among those whose mothers were merchants. Study participants who watch pornographic movies were 8.8 times more likely to be engaged in risky sexual behaviors and those who consume alcohol were 2.71 times more likely to be engaged in risky sexual behaviors. The odds of practice of risky sexual behaviors were 14.88 and 2.89 among respondents who use hashish/shisha and poor knowledge about HIV/AIDS, respectively.

The status of risky sexual behaviors was in line with some of the studies done in Ethiopia and Nigeria. This finding was low, compared to different studies conducted in Ethiopia, Spain and Iranian. However, it was inconsistent with some studies conducted in parts of Ethiopia (Cherie and Berhanie, 2015; Tadesse and Yakob, 2015; Adeomi et al., 2014; Alamrew et al., 2013;

Table 1. Socio-demographic characteristics of respondents among preparatory school students in Arba Minch town, Southern Ethiopia, 2018 *(n=465)*.

Variable	Frequency	Percentage
Age		
15-19	407	87.5
20-29	58	12.5
Religion		
Orthodox	140	30.1
Protestant	306	65.8
Muslim	13	2.8
Catholic	6	1.3
Educational status of father		
Cannot read and write	41	8.8
Read and write	23	4.9
Primary (grade 1-8)	74	15.9
Secondary (grade 9-12)	171	36.8
College and above	156	33.5
Occupation of father		
Government employer	153	32.9
Merchant	64	13.8
Farmer	163	35.1
Daily labor	23	4.9
Private worker	40	8.6
Other†	22	4.7
Educational status of mother		
Cannot read and write	45	9.7
Read and write	27	5.8
Primary (grade 1-8)	45	9.7
Secondary (grade 9-12)	221	47.5
College and above	127	27.3
Occupation of mother		
Governmental employer	91	19.6
Merchant	130	28
Farmer	89	19.1
Daily labor	13	2.8
Private worker	41	8.8
House wife	101	21.7
Number of sisters/brothers		
1-3	116	24.9
4-6	211	45.4
>6	138	29.7

†Driver and wavier

Table 2. Sexual and reproductive history of respondents among preparatory school students in Arba Minch town, Southern Ethiopia, 2018 (n=465).

Variable	Frequency	Percentage
Had sexual intercourse		
Yes	122	26.2
No	343	73.8
Reason to start sexual intercourse		
Marriage	36	29.5
Peer pressure	34	27.9
Personal desire	52	42.6
Age at first sex		
<18 years old	94	77
≥18 years old	28	23
First sexual intercourse with		
Girl/boy friend	93	76.2
Husband/wife	29	23.8
Number sexual partner in life time		
One	72	59
Two	39	32
Three or more	11	9
Had sexual intercourse within 12 month		
Yes	111	91
No	11	9
Number of sexual partner within 12 month		
One	74	66.7
Two	27	24.3
Three or more	10	9

Asrese and Mekonnen, 2018; Mariam et al., 2018; Abebe et al., 2013; Manee and Aria, 2018; Mullu et al., 2016; Abdu et al., 2017; Dadi and Teklu, 2014; Kahsay et al., 2017; Mamo et al., 2016; Ali, 2017). The reason for this discrepancy is due to the difference in the study area and period difference, socio-cultural factors and difference in methodological aspects.

In this study, 26.2% study participants had sexual intercourse and of them, 91% had sexual intercourse within the last twelve months. This was incongruent with some of the studies done in different parts of the world (Cherie and Berhanie, 2015; Adeomi et al., 2014; Asrese and Mekonnen, 2018; Dadi and Teklu, 2014). Regarding sexual start, 77% of respondents began before the age of 18 years. This was inconsistent with studies done in Nigeria and Ethiopia (Mullu et al., 2016; Ali, 2017). This incongruence may be due to socio-cultural and environmental factors and advance in different factors that promote early sexual start (peer pressure, visiting night clubs, watching different moves and substance abuse).

This finding indicated that 41% of participants had multiple sexual partners having more than one partner in lifetime and 33.3% had within twelve month. This finding was comparable with some studies done in Ethiopia (Furry, 2015; Regassa et al., 2016). However, it was low when compared with other studies done in Ethiopia and Nigeria (Cherie and Berhanie, 2015; Tadesse and Yakob, 2015; Alamrew et al., 2013; Asrese and Mekonnen, 2018; Mengistu et al., 2013; Kahsay et al.,

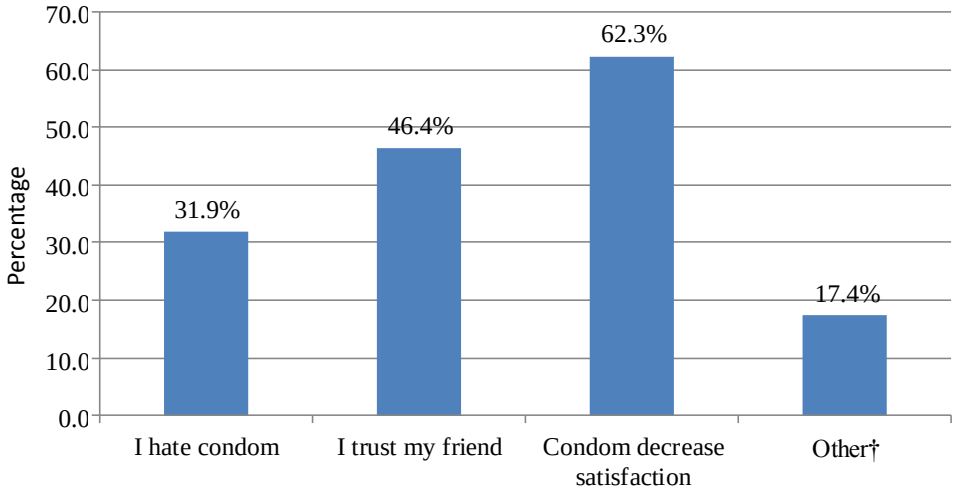

Figure 2. Reasons for not using condom among preparatory school students in Arba Minch town, Southern Ethiopia, 2018 (n=465). †Sexual partner is not volunteer and does not have access to condom during that time.

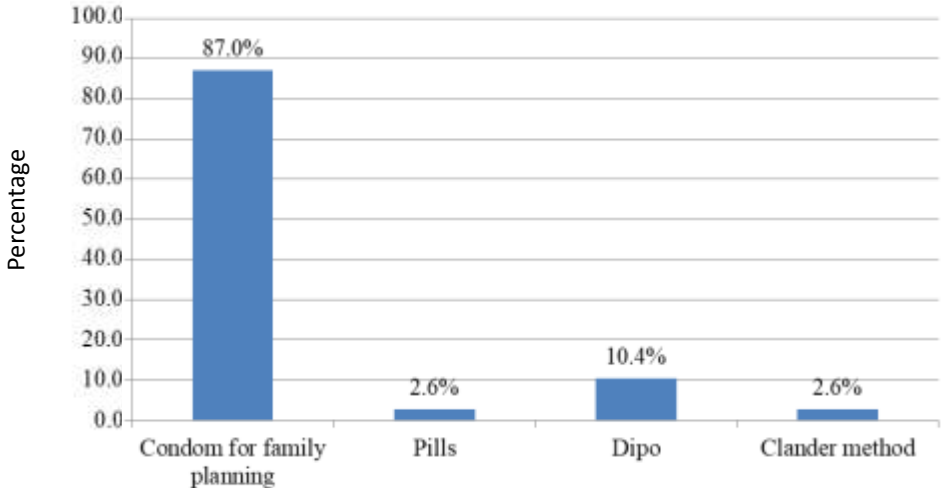

Figure 3. Types of family planning used among preparatory school students in Arba Minch town, Southern Ethiopia, 2018 (n=465).

2017; Mamo et al., 2016; Ifeadike et al., 2018; Teferra et al., 2015) and high as compared to some studies done elsewhere (Negeri, 2014; Abebe et al., 2013). The reason for this may be the fact that lives in risky place or environments (urban with a number of nightclubs), luxuries life style and substance abuses. As stated in this study, 82% of respondents had used condom for sex and from them only 46.2% used constantly and consistently. This finding was congruent with studies done in parts of Ethiopia (Cherie and Berhanie, 2015; Kahsay et al., 2017). However, it was inconsistent with studies conducted in Ghana and Ethiopia (Fentahun and Mamo, 2014; Abebe et al., 2013; Amoah, 2017; Gizaw et al., 2018; Henok et al., 2015; Mavhandu-Mudzusi and Asgedom 2016). This may be due to an awareness gap, lack of access to sexual and reproductive health services in friendly way and environmental factors. In this study, only 9% had contact with high risky individual or commercial sex workers (CSWs). This was more or less congruent with one of the study done in Ethiopia

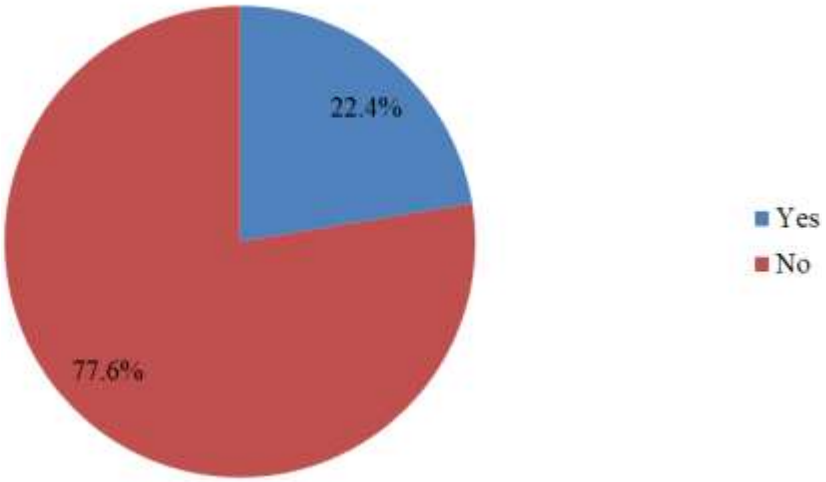

Figure 4. Risky sexual behaviors among preparatory school students in Arba Minch town, Southern Ethiopia, 2018 (n=465)

Table 3. Substance abuse among preparatory school students in Arba Minch town, Southern Ethiopia, 2018 (n=465).

Variable	Frequency	Percentage
Chewing chat		
Yes	63	13.5
No	402	86.5
Drinking alcohol		
Yes	151	32.5
No	314	67.5
Smoking cigarette		
Yes	33	7.1
No	432	92.9
Using hashish/shisha		
Yes	32	6.9
No	433	93.1

(Mamo et al., 2016).

In this study, marital status, those of whose fathers had low educational status and occupational status of governmental employer and mother's educational status of merchant were significantly associated with risky sexual behaviors. This was in line with studies done in Ethiopia (Tadesse and Yakob, 2015; Alamrew et al., 2013). However, it was inconsistent with Nigeria and Ethiopia studies (Ali, 2017; Ifeadike et al., 2018). The reason for these controversies is socio-economic stability and environmental factors in favor of socio-cultural factors. Exposure to pornographic movies was one factor that promotes unhealthy sexual relationship and this study showed those who had exposure were more likely to practice risky sexual behaviors. This result was supported by different studies done in Tanzania and parts of Ethiopia (Tadesse and Yakob, 2015; Mariam et al., 2018; Nigatu et al., 2018; Kahsay et al., 2017; Yarro and Kafanabo, 2016). Nevertheless, contradictory to some studies done in Ethiopia (Alamrew et al., 2013; Ali,

Table 4. Knowledge about HIV/AIDS among preparatory school students in Arba Minch town, Southern Ethiopia, 2018 *(n=465)*.

Variable	Frequency	Percentage
Transmission ways		
Unprotected sexual intercourse		
Yes	447	96.1
No	18	3.9
Sharing needles		
Yes	397	85.4
No	68	14.6
Breastfeeding		
Yes	351	75.5
No	114	24.5
Blood contact		
Yes	363	78.1
No	102	21.9
Prevention ways		
Using condom		
Yes	443	95.3
No	22	4.7
Do not eating together		
Yes	0	0
No	465	100
Do not sharing needles		
Yes	374	80.4
No	91	19.6
HIV/AIDS is curable		
Yes	33	7.1
No	432	92.9
Do you think that healthy looking individuals have HIV		
Yes	253	54.4
No	212	45.6
Knowledge about HIV/AIDS		
Good	323	69.5
Poor	142	30.5

2017). Drinking alcohol and using hashish/shisha result in inappropriate judgments and unwanted outcomes. This study speculated that those individuals were more prone to risky sexual behavior. This finding correlates with studies done in parts of Ethiopia, in three Asian countries (Hanoi, Shanghai, and Taipei) and Nigeria (Negeri, 2014; Mariam et al., 2018; Nigatu et al., 2018; Fentahun and Mamo, 2014; Kahsay et al., 2017; Ifeadike

Table 5. Bivariate and multivariate analysis of factors associated with risky sexual behaviors among preparatory school students in Arba Minch town, Southern Ethiopia, 2018 *(n=465).*

Variable	Risky sexual behavior		(95% CI)	
	No (%)	Yes (%)	Crude OR	Adjusted OR
Sex				
Male	183 (71.8)	72 (28.2)	1	
Female	178 (84.8)	32 (15.2)	0.46 (0.29-0.73)	
Age				
15-19	322 (79.1)	85 (20.9)	1	
20-29	39 (67.2)	19 (32.8)	1.85 (1.02-3.36)	
Marital status				
Single	348 (82.7)	73 (17.3)	1	1
Married	13 (29.5)	31 (70.5)	11.37 (5.67-22.78)	3.28 (1.24-8.70)***
Grade level				
Grade 11	175 (73.8)	62 (26.2)	1	
Grade 12	186 (81.6)	42 (18.4)	0.64 (0.41-0.99)	
Educational status of father				
Cannot read and write	32 (78)	9 (22)	1	1
Read and write	13 (56.5)	10 (43.5)	2.74 (0.90-8.28)	5.96 (1.35-26.25)**
Primary	51 (68.9)	23 (31.1)	1.60 (0.66-3.89)	3.12 (0.90-10.77)
Secondary and above	265 (81)	62 (19)	0.83 (0.38-1.83)	1.35 (0.44-4.14)
Occupational status of father				
Government employer	131 (85.6)	22 (14.4)	0.63 (0.31-1.25)	0.33 (0.12-0.93)*
Merchant	46 (71.9)	18 (28.1)	1.46 (0.69-3.09)	1.39 (0.51-3.81)
Farmer	117 (71.8)	46 (28.2)	1.46 (0.79-2.73)	0.86 (0.33-2.23)
Other†	67 (78.8)	18 (21.2)	1	1
Educational status of mother				
Cannot read and write	32 (71.1)	13 (28.9)	1	
Read and write	16 (59.3)	11 (40.7)	1.69 (0.62-4.61)	
Primary	35 (77.8)	10 (22.2)	0.70 (0.27-1.83)	-
Secondary and above	278 (79.9)	70 (20.1)	0.62 (0.31-1.24)	
Occupational status of mother				
Government employer	75 (82.4)	16 (17.6)	0.56 (0.29-1.06)	0.60 (0.22-1.63)
Merchant	111 (85.4)	19 (14.6)	0.45 (0.25-0.81)	0.22 (0.09-0.51)******
Farmer	63 (70.8)	26 (29.2)	1.08 (0.60-1.91)	0.58 (0.25-1.35)
Other††	112 (72.3)	43 (27.7)	1	1
Living with family				
Yes	333 (80.6)	80 (19.4)	0.28 (0.15-0.51)	-
No	28 (53.8)	24 (46.2)	1	

Table 5 Contd.

Watching pornographic movies				
Yes	126 (59.2)	87 (40.8)	9.54 (5.44-16.76)	8.80 (4.04-19.17)******
No	235 (93.3)	17 (6.7)	1	1
Participation in religious education				
Yes	331 (80.3)	81 (19.7)	0.32 (0.18-0.58)	-
No	30 (56.6)	23 (43.4)	1	
Chewing chat				
Yes	35 (55.6)	28 (44.4)	3.43 (1.97-5.98)	-
No	326 (81.1)	76 (18.9)	1	
Drinking alcohol				
Yes	84 (55.6)	67 (44.4)	5.97 (3.73-9.55)	2.71 (1.35-5.46)****
No	277 (88.2)	37 (11.8)	1	1
Smoking cigarette				
Yes	13 (39.4)	20 (60.6)	6.37 (3.05-13.33)	
No	348 (80.6)	84 (19.4)	1	
Using hashish/shisha				
Yes	13 (40.6)	19 (59.4)	5.98 (2.84-12.59)	14.88 (4.52-48.96)******
No	348 (80.4)	85 (19.6)	1	1
Knowledge about HIV/AIDS				
Good	268 (83)	55 (17)	1	1
Poor	93 (65.5)	49 (34.5)	2.57 (1.64-4.03)	2.89 (1.42-5.88)*****

†Daily labor, private worker, driver and wavier. ††House wife, daily labor and private worker. *P=0.037, **P=0.018, ***P=0.017, ****P=0.005, *****P=0.003 and ******P<0.001.

et al., 2018; Mavhandu-Mudzusi and Asgedom, 2016); however, inconsistent with some studies done elsewhere (Alamrew et al., 2013, Dadi and Teklu, 2014). For this discrepancy, methodological aspects over weight other situations. In general, knowledge gap can be a major factor that results in sexual and reproductive health problems. In this finding those students who had poor knowledge about HIV/AIDS was significantly associated with risky sexual behaviors. This is in line with a study conducted in Ethiopia (Mullu et al., 2016).

Sex, current age of participants, grade level, live with family and participation in religious education were not significantly associated with risky sexual behaviors. This was congruent with studies conducted in Ethiopia (Negeri, 2014; Mariam et al., 2018; Mullu et al., 2016; Ali, 2017). However, it contradicts studies conducted in three Asian countries (Hanoi, Shanghai, and Taipei), Nigeria, Bahamas, Cambodia and else were in Ethiopia (Nigatu et al., 2018; Dadi and Teklu, 2014; Kahsay et al., 2017; Ifeadike et al., 2018; Wang et al., 2015). Maternal educational status was not a significant contributing factor to student's risky sexual behaviors. This agreed with studies done in Cambodia and Ethiopia (Derbie et al., 2016). In addition, chewing chat and smoking cigarettes were not significant after controlling for confounders in this study.

Conclusion

This finding noted that significant numbers of students were engaged in risky sexual behaviours. Those students had multiple sexual partners, inconsistent use of condoms, sex with risky individuals and an early sexual start (by ages 13 to 14). Marital status, educational and occupational status of father's, occupational status of mother's, watching pornographic movies, drinking alcohol and using shisha/hashish and poor knowledge

about HIV/AIDS were associated factors for risky sexual behaviours in this study. Awareness creation for youths to reduce substance abuse, HIV/AIDS and sexual and reproductive health within the school system should be promoted. Further research should identify other contextually specific factors that contribute to risky sexual behaviours in youth, and develop and tailor programs accordingly.

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CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ABBREVIATIONS

AIDS, Acquired immune deficiency syndrome; **AOR,** adjusted odds ratio; **CI,** confidence interval; **CSWs,** commercial sex workers; **HIV,** human immune deficiency virus; **STIs,** sexual transmitted infections

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Prevalence of hepatitis B virus, its risk factors and co-infection with human immune deficiency virus among clients of voluntary counseling and testing center in Hosanna, Southern Ethiopia

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Hepatitis B infection (HBV) infection is a serious public health problem worldwide and its co-infection with human immune deficiency virus (HIV) is common due to shared routes of transmission. An increased mortality due to accelerated hepatic disease progression and the frequent hepatotoxicity caused by antiretroviral therapy are the challenges in the clinical management of HIV. Epidemiological studies on HBV and HBV/HIV co infection are scarce in Ethiopia, particularly at the study area. The aim of this study was to determine the magnitude of HBV, its risk factors and co-infection with HIV among clients of a voluntary counseling and testing (VCT) center in Southern Ethiopia. A facility based cross-sectional study was conducted from 1st February 2016 to 15th March among clients of Nigist Eleni Memorial Hospital VCT Center. Data were collected by face-to-face interview and specific formula sheet as well recorded results of laboratory diagnosis of blood sample from each participant. Both descriptive and inferential statistics were used for data analysis. Multivariable logistic regression modeling was done to identify predictors of HBV. Overall, 331 participants were included in the study. The prevalence of HBV was 8.8%, HBV/HIV co-infection was found in 3.6%. Individuals with a history of multiple sexual partner [AOR = 10.3; 95% CI, 3.71 - 28.83], previous history of invasive procedure [adjusted odds ratio (AOR) = 10.88; 95% CI, 3.84 - 30.86] and history of surgical procedure [AOR = 9.2; 95% CI, 3.1 - 27.88] were identified as in dependent predictors of HBV infection. High HBV infection and HBV/HIV co-infection was found in the study. Previous history of surgical procedure, invasive procedure and multiple sexual partners were identified as independent predictor of HBV infection.

Key words: Hepatitis B virus (HBV), human immune deficiency virus, HBV-HIV co-infection, risk factors, Hosanna.

INTRODUCTION

Hepatitis B infection is caused by the hepatitis B virus (HBV).which is an enveloped DNA virus that infects the liver and causes inflammation and hepatocellular necrosis (WHO, 2015; Marcellin, 2009). It is one of a serious public health problem worldwide (Adibi et al., 2012) and It is 50 to 100 times more contagious than HIV (Verma et al., 2011). Recently,WHO estimates the Global Burden of Disease study as viral hepatitis accounts for

approximately 1.34million deaths annually, which is equivalent to the number of deaths from HIV/AIDS (1.3 million), malaria (0.9 million), and tuberculosis (1.3 million) (WHO, 2017; GBD, 2016). Globally, 350 million people are infected with HBV and 33 million people are infected with HIV. Next to Asia, Africa has been highly infected by HIV pandemic and the second for HBV infection. These regions are high endemic areas for HBV (Marcellin, 2009; Burnett et al., 2005). Ethiopia, being part of this region, is ranked as an area with medium to high endemicity for HBV infection, based on previous population surveys (Abebe et al., 2003). As Ethiopia is most hit by HIV infection (prevalence of 2.1%), the likelihood of HBV/HIV co-infection is expected to be high due to shared routes of transmission (FMOH, 2007). WHO set a goal to eliminate viral hepatitis as a public health problem by the year 2030 (WHO, 2016). However, in Ethiopia, there was no mass HBV vaccination to the general population; even the burden of HBV in the community is not adequately addressed. Moreover, information on the magnitude of HBV, its risk factors and prevalence of HBV-HIV co-infection are scarce. Therefore, this study was conducted among clients Nigist Eleni Memorial Hospital voluntary counseling and testing (VCT) center, to determine the prevalence of hepatitis-B surface antigen (HBsAg), its risk factors and prevalence of HIV co-infection. The results of this study will help health authorities and other concerned bodies to design interventions to improve the health status of people infected with HBV and HIV. Further, the study can provide base line information for other studies. So, the study is relevant for policy formulation and health care provision.

METHODOLOGY

Study design, setting and participants

Facility based cross-sectional study was conducted at Nigist Eleni Memorial Hospital VCT center, Hossana, Southern Ethiopia, from 1st February 2016 to 15th March. The VCT center at the hospital routinely gives HIV counseling and testing for clients. All individuals attending Nigist Eleni Memorial Hospital for VCT testing during the study period were eligible for inclusion in the study. The study area was Hadiya zone, Hossana town, Southern Ethiopia. There is one hospital in the town which serves more than 1.5 million people.

According to 2007 census report and as projected in 2011, total population were 92733 with total number of male 45,875 and female 46,858. The total number of households is 18,925 according to HEWs numbering report.

Sample size was determined using single population proportion formula:

$$n = \frac{\left(Z_{\left(\frac{\alpha}{2}\right)}\right)^2 P(1-P)}{d^2}$$

Considering the following assumptions: p = 7.7% (proportion of people infected by HBV) (Belayneh, 2015), Zα/2 is the value of the standard normal distribution corresponding to a significant level of alpha (α) of 0.05, which is 1.96 and desired degree of precision (d) of 3%, the computed sample size was 303 and by adding 10% non-response rate, the total sample size computed was 334. Participants were included in the study using systematic sampling technique. Every other two clients were included by considering the monthly average flow of patient from previous data. For data collection, two counselor nurses and one laboratory technician were recruited; and one supervisor was also recruited. Face-to-face interviews using pretested structured questionnaire were done to collect data on socio-demographic characteristics and other risk factors. Three milliliters of venous blood was collected from each patient. Serum was separated by centrifugation at 3000 rpm for 5 min after the blood has been clotted. Rapid HIV kits (HIV (1 + 2) Antibody Colloidal Gold (KHB, Shanghai Kehua Bio-engineering Co Ltd, China) was used as the screening test, followed by HIV 1/2 STAT-PAK® (Chembio Diagnostics, USA) if positive, where the result of STAT-PAK® is discordant with KHB, a third test, Unigold™ HIV (Trinity Biotech, Ireland, tie breaker)) were used to determine the result. The serum was also tested for HBsAg by one step according to the Guangzhou Wondfo Biotech Co., Ltd (Wondfo) instruction. This test has a sensitivity and specificity of 96.2 and 99.3%, respectively (Belayneh, 2015).

Statistical analysis

First, data were entered into Epi data 3.1 and exported to SPSS version 20 for analysis. Then, data cleaning (editing, recoding, checking for missing values, and outliers) was performed. Missing data were treated using multiple imputations. The basic descriptive summaries of patients' characteristics and outcome of interest was computed. Bi-variate analysis was used to show the relation between HBV infection and various associated factors. Finally, all associated variables that results ($P < 0.2$) with the outcome variable were entered into multivariable logistic regression model using backward likely hood ratio method to identify independent predictor of HBV infection. *P*-value < 0.05 was considered as statistically significant. Odds ratio (OR) with 95% confidence intervals (CI) were calculated as well.

Data quality control

The tool was adapted from different previous literatures and modified by the study context. It was first prepared in English and translated into Amharic, and then translated back to English by an expert who is fluent in both languages to ensure reliability. Training was given for data collectors and the supervisor on the objectives of

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the research, how to collect the data through interviewing approach, and data recording. Data collectors already trained for the test kits were used. Pre testing of the questionnaires was made on 16 VCT clients in the nearby district health center a week prior to the actual survey. Consequently, based on the feedback obtained from the pre-test, questions which needed clarification were revised and updated. Daily, the data were strictly revised for completeness, accuracy and clarity by the supervisors and principal investigator. In addition, the data were thoroughly cleaned and carefully entered into computer using Epidata version 3.1 using double entry verification.

Ethical statement

Ethical approval was obtained from Hadiya zone health department. Verbal consent was taken from Nigist Elienie Mohammed Hospital and each participant after the purpose of the study was explained. They were told to withdraw at any time from responding to questions. Participants were informed that all the data obtained from them will be confidential and code was used instead of any personal identifiers. Individuals positive for HBV/HIV were linked to the hospital outpatient department (OPD) for further management.

RESULTS

A total of 331 individuals were in the study, with a response rate of 99.1%. Sixty one percent were females and 64% of the study subjects were in the age range of 28 to 37. The mean (±standard deviation [SD]) age was 33 (5.5) years old. About 74% of the participants were living in urban areas; 76% were married. Sixty one percent of the participants were followers of protestant religion. Nearly 21% of the participants were unemployed. About 60% of participants had a monthly income of ≥1000 Ethiopian Birr ($5.45 USD) (Table 1).

As regards the health status characteristics shown in Table 2, 8.15% of participants had a history of surgical procedure, 8.76% of invasive procedures, 6.61% of sexually transmitted infections, 9.97% of multiple sexual partners, 10.57% of using sharing sharp materials, and 4.5% of blood transfusion.

Prevalence of HBV infection and co-infection with HIV

The prevalence of HBsAg was found to be 8.8% (Figure 1). The prevalence of HBV/HIV co-infection was found in 3.6% (Figure 2).

Males were most affected by HBV (10.24%). The prevalence of HBsAg was 14.28% in the age category of 18 to 25 years, 7.14% in age category of 26 to 34 years and 12.9% for those above 34 years old. About 10% of the participants with HBsAg positive results lived in urban areas.

In bivariate analysis, average family income, previous history of surgery, blood transfusion, alcohol consumption, Khat chewing, cigarette smoking, STI, invasive procedure, and sharing of sharp instruments were selected for inclusion in the multiple logistic regression analysis (P-value <0.2) by backward likelihood method of data entry. Individuals with history of multiple life time sexual partner were about ten times more likely to show HBV surface antigen marker than who did not [AOR = 10.3; 95% CI, 3.71 - 28.83], those with previous history of invasive procedure were about ten times more likely to show HBV surface antigen marker than who did not [AOR = 10.88; 95% CI, 3.84 - 30.86] and individuals with history of surgical procedure were nine times more likely to be affected by HBV [AOR = 9.2; 95% CI, 3.1 - 27.88] (Table 3). Regression diagnostic procedures were carried out and showed no evidence of multi-co linearity and there was no interaction between the potential predictor variables. Chi-square assumptions were checked and met the criteria.

DISCUSSION

Overall, the prevalence of HBV among VCT clients of Nigist Elienie Mohammed Hospital VCT center was 8.8% and the magnitude of HIV/HBV co-infection was 3.6%. A study conducted in Addis Ababa (Shimelis, 2008) and Shashemene (Negero et al., 2011) revealed a 5.7% HBsAg prevalence among VCT clients, which is lower than the present study. The difference might be due to difference in socio-economic factors. A prevalence of almost 4% was also reported among pregnant women in Jimma (Awole and Gebre-Selassie, 2005). A community based sero-epidemiological study conducted in Addis Ababa revealed 7% HBsAg prevalence (Abebe, 2003). A hospital based survey at South Gondar showed 6.1% HBsAg prevalence (Balew, 2014). The HBV/HIV co-infection rate in this study is high is consistent with a study done in sub Saharan Africa (Burnett, 2005), Shashemene (Negero et al., 2011) and at Hawassa (Belayneh, 2015). However, a study done at VCT centers in Addis Ababa showed no significant difference between HBsAg carriages per HIV status (Shimelis, 2008). Other study among pregnant HIV infected women in the USA showed a much lower prevalence of HBV as compared to this study (Particia, 2005). The justification of this finding could be due to the fact that in most developed parts of the world the prevalence of HBV infection is low (Burnett, 2005). There was a higher prevalence of HIV/HBV co infection (13.6%) observed in a systematic review conducted in Ghana (Agyeman and Ofori-Asenso, 2016). The difference could be due to socio-economic difference in the study population.

In this study, a history of invasive procedures was

Table 1. Socio-demographic and life style characteristic among study population.

Variable	Category	Number (%)
Sex	Male	129 (39)
	Female	202 (61)
Age	18-27	19 (5.74)
	28-37	220 (66.46)
	≥38	93 (28.00)
Place of residence	Urban	233 (67.37)
	Rural	98 (32.63)
Religion	Protestant	203 (61.33)
	Orthodox	49 (14.8)
	Muslim	62 (18.73)
	Others*	17 (5.14)
Marital status	Married	252 (76.13)
	Single	23 (6.95)
	Divorce	40 (12.08)
	Windowed	16 (4.84)
Occupation	Farmer	76 (22.96)
	Government	65 (19.64)
	Self-employed	73 (22.05)
	Unemployed	68 (20.54)
	Others+	49 (14.8)
Income(ETB)	≤500	110 (33.23)
	501-999	22 (6.65)
	≥1000	199 (60.12)
Alcohol consumption	Yes	42 (12.69)
	No	289 (87.31)
Khat chewing	Yes	27 (8.16)
	No	304 (91.84)
Cigarette smoking	Yes	7 (2.11)
	No	324 (97.88)

*Adventist and Johva; + Daily labour (25) and House wife (24).

significantly associated with HBV infection. This is in agreement with a study conducted in Jimma (Awol and Gebre-Selassie, 2005). A previous history of surgical procedure showed significant association with HBV infection. This result is in line with the results of the studies conducted in Ethiopia at Hawassa (Belayneh, 2015). Individuals with history of multiple life time sexual partners were more likely to show HBsAg positive. This finding was in line with a study conducted inNigeria (Nwokediuko, 2009).

The study has the following limitations. First, since we employed a cross-sectional design, we cannot infer causality. Secondly, the findings of the present study were based on rapid test kit which might have

Table 2. Health care related characteristics study population.

Variable	Category	Number (%)
Surgical procedure	Yes	27 (8.15)
	No	304 (91.85)
Invasive procedure	Yes	29 (8.76)
	No	302 (91.24)
STI	Yes	22 (6.61)
	No	309 (93.39)
Multiple sexual practice	Yes	33 (9.97)
	No	298 (90.03)
Blood transfusion	Yes	15 (4.53)
	No	316 (95.46)
Sharing of sharp materials	Yes	35 (10.57)
	No	296 (89.43)

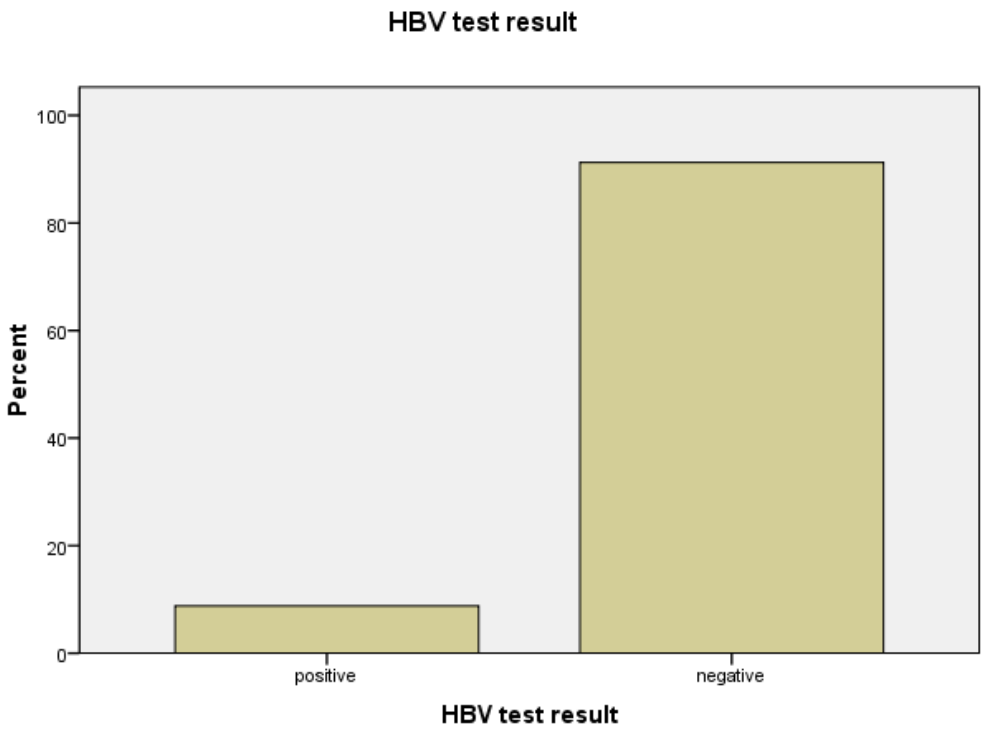

Figure 1. Prevalence of HBV among VCT clients in study population.

underestimated the true prevalence. In this study, HBV DNA was not detected by polymerase chain reaction due to unavailability of resources, as it would allow early diagnosis of HBV infections before surface antigen of

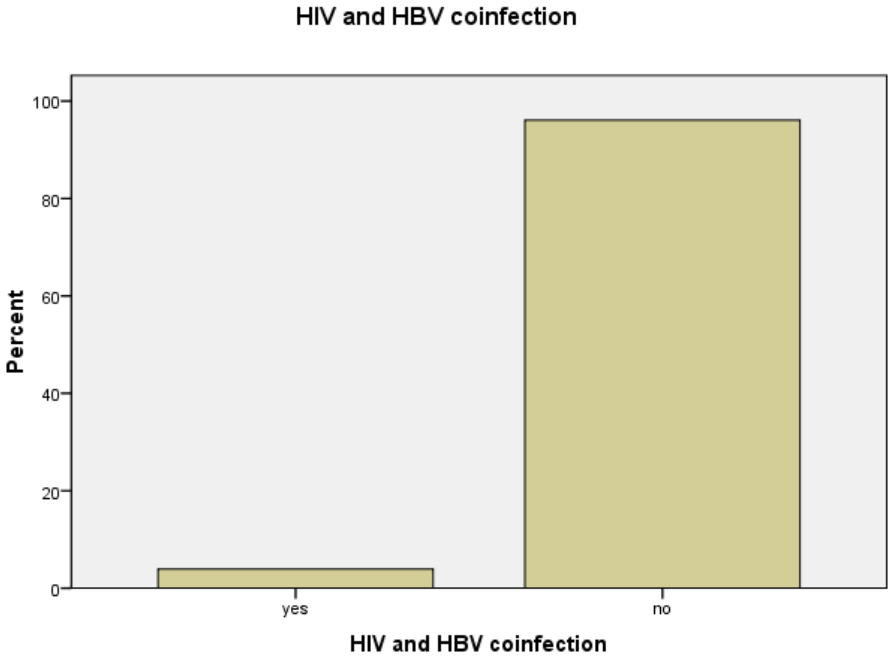

Figure 2. Prevalence of HBV/HIV co-infection among VCT clients in study population.

Table 3. Multivariable logistic regression models predicting HBV infection among VCT visitors in the study population.

Factor	Category	Yes	No	HBV infection	
		N (%)	N (%)	COR (95% CI)	AOR (95% CI)
Invasive procedure	Yes	12	17	11.83 (4.88-28.71)*	10.88 (3.84-30.86)*
	No	17	285	1	1
Surgical procedure	Yes	9	18	7.11 (2.83-17.81)*	9.23 (3.12-7.88)*
	No	20	284	1	1
Multiple sexual character	Yes	12	21	9.44(3.99-22.36)*	10.35 (3.71-28.83)*
	NO	17	281	1	1
Sharing of sharp materials	Yes	6	29	2.45 (0.92-6.52)	3 (0.96-9.57)
	NO	23	273	1	1

*p<0.05.

HBV were detectable in serum. So, prevalence may be underestimated.

CONCLUSIONS AND RECOMMENDATIONS

A high proportion of HBsAg and HBV/HIV co-infection was found in the study area. A previous history of surgical procedure, invasive procedure and multiple sexual partners was identified as independent predictor of HBV infection. This indicates the importance of strengthening preventive measures including vaccination to risky population and IEC to the general population about transmission of HBV. In addition, routine HBV screening program at VCT centers should be integrated, particularly for clients found positive of HIV antibody. So,

HBV carriers could be identified early and managed appropriately.

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CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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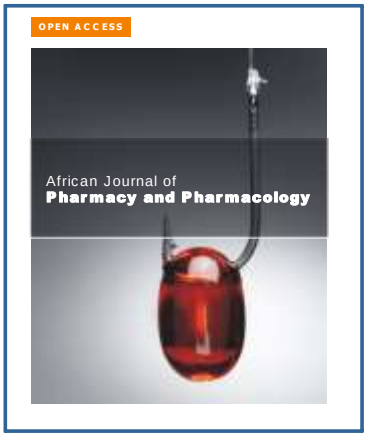

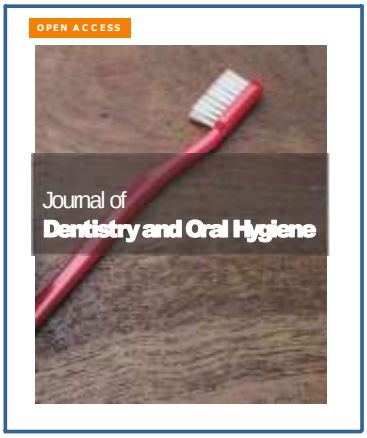

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