Prevalence of Alcohol use during pregnancy and its association with partner alcohol use in East Africa: systematic review and meta-analysis

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Abstract

Introduction: maternal alcohol beverages consumption (any amount) during pregnancy can result in multiple major health and social problems both for the mother and fetus; including miscarriage, stillbirth, low birth weight, and prematurity. At the regional and national level, alcohol use prevalence data is a use full indicator for maternal and child health.

Methods: the researchers were searched for studies using a computerized search engine, main electronic databases, and other applicable sources. Observational studies (case-control, cross-sectional and cohort) which assess the prevalence of alcohol use and associated factors among pregnant mothers in East Africa were eligible. Data was extracted thoroughly by two authors independently and screened for eligibility. The Pooled prevalence of alcohol use during pregnancy and its association with partner alcohol use was determined by using Epi data version 14 statistical software.

Results: the study included eighteen studies with the total sample size of 41,022 and The overall pooled prevalence of alcohol use during pregnancy from the random effects method was found to be 18.85% (95% CI; 11.26, 26.44)**.** The overall weighted odds ration revealed that pregnant women partners' alcohol use did not have a significant association with study subjects alcohol use during pregnancy; i.e. OR=**0.32** (**95% CI: -0.39, 1.03**).

Conclusions: The overall alcohol use (any amount) during pregnancy is higher in magnitude and pregnant mothers who had alcohol user partner had no association with their use of alcohol beverages. The prevalence of alcohol use during pregnancy may be underestimated in the current study due to social desirability bias. Since related study articles were found only in four East African countries, the region may be under-represented due to the limited number of studies included.

1. **Introduction**

Alcohol is the most commonly used teratogen and harmful substance that can cause a problem for pregnancy and places the mother at hazard but also unfavorable effects on the growing fetus which can permanent (1). According to the world health organization, there is no safe amount of alcohol, time of gestation and type of alcohol during pregnancy. Pregnant women never drink alcohol alone; when the mother drinks so does the fetus. The bad news here is the fetus cannot metabolize alcohol(2).

Perinatal alcohol use disorder can result in major organ birth flaws, neurodevelopmental disorders, Fetal alcohol syndromes and damage to multiple structures in the brain. Excessive alcohol consumption during pregnancy can result in lasting disabilities and numerous health and social problems for both mother and child, including miscarriage, the death of a fetus, low birth weight, and prematurity(3).The effect of excessive alcohol drinking on behavior, health, and society is a major public health problem globally (4). Furthermore, cognitive deficits have also been manifested in language, motor development, concentration, memory, and judgment. In addition, heart, muscle, kidney, vision, and hearing deficits have been substantiated the effect of alcohol use during pregnancy(5).

The disorderly drinking of alcohol in the first weeks of gestation may be associated with cases of spontaneous abortion, and its consumption between the third and eighth weeks of gestation might increase the risk of bodily malformations in the fetus (Fetal Alcohol Syndrome); which affects 33% of children born from mothers who consume more than 150 gram of alcohol per day. Moreover, children of women who drink alcohol moderately may present agitation, suction deficiency during feeding, irritability, sweating and abnormal sleep patterns, characterizing a condition of abstinence syndrome(6).

The prevalence of alcohol use (any amount) during pregnancy found to be higher in Africa countries including East Africa. From a compilation of the studies identified in Africa, the prevalence of alcohol use during pregnancy ranges from 2.5% to 37.9% (7-18). Different determinant factors are identified for maternal alcohol drinking and use disorder during pregnancy. Of them the mostly reported   predictors are previous pregnancy obstetric complication, prior

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alcohol use, maternal mental health problem, partner alcohol use, making local brews, unplanned pregnancy and mothers educational level were frequently reported (7, 10, 12, 15, 16, 19-23). Local and standard Alcoholic beverages are rampant in East Africa and individuals drink them irrespective of gender and pregnancy status (2, 24-28). East African administrations are drafting different strategies currently to promote maternal and child health by giving special emphasis to pregnant women and the conceived fetus. Therefore the pooled prevalence data of maternal alcohol consumption (any amount) and its association with predictors is needed to evaluate the status of women alcohol use and the factors for their alcohol consumption.

2. Methods

2.1. Identification and study selection

The current study was conducted to quantify the pooled prevalence of alcohol use (any amount) and its association with newborn birth outcome. Articles were reviewed from national and international databases. The following databases were systematically searched: Boolean operator, Cochrane library, PubMed, EMBASE, Google Scholar, libraries and direct google search from conception to last January 2018. The reports will accessed using the following key terms/like Mesh terms; "alcohol use", "alcohol consumption", "alcohol drinking", "pregnancy", "anemia", "preterm birth", "low birth weight", "adverse outcome", and "each east Africa country". The key terms were used individually and in combination through "AND" string. Each east African countries were combined with the above terms to intensively extract articles from the databases. Direct google search and library searching were done to identify grey literature. In addition, after the identification of studies and review articles, their lists of reference were searched to identify more eligible studies. The above database search strategy and terms were presented. This systematic review and meta-analysis used the PRISMA checklist to determine the eligibility of the articles included in the study.

2.2. Eligibility criteria
2.2.1. Inclusion criteria

Study area: only studies done in East Africa countries were included
Study design: All observational studies (cross-sectional, cohort and case controls) that contain Original data; reporting the prevalence among alcohol use among pregnant women were considered.
Language: Literature published in the English language were included.
Population: Studies conducted among pregnant women were considered
Publication condition: Both published and unpublished articles were considered. All published studies and grey literature from January first, from conception to January last, 2018 were

considered for the review. Duplicate studies: here, the most comprehensive and/or recent study with the largest sample size was chosen during the abstraction.

2.2.2. Exclusion criteria

The following studies were excluded from the review:
Studies which did not report the main outcome of the study were excluded. In addition, articles, which were not fully accessible after at least two-email contact with the corresponding author was excluded; because, in fact, it affects the quality of data in the absence of full text.

2.3. Data abstraction

Five reviewers (AD, YE, WS, YA, and KD) were screened the searched articles against the inclusion criteria through independent reading of the titles and abstracts, which were searched and accessed broadly. The full texts of these articles were accessed, and independent assessment was carried out by two reviewers; i.e. AD and YE, for eligibility based on the predetermined inclusion and exclusion criteria. Discrepancies between the reviewers were resolved through discussion and common consensus of all investigators. Multiple publications of the same study data from the included papers were extracted by YA; WS and KD independently. Assessment of the study quality was performed by four reviewers (AD, YE, YA, WS, and KD) independently and discrepancies between the evaluators were summarized with consensus. In the grading of the quality of studies, the reviewers were guided by the Newcastle– Ottawa Scale(29).

2.4. Outcome measurement

This systematic review and meta-analysis have two main outcomes. The primary outcome was to determine the weighted prevalence of alcohol use during pregnancy. The second outcome of the study was the association of partner alcohol use with pregnant women alcohol use. The prevalence was calculated by dividing the number of participants engaged alcohol use to the total number of participants who have been included in the study (sample size) multiplied by 100. Regarding the predictor variable, we calculated the odds ratio from the primary studies using their reported odds ratio and its confidence interval.

2.5. Quality assessment

The abilities of each of the finding reports in the systematic review were assessed by using a checklist adjusted from the Joanna Briggs Institute (JBI) Critical Appraisal for Study Papers(30).

To assess the quality of studies, the researchers used the tool Newcastle-Ottawa Scale adapted for cross-sectional studies quality assessment. The tool has indicators consisting of three main sections; the first section has five stars and assesses the methodological quality of each study. The second section of the tool evaluates the comparability of the studies. The last part of the tool measures the quality of the original articles with respect to their statistical analysis(29) . Using the tool as a protocol, the two authors independently evaluated the qualities of the original articles. The quality of the studies was evaluated by using these indicators; those with medium (fulfilling

50% of quality assessment criteria) and high quality (6 out of 10 scales) were included for analysis. By taking the mean score of the two researchers, disagreements of their assessment results were resolved (see table 1).

2.6. Statistical analysis

Data were extracted from each appropriate article using a Microsoft Excel spreadsheet software and imported into STATA Version 14 software for analysis. Stata version 14 was used to calculate the pooled effect size with 95% confidence intervals of alcohol use. Statistical heterogeneity between the studies and publication bias were performed with appropriate test statistics. A weighted inverse variance random-effects model was used to estimate the pooled prevalence of alcohol use during pregnancy in the current meta-analysis. The included eighteen studies outcome were evaluated for heterogeneity and publication bias. Heterogeneity across the studies was assessed using I^2 statistic were 25, 50 and 75% representing low, moderate and high heterogeneity respectively(31).A Funnel plot and Egger's regression test were used to check publication bias(15). Consequently, the analysis showed a substantial heterogeneity of egger test (p < 0.001) and I^2 statistics (I^2 = 99.5%). The funnel plot for publication bias also showed no symmetry verifying the presence of bias. Forest plot was also used to show the pooled prevalence of alcohol use during pregnancy. In addition, to minimize the random variations between the point-estimates of the primary study, subgroup analysis was done based on the country, study design and sample size.

3. Results

3.2. Search Results

All studies were done in East Africa countries and published in an indexed journal and grey literature from direct google search and libraries searching were eligible for this study. A total of eighteen studies were included and fifteen of them were cross-sectional studies, one cohort and the remaining two were case-control studies. The advanced search by using PUBMED/EMBASE Database 29,749 articles, direct google search 12,963 articles, and library two articles have resulted. After immense efforts of reviewing the accessed articles, eighteen eligible research articles were included for the quantitative meta-analysis with a total sample size of 40,722 pregnant mothers who consume alcohol during pregnancy (see Fig. 1).
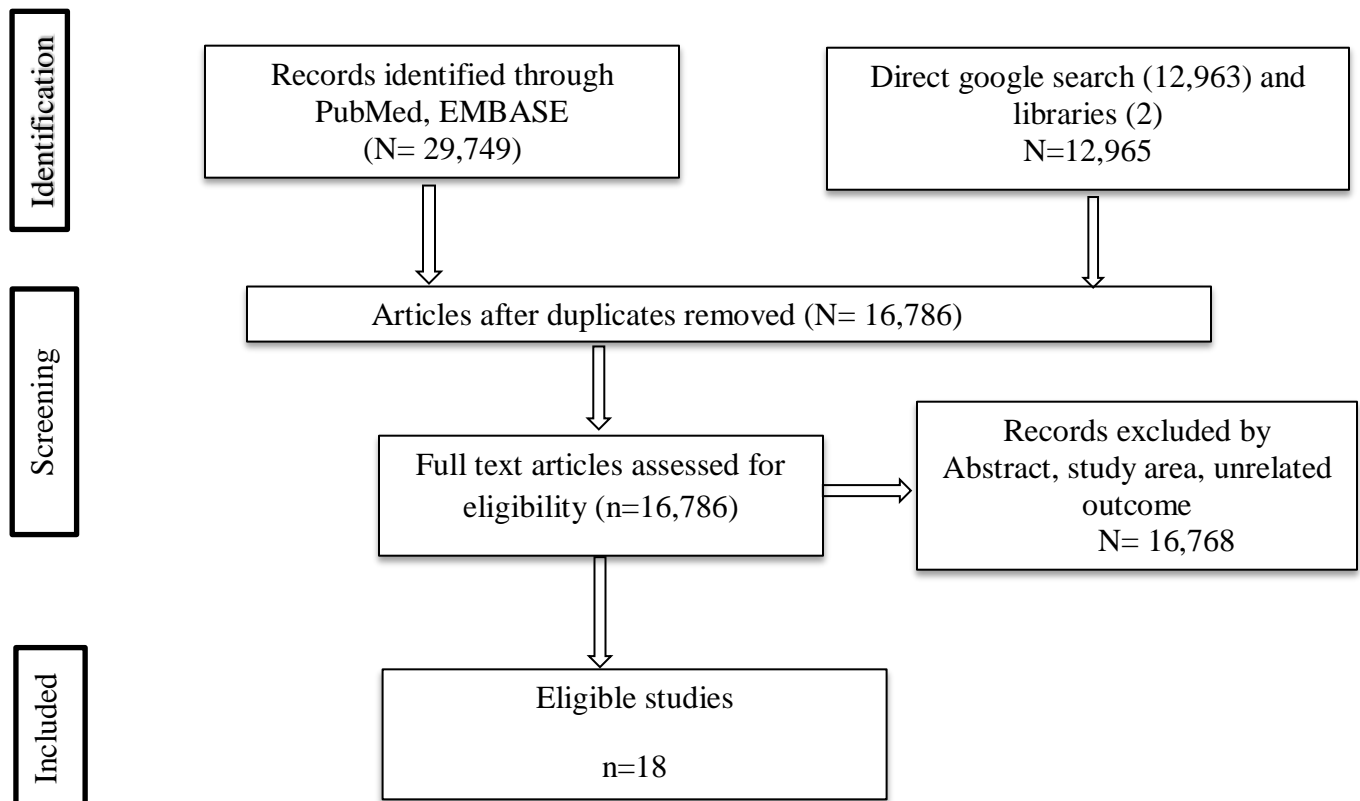
Identification
- Records identified through PubMed, EMBASE (N= 29,749)
- Direct google search (12,963) and libraries (2) N=12,965

Screening
- Articles after duplicates removed (N= 16,786)
- Full text articles assessed for eligibility (n=16,786)
- Records excluded by Abstract, study area, unrelated outcome N= 16,768

Included
- Eligible studies n=18

Fig. 1: Selection Process for the Studies Included in the Systematic Review and Meta-Analysis in East Africa, 2019.

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Information about authors, publication year, population, study area, study design, outcome and main results from the selected articles were extracted and summarized on the table. The overall response rate was between nighty four percent (94%) to a hundred percent (100%).

The current study was conducted by compiling studies done in different east African countries; Ethiopia (10, 11, 17, 19-22, 32, 33), Uganda(7, 16), Tanzania(12, 14, 15), and Kenya(13, 18). Fifteen cross-sectional studies and two case-control and one cohort study articles were used for the final analysis. The sample size of the studies ranging from 136 to 34,090 pregnant women.

Table 1: Descriptive summary of 18 studies included in the meta-analysis of the prevalence of alcohol use during pregnancy in East Africa, 2019.

Author	Publication Year	Country	Total Samples	Response Rate (%)	Prevalence (95% CI)	Quality score (10 pt.)
Isaksen et al.(12)	2015	Tanzania	34090	100	34.1(33.6,34.6)	8
Popova et al.(7)	2016	Uganda	505	100	16(12.8,19.2)	7
Anteab et al.(22)	2014	Ethiopia	810	100	34(30.74, 37.26)	7
Namagembe et al.(16)	2010	Uganda	618	98.7	25(21.56,28.44)	7
Mpelo et al.(15)	2018	Tanzania	365	100	15.1(11.43,18.77)	6
Tesso et al.(10)	2017	Ethiopia	296	99	37.9(32.37,43.43)	6
Abate et al.(19)	2018	Ethiopia	685	100	16.1(13.35,18.85)	7
Obse et al.(17)	2013	Ethiopia	296	98.9	37.9(32.35,43.45)	6
Demelash et al.(33)	2015	Ethiopia	136	94.9	24.8(17.35,32.25)	6
Hanlon et al.(11)	2009	Ethiopia	515	100	3.3(.76,4.84)	7
Mosha and Philemon(14)	2010	Tanzania	157	100	2.5(0.06,494)	6
Namagembe et al.(16)	2010	Uganda	618	98.7	30(26.36,33.64)	7
Aboye et al.(20)	2018	Ethiopia	308	100	16.2(12.09,20.31)	6
Wagura et al.(18)	2018	Kenya	322	100	6.5(3.41,9.19)	6
Demelash et al.(33)	2015	Ethiopia	408	94	18.8(14.86,22.76)	7
Asmare et al.(32)	2018	Ethiopia	453	94.7	11.4(8.16,14.64)	7
Ahmed et al.(21)	2018	Ethiopia	286	97.6	7.2(4.17,10.23)	6
Makayoto et al.(13)	2013	Kenya	300	100	3.7(1.56,5.84)	6

3.2. The pooled prevalence of alcohol use during pregnancy

In the current systematic review and meta-analysis, the pooled prevalence estimates of maternal alcohol use during pregnancy were showed by forest plot (Fig. 2). In the random effect model, weight for every study was given based on individual study effect size and sample size. In this case, the weight given for each included studies is presented in figure 3. In this review, the prevalence of each study ranged from 2.5 % to 37.9% with substantial heterogeneity across studies (I^2 = 99.5%). The overall pooled prevalence of alcohol use during pregnancy from the random effects model was found to be 18.85% (95% CI; 11.26, 26.44).
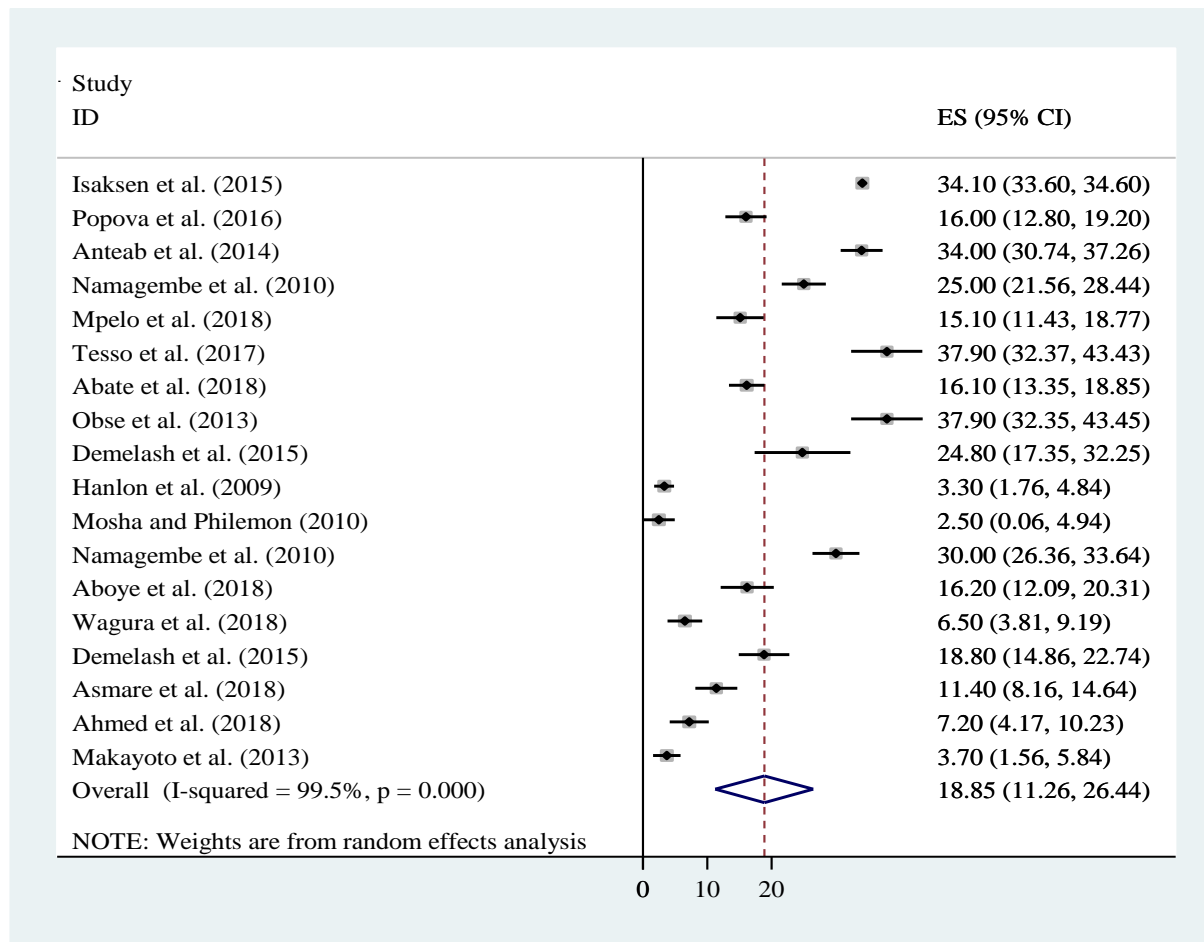
Figure 2: Forest plot of the overall pooled prevalence *of prenatal alcohol exposure as measured by maternal self-reports in East Africa, 2019*

On eyeball test, the funnel plot was found to be asymmetric and Egger's test of the intercept (B_o) was found to be significant at a p-value of 0.00 which confirms that there is a publication bias within articles which needs subgroup analysis by different characteristics of the included journals.
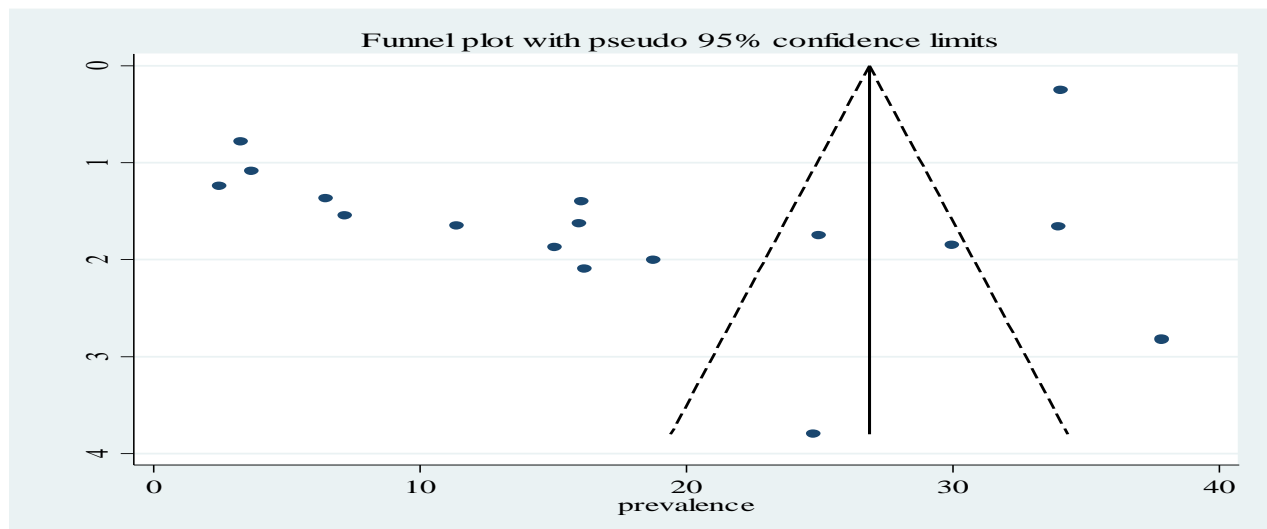

Fig.3: Funnel plot of the prevalence of prenatal alcohol exposure as measured by maternal self-reports in East Africa, 2019

3.3. Subgroup analysis of the research articles

Subgroup analysis was carried out based on the country, study design and number of samples included (see fig). Accordingly, the highest prevalence was reported in Uganda, 23.63 % (95%CI: 15.5, 31.76) followed by Ethiopia, 20.6% (95%CI: 12.76, 28.43). In the current systematic review and meta-analysis, the lowest prevalence was recorded in cross-sectional studies, 21.59% (95%CI: 14.01, 29.18). The single cohort study done in Ethiopia showed a lower magnitude of alcohol use during pregnancy. In addition, the reviewers performed subgroup analysis based on the number of samples included in each the study; the largest magnitude was found in studies done with a sample size of five hundred and above;22.63% (95%CI:10.67, 34.59), (Table 2).

Table 2: Summary of the subgroup analysis of the *prevalence of prenatal alcohol exposure as measured by maternal self-reports in East Africa, 2019*

| Subgroups	Characteristics	Included studies	Sample size	Prevalence(95% CI)
By country	Tanzania	3	34,612	17.3(-5.32,39.83)
	Uganda	3	1,725	23.63 (15.5,31.76)
	Ethiopia	10	4,063	20.6(12.76,28.43)
	Kenya	2	622	4.98 (2.24,7.71)
By design	Cohort	1	515	3.3 (1.76,4.84)
	Cross-sectional	14	39,459	21.59 (14.01,29.18)
	Case control	2	748	15.01(7.76,22.26)
By included sample size	≥ 500	7	37,825	22.63 (10.67, 34.59)
	<500	11	2,897	16.21(10.36,22.06)
Over all		**17**	**41,022**	**18.85%(11.26,26.44)**
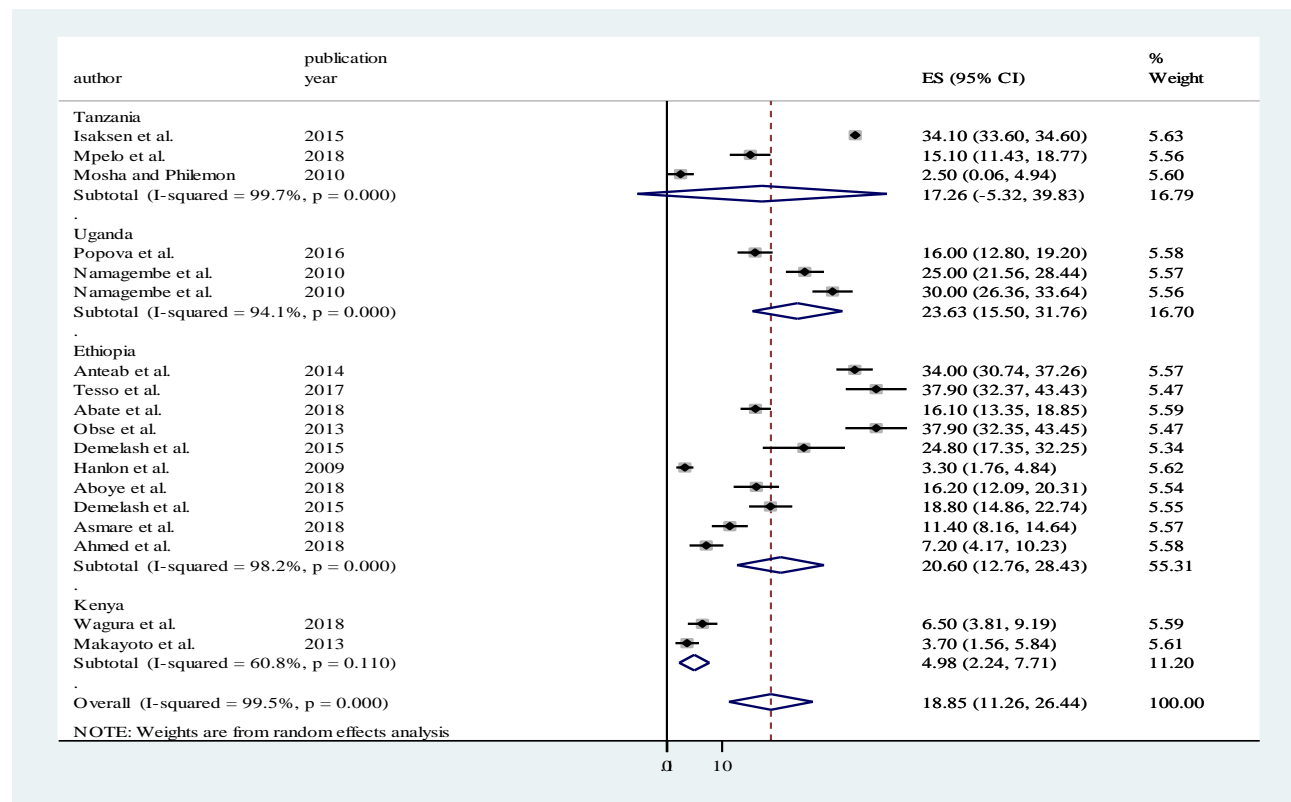
Fig. 3. *The subgroup prevalence of alcohol use during pregnancy by country in East Africa, 2019*
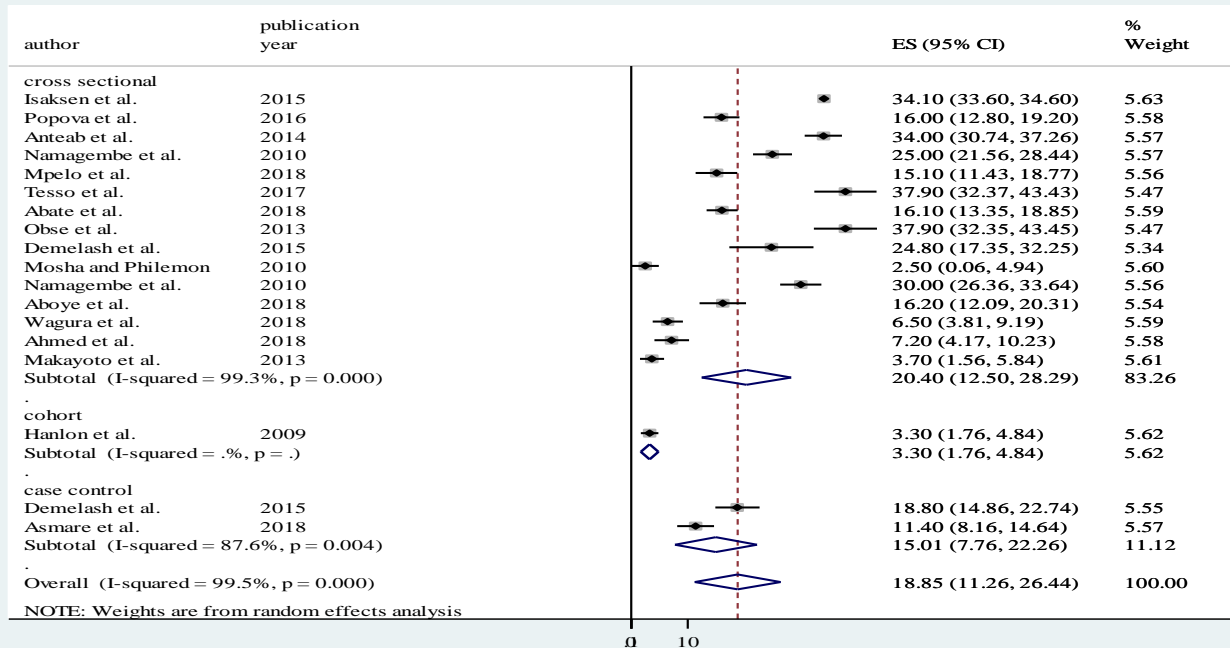
Fig. 4. The subgroup prevalence of alcohol use during pregnancy by study design in East Africa, 2019
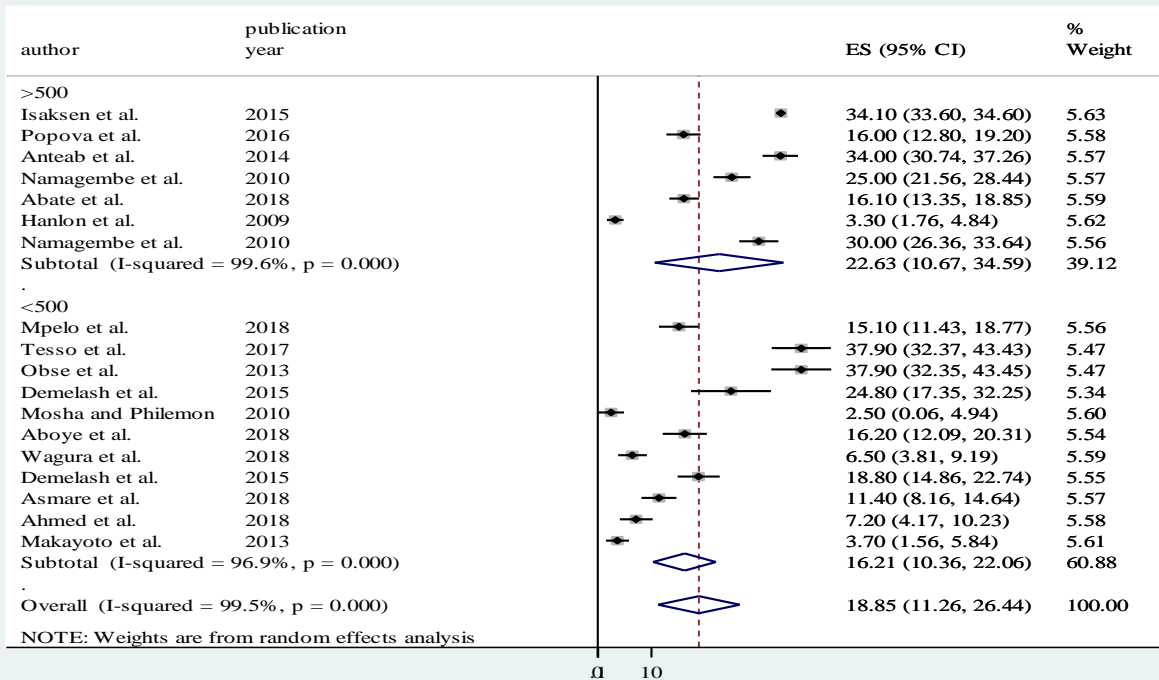

Fig. 5. The subgroup prevalence of alcohol use during pregnancy by sample size included in the study in East Africa, 2019

3.4. Association of partner alcohol use with alcohol use during pregnancy

Is having an alcoholic partner a risk factor for pregnant women alcohol use? In five studies, having an alcoholic partner had no significant association with alcohol use during pregnancy when compared to counterparts (Fig. 7). Five studies (13, 15-17, 22), which assessed the association of partners alcohol use with maternal alcohol use during pregnancy was included to examine the association. Eyeball examination of the funnel plot also showed no variability across the individual studies (fig. 6).
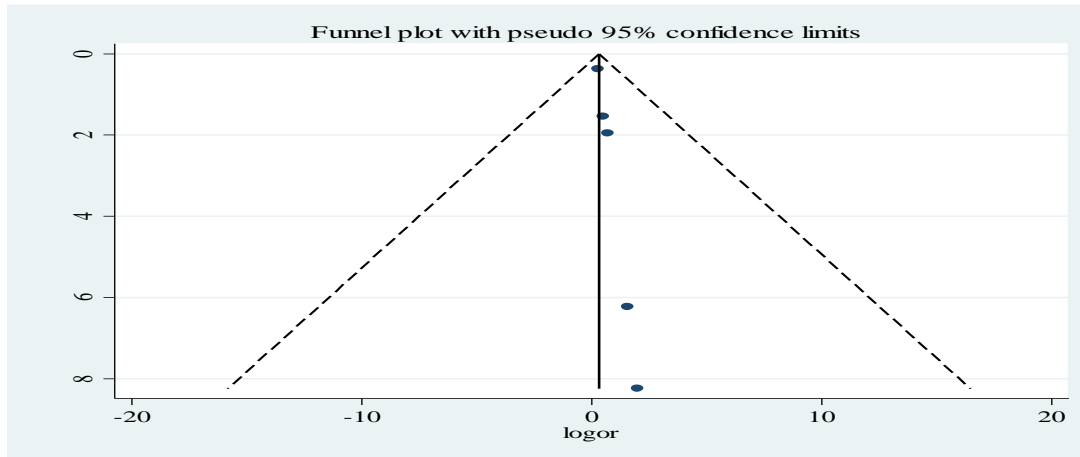

Fig.6: Shows funnel plot of the parent's alcohol use to show the statistical heterogeneity in East Africa, 2019

The pooled odds ratio was **0.32** (**95% CI: -0.39, 1.03**), I^2= 0.0% with a p-value of 0.997); the pooled odds ration showed that there was no significant association between partner alcohol use and mothers' alcohol use during pregnancy (fig.7). Heterogeneity chi-square= 0.15 (d.f. =4), P-value=0.997 tests reveal no publication bias.
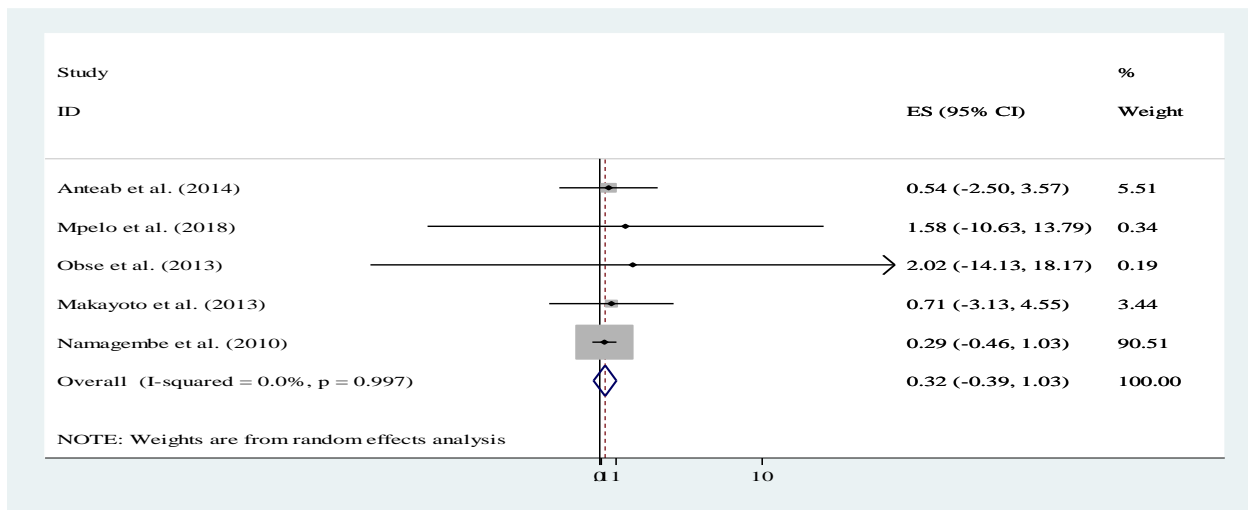

Fig. 7. The pooled odds ratio of alcohol use during pregnancy in East Africa, 2019

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4. Discussions

The results of this study reveal that in east African countries (Ethiopia, Tanzania, Uganda, and Kenya), the weighted prevalence of alcohol use among pregnant women is high; 18.85 %(95%CI= 11.26, 26.44). The prevalence of alcohol use during pregnancy varied within countries. Between-country variations in the prevalence of alcohol use during pregnancy likely originate not only from variation in maternal drinking behaviors but also from political, religious, ideological and cultural differences in East Africa. In East Africa, varying pooled weight of alcohol use have been found; the highest reported prevalence of alcohol use found in Uganda (23.6%); followed by Ethiopia (20.6%), Tanzania (17.3%) and Kenya (5%); which is clearly high rates of alcohol drinking during pregnancy (see fig.3).

Alcohol consumption during pregnancy may be influenced by lack of access to health information regarding the negative outcomes of alcohol consumption during pregnancy. In a study among pregnant women in Uganda, it was reported that 53.5% of respondents were not believed that alcohol consumed during pregnancy affects baby's health and only 5 % of respondents had never attended formal education. Almost 61%(n=233) of pregnant mothers were not informed about the effect of alcohol drinking during pregnancy among Ethiopian women and 26%(n=99) study subjects unable to read and write (16, 19).

Easily availability of alcohol also influences consumption patterns. In many countries of the East African Region, alcohol is widely available due to either weak licensing systems or execution procedures. For instance, pubs and bars working on a 24-hour basis and low-cost alcoholic beverages are commonly retailed without a license; are very common in Ethiopia, Uganda, Kenya, and Tanzania. Policies to regulate alcohol publicizing in almost all African countries are also very fragile(26).

The unsatisfactory rules concerning alcohol affect drinking in general. Integral cultural practices may also vary the prevalence at which alcohol is consumed during pregnancy. For instance, in Africa, there are noticeable variances in the cultural practices witnessed between regions, countries and communities and their beliefs surrounding alcohol consumption in general. (34)

The meta-analyses on the consumption of any amount of alcohol consumed during pregnancy for both Tanzania and Uganda were based on only three studies; and only two studies in Kenya. The actual prevalence value of alcohol use during pregnancy may fluctuate from the true prevalence due to most East Africa countries were not included in the current study (no related articles found) and also limited research articles were found in the included countries.

Yet, our study offers an operational estimate of the prevalence of alcohol use during pregnancy in countries that do not currently have actual data. The current prevalence estimates (meta-analysis or regression estimations) are useful indicators of the communal health problem of alcohol drinking during pregnancy and provide a basis for resource allocation for prevention strategies. The results of this study will optimistically encourage countries to conduct their own studies in order to estimate their own prevalence statistics on alcohol drinking during pregnancy.

5. Conclusions: The overall alcohol use (any amount) during pregnancy is higher in magnitude and pregnant mothers who had alcohol user partner had no association with their use of alcohol beverages.Since related study articles were found only in four East African countries, the region may be under-represented due to the limited number of studies included.

6. Recommendations

Africa is a highly varied continent in socioeconomic status, religion, and ethnicity and all recommendation provided below will not be applicable to all countries. Though, the current study findings highlight that there is a need to educate all pregnant women about the possible harmful effects of alcohol exposure on the growing fetus and to establish screening protocol and provide brief interventions, where appropriate, to all pregnant women at the health service institutions and community level. Additionally, both the availability and the effectiveness of substance use disorder treatment programs for women of reproductive age and the mothers of children with fetal alcohol syndrome should be expanded and strengthened.

7. The strength of the study

Strengths of this study include: - having intensive searching strategy along with demanding inclusion and exclusion criteria, and statistical analyses.

8. Limitation of the study

The self-reported data on alcohol consumption during pregnancy are sensitive to social desirability bias and recall bias. Therefore, the prevalence of alcohol use during pregnancy may be underestimated in the current study. Only English articles were considered to be included in this review. In addition, the majority of the studies included in this review were cross-sectional in nature as a result; the outcome variable might be affected by other confounding variables.

9. Declarations

9.1. Availability of data: Data will be available upon request of the corresponding author.

9.2. Authors' contributions: AD: Conception of the research protocol, study design, literature review, data extraction, data analysis, interpretation and drafting the manuscript. YA, WS, and YE: data extraction, quality assessment, data analysis and reviewing the manuscript. All authors have read and approved the manuscript.

9.3. Ethics approval and consent to participate: Since the review was concerned with the published research articles, there was no need for ethical approval and/or additional consent from participants.

9.4. Funding and Consent for publication: not applicable

9.5. Competing interest: The authors declare that they have no competing interests.

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