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Prevalence and Associated Factors of Pterygium in Africa: Systematic Review and Meta- Analysis, 2024

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Abstract

Background and aim

Pterygium is one of the most prevalent pathologies involving the cornea, which can lead to various vision signs and even reduction in eyesight. No accurate estimate has been reported about the prevalence of pterygium in Africa. Hence, this study aimed to determine the prevalence and determinants of pterygium in Africa by meta-analysis method.

Methods

The report was presented according to the Preferred Reporting Items for Systematic Review and Meta Analyses checklists. Twenty articles were searched using PubMed/MEDLINE, EMBASE, Scopus, Google Scholar, Science Direct, and African Journal Online. Data were extracted using Microsoft Excel and exported to STATA 17 for analysis. The data were analyzed using the random effects model. Heterogeneity of studies was assessed by Cochran's Q test and I^2 statistics. Publication bias was detected by funnel plot and statistical Egger's test.

Result

In 20 studies conducted in Africa, with a sample size of 14,442 people between 2000 and 2024, the pooled prevalence of pterygium was 18% (95% CI 13% -23%) in Africa. In sub-group analysis, the pooled prevalence was higher in studies with publication year from 2020–2024 (22% (95% CI: 14–30, I^2=95.91%, p-value = 0.00)) than from 2015–2019 (22% vs 19%) and from 2000–2012(22% vs 9%). Pooled prevalence were also higher in; sample size < 500 than 500–1000 (22% vs 12%) and > 1000(22% vs 12%), Community based than facility based study design (21% vs 16%). Older age (OR = 4.93; 95% CI; 2.70, 7.15), male gender (OR = 2.04; 95% CI: 1.85, 2.23), use of traditional eye medication (OR = 2.27; 95% CI: 1.68, 2.86), family history (OR = 4.93; 95% CI: 3.13, 6.72), alcohol drinking (OR = 2.24; 95% CI: 1.82, 2.66) and outdoor work (OR = 2.78, 95% CI = 1.81–3.76) were factors associated with pterygium among adults.

Conclusions

The prevalence of pterygium in Africa was high. Older age, family history, use of traditional eye medication, male sex, alcohol drinking and outdoor occupation were significantly associated with pterygium. The higher burden of pterygium across the country calls for efforts to warranting enhanced clinical and public health interventions.

1. Background

Pterygium is commonly known as surfer's eye, is the wing-like development of conjunctiva and limbal tissue over the neighboring cornea. Proliferative clusters of limbal stem cells (LSCs), epithelial metaplasia, active fibro-vascular tissue, inflammation, and disruption of Bowman's layer along the invasive apex of the pterygium are the primary components of pterygium, which is caused by changes in local ocular surface homeostasis[1, 2].

Pterygium is mostly asymptomatic, however it can cause pain, dry eyes, itching, and ocular irritation[3, 4]. Reduced eyesight, uneven astigmatism, and aesthetic concerns are significant problems linked to pterygium [5]. Both visual impairment and severe stigmatization can result from pterygium. Pingueculum, a related non-cancerous disease, frequently occurs before pterygium. Redness, irritation, blurred vision, and ocular pain are its primary clinical manifestations. Asymptomatic is another possibility[6, 7].

Due to fibro-vascular covering of the conjunctiva over the cornea's visual axis, pterygium can cause blindness or vision impairment if treatment is not received and the associated factors linked with it are not prevented or minimized. This results from the induction of opacity and astigmatism[8, 9].

The main risk factor for pterygium is prolonged exposure to the sun's UV rays. Other potential associated factors, however, include smoking, low income, living in an urban or rural area, being older, male, living in a certain latitude, and farming[10–16].

Pterygium prevalence ranges from 1.1–53% worldwide depending on environmental factors [6, 17–19], and it can range from 8.8–38.7% in Ethiopia [14–16, 20]. Due to higher levels of outdoor UV exposure, it is more severe in nations nearer the equator[21].

Many studies done in different areas of the world indicated that exposure to ultraviolet radiation, geographical latitude near to the equator, outdoor activity [22], aging, male gender [23], and dusty environment are possible associated factors of pterygium [15, 18, 24]. Ultraviolet radiation is the major risk factor to pterygium [25] wearing sunglasses with UV protective lens and brimmed hats are recommended[15, 25]. Refractive correction for astigmatisms, artificial tears, non-steroidal anti-inflammatory eye drops, and surgery[26–28]] are the most common management options of pterygium depending on its stage[25]. The indications for pterygium surgery include; unusual occurrence to the cornea (cosmetic issue), if it extends close to the visual axis, when it restricts eye movement, when it causes visual loss from astigmatism, and when a patient reports growth of the pterygium [26].

Studies have been conducted to determine the type and amount of the effect of each causative factor, but estimates vary and sometimes produce contradictory results. Until now, there is no national, population-based study on the prevalence of pterygium in Africa. The objective of the current systematic review and meta-analysis is to provide an accurate estimate of the prevalence of pterygium and to identify its determinants using a combination of all clinical and population-based studies in Africa.

2. Methodology

2.1. Protocol and registration

The PROSPERO website holds the protocol for this systematic review and meta-analysis and is filed under registration number CRD 42024598577. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were adhered in this review [29].

2.2 Search strategy

We conducted the search to identify all papers published between January 2000 and January 2025. We used the following data bases namely:- MEDLINE, EMBASE, Web of Science and Google Scholar. A combination of the following search terms was applied: “incidence” OR “prevalence” OR “morbidity” OR “magnitude” OR “epidemiology”, combined with “pterygium” AND “risk factor OR determinants” “Associated factors” OR “Predictors” AND “ptergium” OR “pterygia” AND “Africa”. Snowball searching of reference lists was also conducted to further identify studies of interest.

2.3. Inclusion and exclusion criteria

The review and analysis were conducted using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) Statement as a guide. Reports potentially eligible for inclusion in this systematic review and meta-analysis had to meet the following criteria: they had to be population-based studies, original, written in English and needed to provide sufficient information to estimate the pooled prevalence of, and associated factors for pterygium. If more than one study was based on the same population sample, the study of the highest quality was included. We excluded studies that were on the duplicate population groups but were of lower quality, whose participants were drawn from a particular occupation or population, and that did not satisfy one or more inclusion criteria.

2.4. Data extraction

To ensure that the papers were properly selected based on their applicability to the research topic and their adherence to the inclusion criteria, three researchers (KS, EKB, and GKG) independently evaluated them. The results, journal title, and author identities were disclosed to the reviewers. If there was a disagreement, it was resolved through consultation with a third party or through talks.

The first author's name, the year of publication, the country and city of the study, the study design, the type of population under study, the region of residence (town or village.

2.5. Quality assessment

We evaluated the research' technique and reporting quality using the Newcastle-Ottawa Scale. The Khambalia and Seen quality assessment standards [30] of literature were used to assess the included studies' quality. Subsequently, these criteria were used to rate and summarize the included literature.

2.6. Statistical analysis

To assess the heterogeneity of the prevalence across studies, the Cochran's Q statistic and I^2 index were calculated [16, 17]. A p-value < 0.05 indicates heterogeneity in the effect size between studies in Q statistic, and I^2 represents the percentage of the total variability due to heterogeneity rather than chance, where a value of 0% indicates no observed heterogeneity and values of 25%, 50% and 75% reflect low, moderate and high heterogeneity, respectively. Due to the high heterogeneity across studies (I^2 >75%), the overall prevalence was pooled based on the random-effect (DerSimonian and Laird method) meta-analysis [16]. Forest plots were also generated to illustrate the prevalence with corresponding 95% Confidence Intervals (CIs) for each study and the overall random-effects pooled estimate [31, 32]. The data were analyzed using Stata (Version 17, Stata Corp.), and a 95% confidence level was applied to the random effects model.

A subgroup analysis was carried out according to the conditions of the study. 95% CIs and pooled OR were calculated. To show the number of publications, author names, and individual and pooled ORs with 95% CIs, a forest plot was made. Publication bias was assessed by visually inspecting a funnel plot. A p value less than 0.05 were considered statistically significant[31, 32].

3. RESULT

3.1. Study selection

Figure 1 illustrates the study selection process. The initial search identified a total of 517 potentially relevant articles published between January 2000 and January 2025. After removal of duplicates, and title and abstract screening, 31 full-text articles were assessed for eligibility. Finally, 20 articles that met the inclusion criteria were included in the final analysis.

3.2. Overview of Included studies

In this systematic review and meta-analysis study, 20 studies were included in eight different African countries [14, 15, 20, 33–48]. All the studies report prevalence of pterygium except one study which was conducted only determinants of pterygim[49]

. The included studies, published up to January, 2024, had a total sample size of 14, 398 participants, with individual study sizes ranging from 73 to 3,229 participants.

Among studies, 8 studies[33, 41–45, 47, 48, 50] were conducted in Nigeria with the sample size of 4823 people between 2007 and 2024, 4 studies[14–16, 20] in Ethopia and 2 studies [34, 35]conducted in Uganda. All the included articles were published in peer-reviewed journals. Regarding the study design, eleven studies [34, 36, 41–48] utilized facility-based cross-sectional study design and 9 studies [14–16, 20, 35, 40, 44, 49, 51] used case control study design. The prevalence of pterygium was ranged from 0.9 to 41% (Table 1).

Table 1
Characteristics of the studies, study participants and prevalence of pterygium in individual studies included in the systematic review (n = 20)

Author, publication years	Country	Study settings	Study design	Sampling technique	Participants	Sample size	prevalence of pterygium	Quality score
Kumah et al. 2017[39]	Ghana	Institutional based	cross-sectional	Census	Adults	150	41.33%	7
Gichuhi et al. 2015[46]	Kenya	Institutional based	prospective	Census	Adults	100	36.00%	8 7
André Omgbwa Eballé., et al 2018[36]	Cameroon	Institutional based	cross-sectional	Census	Adults	1640	3.60%	8 8
Atukunda et al. 2019[34]	Uganda	Institutional based	cross-sectional	Simple random sampling	Adults	343	8%	8 8
Umar, et al.2024[45]	Nigeria	Institutional based	Prospective	Census	Adults	73	37%	8 8
Umar Fh et al. 2022[44]	Nigeria	Institutional based	Prospective	Census	Adults	531	0.9%	8
Eziechila et al 2017	Nigeria	Institutional based	cross-sectional	stratified random sampling	Adults	428	21.8%	8
Onyiaorah et al 2022[42]	Nigeria	Institutional based	cross-sectional	Systematic random sampling	Adults	382	8%	8
Ukponmwan et al 2007[43]	Nigeria	Institutional based	cross-sectional	Census	Adults	144	8%	8
Ndukuba 2022[41]	Nigeria	Institutional based	cross-sectional	Simple random sampling	Adults	100	15.79%	8
Fsasi et al.2015[37]	Nigeria	Institutional based	Retrospective	Census	Adults	2760	3.6%	8
Kassie Alemayehu et al. 2020[16]	Ethiopia	Community based	cross-sectional	Systematic random sampling	Adults	605	18.5%	8
Anbesse et al. 2017[14]	Ethiopia	Community based	cross-sectional	Multistage systematic random sampling	Adults	370	38.7%	8
Fekadu et al. 2020[15]	Ethiopia	Community based	cross-sectional	systematic random sampling	Adults	400	31.8%	8
Messeret et al. 2008[20]	Ethiopia	Community based	cross-sectional	simple random sampling	Adults	922	8.8%	6
Mc carty et al 2000[40]	Australia	Community based	cross-sectional	Stratified sampling design.	Adults	3229	1.20%	7

Author, publication years	Country	Study settings	Study design	Sampling technique	Participants	Sample size	prevalence of pterygium	Quality score
Tesfai et al 2021[51]	Eritrea	Community based	cross-sectional	Census	Adults	516	40%	8
Denis et al 2020[35]	Uganda	Community based	cross-sectional	multistage stratified	Adults	1150	13.6	9
Anguria et al 2012[33]	South Africa	Facility based	cross-sectional	Census	Adults	405	18%	9
Monsudi et al 2015 [48]	Nigeria	Facility based	Retrospective	Census	Adults	2760	4%	8
Eziechila et al 2017 [47]	Nigeria	Facility based	cross-sectional	Simple random sampling.	Adults	428	4%	8
Anguria. 2015[49]	Rural Africa	Community based	Case -control		Adults	150	-	9

3.3. Pooled prevalence of pterygium in Africa

In this study, the pooled prevalence of pterygium in Africa is estimated to be 18% (95% CI: 12.9 – 22.8, I^2=97.8%, p-value = 0.000). An I^2 statistic of 97.8% suggests the presence of heterogeneity among the included studies. Due to this heterogeneity, a random-effects model was used to determine the pooled prevalence of pterygium (Fig. 2).

3.4. Subgroup analysis

The subgroup analysis revealed that studies done from year 2020–2024[15, 35, 38, 41, 42, 44, 45, 51] showed the highest pooled prevalence of pterygium in Africa, which is 22% (95% CI: 14–30, I^2=95.91%, p-value = 0.00) (Fig. 3). The subgroup analysis based on sample size revealed that the highest pooled prevalence of pterygium was sample size < 500 studies is 22% (95% CI: -14-31, I^2=97.84%, p-value = 0.00) (Fig. 4). The other subgroup analysis based on study setting showed that the highest pooled prevalence of pterygium was from 8 studies conducted at community based, which is 21% (95% CI: 11–31, I^2=98.15%, p-value = 0.00) (Fig. 5).

3.5. Sensitivity analysis

Sensitivity analysis was also performed to check the effect of each study on the pooled prevalence.

3.6. Publication bias

Publication bias was detected by the visual inspection of the funnel plot and statistical Egger's test. Visual inspection of the funnel plot showed publication bias among the included studies, as illustrated by the asymmetrical distribution of the funnel plot (Fig. 6). For illustration, we perform the traditional version of the Egger regression-based test and got a p-value is 0.00, which is less than 0.05 from Egger's test indicated notable publication bias, implying that studies with larger effects (either positive or negative) are more likely to be published (Table 2).

Table 2
Egger test among the included studies in Africa (n = 19)

_meta_es	Coefficient	Std. err.	t	P>|t|	[95% conf. interval]
Prevalence of pterygium	1	.0361618	27.65	0.000	.9237053 1.076295
_cons	0	.0046535	0.00	1.000	− .0098181 .0098181
Test of residual homogeneity: Q_res = chi2(17) = 0.00 Prob > Q_res = 1.0000					

Factors associated with pterygium

Based on this meta-analysis, pterygium was associated with age ≥ 40 years, family history, use of traditional eye medication, male sex, alcohol drinking and outdoor occupation From 20 included studies in Africa.

Socio-demographic factors associated with pterygium

To investigate the association between age and associated factors of pterygium, four studies [14, 34, 35, 40] were taken into consideration. The results of the review indicated that patients whose age is above 40 years were 4.93 times more likely to develop pterygium than their counter parts (OR 4.93, 95% CI: 2.70–7.15, p = 0.00) (Fig. 7). Another socio-demographic factors associated with pterygium are male gender [14, 15, 20, 40] (OR 2.04, 95% CI: 1.85–2.23, p = 0.00) (Fig. 8) and family history[14, 35, 49] (OR 4.93, 95% CI: 3.13–6.72, p = 0.00) (Fig. 9).

Association between outdoor work and pterygium

Three studies [14, 15, 38]were considered in order to examine the relationship between outdoor work and pterygium. According to the study's findings, The odds of developing pterygium among study participants with an outdoor working environment were 2.78 times more likely as compared to those with an indoor working environment (AOR = 2.78(95% CI: 1.81, 3.76)) (Fig. 10).

Alcohol drinking associated with occurrence of pterygium

Two studies [35, 38] were considered in order to evaluate the association between alcohol drinking and prevalence of pterygium. Alcohol drinking had a positive association with pterygium and those participants who had history of drinking alcohol were 2.24 times more likely to develop pterygium as compared to non-drinkers (AOR = 2.24 (95% CI: 1.82, 2.66)) (Fig. 11).

Association between use of traditional eye medication and prevalence of pterygium

In this meta-analysis, there were two studies [14, 49] considered to see the association use of traditional eye medication and occurrence of pterygium. The use of traditional eye medication is 2.27 times more likely to develop pterygium than non-user (AOR = 2.27 (95%CI: 1.68, 2.86)) (Fig. 12).

Discussion

Pterygium prevalence varied greatly between studies. It would be instructive to aggregate the results of several investigations in a straightforward meta-analysis. To the best of our knowledge, this is the first meta-analysis of pterygium prevalence and associated factors in Africa. A total of 20 studies with 14442 samples between 2000 and 2024 were included in this meta-analysis.

In this meta-analysis the pooled prevalence of pterygium was 18% (95% CI 13–23%) in Africa. According to the subgroup analysis based on publication years, prevalence of pterygium was 22% (95% CI 14–30) publication years from 2020–2024, 22% (95% CI 14–31) for studies with sample size of < 500, and 21% (95% CI 11–31) in community based studies.

The finding of this meta-analysis is higher than from another meta-analysis studies done in the world (12%)[19], Iran (12%) [52] and China (9.84%)[24]. Given that the prevalence of pterygium differed among ethnic groups, this variation may be the result of differences in the target population and ethnicity [12, 53, 54]. Another reason might be difference in geographic location, climate change, altitudinal variance, lifestyle, publication years and other environmental factors could all be contributing factors to this disparity. The majority of the aforementioned research was conducted on persons aged 40 and up.

Age was identified as a significant risk factor for pterygium in the current meta-analyses; numerous other research have already demonstrated this [6, 19, 24, 52]. This might be related to increasing vulnerability of ultraviolet radiation in older people, As age increases the exposure to predictors such as ultraviolet light, outdoor working habit, dust particles will increase the precipitation of pterygium [55]

In this meta-analysis, male gender is significantly associated with prevalence of pterygium. This finding is supported by studies done in the world and china [6, 19, 24]. This might be explained by the male population is more likely to be afflicted by pterygium since they were exposed to dust particles and UV rays while working outside.

Among socio-demographic factors, family history is positively associated with occurrence of pterygium. This is supported by research done in Nigeria and Ethiopia [14, 35, 49]. This might be due to that pterygium is hereditary and hared environment of the affected individuals and their family.

The present meta-analysis found that there is a positive association between outdoor working environment and pterygium. This finding is supported by previous meta-analysis done in the world[6, 19] and China[24]. This might be explained by at an outdoor environment, high light reflectivity, including from sand and water cause damage to limbal stem cells by ultraviolet light and by activation of matrix metalloproteinase and leads to pterygium.

Alcohol consumption was another lifestyle-related risk factor in the development of pterygium revealed in our study. According to our findings, the risk of pterygium was 2.24 times higher in consumers of alcohol than non-consumers. This finding is supported by similar meta-analysis done in the world[19]. Therefore, to address these challenges and provide stronger evidence thorough meta-analyses, it is necessary to conduct cohort studies as well as dose-response studies on alcohol.

The utilization of traditional eye medication was also one of the positive predictors of pterygium in this present Meta-analysis. This finding is supported by studies conducted in Ethiopia[14] and South Africa[19].

Strength and Limitations

We estimated the pooled prevalence data using meta-analysis, rather than the prevalence in a single national population-based study. As a strong point, the authors used some of the important major databases to search for original articles. However, this systematic review and meta-analysis is not free from limitations. Firstly, it solely considered articles published in English, potentially excluded relevant studies in other languages which could provide unique insights into pterygium in Africa. Moreover, most studies included were cross-sectional, limiting the ability to assess causality or observe longitudinal trends. Substantial statistically significant heterogeneity was observed across studies which undermine the pooled estimate of pterygium suggests that chance could be responsible for between study variability.

Conclusion

This systematic review and meta-analysis showed that the pooled prevalence of pterygium among adults living in Africa remains significant. Older age, male gender, use of traditional eye medication, alcohol consumption, family history of pterygium and outdoor working environment were all associated with higher risk of pterygium. Future research is still needed in Africa to explore the variations of pterygium burden in groups with specific individual behaviours and it is necessary to conduct cohort studies as well as dose-response studies on alcohol. The higher burden of pterygium across the country calls for efforts to advocate public health education encouraging people to take appropriate protective measures, such as wearing sunglasses or hats in outdoor environments.

Declarations

'Human Ethics and Consent to Participate declarations: not applicable'.

Competing interests

Regarding the research, writing, and/or publication of this article, the author(s) have stated that they have no potential conflicts of interest.

Availability Data and materials:-all the data are available inside the manuscript.

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Contribution to authorship

KS took part in designing the study, conducted title and abstract screening, took part in the full review of articles, extracted and analyzed the data and wrote the initial and final draft of the paper. **YAW, GKG, FDA, SSL, MD, DTR, YGA, TY and EKB** contributed to analysis and writing of the paper. GKG and EKB independently screened titles and abstracts, reviewed the summary table and contributed to the final draft of the paper. **KS** conceived the idea and took part in designing the study, oversaw its conduct and analysis and contributed to the initial and final drafts of the paper.

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Figures

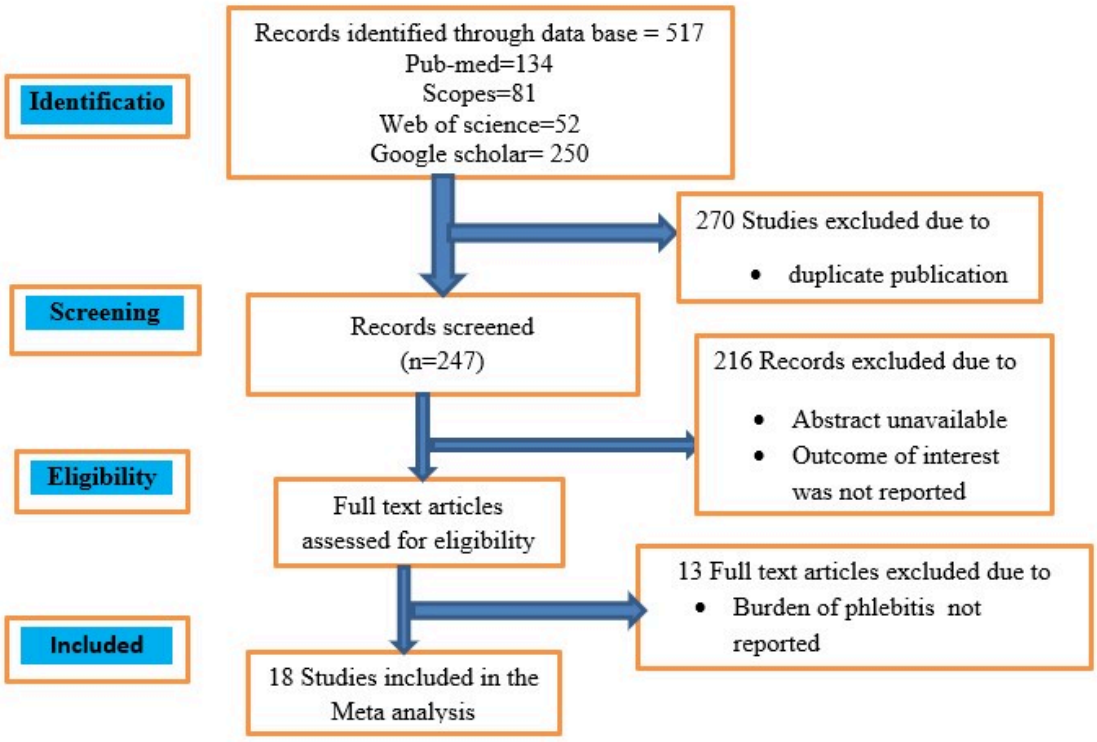


Figure 1

PRISMA Flow diagram

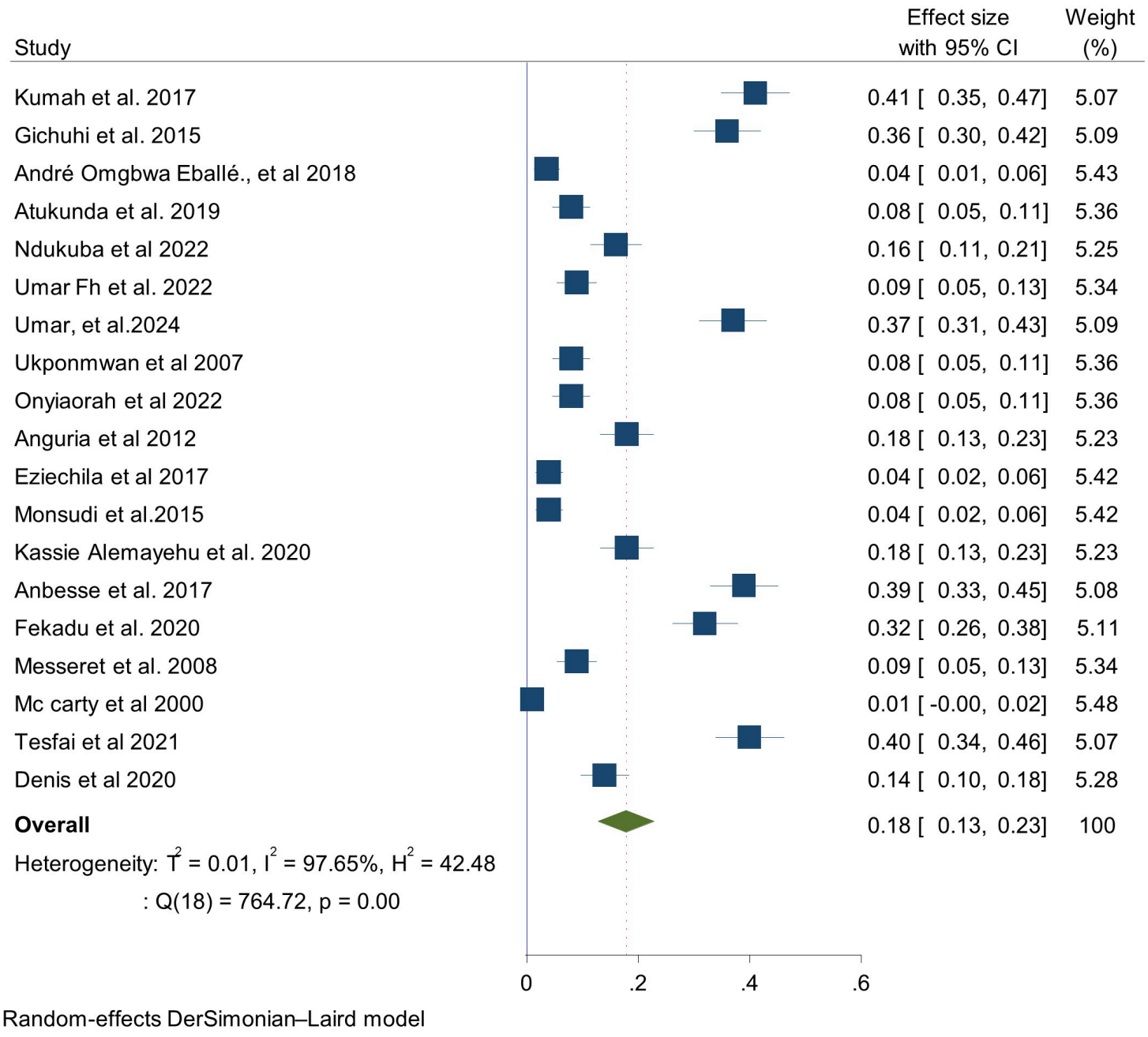


Figure 2

Forest plot for the pooled prevalence of pterygium in Africa (n=19)

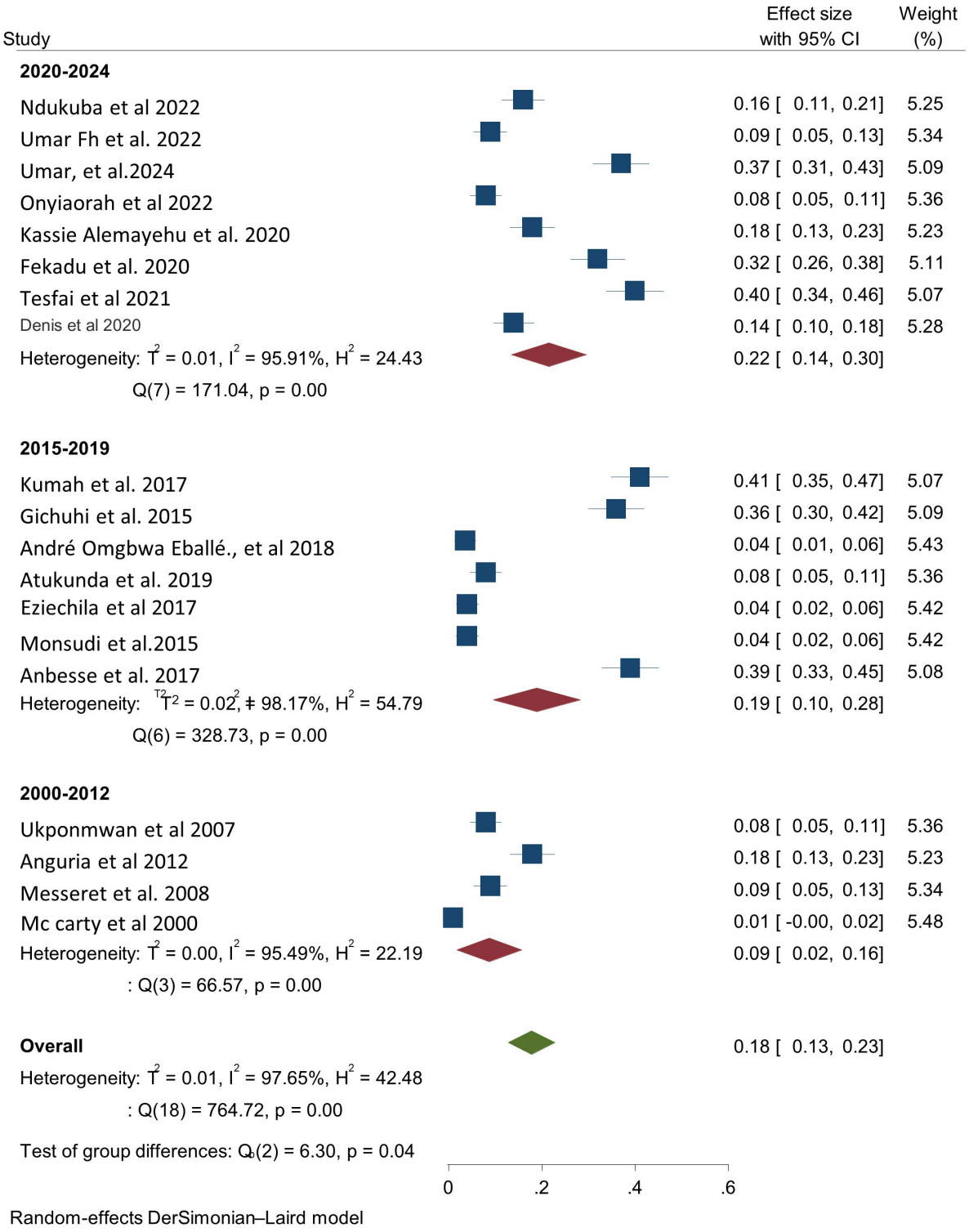


Figure 3

A subgroup analysis of the forest plot showing the pooled prevalence of pterygium in Africa based on year of publication (n=19)

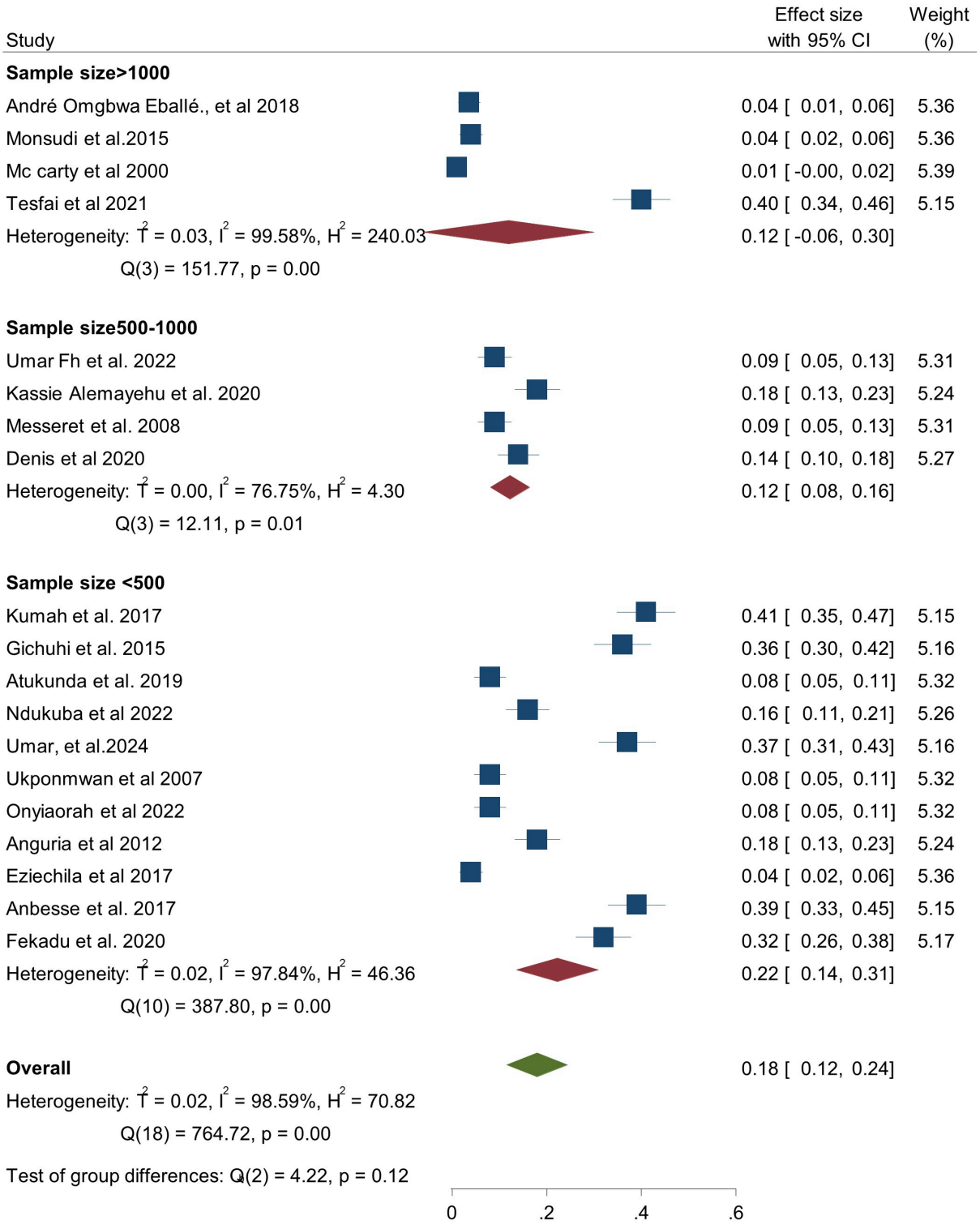


Figure 4

A subgroup analysis of the forest plot showing the pooled prevalence of pterygium in Africa based on sample size (n=19)

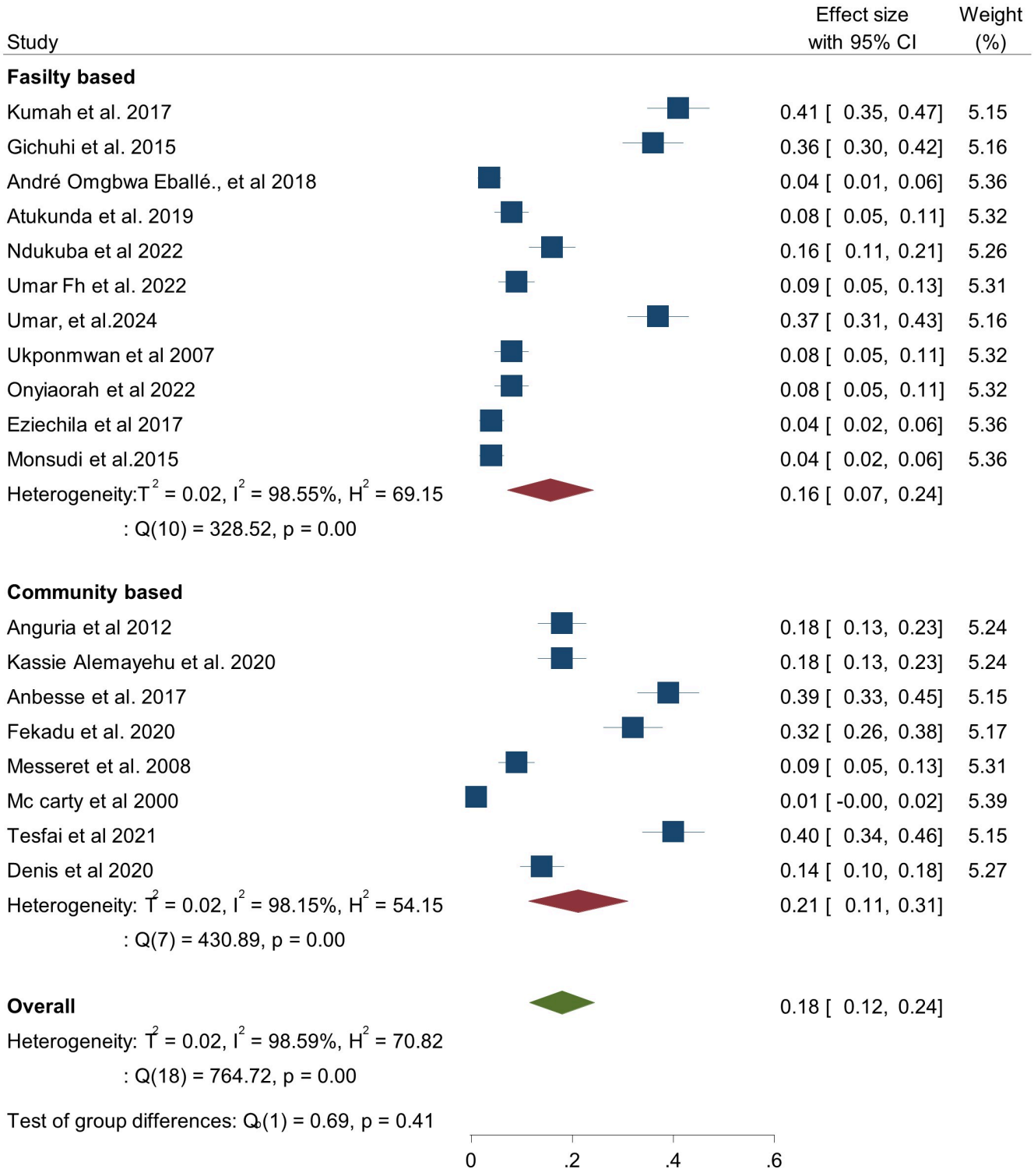


Figure 5

A subgroup analysis of the forest plot showing the pooled prevalence of pterygium in Africa based on study setting (n=19)

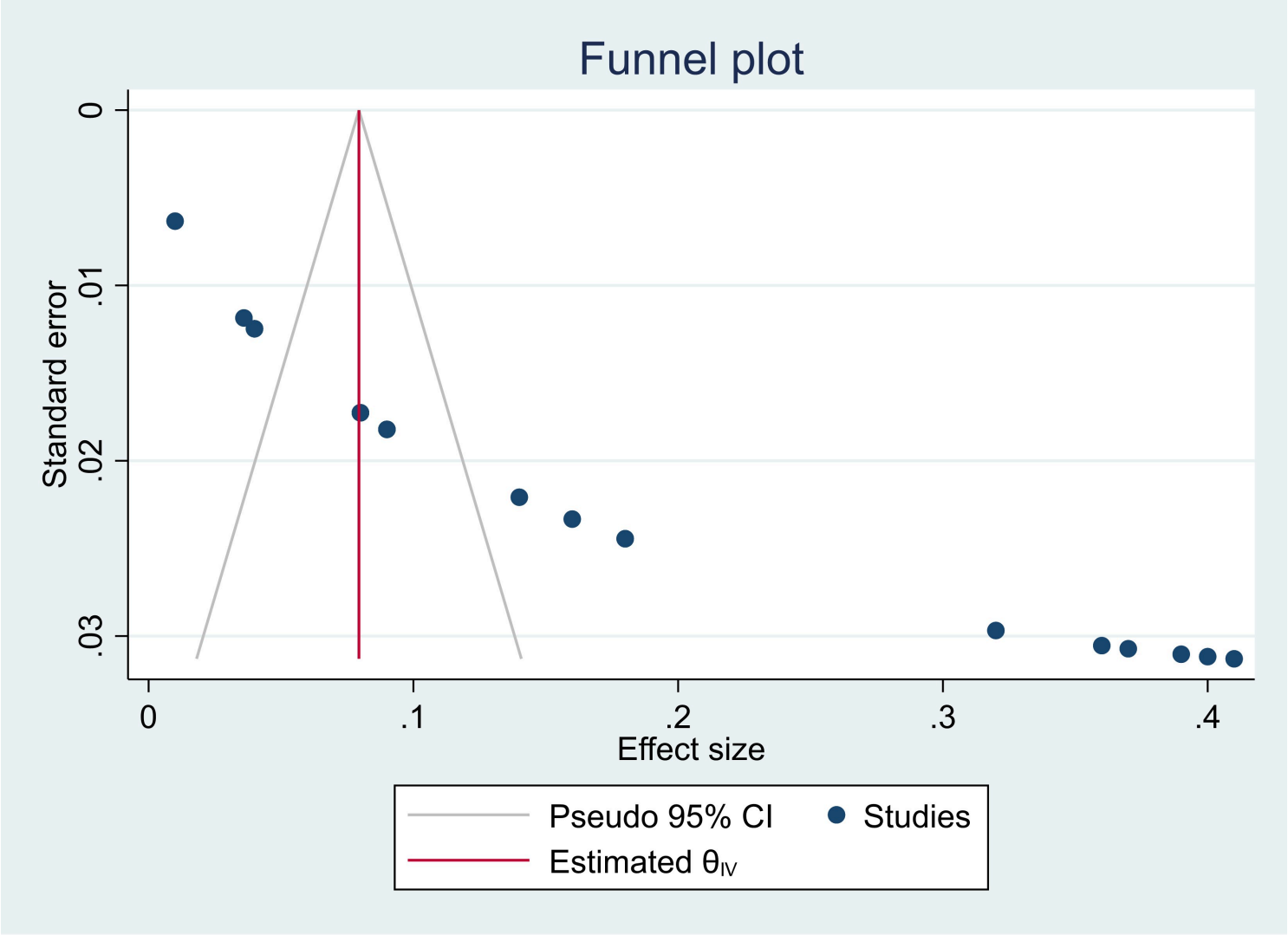


Figure 6

Funnel plot showing publication bias of studies conducted on the prevalence of pterygium in Africa.

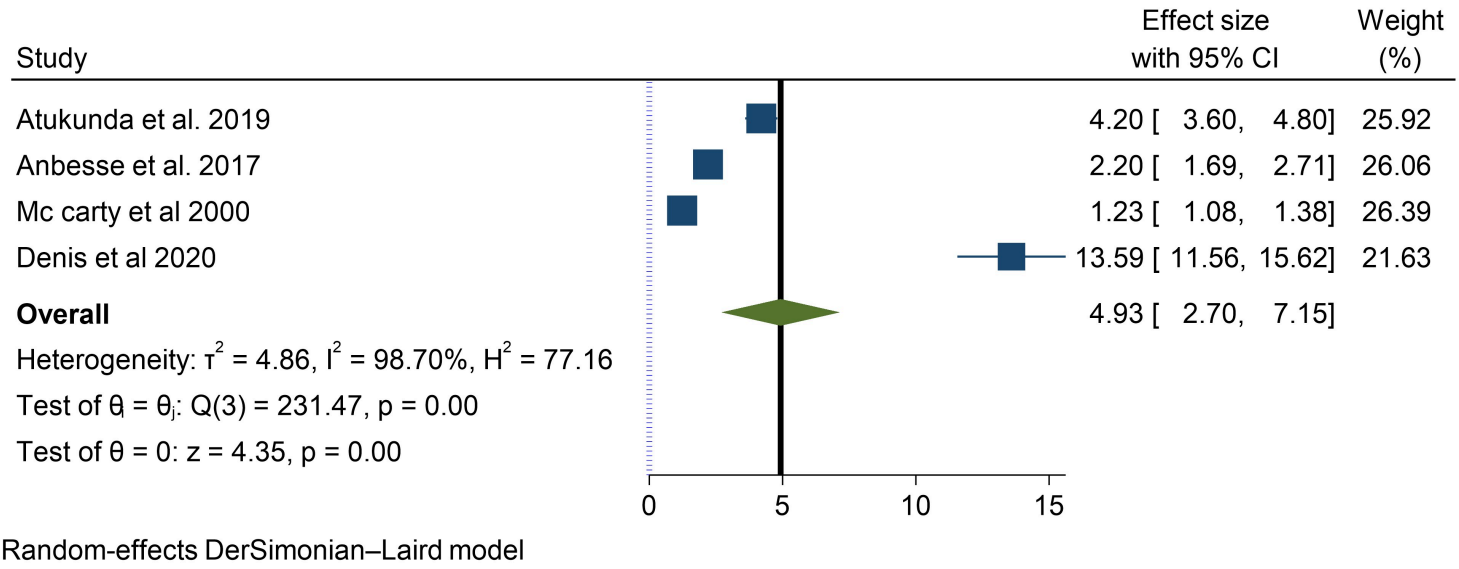


Figure 7

Forest plot for the association between age and prevalence of Pterygium in Africa

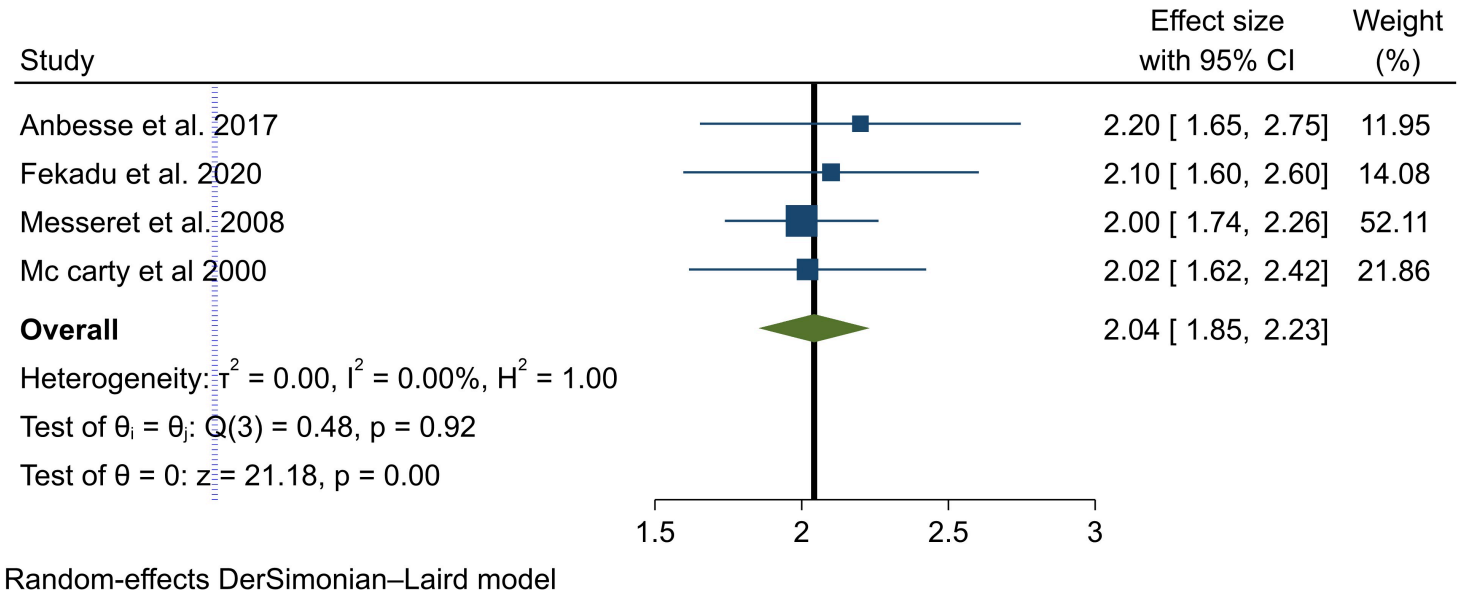


Figure 8

Forest plot for the association between male gender and prevalence of Pterygium in Africa

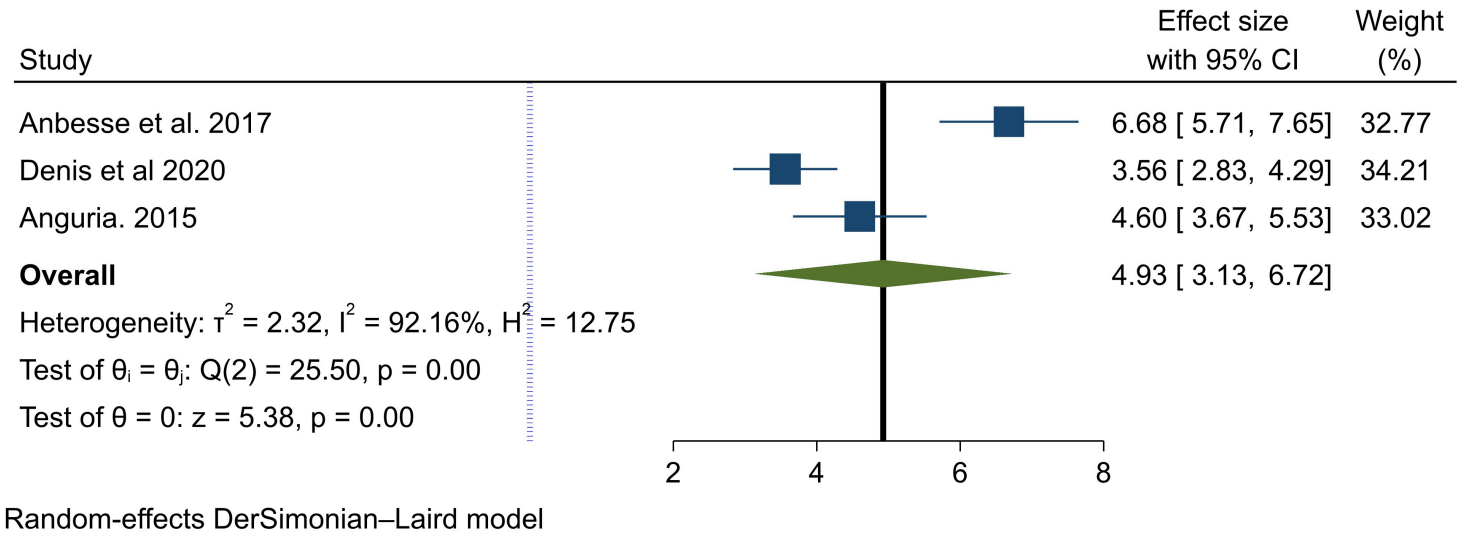


Figure 9

Forest plot for the association between family history and prevalence of Pterygium in Africa

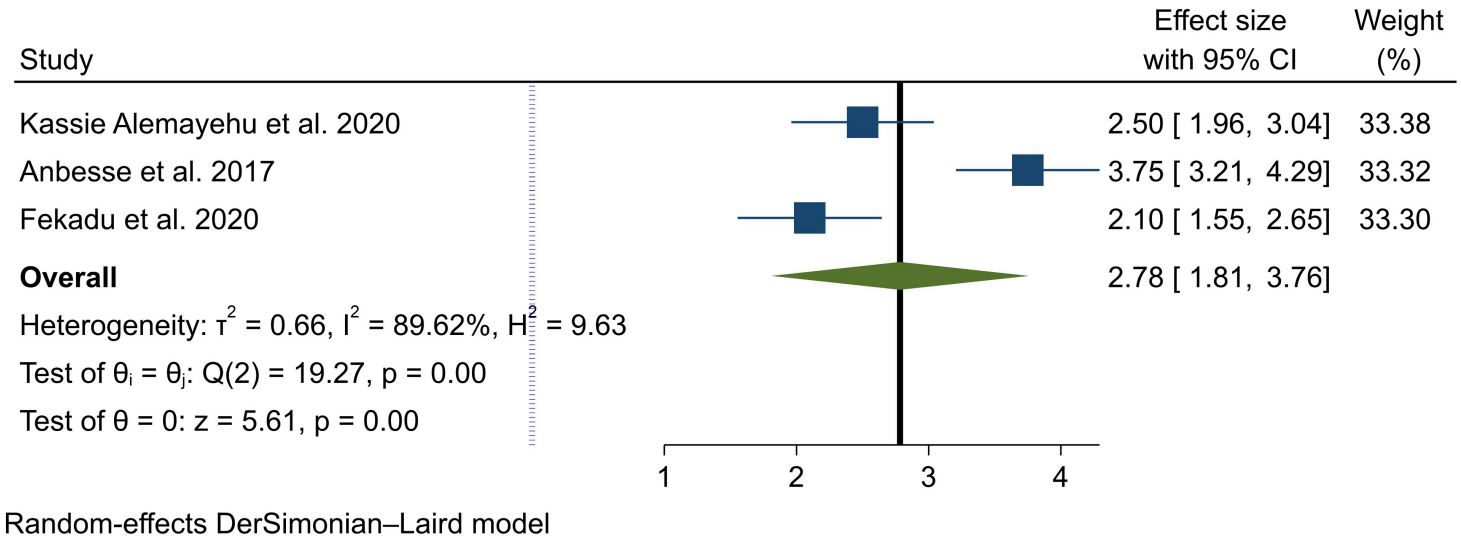


Figure 10

Forest plot for the association between outdoor work and prevalence of Pterygium in Africa

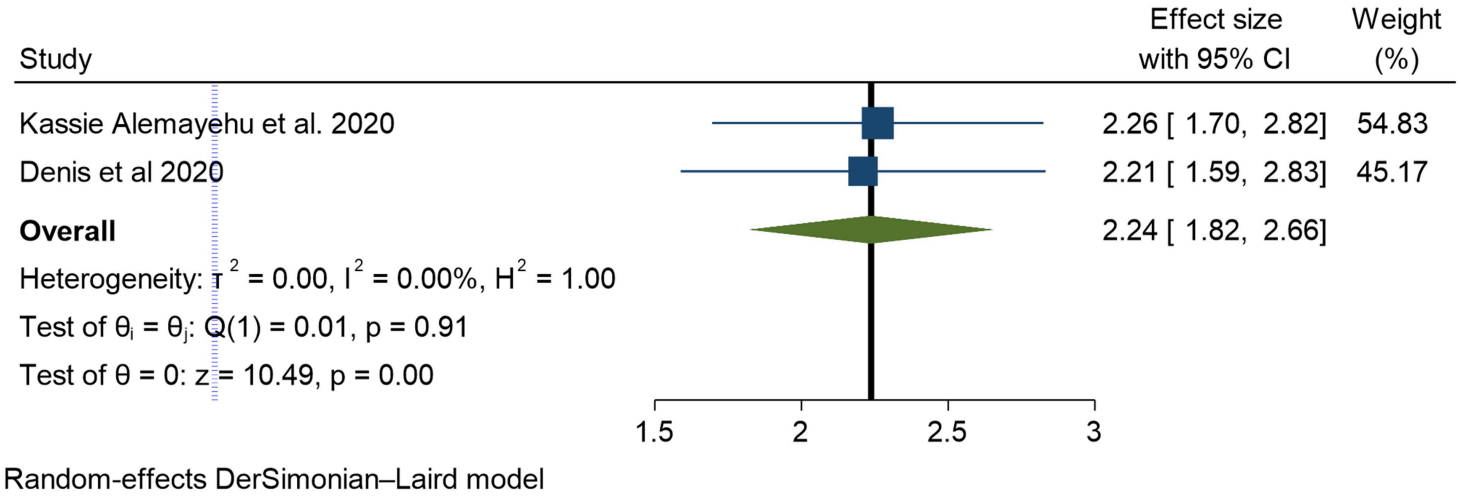


Figure 11

Forest plot for the association between alcohol drinking and prevalence of Pterygium in Africa

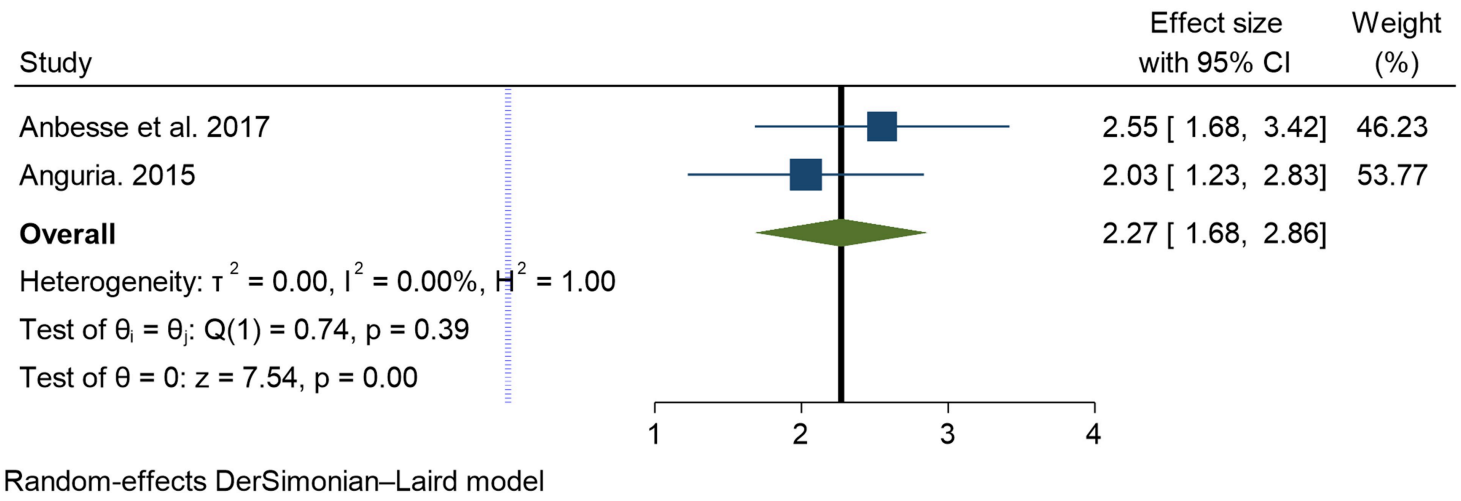


Figure 12

Forest plot for the association betweenuse of traditional eye medication and prevalence of Pterygium in Africa

Supplementary Files

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