

DMFT status in 12 years old Iranian population: A systematic and meta-analysis study

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Abstract

Background Because of the end of permanent teeth eruption duration, 12 years old age has encountered with a great importance. The aim of this study is to determine DMFT status of this age group using systematic review and meta-analysis method. **Methods** Internal and external databases on the basis of inclusion and exclusion criteria were searched using the considered keywords. Heterogeneity and the quality of studies were assessed using I² index and STROBE checklist. Forest plot was plotted using Random Effects Model. Funnel plot and Eggers' test used to indicate publication bias. **Results** 95 studies with 12145 total persons and 393 mean person in each study were entered to the final step of meta-analysis. Using Random Effects model, total mean DMFT of 12 years olds was estimated 2.01 (1.83-2.19) and separately for girls and boys was estimated 2.10 (1.95-2.26) and 2.16 (1.94-2.38), respectively. Funnel plot and Eggers' test were insignificant which indicate reliability of the study results and low publication bias. **Conclusion** The results indicated that mean DMFT of 12 years old population is 2.01 which this mean in boys is higher than girls ones. These permanent teethes need to be in the mouth lifetime, but have encountered with problems in the age of eruption. Review and reforms in dental health system seem necessary.

Background

One of the most prevalent infectious diseases is dental decay. Higher than 80% of people in the higher income countries have experienced dental decay (1-3), but in comparison with lower income countries, only half of dental caries are left untreated (4). From several decades ago, especially after integration of dental healthcare into primary health care (PHC) (5), many studies have been performed regarding dental decay status in different age and gender groups (Table 1). After this integration, it was expected to see improvement in the Iranian dental health status. Health Sector Evolution Plan (HSEP) was another national wide plan which was launched from 2013 to increase access to healthcare services, health literacy and health insurance for all Iranian people (6).

However, 2012 national dental health survey indicated that decay, missing and filled teeth index in 12 years old children is equal to 2.09 which unfortunately have increased 7% in comparison with its previous national survey in 2005 (7).

Countries dental health systems administer different measures from the birth to prevent dental decay and other dental diseases. World Health Organization (WHO) have considered 12 years old age as the most important age to evaluate dental healthcare programs performed in countries. The reasons for this importance are numerous. The main causes are completion of permanent teeth eruption in 12 years old except the third molars and also children in this age are usually in the schools and it is easy to access them.

Caries prevalence is measured using different indices including DMFT which means the number of Decayed, missed and filled teethes in the mouth of each person (8). This is an important index indicating society dental health status and has an important role in healthcare decision making.

WHO goals regarding dental health include an average decay, missing, and filling tooth (DMFT) of not more than 3 in 2000 and not more than 1.0 in 2010 at the age of 12. Based on WHO (2005), the best index of DMFT is 1 among 12-year-old children all over the world (9).

Regarding the importance of current study, though there are some systematic review and meta-analysis studies assessing the relation between socio-economic status and dental caries (10-12) and also there are abroad studies regarding systematic review of DMFT status in 12 years old students (13 , 14), but there is no single review study to

indicate DMFT status in 12 years old Iranian students. So, the aim of current study is to determine DMFT of 12 years old Iranian population using systematic review and meta-analysis.

Methods

Meta-analysis is a method in which the results of different studies are combined to obtain a more accurate estimation rather than traditional reviews. In other word, the aim of meta-analysis is to estimate the amount of real effect more powerful than an individual study.

Search time

In the current study, all published studies from 1995 to 2018 regarding dental caries performed in all Iran provinces have been gathered and through systematic review and meta-analysis, DMFT status of 12 years old Iranian population are presented. Regarding the cause of selecting 1995 to 2018 to collect articles, it is necessary to say that dental services were integrated to primary health care (PHC) in 1995 in order to increase access of low sociodemographic groups to the services. This integration leads to equipment of healthcare services, allocating dentists and dental care providers to the centers, performing educational, preventive and therapeutic services and covering some services by public insurances. So the best time to start searching articles is 1995.

Search strategy

In order to retrieve the most number of articles, a very extensive search strategy was selected. So that only “DMFT” keyword was searched in the internal (Persian) databases and “DMFT and IRAN” keywords were searched in the external databases. Though there wasn’t “12 years old” keyword in title or abstract section of some articles, but they have considered and studied it in the result section. So when searching databases, “12 years old” keyword was neglected.

All epidemiological studies including cross-sectional, case-control, cohort and clinical trial were eligible to be entered to the study. The specific question of current study was: What is DMFT index in 12 years old Iranian population totally and separately for to sexes?

Persian databases of Scientific Information Databases (<http://sid.ir/>), Magiran (<http://www.magiran.com/>) and external databases of Google Scholar (<https://scholar.google.nl/>), PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>), Embase (<https://www.embase.com>), Scopus (www.scopus.com), Web of Science (<http://www.isiknowledge.com>) were searched systematically.

Inclusion and exclusion criteria

The inclusion criteria were existence of DMFT word and 12 years old age group in the articles, studies with random sampling, response rate higher than 50% and attrition rate lower than 50 %. The exclusion criteria were caries studies in children covered by supportive organizations, diabetics, mental diseases, exceptional children, thalassemia, factory workers, asthma, kindergarten, blind, military children, hemophilia, kidney disease and other diseases and problems. Also, letter to editor articles, grey literature and studies before 1995 were excluded from study. The final extracted studies from the databases were entered to EndNote software and duplicated were deleted.

Assessment quality of articles

The quality of articles was assessed using STROBE checklist. This checklist includes 22 questions in which assesses all sections of an article including title, abstract, introduction, methods, results and discussion. This instrument helps authors to correct write observational studies and help editors and reviewers to correct assess articles to be published in the journals and lastly help readers to critically assess published articles (15).

As a simple method to score this checklist, we consider 0-2 score for each one of its questions. The lowest obtainable score for each article to be entered to the data extraction process and meta-analysis. The articles in Table 1 & 2 have obtained this lowest acceptable score.

Predict standard deviation

Articles in which only have stated sample mean not standard deviation (SD), it was estimated using linear regression. So that, at the first, mean and SD in studies which these two measures are specified were entered in 2 separate columns in the SPSS and Linear Regression was performed. In the results, if R Square was more than 0.7, so we can use this model to predict SD in the studies which have not calculated it. In this way, by multiplying B amount obtained from linear regression test in the mean of articles which SD is not specified, we can estimate SD amount. In this study, R Square amount was obtained 0.83 which is more than 0.7, so by multiplying B coefficient amount (which is 0.788) in the reported mean DMFT of each study, SD amount was estimated.

Also, articles in which have reported DMFT/dmft for boys and girls but have not reported pooled mean and SD, they were estimated using the statistical formula. Also, studies in which have reported confidence interval, they were converted to SD using the statistical formula.

Continuous vertical line in forest plot indicates “no effect” or neutral state which its amount for articles in which have reported mean is equal to zero. Interrupted vertical line is corresponding on diamond vertical line which is indicative of index under study (16).

Heterogeneity and publication bias

Heterogeneity was predicted using I^2 index. Because of predicting internal and external heterogeneity between studies, Random Effect Model Used to draw forest plot.

Funnel plot and Egger's test used to indicate publication bias. Funnel plot indicate the effect measure of each study. Symmetric funnel plot indicates no publication bias. Eggers' test is used to interpret funnel plot statistically.

If study had no publication bias, so its Eggers' test is insignificant and its confidence interval encompass 0 digit. Also, funnel plot turns into an inverted funnel. In forest plot, whatsoever study size become larger, its precision increases and its mean index would place in the higher place of funnel plot. This case is opposite in the smaller studies. Finally, the data were analyzed using Stata 13.1, Stata Corp, College Station, TX, USA.

Results

The first search on the basis of articles title in the 7 databases concluded 854 retrieved 854 articles (432 in Magiran, 512 in Google scholar, 44 in Web of Science, 80 in Scopus, 102 in Embase). 512 articles were remained after entering

these articles to EndNote and deleting duplicates. After cross checking of the references, 15 new articles were identified and the articles reached to 527. In the next step, the abstract and full text of articles on the basis of inclusion and exclusion criteria were searched to find DMFT index in 12 years old children. Finally, 12 articles were entered to the final step of the study.

Figure 1. Flowchart of the steps entering studies to the systematic review and meta-analysis

The characteristics of final articles are presented in the table 1. In this table, DMFT mean and SD for 12 years old Iranian population are presented totally and separately for two sexes. The total sample size of these studies is 12145 persons and 393 persons on average for each study.

Table 1. Calculating mean DMFT, SD and publication bias

Part 1. Calculating mean DMFT, SD and publication bias for 12 years old Iranian population

The forest plot of mean DMFT and 95% CI for 12 years olds (sum of boys and girls) is presented in the figure 2. Accordingly, mean DMFT in these persons is 2.01 with 1.83-2.19 CI. Also, on the basis of this figure, heterogeneity of articles which have assessed DMFT in 12 years old Iranian population is 99.8%. By attention that I^2 index lower than 25%, between 25% and 75% and higher than 75% is considered as low, middle and high heterogeneity, respectively, so heterogeneity in this study is high. So, Random Effects Model used to analyze studies.

Figure 2. Forest plot of mean DMFT and 95% CI for 12 years old Iranian population.

Publication bias

The funnel plot of publication bias in DMFT status for 12 years olds is presented in Figure 3. Accordingly, standard error has depicted against mean DMFT. Symmetric funnel plot indicates low publication bias which confirm the reliability of the study results. Also, publication bias using Egger's test was not confirmed, because firstly its test was not significant statistically ($p > 0.05$) and secondly its CI encompass zero (-0.1767032, 0.9576957).

Figure 3. Funnel plot of publication bias of DMFT status of Iranian 12 years olds

Table 2

Part 2. Calculating mean DMFT, SD and publication bias for 12 years old Iranian girls' population

Forest plot of mean DMFT and its 95% CI for 12 years old girls is presented in figure 4. Accordingly, mean DMFT in these persons is 2.10 with 1.95-2.26 CI. By attention that heterogeneity rate is 97.7 %, so Random Effects Model used to depict forest plot.

Figure 4. Forest plot of mean DMFT and its 95% CI for 12 years old Iranian girls

Publication bias

Funnel plot of publication bias in DMFT status of 12 years old Iranian girls is depicted in figure 5. Accordingly, standard error has been depicted against mean DMFT. Symmetric funnel plot indicates low publication bias which confirm the reliability of the study results. Also, publication bias using Egger's test was not confirmed, because firstly its test was not significant statistically ($p>0.05$) and secondly its CI encompass zero (-0.1638292, 0.4297928).

Figure 5. Funnel plot of publication bias in DMFT status in 12 years old Iranian girls' population

Table 3

Part 3. Calculating mean DMFT, SD and publication bias for 12 years old Iranian boys' population

Forest plot of mean DMFT and its 95% CI for 12 years old boys is presented in figure 6. Accordingly, mean DMFT in these persons is 2.16 with 1.94 -2.38 CI. By attention that heterogeneity rate is 97.1 %, so Random Effects Model used to depict forest plot.

Figure 6. Forest plot of mean DMFT and its 95% CI for 12 years old Iranian boys

Publication bias

Funnel plot of publication bias in DMFT status of 12 years old Iranian boys is depicted in figure 7. Accordingly, standard error has been depicted against mean DMFT. Symmetric funnel plot indicates low publication bias which confirm the reliability of the study results. Also, publication bias using Egger's test was not confirmed, because firstly its test was not significant statistically ($p>0.05$) and secondly its CI encompass zero (-1.785516, 13.60859).

Figure 7. Funnel plot of publication bias in DMFT status in 12 years old Iranian boys' population

Table 4

Discussion

The status of DMFT in 12 years old Iranian population was determined in this study on the basis of all articles which have assessed this index all of the country. It is worth fully to state that 12 years old is the latest age of permanent teeth eruption and have an important role comparison dental health situation between countries, because this age is a suitable indicative of countries health situation, administering educational and preventive plans and universal health coverage.

The results indicated that DMFT index in 12-year Iranian population is 2.1, in girls 2.10 and in boys 2.16. A study on 12 years old suburban Nigerian school children indicated that DMFT is 0.14 (45). Also, in 12 years old Macedonian, Italian and Turkish children was 1.94, 1.1 and 1.9, respectively (46-48). On the basis of Gavriilidou study in 2015, DMFT level for 209 countries was estimated 1.86. On the basis of World Health Organization (WHO) Region specific weighted DMFT among 12-year-old children, DMFT rate in east Mediterranean region (EMRO), which includes Iran, was 1.64. Also, the estimation of WHO for 12 years olds globally indicates DMFT equal to 1.86 (49).

On one hand, all these studies indicate that DMFT index has no good status in Iran and is higher than many of global and between countries comparisons. On the other hand, another study by current study researchers regarding the relation between socio-economic situation and dental caries in Iran through systematic review and meta-analysis indicated that Iranian households with low socioeconomic situation (considering income, education and employment) had higher dental caries (12). This means that not only DMFT index in Iran has a bad situation but also equity in access to dental services is not favorite and the poor and low SES groups have much worse access. This is while dental health situation in Iran is in the weakest situation, because in one hand there is no public dental health package and on the other hand private insurances are accessible only for special groups (50).

Dental health policymakers, in this regard and to improve dental health situation, should consider improving primary health care programs such as educational and preventing ones not only merely developing specialized centers, equipping dental units and dental schools (51).

In the recent years, dental schools have developed all over the country rapidly, dental units are produced or are imported as fast as possible, this is while the missing link is lack of attention to preventive health measures actually and seriously. Now, primary health care providers and employees have no enough motivation to deliver prestigious services. Their status and dignity have fallen and their services is not acknowledged as it should be.

Limitations and strengths

In this study, DMFT situation in Iran using systematic review and meta-analysis was estimated. However, this estimation is not without problems and weakness points. These problems originate from different material and methods of basic articles, different sampling and analyzing. This is while, all these articles have used DMFT index to report dental situation, so the comparability rate increases.

In order to reliable the DMFT index obtained from current study, it is necessary to administer nationwide surveys. The most important thing is that these surveys be performed independently from governmental agencies to their findings be real and generalizable to the country.

One of the study strengths is that the articles entered to the systematic review were from different parts of the country and have a high and good variation, so that it is possible to generalize the results to Iran. On the other hand, funnel

plot and egger's tests which were used to assess heterogeneity and publication bias indicated low heterogeneity and publication bias.

Conclusion

Dental health situation in 12 years old indicates deployment status of universal health coverage among countries and comprehensiveness of preventive healthcare programs. This study indicated that dental health situation in Iranian 12 years old population have no good situation in comparison with EMRO region and globally. This issue gets worse when consider the poor have very low access to the services and there is no persist and permanent public dental insurance. Extensive interventions from the macro level to small villages and towns and reforms in dental health system are among the needed proposed changes to decrease DMFT index in Iran.

Abbreviations

DMFT: Decayed, Missed, Filled Teeth; PHC: Primary Health Care; HSEP: Health Sector Evolution Plan; WHO: World Health Organization; PHC: Primary Health Care; SD: Standard Deviation

Declarations

Authors' contributions

Conception and design of study/review/case series: SA, MA(CA). Acquisition of data: SA, MA(CA). Analysis of collected data: RM, SA, MA(CA). Interpretation of data: SA, ZA, JN, RM, MA, MA(CA). Drafting of paper and/or critical revision: SA, ZA, JN, RM, MA, MA(CA). All the authors have read and approved the manuscript to be submitted to BMC Oral Health.

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Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics approval

This study was approved by Ethical Committee of Kerman University of Medical Sciences (Ethical code number: IR.KMU.REC.1395.363).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests

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Tables

Table 1. Characteristics of selected and reviewed articles in the study

NO	Author, year	Province/city	Location data collection	Sampling	No. samples	Gender	DMFT(SD)
1	Afshar et al. 2004 17()	Kashan, Isfahan	schools	Random cluster method	242	242 girls	1.45(1.73)
2	Fadaei and Amiri, 2010 18()	Charharmahal and Bakhtiar	School	Multi-stage cluster random sampling	215	-	2.4(0.19)
3	Eskandarian et al, 1999 19()	Nomads, Eghlid, Fars	Visit to the nomadic residence	Random cluster sampling	244	124 Boys 120 girls	Boys:1.44(1.13) Girls:1.35(1.06) Total:1.39(1.09)
4	Faezi et al, 2011 20()	Tehran, Tehran	School	Purposive sampling	450	Girls	3.56(2.65)
5	Mahvi et al, 2005 21()	Behshahr, Mazandaran	School	Census	300	150 girls 150 boys	Girls:1.75(0.19) Boys:1.21(0.16) Total:1.48(0.13)
6	Farhadi et al. 2013 22()	Hadishahr, East Azerbaijan	School	All 12 years old students	266	-	1.23(0.09)
7	Momeni et al, 1999 23()	Tehran	school	Random	754	-	1.10 (1.50)
8	Momeni et al, 1999 23()	Villages near Isfahan	school	Random	348	-	0.38 (0.82)
9	Sajadi et al, 2008 24()	Sirjan, Kerman	School	Cluster and random sampling	700	-	3.56(2.34)
10	Toumarian et al, 2003 25()	Qom, Qom	School	Multi stage sampling	300	150 boys 150 girls	Boys:2.78(2.18) Girls:2.87(2.03) Total: 2.28(2.1)
11	Nokhostin et al, 2009 26()	Kermanshah; Kermanshah	School	2 stage cluster sampling	450	225 girls 225 boys	Girls:1.65(1.82) Boys:3.88(2.72) Total:2.76(2.57)
12	Ghandehari & Mahboobi, 2002 27()	Sowme'eh Sara, Gilan	School	Random	144	76 boys 68 girls	Boys:1.44(1.64) Girls:1.69(1.91) Total:1.68(1.78)
13	Sadeghi & Bagherian, 2007 28()	Rafsanjan, Kerman	School	Stratified random sampling	353	180 boys	Boys:2.78(1.8) Girls:2.13(2.1)

						173 girls	Total:2.46(2)
14	Hazave'ee et al, 2001 29()	Hamedan, Hamedan	School	Multi stage stratified	268	-	2.25(1.74)
15	Shariat et al, 2009 30()	Saveh, Markazi	School	Multi stage random sampling	282	152 boys 130 girls	Boys:2.3(1.3) Girls:1.95(3.9) Total:2.1(4.3)
16	Daneshkazemi et al, 2001 31()	Yazd & Hadishahr, Yazd	School	Random	1223	654 boys 569 girls	Boys:1.95(1.91) Girls:1.65(1.55) Total:1.8(1.75)
17	Mirzamohammadi et al, 2017 32()	Piranshahr, West-Azarbaijan	School	Random	320	320 girls	2.53(2.28)
18	Arbabzadeh-Zavareh et al, 2000 33()	Shahreza, Isfahan	School	Random	200	100 girls 100 boys	Girls:6.12(3.67) Boys:4.52(3.05) Total:5.32(3.46)
19	Salem et al, 2003 34()	Langeroud, Gilan	School	2 stage stratified randomized	298	148 girls 150 boys	Boys:1.61(1.5) Girls:1.68(1.61) Total:1.65(1.61)
20	Salem et al, 2003 34()	Lahijan, Gilan	School	2 stage stratified randomized	247	122 girls 125 boys	Boys:1.70(1.68) Girls:1.29(1.44) Total:1.49(1.56)
21	Salem et al, 2003 34()	Siahkal, Gilan	School	2 stage stratified randomized	340	161 girls 179 boys	Boys:1.77(1.51) Girls:1.45(1.38) Total:1.60(1.45)
22	Sadr et al, 2011 35()	Zarand, Kerman	School	Cluster-classified sampling	350	-	2.03(1.6)
23	Shafiezadeh et al, 2007-2008 36()	Tehran, Tehran	Social welfare centers	Census	113	-	1.32(0.86)
24	Shakerian et al, 2016 37()	Rafsanjan, Kerman	School	Random	460	230 girls 230 boys	Girls:2.71(1.45) Boys:2.61(1.35) Total:2.66(1.40)
25	Asgari & eghbal, 1996 38()	Qazvin, Qazvin	School	Random classified	960	-	1.1(0.81)
26	Mehralian et al, 2013 39()	Qazvin, Qazvin	Houses	Stratified	187	-	3.53(4.22)

27	Bayat-Movahed et al, 2004 40()	Iran	Health center	Cluster multistage probability sampling	748	378 boys 370 girls	Boys:1.7 (0.2) Girls:2.0 (0.2) Total:1.9 (0.2)
28	Fadaee et al, 2006 41()	Shahrekord, Chaharmahal & Bakhtiari	School	Simple random stratified multistage	257	-	1.26(0.57)
29	Mozaffari et al, 2013 42()	Kermanshah, Kermanshah	School	Randomly cluster systematic sampling	402	210 boys 192 girls	Boys:1.67(1.69) Girls:2.17(1.87) Total:1.91(1.79)
30	Forouzanfar et al, 1996 43()	Birjand, South Khorasan	School	Multi stage stratified systematic sampling	404	-	1.85(1.76)
31	Pourhashemi, 1997 44()	Tehran, Tehran	School	Randomized	320	-	3.08(2.43)

Table 2. Eggers' test of publication bias in DMFT situation of 12 years olds Iranian population.

Due to technical limitations, Table 2 is only available as a download in the supplemental files section.

Figures

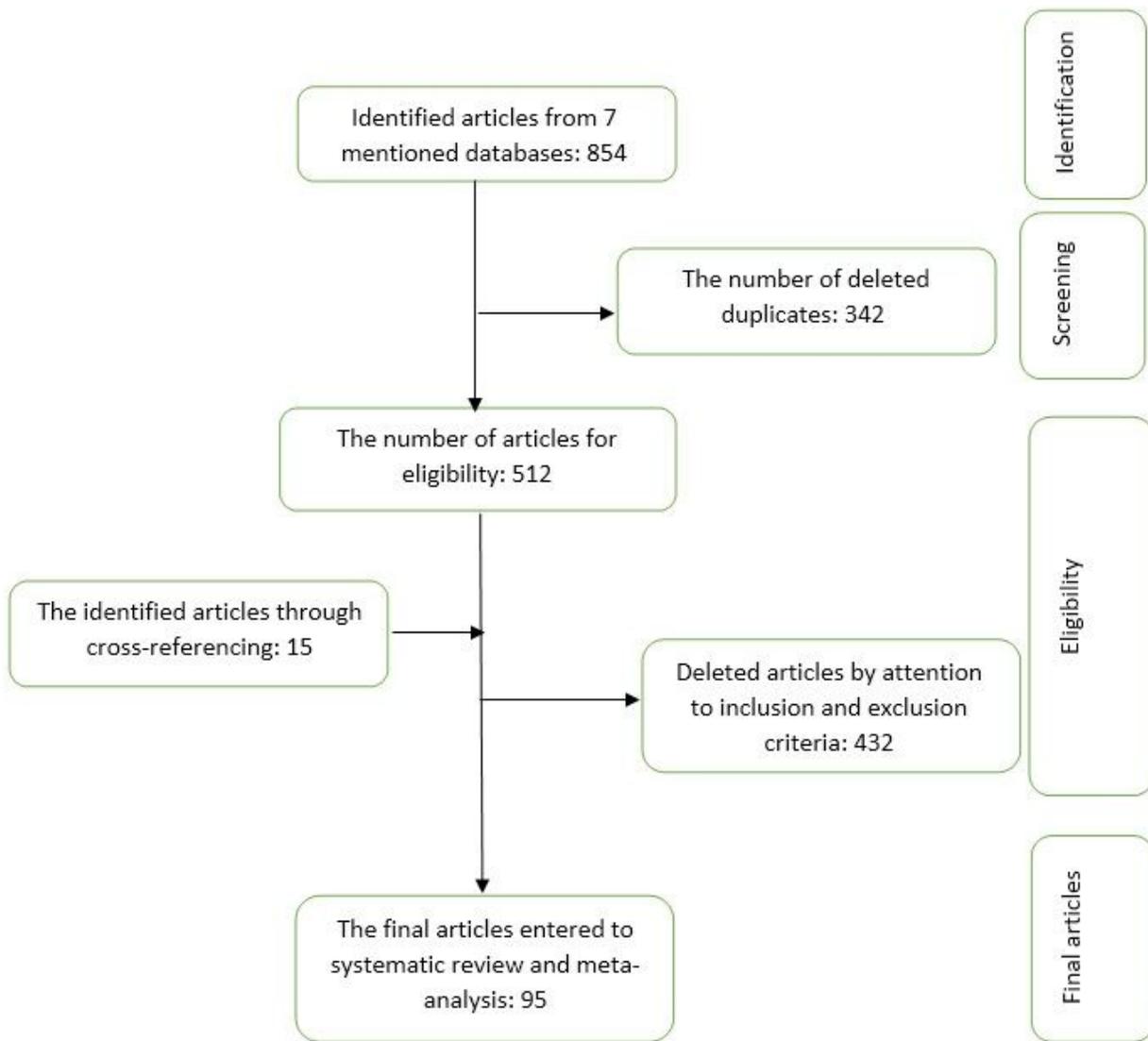


Figure 1

Flowchart of the steps entering studies to the systematic review and meta-analysis

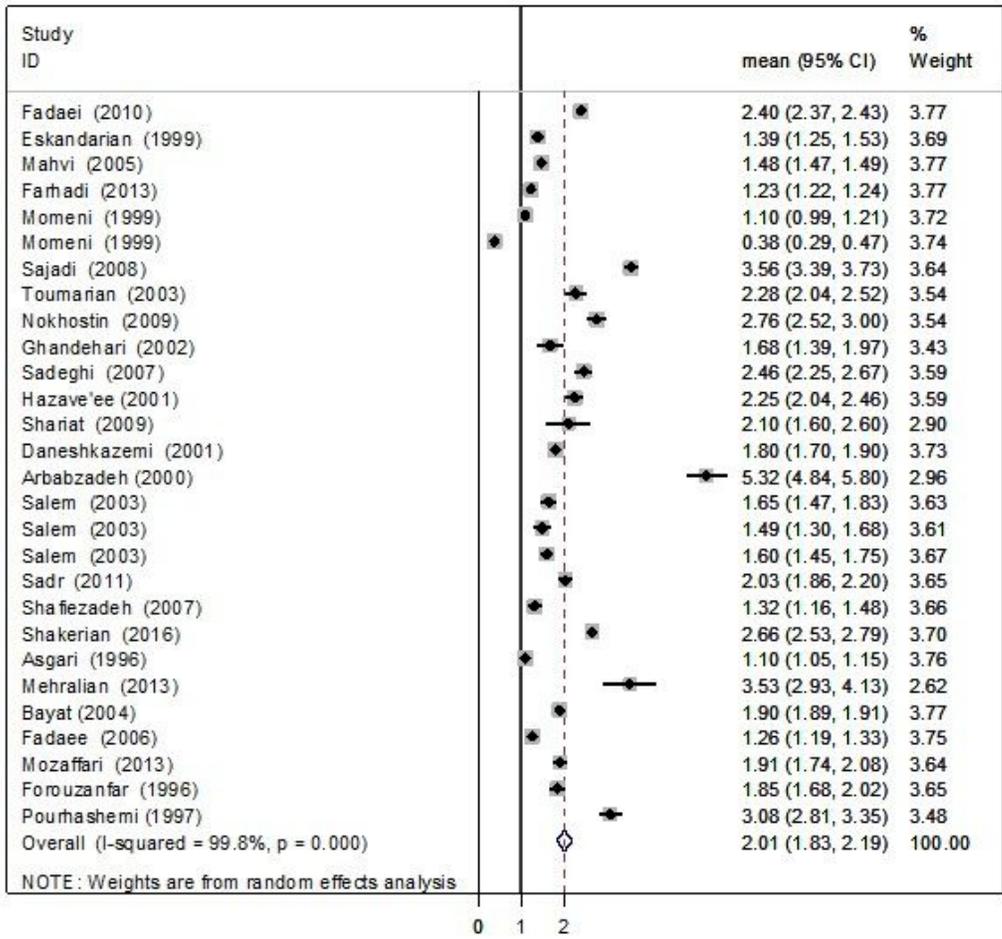


Figure 2

Forest plot of mean DMFT and 95% CI for 12 years old Iranian population

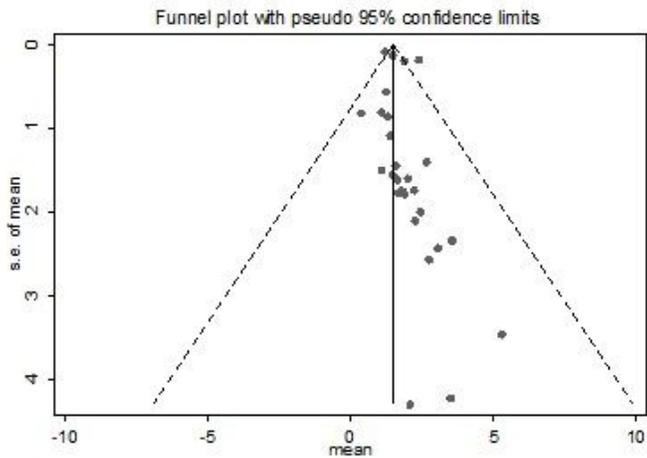


Figure 3

Funnel plot of publication bias of DMFT status of Iranian 12 years olds

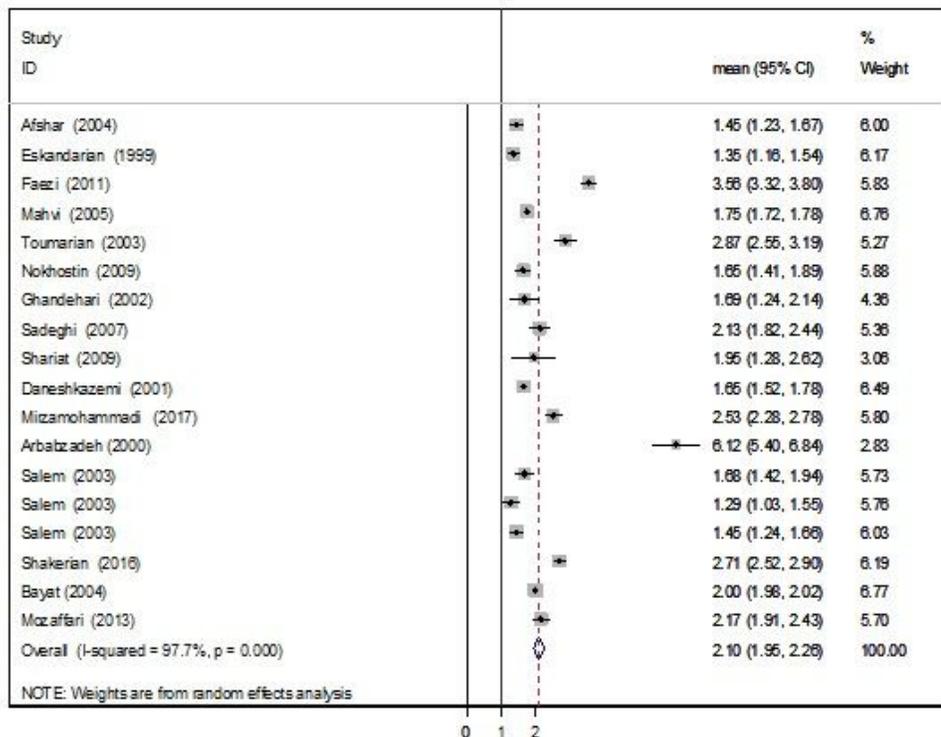


Figure 4

Forest plot of mean DMFT and its 95% CI for 12 years old Iranian girls

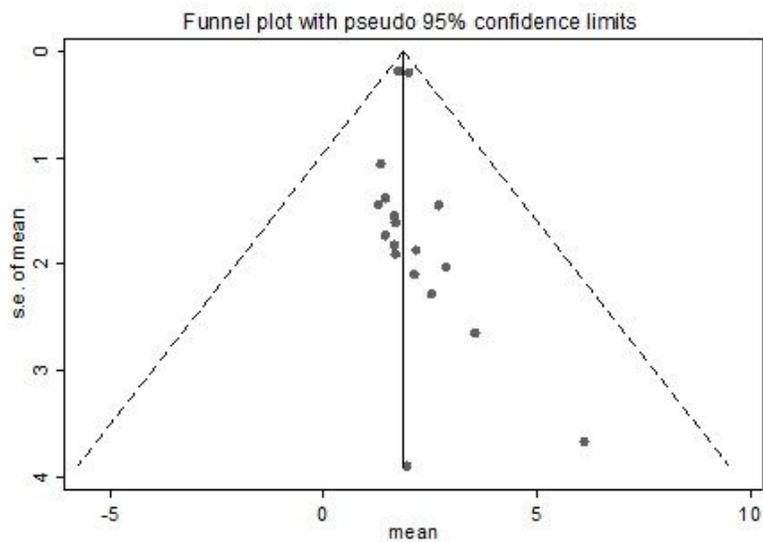


Figure 5

Funnel plot of publication bias in DMFT status in 12 years old Iranian girls' population

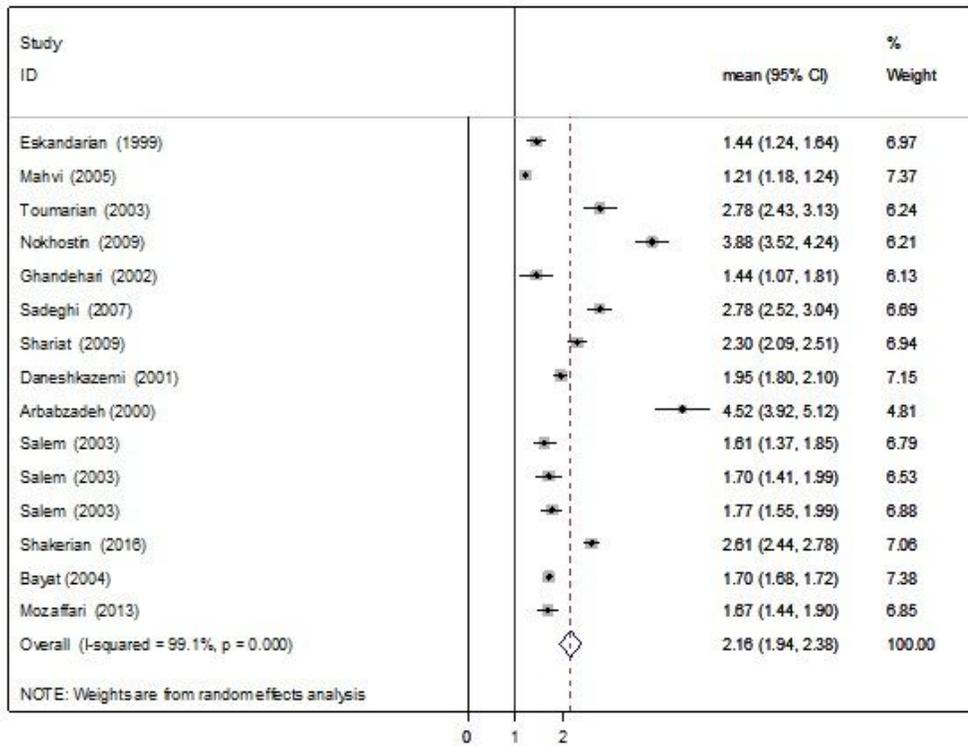


Figure 6

Forest plot of mean DMFT and its 95% CI for 12 years old Iranian boys

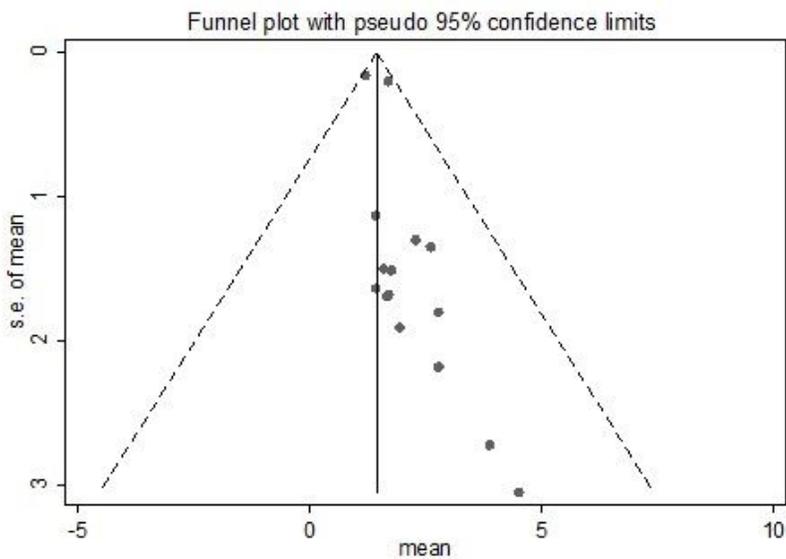


Figure 7

Funnel plot of publication bias in DMFT status in 12 years old Iranian boys' population

Supplementary Files

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- [supplement1.jpg](#)