

Prevalence of Enuresis and its Related Factors among Children in Iran: A Systematic Review and Meta-analysis

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Abstract

Introduction

Enuresis is the second most common disorder among children after allergic disorders. According to the results of previous studies, different estimates of enuresis prevalence and its related factors have been reported. Combining the results of these studies is valuable. This study aims to estimate the prevalence of enuresis and its related factors among Iranian children.

Materials and Methods

Relevant articles published during 2000 to 15 May 2015 were identified by a comprehensive search within national and international databanks. Having applied inclusion/exclusion criteria and quality assessment, eligible papers were selected. In addition, references of the articles were reviewed to enhance the search strategy. Standard error of the prevalence in each study was calculated using binomial distribution. Random effects model was used to combine the results. All data analyses were performed using STATA SE V.11 software.

Results

We entered 15 eligible articles into the systematic review/meta-analysis recruited 20832 Iranian children. Prevalence (95% CI) of enuresis among all children, boys and girls were estimated as of 11.01% (9.2-12.8), 13.9% (11.2-16.7) and 8.4%(6.3-10.6) respectively. Enuresis was more common among children with positive familial history, those with deep sleep, high water consumption, sniffing, low educated and low income parents, mouth breathing, urinary tract infection and children with history of corporal punishment.

Conclusion

Our study showed that a considerable proportion of Iranian children are suffering from enuresis and male gender is a predictive factor for this disorder.

Key Words: Enuresis, Iranian children, Meta-analysis, Prevalence.

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1-Introduction

Enuresis is the second most common disorder among children after the allergic disorders and is one of the most problems during childhood. It refers to the inability of control of urination and involuntary urination in a child during night in an age period the bladder function control must be achieved (1, 2). According to DSM-IV criteria, enuresis is involuntary urination in a child over five years within cloths or in bed at least two in a week for three consecutive months (1, 3).

Enuresis can be primary or secondary (4, 5). Primary (persistent) enuresis is a situation in which a child has never experienced any dryness for six months, while in secondary enuresis, the child has no enuresis for at least six months and starts up again (1, 4, 5). About 90% of patients have primary enuresis which can be due to delay in development of bladder function (4, 5). Another classification, divides the enuresis into monosymptomatic (without complication) and polysymptomatic (with complication). In the first type, no other gastro-intestinal or genito-urinary symptoms are seen, while in polysymptomatic type, one of these symptoms such as urgency, frequency, constipation or incontinence may exist (4).

Several studies carried out to estimate the prevalence of enuresis reported different prevalences. Enuresis prevalence has been reported as of 32% in Hakim study (6), 8%-17.5% in Bakhtiar et al. (1) and Gahramani et al. (4) studies in Gonabad and 18.7% in Mahmoodzadeh study in Urmia (7).

In a study conducted by Sheeram et al. among children in the USA during a 12 months period, prevalence of enuresis was observed as of 4.45% (8). That was 16.2% in the study carried out by Gulumser Dolgum et al. among 5-13 year-old Turkish children (9).

Many studies carried out among Iranian children which observed various related factors for enuresis. These factors were large families, positive familial history, parents with low awareness, unemployed father, employed mother, single parent, low educated parents and positive history of Urinary tract infection (UTI) in the study conducted by Mahmoodzadeh et al.(7). Hakim et al. investigated the related factors of enuresis from the viewpoint of parents and found that positive familial history, deep sleeping and high fluid intake can be associated with enuresis (6). Another study conducted among preschool and school-age children in Khoram Abad, showed significant relationships between enuresis and factors such as familial history (brother and sister), respiratory infections, deep sleeping, corporal punishment in school, itching and history of seizure (1).

Combining the different results observed by the above studies in different parts of Iran with using of meta-analysis (10-11) provides reliable estimates of enuresis prevalence among Iranian children. It also helps us detecting its risk factors and identify effective solutions. This study aims to estimate the prevalence of enuresis and its associated factors among Iranian children using systematic review and meta-analysis methods.

2-Materials and methods

2-1: Search strategy

To identify electronically published articles from January 2000 to 15 May 2015, we searched national (SID, Iranmedex, Magiran and Irandoc) and international (Pubmed, Google scholar, Scopus and ScienceDirect) databanks using the following keywords or their Farsi equivalents: "Prevalence", "Frequency", "Enuresis", "Nocturnal Enuresis", "Diurnal enuresis", "Children",

"Primary School", "Preschool Children" and "Iran".

The search was performed during 16-30 May 2015 by two independent researchers. Moreover, references of the studies were reviewed to increase the search sensitivity. One of the research team members randomly evaluated the search and confirmed that all relevant studies have been identified. In addition, we investigated all paper documents to find any relevant non-electronic articles. We also interviewed with some experts as well as research centers in the field of out systematic review to identify relevant grey literatures.

2-2: Study selection

We extracted full texts or abstracts of all evidences identified during our advanced search. Having excluded duplicates, relevant studies were selected after reviewing titles, abstracts and full texts respectively. To reduce re-print bias, we investigated all results and omitted all repeated findings.

2-3: Quality assessment

All relevant papers regarding their titles and contents were quality assessed using a previously applied checklist (12). This checklist had been designed using contents of STROBE checklist (13). The checklist consisted of 12 questions regarding different views of methodologies such as appropriated sample size, type of the study, sampling design, study population, data collection methods and tools, definition of variables, statistical tests, study objectives and methods of presentation of results. One score was assigned to each question. Each study obtained at least eight scores was eligible to enter into the final meta-analysis.

2-4: Data extraction

All required information such as title, first author name, date and language of the

study, sample size, type of the study, sampling methodology, total sample size and gender-specific sample size, study population, enuresis diagnostic criteria, prevalence of enuresis among all children, boys and girls, relationships between enuresis and factors such as gender, deep sleeping, family history, high liquid intake, parents' educational level, family income, family size, birth rank, sniffing, mouth breathing, UTI and corporal punishment were extracted. Data were entered into Excel spreadsheet.

2-5: Inclusion criteria

All papers written in English or Persian reported sample size and prevalence of enuresis and also achieved enough quality scores were selected for meta-analysis.

2-6: Exclusion criteria

Studies did not report prevalence of enuresis or sample size, abstracts without full texts presented in congresses, case control and clinical trial studies which cannot estimate prevalence and also studies did not obtain minimum quality scores were excluded from the meta-analysis.

2-7: Statistical analysis

We used STATA v.11 software for data analysis. Standard error of prevalence for each study was calculated based of binomial distribution formula. Cochrane (Q) and I Squared indicators were detected as an index for heterogeneity between the results. According to these indices, random effects model and fixed model were used to combine the results. To minimize the random variation between point prevalence, all results were adjusted using Bayesian analysis. We also performed sensitivity analysis to identify studies most affected the heterogeneity. Based on meta-regression models, factors influenced the heterogeneity were detected. Forest plots

were designed to represent point prevalence of enuresis with 95% confidence intervals (crossed lines). In these plots, each box indicated the weight of the study.

3- Results

During our primary search, 1,755 papers were found restricted to 254 articles after excluding duplicates. Reviewing titles, abstracts and full texts as well as quality

assessment and applying inclusion/exclusion criteria, 15 eligible papers selected (1, 4, 6-7, 14-24) for systematic review and meta-analysis (Figure. 1, Figure. 2 and Table. 1).

All studies were carried out between 2000 and 2015 seven of which were written in English. All of them were cross sectional studies. Diagnostic criteria for enuresis were DSM-IV (14 studies) and ICD-10 (one study).

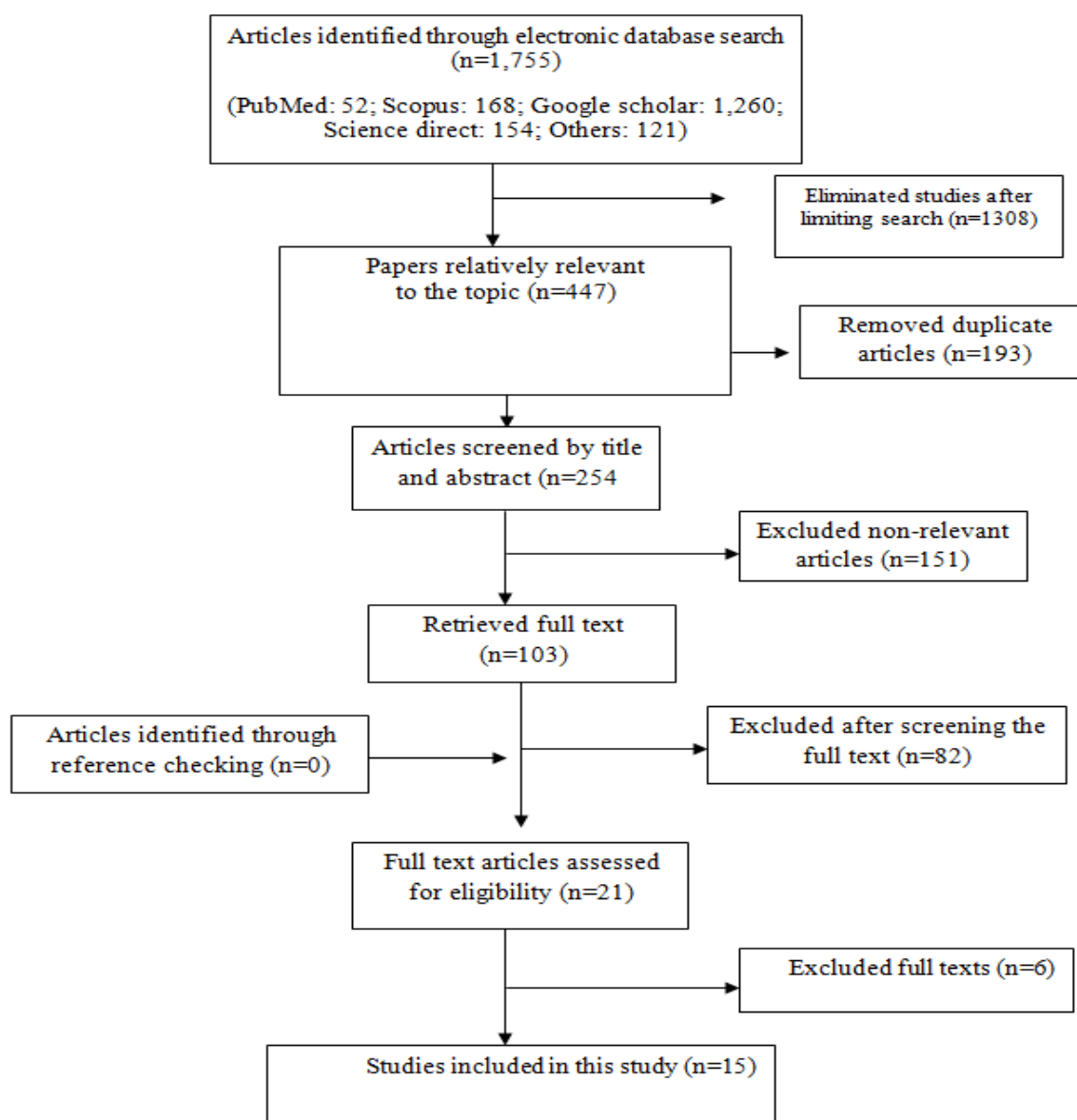


Fig.1: Literature Search and Review Flowchart for Selection of Primary Studies

Table 1-Characteristics of primary studies included to the present meta-analysis

id	First author (reference)	Publication year	Range of age	Sample size			Prevalence of			Association between enuresis with variables of																
				Total	Boys	Girls	Total	Boys	Girls	gender	positive history family	fluid intake	education parents	income	number family member	Birth ranking	snoring	mouth breathing	UTI	Corporal punishment						
1	Hakim (6)	2015	6-12	200	100	100	32	42	22	0.005	0.002	0.004	0.001	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-
2	Akhavan Karbasi (14)	2009	6	400	200	200	8.2	12.5	4	0.062	-	0.126	-	NS	-	NS	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
3	Bakhtiar (1)	2014	-	708	354	354	8	10.7	5.4	0.007	0.009	NS	-	0.01	-	NS	-	0.036	-	0.036	-	0.036	-	0.036	-	
4	Torkashvand (15)	2015	6-8	1080	665	415	10.6	12.3	8.44	-	0.062	-	-	0.520	0.023	0.589	-	-	-	-	-	-	-	-	-	-
5	Enam Ghoreishi (16)	2004	6-11	1000	-	-	16.5	-	-	0.01	-	0.05	-	0.044	NS	NS	-	-	-	-	-	-	-	-	-	-
6	Ghoibi (17)	2000	7-13	681	363	318	8.8	6.1	11.9	-	0.007	0.015	-	-	-	-	-	-	-	-	-	-	-	0.007	-	-
7	Mohammadpour (18)	2012	-	250	99	151	6.8	13.26	1.99	-	0.0001	0.001	<0.05	NS	NS	-	NS	0.05	-	-	-	-	-	-	-	0.03
8	Pashapour (19)	2008	7-12	3500	1829	1671	7.7	8.6	6.7	-	0.032	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Mahmoodzadeh (7)	2013	-	918	453	465	18.7	20.9	16.5	-	-	0.001	-	0.001	<0.05	0.001	-	-	-	-	-	-	-	-	0.001	-
10	Ghahramani (4)	2008	6-6.5	291	123	168	17.5	21	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Zargar (20)	2013	-	807	410	397	10.8	13.2	8.3	0.972	0.026	0.0001	0.0001	0.172	0.107	-	0.077	-	-	-	-	-	0.057	0.893	-	
12	Safarinejad (21)	2007	5-18	7562	-	-	6.8	-	-	0.001	-	0.001	0.072	0.001	0.322	0.028	-	-	-	-	-	-	-	-	-	-
13	Azhir (22)	2006	6-12	3102	1524	1578	6.9	9.3	4.3	-	0.000	-	-	0.028	-	0.837	0.970	-	-	-	-	-	-	-	-	-
14	Khazaei (23)	2005	5.5-6.5	110	-	-	7.68	-	-	-	NS	-	-	NS	<0.05	-	0.001	-	-	-	-	-	-	-	-	-
15	Rangbar (24)	2003	5-16	221	122	99	9.04	16.2	7.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

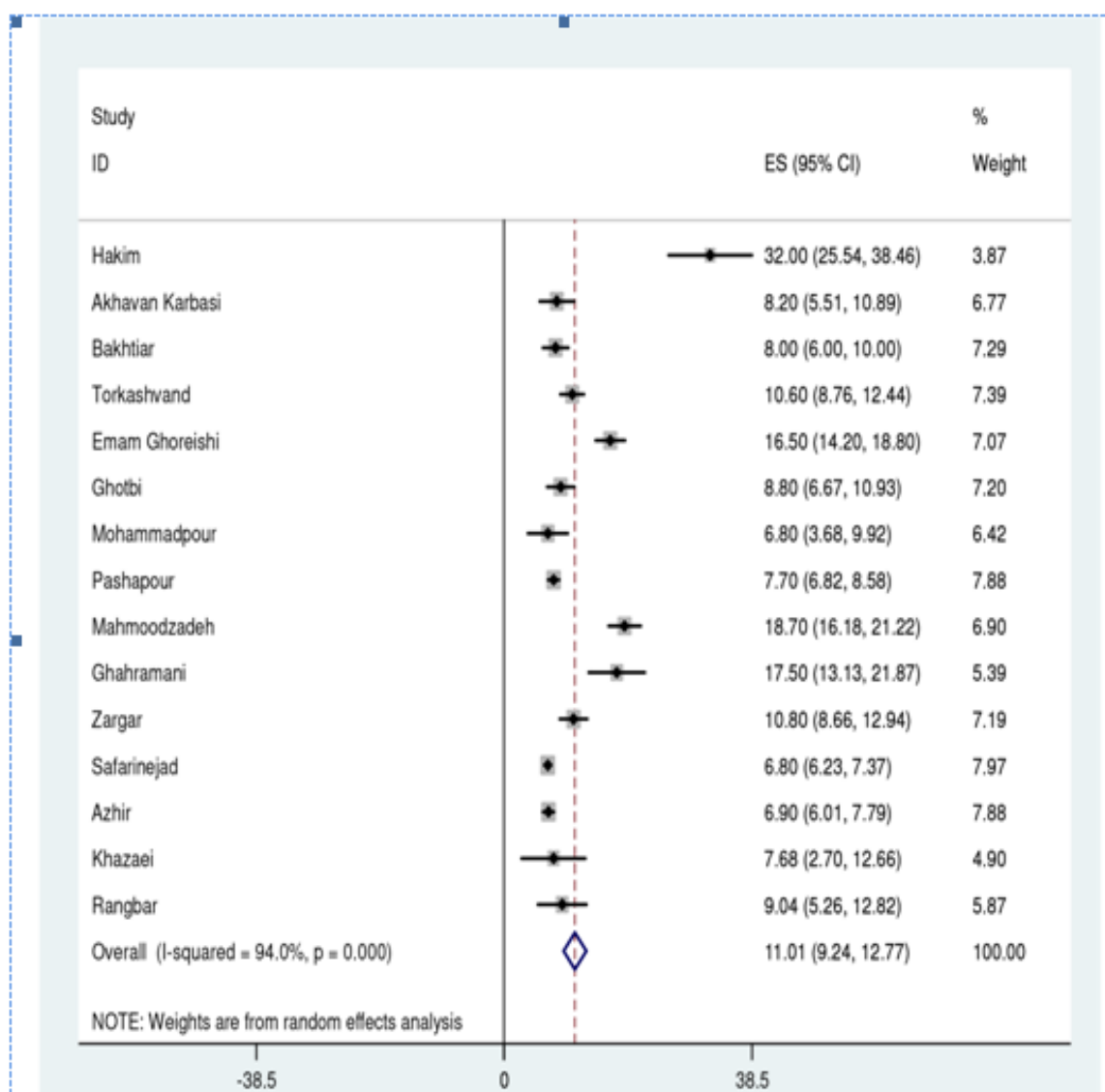


Fig.2: The Prevalence of Enuresis in Children among Primary Studies and Prevalence of Pooled Estimate in IRAN

Prevalence of enuresis among all children varied from 6.8% in the studies conducted by Safarinejad and Mohammadpour among 7,562 and 250 children respectively to 32% in the study carried out by Hakim among 200 children. Having adjusted by Bayesian analysis, corresponding prevalence were changed to 6.8% and 21.1% respectively. Among boys, prevalence of enuresis varied between 6.1% in Ghotbi study to 42% in Hakim study changed to 6.7% and 25.9% respectively after Bayesian adjustment.

Prevalence of enuresis among girls varied from 1.99% in the study conducted by Mohammadpour to 22% in the study carried out by Hakim. Adjustment with Bayesian analysis changed these prevalences to 2.6% and 14.9% respectively.

In this meta-analysis, 20,832 Iranian children (6,242 boys and 5,916 girls) were investigated (gender-specific sample size did not report in three studies). Based on random effects model, prevalence (95%

confidence interval) of enuresis among all children, boys and girls were estimated as of 11.01%(9.2-12.8), 13.9%(11.2-16.7) and 8.4%(6.3-10.6) respectively (Table. 2). Since there is no overlapping among

confidence intervals, it seems that there is no significant difference between these subgroups regarding prevalence of enuresis.

Table 2: The Pooled estimate of Prevalence of Enuresis in Children of Iran According to Random Effect Model

Variable	Sample size	Prevalence of enuresis	Heterogeneity		
			Q	P	I-squared (%)
Total	20832	11.01(9.2-12.8)	231.8	<0.001	94
Boys	6242	13.9(11.2-16.7)	110.5	<0.001	90
Girls	5916	8.4(6.3-10.6)	106.7	<0.001	89.7

Sensitivity analysis showed that Safarinejad study had the most influence on heterogeneity. Excluding this study from the meta-analysis only caused negligible reduction in the I-squared heterogeneity (from 94% to 93.5%). In the second stage of sensitivity analysis, confidence intervals of the rest of studies overlapped each other. Using meta-regression model, study date was observed as one of the factors affected the heterogeneity, although, its effect was not statistically significant ($P>0.05$).

Association between gender and enuresis was investigated in nine studies eight of which showed that enuresis was more common among boys. Relationship between enuresis and positive familial history was assessed in nine studies seven of which reported that positive familial history is a predictive factor. Deep sleeping was associated with enuresis according to the results of four studies out of six studies. High liquid intake was correlated with enuresis in all four studies investigated this association.

Based on the results of five studies out of 11 studies, children of low educated parents had more frequency of enuresis. Moreover, five studies out of 11 studies

assessed the relationship between enuresis and family income showed that enuresis was more common among children living in low income families. Of seven studies investigated the association between enuresis and large family size, only two studies reported significant correlations. Only one study out of seven articles found significant association between birth rank and enuresis. Sniffing was associated with enuresis in two studies out of three studies assessed such relationship. Of four studies investigated the association between mouth breathing and enuresis, two studies observed significant results. Urinary tract infection was correlated with enuresis according to the results of two studies out of four studies assessed the effect of this factor. Effect of corporal punishment on developing enuresis was assessed in two studies which both of them showed significant influence.

4- Discussion

This meta-analysis which was conducted among 20,832 Iranian children showed that 11.01% of them have enuresis. We also observed that the prevalence of enuresis among boys was 1.65 fold greater than that of girls. Enuresis was more common among

children with positive familial history, deep sleeping status, high liquid intake, mouth breathing, UTI, those with history of sniffing, those with low educated or low income parents and those with history of corporal punishment.

Table.3 compares the prevalence of enuresis among children living in eight countries. In a cohort study carried out in

Brazil among 3,602 children aged seven years in 2014, prevalence of enuresis was reported as of 10.6% (25). In Turkey that is culturally similar to Iran, prevalence of enuresis was reported as of 9% in Ozkan study in 2010 (3), 16.2% in Dolgun study in 2012 (9) and 7.5% in Yazici study in 2012 (26). It seems that both countries have similar prevalence.

Table 3: The Prevalence of Enuresis in Children of other Countries

Reference	First author, Publication year	Country	Sample size	Prevalence		
				Total	boys	girls
27	Fockema (2012)	Africa	4700	14.4-16	64.3	35.7
28	Srivastava (2013)	India	1212	12.6	16.3	10.7
26	Yazici (2012)	Turkey	11324	7.5	-	-
29	Su (2011)	Hong Kong	6147	4.6	6.7	2.5
3	Ozkan (2010)	Turkey	15150	9.0	10.2	7.7
17	Denise (2014)	Brazil	3602	10.6	11.7	9.3
9	Dolgun (2012)	Turkey	420	16.2	-	-
8	Shreeram (2009)	USA	1136	4.45	6.21	2.51

Based on the results of a study conducted among 5-10 year-old children in Africa in 2012, total prevalence of enuresis was reported as of 14.4%-16% (27). Srivastava et al. (28) reported enuresis prevalence among Indian children as of 12.6% which is higher than that estimated in the current study.

In countries with different cultures, lower rates of enuresis have been observed. For example it has been reported as of 4.6% in Hong Kong (29) and 4.45% in the USA (8).

Most of studies conducted in Iran, showed higher prevalence of enuresis among boys (1, 4, 6, 7, 14, 15) which was in agreement with the estimates of the other regions (3, 8, 25-29). Su et al. found that higher rates of enuresis among boys are attributed to longer deep sleeping and more severe sleep apnea among boys in compare with girls (29). Conversely, Ghotbi reported higher

prevalence of enuresis among girls compared to that in boys (11.9% vs. 6.1% respectively) due to insufficient cares and higher risk of urinary tract infection among girls (17).

According to the results of the most studies conducted among Iranian children, factors such as positive familial history (1, 6, 7, 14, 22), low knowledge of parents (7, 14, 22) and deep sleeping (1, 6, 14) were risk factors of enuresis which is similar to those reported in studies in other parts of the world. For instance, Yazici found a strong association between enuresis and positive familial history (26). In addition, Ozkan reported sleep problems such as deep sleeping as risk factors of enuresis (3). Filling the bladder causes wakefulness center activation in the brain and converts deep sleep to light sleep. Any problem in this awaking system may lead to deep sleep (14).

There was considerable heterogeneity between the results of primary studies entered into this meta-analysis. Therefore, we applied random effects model to combine the results. Different definitions of enuresis among primary studies might be another limitation of the current study.

Our study provides reliable evidences for health policymakers help them adopting appropriate strategies toward children health promotion. It seems that conducting primary studies estimating prevalence of enuresis is not necessary, but etiologic studies are highly recommended to be carried out.

5- Conclusion

This systematic review/meta-analysis showed that a considerable portion of Iranian children have enuresis and that male gender is a determinant factor for this disorder. In addition, we observed that positive familial history, deep sleep, high liquid intake, parents' socio-economic level, presence of sniffing and mouth breathing and also corporal punishment have determinant role in developing enuresis.

6- Conflict of Interest: None.

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