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Distribution of *Streptococcus agalactiae* Among Iranian Women from 1992 to 2018: A Systematic Review and Meta-Analysis

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Abstract

Context: Group B *Streptococcus* has the capacity of being colonized in the rectovaginal organ of women and causes infections in a mother and her fetus, thereby leading to neonatal diseases.

Evidence Acquisition: The aim of this review was to summarize all of the relevant articles published to highlight the prevalence of group B *Streptococcus* colonization or infection in different regions of Iran. A systematic literature review was conducted by searching PubMed, Scopus, Web of Science (ISI), ScienceDirect, Google Scholar, and domestic databases for papers published in English or Persian from 1992 up to July 2019, concerning the prevalence of group B *Streptococcus* among Iranian women. All information regarding year, location of cases, frequency, author's name, date of publication, participants, pregnancy period, sampling, and quality assessment were recorded. Summary effects were derived using the random effects model.

Results: Among 61 suitable papers, data revealed that 36,807 cases of pregnant and non-pregnant women had been tested for group B *Streptococcus* during 1992-2018. Overall, 11.9% of pregnant and 5.3% of non-pregnant women were positive. Further results were as follows: vaginal, recto-vaginal, rectal, and endocervical colonization rates were 12.9%, 9.7%, 18.5%, and 3.7%, respectively. Group B *Streptococcus* incidence was the highest in Sanandaj (61.5%), and the lowest in Tabriz (1.8%).

Conclusions: Although the prevalence distribution in Iran seems to be acceptable, more investigations are needed to represent the real incidence of group B *Streptococcus* around the country. In addition, a program with a standard lab technique is needed to screen pregnant women for further treatment before birth.

Keywords: Epidemiology, Iran, Pregnant, Prevalence, *Streptococcus agalactiae*, Women

1. Context

As group B *Streptococcus* is a pathogen commonly found in rectovaginal mucosa of pregnant women, it appears reasonable to label this bacterium as a cause of neonatal diseases at birth (1). Several investigations have revealed that about 10 - 40% of healthy women carry group B *Streptococcus* in their vagina and/or rectum. Much as the bacterium threatens the fetus in pregnant women, it can also induce infection of the endometrium or amniotic membrane, bacteremia, as well as sepsis and meningitis in susceptible women (2, 3). Since 1970, the etiological role of group B *Streptococcus* in diseases was highlighted, especially with regard to its ability to cause newborn infections. Recently, two kinds of infantile diseases have been attributed to group B *Streptococcus*; early-onset diseases and late-onset diseases. The early-onset diseases are usually manifested during the first week after birth, while late-onset diseases may appear 2 - 3 months after birth. Pneumonia and sepsis are both attributed to early-onset diseases; however, late-onset diseases likely engender meningitis in newborn infants.

Albeit different structures have been identified as group B *Streptococcus* virulence factors, a polysaccharide capsule is known to carry the most important role in this regard (4). It has antiphagocytic function. Other virulence factors include secreted hemolysin, superoxide dismutase, D-alanylated lipoteichoic acid, and some of the surface proteins such as the surface-localized protease CspA. Although surface proteins of *Streptococcus agalactiae* may have considerable roles during various stages of infection, they at-

tract more and more importance regarding the development of a vaccine. Adhesion to epithelial cells, interactions with human extracellular matrix or plasma proteins, and escape from host immunity are other possible roles of surface proteins of group B *Streptococcus* (5).

Based on the proportion of cps, group B *Streptococcus* has been classified into 10 serotypes; Ia, Ib, and II-IX (1, 6). The prevalence rate of group B *Streptococcus* infections in both pregnant and non-pregnant women varies widely depending on the population studied; however, group B *Streptococcus* is usually isolated from 10% - 30% of women. In Iran, an estimated average of 9.8% of women is rectovaginally infected; however, the colonization rate of their neonates at birth is not clearly known (7). Some authors believe that about 50 - 75% of infants are exposed to the organism during the birth process (8-10). The major infant's diseases are attributed to meningitis and septicemia (11, 12). Furthermore, transmission of group B *Streptococcus* infection to infants at the time of birth, other group B *Streptococcus*-related infection complications, including premature rupture of membrane, low birth weight, and preterm labor may develop during pregnancy (13).

2. Evidence Acquisition

In the present study, almost all of the literature published from 1992 to July 2019 were reviewed to determine the prevalence of group B *Streptococcus* carrier state in different regions of Iran. In addition, this study shows the relative frequency of group B *Streptococcus* positivity with respect to geographical area, date of sampling, and type of the swab specimen.

2.1. Search Strategy

The strategy employed for identifying group B *Streptococcus* prevalence was searching in PubMed, Scopus, Web of Science (ISI), ScienceDirect, Google Scholar, and domestic databases for papers published in English or Persian. Terms such as *S. agalactiae*, group B *Streptococcus*, *S. agalactiae*, *Streptococcus* group B, and Iran were used as keywords to find the relevant published works. In order to find the maximum number of related papers and also gray literature, three local search engines, including the Iranian Scientific Information Database (www.sid.ir), Medlib (www.medlib.ir), and Magiran (www.magiran.com) were used. No limitations were applied when searching the mentioned databases. Extracted references were all reviewed, and the irrelevant titles/abstracts were excluded from the collection. The study selection process was handled by three researchers (MS, AS, NA). To reach a consensus on the selection of the relevant articles, any disagreement was discussed by the team members.

2.2. Inclusion Criteria

The following publications were identified as eligible to be included in the present systematic review and meta-analysis:

A) Investigations assessing the prevalence of *S. agalactiae* in the Iranian women,

B) Group B *Streptococcus* sampling from the vaginal, rectovaginal, endocervical, and rectal regions as well as the urine, and

C) Using culturing and/or PCR method as techniques applied for the detection of group B *Streptococcus*.

2.3. Exclusion Criteria

Studies were excluded if:

A) They had failed to use a standard method for group B *Streptococcus* isolation,

B) They had an irrelevant source of sampling (from men, animal, etc.),

C) They were review, meta-analysis or systematic review, or a duplicate publication of the same study.

2.4. Data Collection

Two authors conducted the data extraction, and the following information was collected: The first author's name and the date of publication, the participants' status, including the pregnancy period, geographic location, group B *Streptococcus* isolation, and finally, the number of group B *Streptococcus* carriers were all noted for further investigation. Any disagreement as for data collection was discussed by the colleagues to reach the final decision (Figure 1).

2.5. Quality Assessment

In this study, a checklist recommended by Hoy et al. (14) was used for the evaluation of the methodological quality. The checklist consisted of nine questions, representing the sampling-related information, technique of sampling, the response rate, the technique applied for data collection, tools for measurement, definition of cases, and the statistical method. Each question was scored 1 or 0, defined as low- or high-risk bias, respectively. Scores 0 to 9 were selected and defined as follows: 0 to 3 as "high-risk", 4 to 6 "moderate-risk", and 7 to 9 as "low-risk" bias.

2.6. Limitations

The overall prevalence of group B *Streptococcus* carriers in our query could not be determined comprehensively. Different factors such as geographical region, collection of

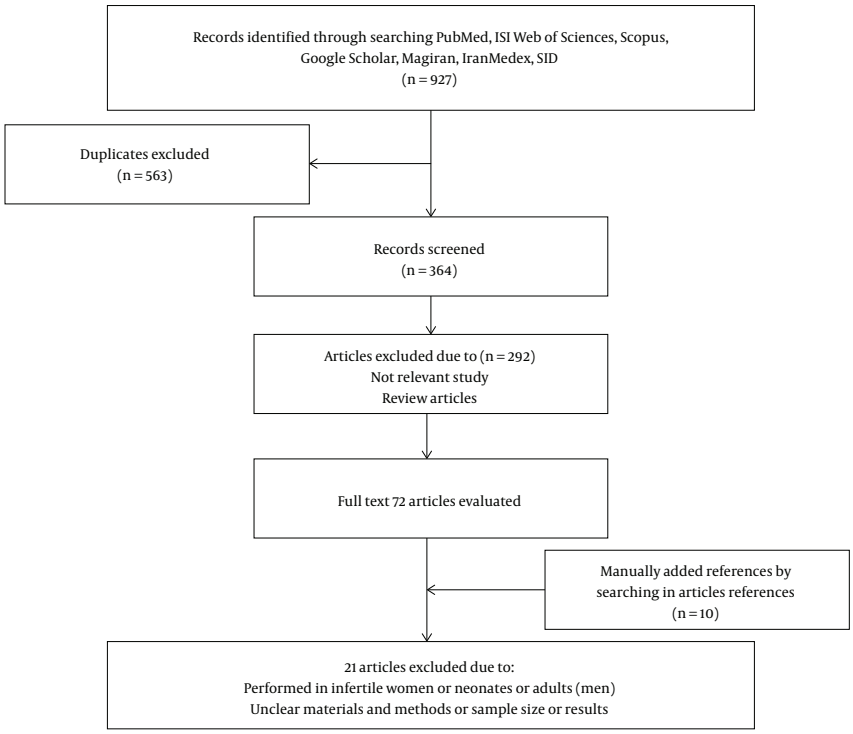

Figure 1. Flow diagram of the study process

samples, site of sampling, socioeconomic status, and microbiological methods all contributed to the results obtained. Also, due to lack of group B *Streptococcus* prevalence works in some provinces such as Golestan, Semnan, Mazandaran, Zanjan, Qom, South Khorasan, North Khorasan, Sistan and Baluchestan, Hormozgan, Kohgiluyeh and Boyer-Ahmad, Alborz, Qazvin, and West Azarbaijan, this review paper failed to present a full account of group B *Streptococcus* prevalence in Iran (Figure 2).

2.7. Statistical Analysis

The total number of the participants and the number of samples with *S. agalactiae* were used to calculate the event rate and confidence interval. The summary estimates were derived using the DerSimonial and Laird random effects model by taking inter-study heterogeneity into account. The I-squared and Cochran's Q tests were used to assess heterogeneity between the studies. Subgroup analysis was used to explore the prevalence rates according to the sampling year, the province in which the study was conducted, and the quality of studies. Sensitivity analysis was carried out to explore the extent to which the overall calculations might depend on a specific study. All analyses were performed using the STATA software version 11.2 (STATA Corp, College Station, TX, USA).

3. Results

According to Databases, 927 articles were selected, among which 563 duplicated articles were excluded. Following reviewing all abstracts of the published works, 292 articles were deleted because of being irrelevant. Full texts of 82 articles were carefully considered, and again, 21 articles that were directly related to infertile women, neonates, adults, and those with ambiguous methods were all excluded from the study. Overall, the remaining 61 articles were approved for further investigation (Figure 1).

3.1. Prevalence of Group B Streptococcus in Iranian Women

Extraction of the information of these articles revealed 36,807 pregnant and non-pregnant women had been examined for group B *Streptococcus* detection during 1992 - 2018, out of which 2,930 cases (9.7%) were found positive for group B *Streptococcus* (Table 1). Observed data demonstrated the prevalence of group B *Streptococcus* among pregnant women to be 11.9% (95% CI: 0.103 - 0.135). Based on swab sampling technique, positive cases were found as the following: (1) vaginal samples with 34 studies (12.9%) (95% CI: 0.103 - 0.155), (2) recto-vaginal samples with 25 studies (9.7%) (95% CI: 0.075 - 0.120), rectum samples with

Figure 2. Incidence of Group B streptococcus-positive in different cities in Iran. Source: Map of Iran powered by http://www.wikipedia.com/ (Note: Rect, rectovaginal; Vag, vaginal)

10 studies (18.5%) (95% CI: 0.096 - 0.275), endocervical samples with one study (3.7%) (95% CI: -0.003 - 0.077), vaginal and urine with one study (6.1%) (95% CI: 0.030 - 0.092), and urine with three studies (2.3%) (95% CI: 0.001 - 0.044). When the recorded data regarding distribution of group B *Streptococcus* among non-pregnant women were extracted, 5.3% (95% CI: 0.034 - 0.072) of the cases were identified as group B *Streptococcus* colonized.

3.2. Prevalence of Group B Streptococcus in Vaginal and Rectovaginal Swabs of Pregnant Women

The majority of group B *Streptococcus* research works were based on vaginal or rectovaginal samples. Therefore, an effort was made to analyze and record the data in terms of city, quality assessment index, and year of publication (Tables 1 and 2). The papers were then classified into high-, moderate-, and low-quality index, and consequently, we found vaginal swab samples were in the low-risk (13.7%) group, while rectovaginal cases were in the high-risk (13%) group. Further observation indicated the prevalence of group B *Streptococcus* from vaginal samples was 15.8% before the year 2000; the city of Sanandaj carried the highest rate with 61.5%, and Tabriz recorded the lowest incidence with 1.8% (Table 2). Data observed from rectovaginal samples (Table 3) revealed that the highest incidence of group B *Streptococcus* had been observed in 2000 - 2009, during which Isfahan had suffered from the highest rate (18.2%), but Jahrom had the lowest rate (1.7%).

4. Discussion and Conclusions

The present systematic review and meta-analysis has summarized 61 published works on group B *Streptococcus* distribution in Iran. Among 36,807 samples examined, 2,930 samples (9.7%) were reported positive for group B *Streptococcus*. The prevalence was estimated to be 11.9% in pregnant and 5.3% in non-pregnant women (Table 1). The worldwide investigations show that a total of 11% - 30% of women are carriers of group B *Streptococcus* in their genital system. The important point is that contaminated women may transfer the bacterium to their fetus or neonates (9, 45, 72).

The knowledge resulting from the present review of group B *Streptococcus* colonization allows us to conclude that since up to 9.7% of females have been found to be group B *Streptococcus*-positive, it seems reasonable to

Table 2. Status of Group B *Streptococcus* Prevalence in Vaginal Samples

Sample	Number of Studies	Prevalence	95% CI	Heterogeneity			P Value
				Q- Statistic	I-Squared (%)	P Value	
Experiment date							
< 2000	2	15.8	0.122-0.194	0.40	0.0	0.528	< 0.001
2000 - 2009	12	11.8	0.076-0.160	339.12	96.8	0.000	
≥ 2010	20	13.4	0.096-0.172	454.24	95.6	0.000	
City							< 0.001
Kerman	2	8.7	0.066-0.108	0.76	0.0	0.384	
Yazd	1	16.5	0.126-0.204	0.00			
Sanandaj	1	61.5	0.548-0.682	0.00			
Mashhad	3	6.4	-0.003-0.131	13.25	84.9	0.001	
Ardabil	2	4.1	0.023-0.059	0.84	0.0	0.359	
Tehran	4	14.1	0.053-0.230	68.97	95.7	0.000	
Ahvaz	1	27.7	0.203-0.352	0.00			
Arak	2	13.4	0.096-0.173	1.80	44.4	0.180	
Kermanshah	1	5	0.003-0.097	0.00			
Amol	1	4	-0.003-0.083	0.00			
Khorram-abad	1	14	0.071-0.209	0.00			
Isfahan	2	23.1	0.082-0.381	38.77	94.8	0.000	
Jahrom	1	16.4	0.128-0.200	0.00			
Hamadan	3	13.8	0.012-0.264	69.17	97.1	0.000	
Ilam	1	4.4	-0.003-0.092	0.00			
Tabriz	1	1.8	0.009-0.026	0.00			
Bushehr	1	9.5	0.060-0.129	0.00			
Kashan	2	8.6	0.067-0.106	0.48	0.0	0.487	
Shahrekord	1	17.6	0.146-0.206	0.00			
Rasht	2	10.7	0.037-0.177	3.26	69.3	0.071	
Babol	1	7.8	0.051-0.104	0.00			
Quality assessment							< 0.001
Low-risk	8	13.7	0.090-0.184	124.62	93.6	0.000	
Moderate-risk	24	12.8	0.093-0.163	729.01	96.8	0.000	
High-risk	2	10.7	0.040-0.174	3.28	69.5	0.000	
Overall	34	12.9	0.103-0.155	865.91	96.1	0.000	< 0.001

suggest a strengthened program for screening the pregnant women to illuminate the more accurate prevalence of group B *Streptococcus* among the Iranian population. Moreover, a variation was discovered in the reported data, which could be mainly due to different methods for group B *Streptococcus* detection. Therefore, it is essential to document a more sensitive method for the studies to come. Furthermore, more serious measures are needed to represent an account of group B *Streptococcus* in infected pregnant women for preventing the transmission of bacterium to their neonates. Additionally, a treatment program must be optimized to eradicate the infection in pregnant women and carriers. Finally, despite controversy in reported data from different populations, group B *Streptococcus* is surely

Table 3. Status of Group B *Streptococcus* Prevalence in Rectovaginal Samples

Sample	Number of Studies	Prevalence	95% CI	Heterogeneity			P Value
				Q- Statistic	I-Squared (%)	P Value	
Experiment date							< 0.001
< 2000	0	-	-	-			
2000 - 2009	10	11.3	0.087-0.139	49.39	81.8	0.000	
≥ 2010	15	8.7	0.056-0.117	286.00	95.1	0.000	
City							< 0.001
Yazd	2	16	0.092-0.228	4.36	77.1	0.037	
Mashhad	1	6	0.026-0.094	0.00	.	.	
Ardabil	3	10.7	0.052-0.162	21.40	90.7	0.000	
Tehran	7	9.9	0.041-0.156	132.41	95.5	0.793	
Ahvaz	1	13.2	0.090-0.174	0.00	.	0.000	
Arak	1	5.2	0.025-0.080	0.00	.	.	
Amol	1	3	-0.010-0.070	0.00	.	.	
Birjand	1	5.2	0.032-0.072	0.00	.	.	
Khorram-abad	1	17	0.096-0.244	0.00	.	.	
Shiraz	2	11.2	0.067-0.157	4.77	79.0	0.029	
Isfahan	1	18.2	0.124-0.241	0.00	.	.	
Jahrom	1	1.7	0.004-0.031	0.00	.	.	
Tabriz	1	9.6	0.059-0.133	0.00	.	.	
Babol	2	6.8	-0.018-0.153	24.23	95.9	0.000	
Quality assessment							< 0.001
Low-risk	6	12.2	0.049-0.195	281.57	98.2	0.000	
Moderate-risk	16	8.1	0.065-0.097	67.98	77.9	0.000	
High-risk	3	13	0.076-0.183	7.01	71.5	0.000	
Overall	25	9.7	0.075-0.120	373.41	93.6	0.000	< 0.001

present in different races around our country. As a result, documenting a legal program is highly recommended for screening pregnant women in rural and low-income populations in this country.

Footnotes

Authors' Contribution: MS contributed to the conception and design; data collection and interpretation of data and final approval of the version to be published. ASA contributed to statistical analysis and drafting the manuscript. NA and FM contributed to data collection and interpretation. MBK and SHHM contributed to revising the article and final approval of the version to be published.

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Table 1. Characteristics of the Studies Included in the Systematic Review and Meta-Analysis

First Author (Ref. No.)	Place (City)	Year (yr)	Age	Pregnancy	Pregnancy Age (wk)	Swab Samples	Identification Method	Sample Size	No. Positive GBS	Carriers (%)	Quality Assessment
Aali (15)	Kerman	2005	25.6	Preg	38-40	Vag	Cult	105	7	6.7	Low-risk
Absalan (16)	Yazd	2002	15-40	Preg		Recto-Vag	Cult. PCR	250	49	19.6	Low-risk
Ahmadi (17)	Sanandaj	2017	19-43	Preg	35-37	Endocervical	PCR	109	4	3.7	Moderate-risk
Akhlaghi (18)	Mashhad	2007	NA	Preg	33-37	Vag	Cult	43	3	7	Moderate-risk
Arzanlou (2)	Ardabil	2008	NA	Preg	35-37	Recto- Vag	Cult	420	56	13.3	Low-risk
Bakhtiari (19)	Tehran	2011	NA	Preg	28-38	Recto- Vag	Cult. PCR	375	35	9.3	Moderate-risk
Bidgani (20)	Ahvaz	2013-2014	16-45	Preg	28-38	Vag	Cult. PCR	137	38	27.7	Moderate-risk
				Preg		Rect	Cult. PCR	137	42	30.7	Moderate-risk
Bornasi (21)	Arak	2012	NA	Preg	35-37	Vag	Cult. PCR	500	60	12	Moderate-risk
Soltan Dalal (22)	Tehran	2008	NA	Preg	35-37	Recto- Vag	Cult. PCR	125	10	8	Low-Risk
Darabi (23)	Tehran	2014-2015	18-35	Preg	35-37	Recto- Vag	Cult	186	22	11.8	Moderate-risk
Daramroodi (24)	Kermanshah	2017	NA	Preg	35-37	Vag	Cult. PCR	100	5	5	Moderate-risk
Fatemi (25)	Tehran	2008	16-40	Preg	35-37	Vag	Cult, PCR	330	68	20.6	Moderate-risk
Fazeli (26)	Amol	2013	NA	Preg	35-37	Vag	Cult, PCR	100	4	4	Moderate-risk
						Rect	Cult, PCR	100	3	3	Moderate-risk
						Recto- Vag	Cult, PCR	100	3	3	Moderate-risk
Frouhesh (27)	Tehran	2011-2012	NA	Non-preg	-	Urine	Cult	5000	104	2.1	High-risk
Ghanbarzadeh (28)	Birjand	2013-2014	16-37	Preg	30	Recto- Vag	Cult	500	26	5.2	Moderate-risk
Goudarzi (29)	Khorramabad	2012	NA	Preg	35-37	Recto- Vag	Cult, Real-time PCR	100	17	17	Moderate-risk
Habibzadeh (30)	Ardabil	2010	NA	Preg	35-37	Vag	Cult	420	19	4.5	Moderate-risk
						Rect	Cult	420	19	4.5	Moderate-risk
						Recto- Vag	Cult	420	24	5.7	Moderate-risk
Hadavand (31)	Tehran	2010-11	15-44	Preg	35-37	Recto- Vag	Cult	210	7	3.3	Moderate-risk
Hamedi (32)	Mashhad	2008-2009	15-39	Preg	34-40	Recto- Vag	Cult	200	12	6	Moderate-risk
Hassanzadeh (33)	Shiraz	2006-2007	19-35	Preg	< 20	Recto- Vag	Cult	310	43	13.9	Low-risk
Jannati (2)	Ardabil	2012	NA	Preg	35-37	Recto- Vag	Cult	420	56	13.3	Moderate-risk
Javadi (34)	Isfahan	2004	NA	Preg	35-37	Recto- Vag	Cult	170	31	18.2	
Javanmanesh (35)	Tehran	2012	16-42	Preg	35-37	Recto- Vag	Cult	1028	234	22.8	Low-risk
Kabiri (36)	Jahrom	2014	16-40	Preg	35-37	Vag	Cult	403	66	16.4	Low-risk
						Rect			21	5.2	Low-risk
						Recto- Vag			7	1.7	Low-risk
Kalantar (37)	Sanandaj	2011-2012	18-37	Preg	28-38	Vag	PCR	200	123	61.5	Moderate-risk
						Rect	PCR	200	160	80	Moderate-risk
Kasraeian (38)	Shiraz	2007	18-36	Preg	18	Urine	Cult	389	1	0.3	Low-risk
Khoshkhoutabar (39)	Arak	2013		Preg	35-37	Recto- Vag	Cult	268	14	5.2	Moderate-risk
Malek-Jafarian (40)	Mashhad	2015	15-40	Non-preg		Urine Vag	Cult	1200	46	3.8	Moderate-risk
Mansouri (41)	Kerman	2006-2007	20-35	Preg	35-37	Vag	Cult	602	55	9.1	Moderate-risk
Mashouf (42)	Hamadan	2013-2014	NA	Preg	35-37	Vag	Cult. PCR	203	15	7.4	Moderate-risk
Mobasheri (43)	Ardal	2010	17-38	Preg	0-40	Vag	Cult	85	2	2.3	Moderate-risk
Nakhaei Moghaddam (44)	Mashhad	2005-2007	16-40	Preg	35-37	Vag	Cult	201	22	10.9	Moderate-risk
						Rect	Cult	201	24	11.9	Moderate-risk

Mohamadi (45)	Ilam,	2014-2015	16-42	Preg	< 35	Vag	Cult	90	4	4.4	Moderate-risk
Mousavi (46)	Hamadan	2013-2014	NA	Preg	35-37	Vag	Cult. PCR	203	15	7.4	Moderate-risk
Saghafi (47)	Mashhad	2015-2016	15-42	Preg	27-37	Vag	Cult	200	3	2	Moderate-risk
Nahaei (13)	Tabriz	2001-2002	NA	Preg	NA*	Vag	Cult	965	17	1.8	Moderate-risk
Namavar Jahromi (48)	Shiraz	2003	14-45	Preg	> 24	Recto- Vag	Cult	1197	110	9.2	Moderate-risk
Nasri (49)	Arak	2010	16-39	Preg	35-37	Vag	Cult	186	30	16.1	Moderate-risk
Nazari (50)	Yazd	2015-2016	15-40	Preg	NA	Vag	Cult	346	57	16.5	Moderate-risk
						Urine	Cult	346	33	9.5	Moderate-risk
Nazer (51)	Khorram Abad	2009	18-39	Preg	28-37	Vag	Cult	100	14	14	Low-risk
Pirouz (52)	Tehran	1992	15-43	Preg	> 37	Vag	Cult	200	34	17	Moderate-risk
Rabiee (53)	Hamadan	2006	18-35	Preg	> 20	Vag	Cult	544	145	26.7	Moderate-risk
Rahbar (54)	Tehran	2010	26.6 ± 19.37 (mean)	Preg	NA	Urine	Cult	11800	19	0.2	Moderate-risk
				Non-Preg	-	Urine	Cult	11800	479	4.1	Moderate-risk
Sadeh (9)	Yazd	2013-2014	15-40	Preg	NA	Recto- Vag	Cult. PCR	237	30	12.7	Moderate-risk
				Non-Preg	-	Recto- Vag	Cult. PCR	413	70	16.9	Moderate-risk
Zarean Seyyed (55)	Isfahan	2010-2011	17-42	Preg	37	Rect	Cult	178	30	16.9	Low-risk
			17-36		20-37 (Preterm labor)	Rect	Cult	151	55	36.4	Low-risk
			17-42		37	Vag	Cult	178	36	20.2	Low-risk
			17-36		20-37 (Preterm labor)	Vag	Cult	151	59	39.1	Low-risk
Sharifi (56)	Tehran	2011	NA	Preg	35-37	Recto- Vag	Cult	250	21	8.4	Moderate-risk
Shirazi (57)	Tehran	2009-2011	19-50	Preg	35-37	Vag	Cult	980	48	4.9	Low-risk
Tajbakhsh (58)	Bushehr	2010-2011	26.39 ± 5.33 mean	Preg	35-42	Vag	Cult	285	27	9.5	Low-risk
Yasini (59)	Kashan	2011-2012	16-45	Preg	28-37	Vag	Cult	382	36	9.4	Moderate-risk
Zamanzad (60) **(unpublished Persian article)**	Shahrekord	2000	NA	Preg		Vag	Cult	624	110	17.6	Moderate-risk
Amirmozafari (61)	Rasht	2005		Preg	28-37	Vag	Cult	100	15	15	High-risk
Haghshenas Mojaveri (62)	Babol	2014	25.9 ± 4.2 (mean)	Preg	35-37	Vag	Cult	400	31	7.8	Low-risk
						Rect	Cult	400	20	5	Low-risk
						Recto- Vag	Cult	400	10	2.5	Low-risk
Jahed (63)	Tehran	2008	NA	Preg	35-37	Recto- Vag	Cult	246	13	5.3	Moderate-risk
Khataie (64)	Tehran	1998	NA	Preg	37	Vag	Cult	191	28	14.7	Moderate-risk
Nasrollahi (65)	Sari	2018	< 25-30 >	Preg	35-37	Vag, Urine	Cult, PCR	246	15	6.1	Moderate-risk
Rostami (66)	Isfahan	2015	29.35 ± 5.509 (mean)	Preg	35-37	Vag	Cult, PCR	200	22	11	Low-risk
						Rect	Cult, PCR	200	7	3.5	Low-risk
Sahraee (67)	Rasht	2017-2018	NA	Preg	35-37	Vag	Cult, PCR	245	19	7.8	Moderate-risk
						Rect		245	24	9.8	Moderate-risk
Abdollahi Fard (68)	Tabriz	2006	22.96 ± 3.89 (mean)	Preg	35-37	Vag, Rect	Cult	250	24	9.6	Moderate-risk
Akbarian Rad (69)	Babol	2012-2014	25.7 ± 5.55 (mean)	Preg	> 26	Vag, Rect	Cult	410	46	11.2	Moderate-risk
Shahbazian (70)	Ahvaz	2007	NA	Preg	35-37	Vag, Rect	Cult	250	33	13.2	High-risk
Sarafrazi (71)	Kashan	2000	NA	Preg	35-37	Vag	Cult	400	32	5.8	High-risk

Abbreviations: Cult, culture; GBS, Group B *Streptococcus*; NA, not available; Preg, pregnant; Rect, rectal; Rect-Vag, rectovaginal; Vag, vaginal.