

Review Article

Intimate hygiene practices and reproductive tract infections: A systematic review

Alaa Daher^{a,1}, Obey Albaini^{b,1}, Lauren Siff^c, Stephanie Farah^b, Karl Jallad^{d,*}^a Department of Obstetrics and Gynecology, American University of Beirut Medical Center, Beirut, Lebanon^b Department of Clinical Research, Lebanese American University Medical Center, Gilbert and Rose-Marie Chagoury School of Medicine, Beirut, Lebanon^c Virginia Commonwealth University School of Medicine, Virginia, USA^d Lebanese American University Medical Center, Gilbert and Rose-Marie Chagoury School of Medicine, Beirut, Lebanon

ARTICLE INFO

Keywords:

Intimate hygiene practice

Reproductive tract infection

Sexually transmitted infection

Vaginal douching

ABSTRACT

Introduction: Worldwide, women perform a variety of vaginal practices to enhance their intimate hygiene and sexual health.**Objective:** To conduct a systematic review to assess the different kinds of intimate hygiene practices and their association with reproductive tract infections and complications.**Methods:** PubMed, Medline and The Cochrane Library were used. Both observational and interventional studies targeting the urogenital infections and their association with hygiene practices were included. Exclusion criteria included studies that assessed the knowledge and attitudes towards intimate hygiene practices rather than their relation to infections. The design of this systematic review complied with the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA).**Results:** Fifteen articles were included. Intravaginal practices were found to be associated with reproductive tract infections. Reusable absorbent material used during menstruation increased the risk of Candida infection with an adjusted proportional reported ratio (aPRR) of 1.54 (95% CI 1.2–2.0), but no association with bacterial vaginosis or *trichomonas vaginalis* infection was noted. Bathing or vaginal washing during menstruation with water only showed a higher association with symptoms of urogenital infections when compared with washing with both soap and water during menstruation. Drying reusable pads inside the house and storing them inside the toilet was found to be associated with a higher candida infection prevalence. Moreover, bathing in sitting position during menstruation, not drying the genital area or using cloth for drying it, and not paying attention to hand washing, were all associated with a higher risk of genital infections. Finally, postpartum use of native homemade vaginal preparations might be a risk factor for ascending vaginal infections, and the use of inappropriate material for menstrual blood absorption was associated with secondary infertility.**Conclusion:** Several hygiene practices put women at higher risk for reproductive tract infections. We should continue to increase awareness to counter the misinformation resulting from marketing campaigns and common misconceptions.

1. Introduction

Worldwide, women perform a variety of vaginal practices to enhance

their hygiene and sexual health.¹ Some of the products commonly used include intravaginal cleaning (e.g., douching or washing with liquids), intravaginal and extra vaginal wiping (e.g., with a cloth or tissue), and

* Corresponding author. Lebanese American University Medical Center, Zahar Street, Achrafieh, Beirut, P.O. Box: 11-3288, Lebanon.

E-mail addresses: ad109@aub.edu.lb (A. Daher), obeyalbaini@gmail.com (O. Albaini), lauren.siff@vcuhealth.org (L. Siff), stephanie.faresfarah@lau.edu (S. Farah), karljallad@gmail.com (K. Jallad).

Publishing services by Elsevier on behalf of KeAi

¹ Co-authors who contributed equally to the manuscript.<https://doi.org/10.1016/j.gocm.2022.06.001>

Received 15 November 2021; Received in revised form 24 April 2022; Accepted 22 June 2022

Available online 19 July 2022

2667-1646/© 2022 The Authors. Publishing services by Elsevier B.V. on behalf of KeAi Communications Co. Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

intravaginal insertion of substances that dry or tighten the vagina and boost sexual pleasure.^{2,3}

However, the standard vaginal pH of 4.5, essential for maintaining a healthy vaginal immune barrier, can be disturbed by such feminine practice.⁴ Products used may affect the composition of the usual vaginal microbiome through alteration of pH or through direct bactericidal effects. Yet, the vaginal microbiome is important for a safe mucosal environment.^{3,4} While the presence of *Lactobacilli* in the vaginal environment indicates a healthy atmosphere and reduces the risk of inflammation, any disruption of this natural microbiome may be associated with major risk of inflammatory complications.⁴

Several studies suggested that unintended and harmful side effects are often correlated with intravaginal practices, increasing the risk of reproductive tract infections. Those in turn can increase the incidence of other serious conditions, such as pelvic inflammatory disease, infertility, ectopic pregnancy, miscarriage and preterm birth.^{1,2,5–10}

Our review is the first of its kind, to our knowledge, that aims to assess the different kinds of intimate hygiene practices and their association with reproductive tract infections and complications.

2. Materials and methods

2.1. Sources

The design of this systematic review complied with the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), while the SPIDER (Sample, Phenomenon of Interest, Design, Evaluation, Research type) guidelines offered a systematic strategy for searching for qualitative and mixed-methods research studies. No review protocol was published. This study was institutional review board (IRB) exempt.

We used electronic databases including PubMed, Medline and The Cochrane Library to search for our targeted articles (Table 1) We narrowed our key terms to “menstrual hygiene products”, “vaginal douching”, “reproductive tract infections” and “sexually transmitted diseases”. All our research was done in English language, and each database was searched until January 2021.

2.2. Study selection

Non pregnant women of menstruating age (10–49 years) were eligible for enrollment. We excluded women who were currently menstruating, underwent previous hysterectomy, were using antibiotics or oral contraceptive pills during the past three weeks, women with history of diabetes mellitus, human immunodeficiency virus (HIV) or other severe medical disorders. Types of intimate hygiene practices included intravaginal douching, that identifies as the practice of cleaning the vagina with liquid agents for hygienic and/or therapeutic purposes; insertion of certain cleansing products that include powders, creams, herbs, tablets, sticks, stones, leaves, and traditional products inside the vagina to dry or tighten it; sanitary napkins; pads; cloths; menstrual cups; cleansing and washing, alongside household environment, homemade vaginal preparations. Urogenital infections included Bacterial Vaginosis and those caused by *Candida*, *Staphylococcus aureus*, Chlamydia, Gonorrhoea, *Trichomonas*, syphilis, HIV, Herpes simplex virus (HSV), Human papilloma virus (HPV), *Escherichia coli* as well as pelvic examination and self-reported symptoms of itching, pain, irritation or discharge. The included studies assessed the rate of urogenital infections and its association with the type of intimate hygiene practices. We included observational (cohort, cross sectional, case control) and interventional studies (randomized controlled trials). We looked for qualitative, quantitative and mixed-methods research. The authors hand searched reference lists of the identified articles as well.

Table 1

Search strategy of the electronic databases used.

Database	Type of search	Search strategy
Pubmed https://pubmed.ncbi.nlm.nih.gov/	Medical subject headings (MeSH)	MeSH Database: (“Reproductive Tract Infections”[Mesh]) AND “Vaginal Douching”[Mesh] (“Menstrual Hygiene Products”[Mesh]) AND “Reproductive Tract Infections”[Mesh] (“Vaginal Douching”[Mesh]) AND “Sexually Transmitted Diseases”[Mesh] (“Sexually Transmitted Diseases”[Mesh]) AND “Menstrual Hygiene Products”[Mesh]
Cochrane Library https://www.cochranelibrary.com/advanced-search	Medical terms (MeSH)	Advanced search: search manager: #1 MeSH descriptor: [Reproductive tract infections] explode all trees #2 [Menstrual hygiene products] explode all trees #3 #1 AND #2 #4 MeSH descriptor [Sexually transmitted diseases] explode all trees #5 MeSH descriptor [Vaginal douching] explode all trees #6 #1 AND #5 #7 #4 AND #5 #8 #4 AND #2
Medline https://www.nlm.nih.gov/medline/medline_overview.html	Medical subject headings (MeSH)	(“Sexually transmitted diseases” [MeSH terms] AND “Vaginal douching”[MeSH terms]) (“Sexually transmitted diseases”[MeSH terms] AND “Menstrual hygiene products”[MeSH terms]) (“Reproductive tract infections”[MeSH terms] AND “Vaginal douching”[MeSH terms]) (“Reproductive tract infections”[MeSH terms] AND “Menstrual hygiene products”[MeSH terms])

MeSH: medical subject headings.

2.3. Data analysis

We carefully performed the following steps: data collection, cleaning, analysis, and interpretation. Two reviewers (AD and OA) independently searched information sources and screened the abstracts of the generated studies while records were managed through a specific software (Microsoft excel). Identified studies were assessed according to the inclusion and exclusion criteria by qualifying each article as eligible, not eligible or might be eligible. Articles that could not be directly excluded had their full texts reviewed by both reviewers. A study was included if both reviewers agreed that it satisfied the inclusion criteria.

2.4. Data synthesis

Data were extracted from individual research studies with similar objectives and outcomes and were carefully evaluated to assess relevance to this systematic review.

Two reviewers (AD and OA) independently extracted data using a standardized form. A third reviewer (KJ) proofread the data for clarity and consistency. Data extracted included the following: study and author details, sample characteristics, sample size, interventions and results. The same reviewers (AD and OA) assessed the risk of bias for non-randomized studies independently using the Newcastle-Ottawa Scale (NOS).¹¹ This scale is based on 3 factors: selection of the exposed participants,

comparability to controls, and assessment of the outcome. Randomized controlled trials were assessed for quality appraisal using Critical Appraisal Skills Programme (CASP) for randomized controlled trials.¹² It focuses on the results, their validity and importance. All tools were piloted prior to data collection. Reviewers (LS) and (SF) contributed in writing and reviewing the manuscript.

It was decided that a meta-analysis of individual variables would be performed if there were data from three or more studies to combine. However, this was not performed due to the heterogeneity of data collected in the included observational studies.

3. Results

Our broad search identified 262 articles from the database and 15 more articles by hand-search of references. Of the 277 studies, 12 studies were duplicates. After abstract screening of the 265 remaining articles, 247 studies were excluded since they did not match our inclusion criteria. After full article review of the remaining 18 articles, a total of three studies were excluded for the following reasons (Supplementary Table 1): Two of them focused on the assessment of functional literacy regarding intimate hygiene practice rather than its relation to infections,^{13,14} and one was a laboratory-based experimental study.⁴

3.1. Overview of the included studies

Fifteen articles met the inclusion criteria (Fig. 1 and Table 2). Most of the studies were cross-sectional,^{1,2,7,8,10,15–17} three were case-control,^{5,18,19} one was a cohort,²⁰ and three were randomized controlled trials (RCT).^{9,21,22} Four studies were conducted in India,^{6,8,10,20} four in China,^{7,15–17} two in Kenya,^{9,22} one in Pakistan,¹⁹ one in Cambodia,² one in Turkey,¹⁸ one in Malawi,¹ and one in Jamaica.²¹ Qualitative or mixed methods studies were not found. All studies were written and published in English. The eligible studies included a minimum of 200 participants^{1,2} and a maximum of 577,758 participants.²⁰

Quality appraisal of all included studies was done according to Newcastle Ottawa Scale¹¹ for non-randomized studies¹² for randomized controlled trials. No low-quality studies were noted, and hence no studies were excluded for low quality appraisal.

Most of the studies targeted sexually transmitted infections. Five studies focused on HIV infection^{5,7,15–17} and blood tests were taken to diagnose it. Two articles investigated the risk of HPV infection,^{1,2} diagnosed using cervico-vaginal specimens, four articles targeted trichomonas infection,^{9,10,16,17} detected by endocervical swabs. Chlamydia and

Gonorrhoea were mentioned in five studies^{7,9,15–17} and were diagnosed using endocervical swabs. HSV was mentioned in two studies^{1,16} and syphilis was targeted in four studies^{7,15–17}; both were detected by blood tests. Vaginal swabs were used to detect bacterial vaginosis, targeted in five studies.^{1,5,6,9,10} Candida infection was mentioned in two studies^{9,10} where they used vaginal swabs for screening. Two studies screened menstrual cups for *Escherichia coli* growth and used vaginal swabs to detect *S. aureus*.^{9,22} It is important to note that three studies relied on pelvic examination and self-reported symptoms of itching, pain, irritation or discharge.^{8,20,21}

The majority of practices identified were intravaginal douching and insertion of certain cleansing products such as powders, creams, herbs, tablets, sticks, stones, leaves, and traditional products.^{1,2,15–17,21} Five articles targeted sanitary napkins, pads and cloths,^{6,9,10,16,18} while two publications studied menstrual cup effects.^{9,22} Four studies investigated cleansing and washing practices alongside household environment,^{6,8,10,18} and just one mentioned the use of self-prescribed prophylactic oral antibiotics and vaginal douching.⁷

Out of the 15 studies that were included, only two showed no association whatsoever between the intimate hygiene practices and the risk of reproductive tract infections.^{1,22}

3.2. Urogenital infection risk and intravaginal practices

Two studies found an association between vaginal douching and history of sexually transmitted diseases (STD) in the last 12 months, but not with current sexually transmitted diseases. The authors concluded that this was explained by the fact that douching was practiced in response to the symptoms of sexually transmitted infections rather than to prevent the infection itself.^{15,17}

Another study suggested that the use of vaginal douching with prophylactic oral antibiotics doubled the risk of developing vaginal infections odds ratio (OR) of 2.9, (95% CI 1.3–6.7). Similarly, the use of prophylactic oral antibiotics only, and prophylactic oral antibiotics with vaginal douching increased the risk of cervical infections with OR of 4.0 (95% CI 1.1–15.4), 4.2 (95% CI 1.7–10.3) and 2.5 (95% CI 1.1–5.7), respectively.⁷

Though data showed that intravaginal practices are associated with reproductive tract infections, some studies^{7,15–17} were targeting female sex workers who are already at a higher risk of sexually transmitted infections.²³

3.3. Urogenital infection risk and sanitary napkins, pads, cloths and menstrual cups

Reusable absorbent material used during menstruation were found to increase the risk of Candida infection with an adjusted proportional reported ratio (aPRR) of 1.54 (95% CI 1.2–2.0), but no association with bacterial vaginosis or *trichomonas vaginalis* infection after adjustment of confounding factors was noted¹⁰; however, an earlier study found that the adjusted odds ratio (aOR) of women applying reusable absorbent pads to have been diagnosed with at least one urogenital infection (bacterial vaginosis or urinary tract infection) was 2.8 (95% CI 1.7–4.5).⁶

3.4. Urogenital infections risk and washing practices

Only one study found that bathing or vaginal washing during menstruation with water compared to water and soap was associated with symptoms of urogenital infections.¹⁸ Similarly, Baker et al. showed that bathing daily with soap, washing hands after defecation with soap, and washing hands after defecation with mud/soil were associated with a higher risk of reproductive tract infections compared to washing with water only or no hand washing, with OR of 6.55 (95% CI = 3.60, 11.94), 10.27 (95% CI = 5.53, 19.08) and 6.02 (95% CI = 3.07, 11.77), respectively.⁸

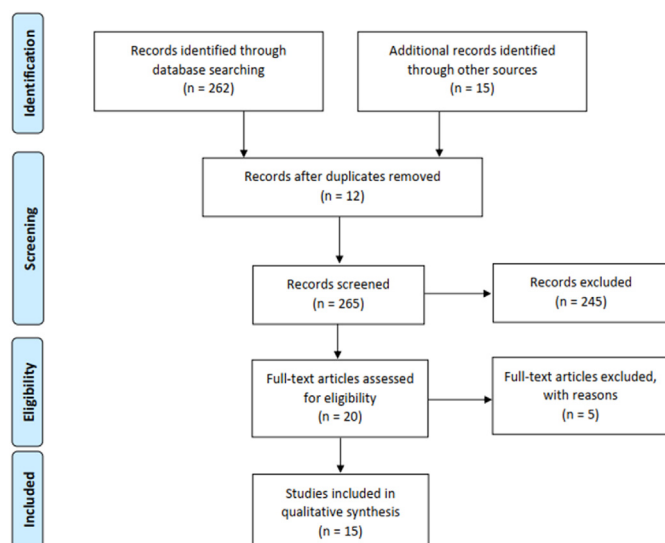


Fig. 1. PRISMA 2009 flow diagram.

Table 2
List of included articles.

First Author	Study Design	Objective	Intimate hygiene practice	Results
Das, P ⁶	Case-control	Identify the relation between menstrual hygiene practices and urogenital infections	Menstrual hygiene practices (reusable cloths, disposable pads, number of changes per day, staying home while menstruating, place where absorbents were changed, washing practices during menstruation, frequency and way of washing during menstruation, access to latrine	The use of reusable pads increased the odds that women experience symptoms of urogenital infection.
Anand, E ¹⁷	Cross-sectional	Determine an understanding of menstrual hygienic practices in India and the risk of RTI	Cloth, locally prepared napkins, sanitary napkins	Unhygienic practices were associated with symptoms of RTI including abnormal vaginal discharge
Bui, T ²	Cross-sectional	Examine the relation between IVPs and HPV infection among FSWs	Intravaginal wiping (using cotton, cloth, tissues) ; Intravaginal insertion of products	Intravaginal washing shortly after sexual intercourse reduced HPV infection risk
Baker, K ⁸	Cross-sectional	Investigate the relationship between washing practices and self-reported RTI symptoms	Bathing location; frequency of bathing; the quality of water used for bathing ; distance to the bathing location; materials used for cleansing the body; general and post-defecation handwashing practices; type of handwashing materials; type of absorbent used during menstruation; having access to a private location to	Walking short distance to reach a bathing location was associated with a decreased RTI symptoms compared to open defecation

Table 2 (continued)

First Author	Study Design	Objective	Intimate hygiene practice	Results
Esber, A ¹	Cross-sectional	Evaluate the associations between type and frequency of IVP, and detection of HPV, BV, and HSV-2	manage menstrual hygiene. IVP: cleansing with soap and water; cleansing with cotton, cloth or tissue; inserting alum or other powder, herbs, leaves, castor oil, or any other vaginal products as well as the frequently of engaging in each practice	No significant association between intravaginal practices and the risk of BV, HPV or HSV-2
Gao, W ⁷	RCT	Assess the effects of preventive practices on STIs and RTIs among FSWs	Vaginal douching and the use of prophylactic oral antibiotics	Prophylactic oral antibiotics and vaginal douching increase the risk of RTIs
Juma, J ²⁰	RCT	Evaluate the safety of menstrual cups against sanitary pads	Menstrual cups and sanitary pads	No significant association between the <i>S. aureus</i> and the use of menstrual cups and pads
Li, J ¹¹	Cross-sectional	Examine the relationship between vaginal douching and STIs	Vaginal douching	FSWs reporting STI symptoms in the past 12 months but not currently were more likely to do vaginal douching
Luo, L ¹²	Cross-sectional	Explore the association between STIs, genital symptoms and HIV among FSWs	Vaginal douching	Vaginal douching increased HIV and HSV-2 risk but decreased <i>Chlamydia trachomatis</i> and <i>Neisseria gonorrhoea</i> risk
Phillips-Howard, P ¹⁹	RCT	Study the effect of menstrual hygiene on schoolgirls' health (reproductive/sexual)	Menstrual cups	Menstrual cups pads were associated with lower risk of <i>Chlamydia trachomatis</i> and <i>Trichomonas vaginalis</i> but not <i>Neisseria gonorrhoea</i> . Menstrual

(continued on next page)

Table 2 (continued)

First Author	Study Design	Objective	Intimate hygiene practice	Results
Sami, N ¹⁶	Case-control	Identify the factors associated with secondary infertility among married women	Homemade intravaginal preparations; sanitary pads; cloth; cotton; location for drying of material; frequency of washing.	cups used for at least 9 months were associated with a lower risk of BV compared to pads Postpartum intra-vaginal indigenous medicines, cotton, washed but dried inside rags and unwashed rags increased the risk of vaginal infections and secondary infertility
Torondel, B ¹³	Cross-sectional	Explore the relation between menstrual hygiene practices and Bacterial vaginosis, Candida, and Trichomonas vaginalis.	Reusable and disposable absorbent; frequency and place of change absorbent; method of washing, drying, pack aging, and storing reusable absorbents; water and sanitation conditions in the households, access to latrine and location of main water source.	Reusable absorbent material especially dried inside and stored in the toilet and infrequent self-washing during menses increased risk of candidiasis. Infrequent self-washing during menses and changing absorbent material outside increased risk of BV
Wang, B ¹⁴	Cross-sectional	Determine association with STIs and vaginal douching	Vaginal douching	There was a significant association between vaginal douching and history of STI but not current STI
Sevil, S15	Case-control	Evaluate the association between genital hygiene practices and genital infection in a group of university students.	Daily pads; frequency of changing underwear; bathing position and frequency; type, material used and frequency of genital area cleaning; genital hair cleaning;	Factors associated with higher RTI risk: daily pads, bathing in sitting position, infrequent self-washing, not bathing during menses, not

Table 2 (continued)

First Author	Study Design	Objective	Intimate hygiene practice	Results
Carter, M ¹⁸	RCT	Describe the association of intravaginal cleansing and STIs	Intravaginal cleansing with water; soap; vinegar; medicinal cream ; commercial douche or cleanser; cloth or tissue and fingers	genital area drying and material used; hand washing. performing appropriate perineal cleaning, soap/ shampoo for cleaning and cloth for drying the genital area, infrequent cleaning of the genital area Factors associated with lower RTI risk: washing hands before and after using the restroom and using water and toilet roll for genital area cleaning. Frequency of changing underwear or the blood absorbent was not associated with RTI risk Intravaginal cleansing 3 days prior to the visit was associated with lower frequency of itching in the genital area

FSW: female sex workers; RTI: reproductive tract infection; BV: bacterial vaginosis; STI: sexually transmitted infection, HIV: human immunodeficiency virus, HSV: herpes simplex virus, HPV: human papilloma virus, IVP: intravaginal practices.

3.5. Urogenital infections risk and household environment

Drying reusable pads inside the house and storing them inside the toilet was found to be associated with a higher candida infection prevalence, compared to drying them in an open space (aPRR = 1.78, 95%CI 1.34–2.38) or being stored within a cupboard in the changing room (aPRR = 1.96, 95%CI 1.49–2.57).¹⁰ Similarly, bathing in sitting position during menstruation, not drying the genital area or using cloth for drying it, and not paying attention to hand washing were all associated with a higher risk of genital infections, while genital cleaning was found to decrease the risk of genital infections.¹⁸

3.6. Urogenital infections risk and homemade vaginal preparations

One study reported that postpartum use of native homemade vaginal preparations might be a risk factor for ascending vaginal infections causing adhesions and secondary infertility, with an aOR of 3.1 (95% CI:

1.6–5.7). Similarly, the use of inappropriate material for menstrual blood absorption such as cotton, unwashed rags or washed rags dried inside the room was associated with secondary infertility.¹⁹

4. Discussion

Our study is the first to assess a variety of female hygiene practices and their association with the prevalence of reproductive tract infections. This systematic review found a significant association between using unhygienic methods during menstruation and the risk of urogenital infections, as presented in four studies.^{6,10,18,20} Women who used daily pads were found to have a high frequency of genital infections.¹⁸ Unhygienic menstrual products^{6,10,18,20} and unsanitary washing practices⁸ create abnormal moist conditions in the genital area and alter vaginal pH. Similarly, some vaginal products sold over the counter affect the vaginal epithelium⁴ and might have a cytotoxic effect on the survival of beneficial *Lactobacillus* species²⁴ in the vaginal environment. For example, soap or shampoo use for vaginal washing in particular might alter the vaginal microbiota,²⁵ leading to a higher risk of vaginal symptoms compared to the use of water only for cleaning.^{8,18}

One study found no significant association between *Staphylococcus aureus* infection and use of cups, pads or the usual practices like clothes, paper and bedding. It also mentioned no detected harms in its small sample, even though *Escherichia coli* growth was found in 37.1% of the used cups.²² Another similar article demonstrated that menstrual cups used for at least 9 months were associated with a lower prevalence of bacterial vaginosis compared to pads and control arms when pooled. Menstrual cups and sanitary pads were also associated with a low prevalence of sexually transmitted diseases, particularly *Chlamydia trachomatis* and *Trichomonas vaginalis* but not *Neisseria gonorrhoea*.⁹

Three studies showed that intravaginal practices were associated with a reduced rate of reproductive tract infections.^{2,16,21} Interestingly, one study found that intravaginal practices, particularly douching with toothpaste or disinfectant, increased the risk of HIV and HSV-2. However, it also reported that those same practices were associated with a lower prevalence of *Neisseria gonorrhoea* and *Chlamydia trachomatis* infections.¹⁶ Bui et al. reported that the majority of the participants used water and added salt, soap or lemon in intravaginal washing and some used commercial products. It was noticed that intravaginal washing in the previous three months and performing this practice shortly after vaginal intercourse reduced the incidence of HPV infection.² Though intravaginal washing before sex can remove the protective vaginal secretions and mucus barrier facilitating HPV acquisition, it may help clear HPV viral loads transmitted when practiced after sex. This was supported by an in vitro study reporting that 90% of HPV infections were prevented by washing 30 min after HPV exposure, which is the approximate timing needed for HPV to attach to cells.²⁶ Nonetheless, one study reported no significant association between intravaginal practices and HPV, bacterial vaginosis or HSV-2.¹

Practicing frequent self-washing during menstruation was associated with a low risk of reproductive tract infections,¹⁸ particularly candidiasis and bacterial vaginosis.¹⁰ Menstrual dysregulations and prolonged accumulation of blood and discharge in the vagina may alter the vaginal ecosystem, thus self-washing and flushing can help prevent reproductive tract infections.²⁷ Interestingly, *Trichomonas vaginalis* infection risk was not significantly increased with such practices,¹⁰ possibly because of its low prevalence,²⁸ along with the fact that it is a sexually transmitted infection.²⁹

Studying water cycle facilities, two studies found that changing the absorbent material in a toilet facility was found to decrease the risk of bacterial vaginosis.^{6,10} Using a latrine without water for defecation and walking short distance to a bathing location were both associated with a lower incidence of reproductive tract infection symptoms compared to open defecation in a cross sectional study.⁸ Thus, our data suggested that having a safe, stress-free, and hygienic place with access to water can decrease reproductive tract infection risk.

The higher frequency of HIV among women who are non-female sex workers practicing intravaginal cleaning and using intravaginal products for sex aiming to tighten and dry the vagina can be attributed to epithelial injuries.^{3,5} Those products were in fact a way to facilitate viral entry during intercourse by causing physical abrasions in the cervico-vaginal epithelium.³⁰

In summary, any intimate feminine practice that alters the vaginal pH, injures the vaginal epithelium, or the use of unhygienic menstrual products and unsanitary washing practices may increase the risk of reproductive tract infections.

4.1. Strengths and weaknesses

The main strength of this review is that it is the first of its kind, to our knowledge, to include several female hygiene practices and correlate their use with reproductive tract infections. Another strength is that recent studies were involved including randomized control trials, which enhanced the quality of evidence. There are potential limitations in our review. Most of the studies involved were observational, conducted mainly in South Asia and Africa. Access to intimate products and safe, clean and private hygiene spaces are often not uniform across countries with different socio-economic status and geography, which made it challenging to generalize the results. In addition, some studies were based on self-report, increasing the risk of bias.

4.2. Clinical implications

Medical practitioners should be aware of the diversity of intimate hygiene practices and their adverse outcomes on the gynecological health including changes in the vaginal microbiota. It is their role to advise women on the methods and frequency of hygiene practices.

4.3. Conclusion

Intimate hygiene practices may put women at a higher risk of several reproductive tract infections. Health care providers and public health experts should continue to increase awareness regarding intimate hygiene practices to counter the misinformation resulting from marketing campaigns particularly through social media and common misconceptions.

Author contribution

All authors participated in at least one of the following: designing the work; data collection; data analysis. They all contributed to drafting and revising the paper and approved of the final version, and are thus will be held accountable for all aspects of the work.

Conflict of interest

None.

Financial Support

None.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gocm.2022.06.001>.

References

- Esber A, Rao N, Norris A, et al. Intravaginal practices and prevalence of sexual and reproductive tract infections among women in rural Malawi. *Sex Transm Dis*. 2016; 43(12):750–755. <https://doi.org/10.1097/OLQ.0000000000000531>.
- Bui TC, Scheurer ME, Pham VTT, et al. Intravaginal practices and genital human papillomavirus infection among female sex workers in Cambodia. *J Med Virol*. 2018; 90(11):1765–1774. <https://doi.org/10.1002/jmv.25268>.
- Hilber AM, Francis SC, Chersich M, et al. Intravaginal practices, vaginal infections and HIV acquisition: systematic review and meta-analysis. *PLoS One*. 2010;5(2), e9119. <https://doi.org/10.1371/journal.pone.0009119>.
- Fashemi B, Delaney ML, Onderdonk AB, et al. Effects of feminine hygiene products on the vaginal mucosal biome. *Microb Ecol Health Dis*. 2013;24. <https://doi.org/10.3402/mehd.v24i0.19703>.
- Low N, Chersich MF, Schmidlin K, et al. Intravaginal practices, bacterial vaginosis, and HIV infection in women: individual participant data meta-analysis. *PLoS Med*. 2011;8(2), e1000416. <https://doi.org/10.1371/journal.pmed.1000416>.
- Das P, Baker KK, Dutta A, et al. Menstrual hygiene practices, wash access and the risk of urogenital infection in women from Odisha, India. *PLoS One*. 2015;10(6), e0130777. <https://doi.org/10.1371/journal.pone.0130777>.
- Gao W, Li Z, Yan H, et al. Preventive measures against sexually transmitted infections among female sex workers in Lanzhou, China. *Scand J Infect Dis*. 2012;44(5): 374–380. <https://doi.org/10.3109/00365548.2011.644250>.
- Baker KK, Padhi B, Torondel B, et al. From menarche to menopause: a population-based assessment of water, sanitation, and hygiene risk factors for reproductive tract infection symptoms over life stages in rural girls and women in India. *PLoS One*. 2017;12(12), e0188234. <https://doi.org/10.1371/journal.pone.0188234>.
- Phillips-Howard PA, Nyothach E, Ter Kuile FO, et al. Menstrual cups and sanitary pads to reduce school attrition, and sexually transmitted and reproductive tract infections: a cluster randomised controlled feasibility study in rural Western Kenya. *BMJ Open*. 2016;6(11), e013229. <https://doi.org/10.1136/bmjopen-2016-013229>.
- Torondel B, Sinha S, Mohanty JR, et al. Association between unhygienic menstrual management practices and prevalence of lower reproductive tract infections: a hospital-based cross-sectional study in Odisha, India. *BMC Infect Dis*. 2018;18(1):473. <https://doi.org/10.1186/s12879-018-3384-2>.
- Wells GA, Shea B, Connell DO, et al. The Newcastle-Ottawa Scale (NOS) for Assessing the Quality of Nonrandomised Studies in Meta-Analyses. Ottawa Hospital Research Institute. Available from: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp. [Last accessed on 2022 April 23]
- Branum C. Defining randomized controlled trials under understanding research study designs by university of Minnesota. Critical appraisal tools for randomized controlled trials studies. <https://researchguides.gonzaga.edu/c.php?g=154358&p=1115957>. [Last accessed on April 23, 2022].
- Belayneh Z, Mekuriaw B. Knowledge and menstrual hygiene practice among adolescent school girls in southern Ethiopia: a cross-sectional study. *BMC Publ Health*. 2019;19(1):1595. <https://doi.org/10.1186/s12889-019-7973-9>.
- Garg R, Goyal S, Gupta S. India moves towards menstrual hygiene: subsidized sanitary napkins for rural adolescent girls-issues and challenges. *Matern Child Health J*. 2012;16(4):767–774. <https://doi.org/10.1007/s10995-011-0798-5>.
- Li J, Jiang N, Yue X, Gong X. Vaginal douching and sexually transmitted infections among female sex workers: a cross-sectional study in three provinces in China. *Int J STD AIDS*. 2015;26(6):420–427. <https://doi.org/10.1177/0956462414543937>.
- Luo L, Xu JJ, Wang GX, et al. Vaginal douching and association with sexually transmitted infections among female sex workers in a prefecture of Yunnan Province, China. *Int J STD AIDS*. 2016;27(7):560–567. <https://doi.org/10.1177/0956462415589044>.
- Wang B, Li X, Stanton B, et al. Vaginal douching, condom use, and sexually transmitted infections among Chinese female sex workers. *Sex Transm Dis*. 2005; 32(11):696–702. <https://doi.org/10.1097/01.olq.0000175403.68410.ec>.
- Sevil S, Keveser O, Alaettin U, et al. An Evaluation of the relationship between genital hygiene practices, genital infection. *Gynecol Obstet*. 2013;(6). <https://doi.org/10.4172/2161-0932.1000187>, 03.
- Sami N, Ali TS, Wasim S, et al. Risk factors for secondary infertility among women in Karachi, Pakistan. *PLoS One*. 2012;7(4), e35828. <https://doi.org/10.1371/journal.pone.0035828>.
- Anand E, Singh J, Unisa S. Menstrual hygiene practices and its association with reproductive tract infections and abnormal vaginal discharge among women in India. *Sex Reprod Healthc*. 2015;6(4):249–254. <https://doi.org/10.1016/j.srhc.2015.06.001>.
- Carter M, Gallo M, Anderson C, et al. Intravaginal cleansing among women attending a sexually transmitted infection clinic in Kingston. *Jamaica. West Indian Med J*. 2013; 62(1):56–61.
- Juma J, Nyothach E, Laserson KF, et al. Examining the safety of menstrual cups among rural primary school girls in western Kenya: observational studies nested in a randomised controlled feasibility study. *BMJ Open*. 2017;7(4), e015429. <https://doi.org/10.1136/bmjopen-2016-015429>.
- Toukara FK, Teguété I, Guédou FA, et al. Prevalence and factors associated with HIV and sexually transmitted infections among female sex workers in Bamako, Mali. *Sex Transm Dis*. 2020;47(10):679–685. <https://doi.org/10.1097/OLQ.0000000000001231>.
- Łaniewski P, Owen KA, Khanisho M, et al. Clinical and personal lubricants impact the growth of vaginal lactobacillus species and colonization of vaginal epithelial cells: an in Vitro Study. *Sex Transm Dis*. 2021;48(1):63–70. <https://doi.org/10.1097/OLQ.0000000000001272>.
- Chen Y, Bruning E, Rubino J, et al. Role of female intimate hygiene in vulvovaginal health: global hygiene practices and product usage. *Womens Health (Lond)*. 2017; 13(3):58–67. <https://doi.org/10.1177/1745505717731011>.
- Chu TY, Chang YC, Ding DC. Cervicovaginal secretions protect from human papillomavirus infection: effects of vaginal douching. *Taiwan J Obstet Gynecol*. 2013; 52(2):241–245.
- Greenbaum S, Greenbaum G, Moran-Gilad J, et al. Ecological dynamics of the vaginal microbiome in relation to health and disease. *Am J Obstet Gynecol*. 2019;220(4): 324–335. <https://doi.org/10.1016/j.ajog.2018.11.1089>.
- Hanna J, Yassine R, El-Bikai R, et al. Molecular epidemiology and socio-demographic risk factors of sexually transmitted infections among women in Lebanon. *BMC Infect Dis*. 2020;20(1):375. <https://doi.org/10.1186/s12879-020-05066-8>.
- Van Gerwen OT, Muzny CA. Recent advances in the epidemiology, diagnosis, and management of Trichomonas vaginalis infection. *F1000Res*. 2019;8. <https://doi.org/10.12688/f1000research.19972.1>.
- Nserenko E, Moreland PJ, Dunlop AL, et al. Consideration of cultural practices when characterizing the vaginal microbiota among African and African American Women. *Biol Res Nurs*. 2021;23(1):91–99. <https://doi.org/10.1177/1099800420940788>.