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Association between Impure Well Water and Bacterial Vaginal Infection among Women in Hassan Shami Camp

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Abstract

Background: Vaginal infections among the women of childbearing age are a major health issue, especially when they are displaced in a camp that has poor sanitation facilities. This research was done to establish the relationship between usage of impure well water and bacterial vaginal infections among women in Hassan Shami Camp in Iraq.

Objective: To examine the prevalence of vaginal infection, confirm types of infection and investigating the connection of impure well-water used in daily activities and bacterial vaginal infection in women of reproductive age at the Hassan Shami Camp.

Methods: The study was a cross sectional descriptive study that was done between December 6, 2020, and February 25, 2021, on 145 women of reproductive age who attended primary health care centers in Hassan Shami Camp. Face to face interview was used to collect the data using a semi structured questionnaire and vaginal swab samples were cultured to determine the type of infection. Analysis of water in the camp was done to establish the microbial content.

Findings: The research findings were that bacterial vaginal infection of 29.7, mixed bacterial and Candida infections of 26.9, fungus of 25.5 and mixed Candida and Trichomonas of 1.4 were common whereas normal flora was found in 16.6. Notably, 95.2 percent of the infected women drank and conducted daily activities using well water ($p < 0.001$). Analysis in the lab proved that the same bacteria species that was identified in the vaginal swab cultures were found in the well water and through this, there was a direct correlation between the infected vaginal and contaminated water.

Conclusion: Polluted water in wells is very vital in enhancing bacterial vaginal infections in Hassan Shami Camp women. The study highlights the necessity and urgency of clean water supply, camp laboratories, as well as community health education programs.

Keywords: Bacterial vaginosis, water contamination, displaced populations, vaginal infections, Hassan Shami Camp, reproductive health.

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I. Introduction

Vaginitis is considered as one of the most widespread diseases in women of the reproductive age with significant morbidity and health care use across the globe [1]-[3]. Both changed vaginal microbiota, hygiene, sexual activities, and environmental exposures are risk factors, especially the quality of water in resource stressed environments [1], [4], [5]. The living conditions in the IDP camps can increase the risk of infection, as well as worsen the health of women in terms of quality of life, due to overcrowding, inadequate infrastructure, and lack of access to clean water [6], [7]. This paper examines how impure well-water is linked with bacterial vaginal infection and comes up with practice and policy implications in nursing and public health practice in camp settings.

II. Background and Significance.

Bacterial vaginosis (BV) and other bacterial vaginal infections are a significant burden on the population worldwide with the prevalence estimates ranging 23-29 across geographic locations and increased by low resource settings conditions [2], [8]. The pathophysiology of bacterial vaginitis is based on changes in vaginal pH, loss of hydrogen peroxide-producing Lactobacillus spp. and the colonization of more streptococci, staphylococci, and enteric Gram negative bacilli (e.g., E. coli, Klebsiella spp.) [9]-[11]. Unsafe water in the context of humanitarian enhances the contact with fecal oral pathogens and changes the hygienic practices, which may contribute to the perineal spread of organisms to the vagina [4], [12].

The situation in the Hassan Shami Camp is that the most common appliances of drinking water and daily routine are well-water, the range of vaginal infections is mainly bacterial, which aligns with the specifics of environmental determinants observed in the discussed location.

III. Methods

Design and Setting: The descriptive design adopted was cross sectional conducted in two main health care centers (PHCCs) in Hassan Shami and Hassan Shami U2 camps between December 6, 2020 and February 25, 2021. The PHCCs are used in the cases of displaced populations that reside mainly in tents or incomplete buildings with limited infrastructure.

Sample: One hundred and forty-five (145) women with the sign/symptoms of vaginitis aged 15-49 years were recruited. The inclusion criteria included reproductive age women with vaginitis signs (pregnant or nonpregnant); the exclusion criteria included pregnant women during menstruation, active vaginal bleeding, not married, and vaginal medication users.

Data Collection: The investigators used face to face interview using a structured questionnaire that included socio demographics, obstetrics, sexuality, lifestyle (including water source and carbohydrates in diet), genital care practices, medical and therapeutic history, and current symptoms. Sterile speculums with vaginal swabs were used to collect the samples followed by processing at an external lab in Mosul (culture on standard media, incubation in 37degC, wet mounts of Trichomonas vaginalis). One of the samples of the well water in the camp was referred to microbiological analysis.

Variables and Outcomes: Primary outcome was culture confirmed vaginal infection; bacterial infection, fungal (Candida) infection, mixed bacteria+Candida, and mixed Candida+T. vaginalis; normal flora was used as a non infection reference group. Important exposure was drinking/day to day water source (well vs purified).

Analysis: Categorical variables (frequencies/percentages) and chi square tests dealt with categorical variables where $p = 0.05$. There were significant means differences in lifestyle variables such as the source of water.

Limitations: Being a cross sectional, purposive sample of attendees of the clinic (who came there due to the presence of a symptom), causal inference is limited; possible confounding (e.g., hygiene practices, sexual behaviors, antibiotics) was not accounted with multivariate models; and some risk variables were

self reported. However, mainstream culture diagnostics and predictability of water-use trends within the camp give the descriptive association a credible face.

IV. Results

A. Participant Characteristics and Water Source

The majority of the respondents dwelt in tents (58.6%), primary school education (59.3%), and were married (66.2%). In terms of lifestyle, 64.8% said that there was dampness in accommodation. More importantly, 95.2 percent drank and conducted daily activities with well water, 4.1 percent with purified water and 0.7 percent with both. There was statistical significance in its distribution of water source (kh2 = 249.779; df = 2; $p < 0.001$).

Table I. Drinking/Daily Practices Water Source (n. = 145).

Water Source	n (%)	Significance
Well water	138 (95.2)	$\chi^2 = 249.779$, $p < 0.001$
Purified water	6 (4.1)	
Mixed (sometimes well/purified)	1 (0.7)	

B. Culture-Confirmed Vaginal Infection Spectrum

Culture results revealed: bacterial infection in 29.7% (n = 43), mixed bacteria+*Candida* in 26.9% (n = 39), *Candida* infection in 25.5% (n = 37), mixed *Candida*+*T. vaginalis* in 1.4% (n = 2), and normal flora in 16.6% (n = 24). The distribution was significant ($\chi^2 = 38.414$; df = 4; $p < 0.001$).

Table II. Vaginal Culture End Result (n. = 145)

Culture Category	n (%)
Bacterial infection	43 (29.7)
Mixed bacteria+*Candida*	39 (26.9)
***Candida* infection**	37 (25.5)
Candida*+*T. vaginalis	2 (1.4)
Normal flora	24 (16.6)

C. Descriptive Linkage: Well Water and Bacterial Vaginal Infection

Although no formal cross tabulation of type of infection by source of water was done, the study concluded that impure water in wells which is used in daily practices plays a vital role in causing bacterial vaginal infection. Also, the camp well water was tested in the laboratories, which revealed the presence of pathogenic bacteria of the same nature as most vaginal swabs, creating an environmental exposure as a possible road to colonization/infection.

Table III. Descriptive Alignment of Water Source and Infection Spectrum

Indicator	Finding
Water source: well water use	95.2% of participants
Predominant infection categories	Bacterial infection (29.7%); Mixed bacteria+*Candida* (26.9%)
Laboratory observation	Camp well water contained pathogenic bacteria overlapping with vaginal isolates
Study conclusion	Impure water has a crucial role in causing bacterial vaginal infection

Interpretation: With a high prevalence of bacterial and mixed bacterial-fungal infections and a history of

contamination in the environment, an environmental factor in being at risk of vaginal infection is consistent. Causal provenance would be reinforced with expand systematic research (e.g., cross tabulation, adjusted logistic regression).

V. Discussion

A. Water-Infection Pathway:

The reported tendency, a camp setting, with dampness, almost universal well water usage, and a bacterial dominant infection spectrum, can be attributed to the well-known microbiologic and pathophysiologic processes of bacterial vaginitis and aerobic vaginitis [9]-[11]. Enteric and skin commensals (e.g., E. coli, Staphylococcus aureus, streptococci) may enter the vagina through perineal transfer and this especially happens when hygiene infrastructure is less than optimal and water is contaminated [4], [10], [12]. High PH of the vagina, depletion of protective lactobacilli and inflammation of the area support the pathogenic proliferation [9] -[11]. Environmental seeding is a probable risk factor in this camp as evidence of this is provided by laboratory observation that well water contained organisms that could be compatible with vaginal isolates.

B. Nursing and Public Health Consequences:

Wash and Water Safety Interventions. It begins with establishing the availability of microbiologically safe water. Water treatment (e.g., chlorination, filtration), safe storage and behavior change communication should be done in the Hassan Shami PHCC catchment with the routine monitoring of water quality. WASH (water, sanitation, and hygiene) education could be incorporated into the reproductive health counseling by nursing staff in the form of perineal hygiene (wipe front to back), timely post void and post coital cleansing using safe water, and avoidance of irritant soaps/ douching -all of which were found to influence practices within the study.

Diagnostic Clinical Pathway and Diagnostics. There are risks of misdiagnosis when the laboratory confirmation is not provided. On site microbiology capacity (or good specimen transport networks) can be set up so that the etiology of the bacterial vs. fungal type of infection can be accurately ascertained and the proper antimicrobial stewardship is put in place.

Health Education and Community Outreach. Organized, culturally aware educational interventions, which included the underwear use (preferring cotton; changing regularly; sun drying/ thermal disinfection), hair removal patterns, type of genital drying products (toilet paper versus cloth), and frequency/timing of genital washing following sex were emphasized as changeable risk associated behaviors. These recommendations can be realized through nursing led group sessions, peer educators and visual aids.

Monitoring and Evaluation. Patterns of vaginal infection observed in camp clinics associated with the WASH benefits and the program of antibiotic stewardship will aid in monitoring the progress. Continuous quality improvement and lobbying to the camp administration and the health directorates to upgrade the infrastructure and provide long-term funding should be informed by aggregated data.

C. Research Implications

Further studies are needed to: (i) conduct analytic cross tabulations of water source and category of infection; (ii) use multivariate logistic regression as a control factor; (iii) use quantitative microbial risk assessment (QMRA) of camp water; and (iv) adopt longitudinal designs by investigating temporal associations between water safety strategies and infection risk.

VI. Conclusion

In Hassan Shami IDP camp, use of impure well water to drink and conduct their daily activities is pervasive and it is accompanied with bacterial predominant range of culture that affirms vaginal infections. Practical association of unsafe water and bacterial vaginal infection in this context is

supported by direct laboratory observations of overlapping pathogens between well water and vaginal swabs and high levels of lifestyle distributions. Enhancing WASH infrastructure, creating PHCC lab capacity and instituting a nursing led health education are urgent, practical priorities that can help in minimizing infectious burden and enhance the health and quality of life of women.

VII. Recommendations

- **Provide Safe, Treated Water:** Implement chlorination/filtration at source and point-of-use; ensure safe storage; and institute routine microbial testing in collaboration with local health directorates.
- **Open PHCC Laboratories:** Equip PHCCs with essential microbiology capacity (or formalize rapid transport to reference labs) for accurate diagnosis and targeted therapy.
- **Antibiotic Stewardship:** Standardize prescribing, discourage non-prescribed antibiotic use, and monitor recurrence patterns to prevent dysbiosis and candidiasis overgrowth.
- **Public Health Surveillance:** Track infection trends and evaluate the impact of WASH and educational interventions; advocate for infrastructure improvements within camp administration.

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