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Efficacy of Sodium Bicarbonate in Early Management and Reduce Vaginal Yeast Infection among Women in Jordan: A Quasi-Experimental Study

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Abstract: Objective: The aim of the study was to determine the efficacy of sodium bicarbonate in early management and improvement of vaginal yeast infection among women in Jordan. Design: A quasi-experimental design with purposive sample was used in this study. Methods: The study sample included women attending maternal and child health (MCH) centers, who were suffering from vaginal yeast infection that that had been confirmed by clinical diagnosis (vaginal examination and swab) or women with high risk factors of developing vaginal yeast infection. A total of 300 women are included in the current study. The participants were divided into three equal groups: group (1) infected women who used sodium bicarbonate only; group (2) infected women who used sodium bicarbonate with medical treatment; and control group (3) infected women who used medical treatment only. Results: 93% of the case group improved than the control group. There were significant differences between the women before and after using sodium bicarbonate only, sodium bicarbonate with medication, and women who use medication only. Conclusion: Vaginal washing by baking soda / sodium bicarbonate helps to reduce vaginal yeast infection, particularly when it is used in combination with medication. The health care providers should pay an attention to, and acknowledge the efficacy of, sodium bicarbonate and combine it with medication to achieve early management and reduction of vaginal yeast infection.

Keywords: Early management; Efficacy; Sodium bicarbonate; Vaginal yeast infection.

1. Introduction

Vaginal yeast infection is not considered a sexually transmitted disease; nearly 75% of all adult women have had at least one genital yeast infection in their lifetime [1, 2]. Yeast infection is caused by an overgrowth of normally growing fungi in the vagina that creates unpleasant symptoms. The yeast is kept under control by normally growing bacteria in the body. If the natural balance of microorganisms is disrupted, the yeast grows out of control. It is not clear how fungal infections originate, but they are not thought to be sexually transmitted. A woman's own natural bacteria allow this type of infection to happen when an imbalance occurs [3].

The Vaginal Health Organization [4] has suggested that yeast infections can be easily prevented in most cases; this could be done by keeping then vaginal area dry, especially after a shower; wipe from front to rear after using the toilet; switch to looser fitting cotton underwear; change wet bathing suits after a swim and avoid tight-fitting jeans or pantyhose. [5].

Baking soda (bicarbonate of soda) has a high level of PH, which is alkaline. In the past, people used it as a cleaning agent as well as for medicine. Baking soda could be used for candida through effectively balancing the vagina's naturally occurring bacterial and yeast levels; as a result the infection will be cured. Candida proliferates in the presence of low pH levels; using bicarbonate of soda increased the alkalinity of the vaginal area and consequently slowly kills the fungus. Some researchers administered baking soda for candida both orally and intravenously (IV). [6]

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1.1. Significance of the Study

When women are continuous re-infection occurs, the problem can become troublesome and chronic. If a fungal infection has taken hold in the body it can become a recurrent problem that is more difficult to treat with conventional anti-fungal agent. This problem can turn a simple infection into chronic condition that can seriously affect the immune system and the individual's overall health. Soon after birth, the fungus *candida alb cans* develops in the intestinal tract of healthy individuals in a yeast-like friendly form. Under certain condition, however candida organisms can convert to a more menacing form, with root-like growths penetrating into the intestinal wall. When this happens, toxins can be absorbed from the bowel into the blood stream with debilitating consequences [7, 8].

There is an urgent need to focus on the vaginal infection, home care and the efficacy of sodium bicarbonate in early management and reduction of vaginal yeast infection among women in Jordan. Early use of sodium bicarbonate at home has the potential to prevent and manage vaginal yeast infection. Therefore, the current study was aimed to determine the effect of sodium bicarbonate in early management and improvement of vaginal yeast infection among women in Jordan

2. Methods

2.1. Design

Quasi-experimental design was used in the current study.

2.1.1. Participants and Setting

The study was conducted at the maternal and child health care centers (MCH) in the Jordanian cities of Jarash and Amman, from August 2014 to May 2015.

2.1.2. A Convenience Sampling

Technique was used. Women who met the following criteria were included in this study: a) women attending the MCH center who were suffering from a vaginal yeast infection that had been confirmed by clinical diagnosis (vaginal examination and swab) or b) women who have a high risk of developing vaginal yeast infection.

Sample size: The current study included 300 women attending the MCH centers in two Jordanian cities, who were suffering from vaginal yeast infection that had been confirmed by clinical diagnosis (vaginal examination and swab) or women who have a high risk of developing vaginal yeast infection.

This formula was used to determine sample size $n = \frac{N}{1+N(e)2}$

Where n = sample size, e = level of precision=0, 05, N = population size.

Purposive sampling was used in this study for infected women so all participants were divided into three equal groups:

Study group (1): infected women who used sodium bicarbonate only.

Study group (2): infected women who used sodium bicarbonate with medical treatment. **Control group (3):** infected women who use medical treatment only.

2.1.3. Data Collection Tools

A structured interviewing questionnaire was developed by the researcher, based on a review of the literature considering the aim of the study and the data that needed to be collected. The interviewing questionnaire was compileded in simple clear Arabic language. It contained three main parts:

Participants' characteristics:

Socio-demographic data: details of age, education level, occupation, marital status and obstetric history (e.g. number of pregnancies, deliveries, abortions, and number of live birth, space between pregnancy, and pregnancy complication) were recorded.

Clinical characteristics: assessment of risk factors of vaginal yeast infection such as vaginal douching, wearing tight underwear, taking antibiotics, using cosmetics, personal hygiene, wearing underwear made from synthetic fibers and using oral contraceptive pills.

Participant's knowledge: assessment of women's knowledge about vaginal yeast infection (i.e. definition, causes, symptoms, diagnosis, prevention and most common home remedies used for treatment of vaginal yeast infection).

Efficacy of using sodium bicarbonate: evaluate effectiveness of sodium bicarbonate in treatment of vaginal yeast infection, recording details of regular use, duration, and time of improvement, side effects, and patients' satisfaction and follow up.

2.1.4. Data Collection Procedure

An invitation letter and information sheet with the researcher's contact details were sent to the potential participants. Women who showed inertest contact the researcher. An interview was done with interested participants who me the inclusion criteria to answer their questions and to confirm their rights (i.e. voluntary participation, withdrawal from the study, confidentiality and privacy). After the initial contact a signed consent form was obtained. The researcher attended the MCH centers three days per week from 09.00 to 14.00 until the desired number of

participants was identified. The diagnosis was confirmed by the doctor through clinical manifestation and vaginal examination (the researcher assisted the doctor with the examination). The researcher interviewed 2-3 women per day, with each interview being completed in a period of 25-30 minutes. During that time, the researcher collected data about the participant's socio-demographic characteristics and obstetric history; distributed a pre-test in the form of a pre-knowledge questionnaire. After obtaining the acceptance of women to participate in the study, they were randomly divided into three equal groups. Groups 1 and 2 received health education about the importance of sodium bicarbonate in the treatment of vaginal yeast infection. Those groups also were encouraged to use sodium bicarbonate effectively by adding five grams (1 small tea spoon) to one liter of tap water (0,5%). The women were then instructed to thoroughly dissolve the mixture and then then wash the vagina with it. This procedure was to be repeated twice a day for one week until the symptoms disappear and patient was once more feeling comfortable [9]. The educated women filled the data collection tools by themselves and the researcher filled the questionnaire for the uneducated woman. Then the researcher gave each of the women educational session about vaginal yeast infection and herbal remedies used to prevent and treat it. After that, each woman was given a post-test in order for the researcher to obtain feedback about the effectiveness of the educational session. At the end of the post-test a follow up appointment was made for women to evaluate the effect of their treatment; the women were to come to the center after one week in order to evaluate any improvement in their condition improvement.

2.1.5. Validity of the Tools

A pilot study was conducted to test the feasibility, clarity and applicability of the developed tools, and to estimate the time needed to collect the data; it was carried out on 10% of each sample. The results of the pilot study were used to finalize the tool and schedule the time needed for the fieldwork. Some modifications were made to the questionnaires based on the findings from the pilot study.

2.1.6. Human Rights and Ethical Considerations

Ethical approval was obtained from the Ministry of Health, Jordan and the MCH centers involved in the study. Informed consent was obtained and the participants' rights were confirmed.

3. Data Analysis

Data was entered into the computer using the SPSS 13 (Statistical Package for Social Science version13) program for statistical analysis. Data was entered as numerical or categorical, as appropriate. Data was shown as mean, SD, and range. Qualitative data was expressed as frequency and percent at 95% confidence interval (95% CI). P (probability) value was considered to be of statistical significance if it is less than 0.05 and of high statistical significance if it is less than 0.001. A chi- square test and Fisher exact test were used to measure association between qualitative variables.

4. Results

4.1. Participant's Characteristics

The mean age was 29.9 ±7.4 for group 1; 29.1±5.9 for group 2, and 28.1±5.9 for the control group. more than half of three groups were working women who had secondary education.There were sigificant differences in terms of age and duration of marriage (see **Table 1**).

Table 2 shows the assessment of risk factors for vaginal yeast infection between groups. The results revealed that the three groups were highly susceptible to developing vaginal candida; they practiced vaginal douching, used odor cosmetic products for hygiene, and wore tights and synthetic fiber underwear.

Table 3 shows there was no statistically significant difference between case and control group regarding pre-test for the assessment of women's knowledge about vaginal yeast infection and home remedies that were used for prevention. However there were highly significant differences between case and control groups regarding definition, causes, risk factors, symptoms, prevention and home remedies ($p<0.001$).

Table 4 shows the evaluation of the effect of sodium bicarbonate among women suffering from vaginal yeast infection. The results showed a highly significant difference between case and control regarding time of improvement and feeling improvement after using the recommended rinse

Table 5 shows the comparison between case groups (group 1 and 2) and the control group regarding treatment. Statistically significant differences between case and control group regarding time of improvement ($p<0.05$), improvement after treatment and the mean and SD of time of improvement after treatment ($p<0.001$).

Table-1. Distribution of the study sample according to socio-demographic characteristrics

Variables	Study G1 N=100	Study G2 N=100	Control N=100	X2	P-value
	%	%	%		
Age?years					
<20	1%	8%	1%		
21-30	35%	40%	31%	5.46	0.046*
31-40	64%	52%	68%		
Age (mean ± SD)	29.9±7.4	29.1±5.9	28.1±5.9	Z=2	0.131
Occupation					
Working	55.0%	72.0%	60.0%	4.20	.122
House wife	45.0%	28.0%	40.0%		
Education					
Primary	16	13	15	8.39	0.136
Secondary	50.0%	66%	56%		
University	34.0%	21%	29%		
Age at marriage	20.2±3.8	21.7±3.9	21.7±3.9	-2.75	.006*
Duration of marriage	8.8±6.7	6.5±5.02	6.5±5.1	2.74	.007*

Table-2. Assessment of risk factors for vaginal yeast infection between the study sample

Variables	Study G1 N=100	Study G2 N=100	Control N=100	Fisher's Exact Test	P-value
Vaginal douching					
Yes	53	57	60	1.12	0.916
No	47	43	40		
Use odor cosmetics product for hygiene					
Yes	90	96	80	2.850	.164
No	10	4	20		
Types of underwear					
With industrial fibers	94	93	75	.072	1
Cotton	6	7	25		
Tight Underwear					
Yes	85	93	83	3.337	.112
No	15	7	17		
Intercourse/week					
1 - 2	24	26	35	1.81	.851
3 – 4	76	74	65		
Taking antibiotics frequently					
Yes	71	65	52		.449
No	29	35	48	.828	

Table-3. Assessment of women's knowledge regarding vaginal yeast infection pre-test and post-test

Variables	Study G1 N=100		Study G2 N=100		Control N=100		Fisher's Exact Test	P-value
	Pre-test	Post – test	Pre-test	Post –test	Pre-test	Post – test		
Definition **Yes** **No**	14.0 86.0	94.0% 6.0%	20 80	82 18	10 90	60 40	23.93	<0.001**
Causes **Yes** **No**	2.0 98.0	90% 10%	22 88	90 10	4.0 96	95 5	29.49	<0.001**
Risk factors **Yes** **No**	5.0 95.0	95.0%. 5%	10 90	89 11	7.0% 93%	96 4	32.44	<0.001**
Symptoms **Yes** **No**	14.0 86.0	92% 8.0%	35 65	95 5	10.0% 90%	89 21	22.25	<0.001**
Prevention **Yes** **No**	10% 90.0%	91% 9.0%	5 95	90 10	8% 92.0%	90 10	21.96	<0.001**
Methods of prevention **a-vaginal douche** **b-taking antibiotics**	80% 20%	86.8% 13.2%	20 80	75 25	75 25	70 30	3.1	0.224
Natural methods for treatment **Yes** **No**	9% 91.0%	87% 13%	15 85	88 12	10 90	97 3	19.76	<0.001**

Table-4. Evaluation of the effect of sodium bicarbonate among women suffering from vaginal yeast infection

Variable		Do you rinse vaginal regularly				Fisher's Exact Test	P-value
		Yes N=93		No N=7			
		No	%	No	%		
Timeof improvement of symptoms after treatment(mean±SD)		2.04±0.83		3.14±0.69		t= -3.4	0.001*
Do you feel improvement when you use this rinse	**Yes** **No**	91 2	97.8 2.2	4 3	57.1 42.9	10.8	.002*
Haveyoufeltanypainwhenyouuse thisrinse	**Yes** **No**	2 91	2.2 97.8	0 7	0.0 100.0	.1	1
Number of use/ day	**1** **2-3** **> 3**	41 47 5	44 50.6 5.4	4 3 0	57.1 42.9 0	0.8	0.78
Duration of use /W	**1** **2-3** **> 3**	46 37 10	49.5 39.8 10.7	4 3 0	57.1 42.9 0	3.3	0.142

Table-5. Comparison between case and control group regarding treatment

Variables	Case (using sodium bicarbonate only No %		Case (using sodium bicarbonate with gynechozole) No %		Control (using gynechozole only) No %		X2	P-value
Do you feel improvement after treatment:								
Yes	89	89	93	93	55	55	19.6	<0.001**
No	11	11	7	7	45	45		
Time of improvement/week								
a) 1	30	30	70	70	33	33	49.5	<0.001*
b) 2	40	40	20	20	7	7		
c) 3	3	3	3	5	15	15		
d) no improvement	7	7	7	7	45	45		
(mean and SD)	3.1±.87		3.1±.87		5.8±3.17		Z= -8.26	<0.001**

5. Discussion

The findings of this study revealed that sodium bicarbonate improved the prognosis of women with vaginal yeast infection. Additionally, the data showed that the participants in the current study exposed themselves to many risk factors that made them liable to develop a vaginal yeast infection.

Thirty percent of the women who are taking prescribed antibiotics were liable to have a vaginal yeast infection [10] the present study illustrated that about three quarters of the case groups (71%) and about two thirds of the control group (65%) were taking antibiotics. These data indicated that antibiotic use increases the risk of developing a vaginal yeast infection. This finding agreed with Mayo clinic.com [11] who stated that thrush is more likely to occur when women take antibiotics for other conditions. Antibiotics may kill the normal harmless bacteria in the vagina which help to defend against candida . As candida is yeast and not bacteria, the infection will not be killed by antibiotics. This is not to say that every course of antibiotics would lead to thrush. Furthermore, Eric [12] claimed that these little yeasts and bacteria live in the same territory of our bodies, generally in balance with one another. When antibiotics kill off the bacteria, the yeast may then take over, causing a yeast infection.

This study showed that about half of the case group (53%) and control group (57%) practiced vaginal douching, indicating that vaginal douching increases the risk of vaginal yeast infection. Our finding agreed with several studies [1, 10, 13]. Selvin [14] found that women who used vaginal douches frequently had four times the risk of developing a yeast infection. Douching could also disturb the normal organisms in the vagina reducing lactobacilli which protect against genital pathogens.This study disagreed with a survey conducted by Young and Jewell [15] which showed that around 27% of women between 14-55 years of age douche on a regular basis as an effective way of keeping the vagina clean and free from infection.

The current study showed that about half of the case groups (47%) and control group (49%) practiced sexual intercourse four times per week, which indicated that frequent sexual intercourse could increase risk for vaginal yeast infection. This suggestion agreed with previous research findings [7, 10, 16] this could be explained by friction, when a person hainge sex may cause minor damage to the vagina which, in turn, may make candida spp more likely to thrive. Additionally Eric [12] reported that semen is usually much more alkaline than vaginal fluids, favoring the growth of yeast. Too, the rubbing on internal tissues during sex may cause irritated spots that are vulnerable to infection. Lortholary and Dupont [17] reported that in multivariate analysis, risk factors for positive C albicansculture included condom use, as well as sexual intercourse more than four times per month.

There are products that change the natural acidity of the vagina, such as vaginal deodorants, sprays, gels and wipes, perfumed bubble baths, and douching [12, 18]. This agreed with our study findings, which showed that from the three groups the use of such products as perfumed cosmetics for hygiene averaged 95.5% of the study population; behavior that increased the risk of developing vaginal yeast infection. Therefore, the women should stay away from deodorant sanitary pads and tampons, sprays such as does perfumes, bubble baths and colored toilet papers; all of which might cause irritation to the vaginal tissues [18].

Using sodium bicarbonate with medication, group 2 in the current study, there was a greater infection decrease in a short period of time than occurred in the control group. Previous studies agreed with this findings. [9, 19, 20]

Sharon, *et al.* [21] reported that the balance of organisms in the vagina is a fragile one, and any disruption can lead to major problems and infection. There is a balance where the healthy bacteria work tirelessly to fight back the overgrowth of harmful bacteria and funguses; if established it is a balance that creates the optimal level of acidity in the vagina. However, when this acidity level is changed by outside entity yeast, including the candida albicans species, can and will proliferate. According to doctors, any kind of douching, including a vinegar, iodine or baking soda douche, can rapidly change the pH level in the vagina. The reason for this change is because the douche has chemicals in it that destroy the healthy bacteria that reside in the vaginal environment, ultimately leading to a myriad of possible vaginal complications, including frequent or recurrent vaginal yeast infections. Eric [12] the findings of

this study could be considered as strength. However, these findings are limited by the relatively small number of participants.

6. Conclusion

In the light of the results of the study, it can be concluded that vaginal washing with a baking soda (sodium bicarbonate) solution counteracts vaginal yeast infection, when used in combination with medication. Vaginal douching, prolonged use of antibiotics, oral contraceptive pills, perfumed feminine hygiene, tight under wear made from synthetic fibers and repeated sexual intercourse, are the major risk factors for vaginal yeast infection.

6.1. Implementation and Recommendations

Based on the results of the study, assessment of risk factors of vaginal yeast infection should be included in routine women's care that is provided at the MCH centers. Nurses should practice their educator's role in terms of health education about vaginal yeast infection, definitions, risk factors, signs and symptoms, drug and particularly non-pharmacological treatment. Additionally, health care professionals should pay attention to the value sodium bicarbonate as a treatment of vaginal infection, besides standard medication. Further studies need to be carried out about the efficiency and efficacy of herbal methods of treatment of vaginal infections.

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