

Efficacy of Sodium Bicarbonate in Early Management of Women Suffering from Vaginal Yeast Infection

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Abstract: Background Vaginal yeast infection is a common condition that affects women during reproductive age was more than 25% of women worldwide, sodium bicarbonate is one of non-pharmacological agent that help balance out the PH levels of the vagina lead to are vaginal yeast infection. Aim of the study: To evaluate the efficacy of sodium bicarbonate in early management of women suffering from vaginal yeast infection. Design: Quasi-experimental research (pre/post-test) of the study was used. Setting: the study was conducted at outpatient clinic in Fayoum general hospital, Egypt. Subjects: A total of 100 women were divided into two group were recruited (50 for each) Study group who received sodium bicarbonate in plus routine hospital care and control group who received routine hospital care. Tools: three tools were used for data collection. 1) A structured interviewing questionnaire, 2) Assessment of women's level of knowledge regarding vaginal yeast infection, and 3) Follow up assessment tool for symptoms of yeast infection Results: The study group exhibited a mean age of 28.58 ± 4.99 years, while the control group had a mean age of 29.88 ± 6.13 years. After the intervention, 86 % of the participants in the study group demonstrated a satisfactory level of knowledge, contrasting with 14% in the control group. The study group experienced significant relief in the majority of signs and symptoms compared to the control group. These differences were highly statistically significant during weekly follow-ups up to the third week. Conclusion: the findings of the current study concluded that, level of knowledge was improved after intervention. As well, there is improvement in signs and symptoms of vaginal infection among study samples after applying sodium bicarbonate throughout three weeks as compared to control group who received routine hospital care with statistically significant differences. Recommendation: Healthcare providers are advised to recognize and appreciate the effectiveness of sodium bicarbonate, incorporating it into routine care for early management and prevention of vaginal yeast infections.

Keywords: Vaginal yeast infection, Efficacy, Sodium bicarbonate, Women.

1. INTRODUCTION

The reproductive system is a biological system that is responsible for producing, transporting, and storing eggs and facilitating the meeting between eggs and sperm for fertilization. The female reproductive system consists of internal and external organs, the external organ including the labia majora and minora, vestibule, Bartholin glands, Skene glands, clitoris, mons pubis, perineum, urethral meatus, and periurethral region, and internal organ components include the cervix, uterus, fallopian tubes, and ovaries (Garcia., 2023). The reproductive system is also influenced by reproductive hormones as; estrogen, progesterone, and gonadotropins which are produced by the pituitary gland and ovaries. Furthermore, the uterus secretes substances into the vagina known as vaginal discharge, which is normal. The purpose of vaginal discharge is to protect the vagina from infection and facilitate sperm passage into the fallopian tubes, but it can also become abnormal

and cause infection, such as a yeast infection. Women have a 40–45% lifetime risk of getting two or more some symptoms of infections. lifetime (*Andina., 2023*).

Symptoms of vaginal yeast infection include burning, leukorrhea, edema, vulvovaginal erythema, dyspareunia, dysuria, and severe vulvar pruritus. Additionally, patients have a thick, lumpy, white, odorless vaginal discharge that sticks to the walls of the vagina and resembles curd cheese or curdled milk (*Gigi et al. 2023*). Several risk factors for occurrence of vaginal infection as; smoking, drinking alcohol, using fizzy beverages, eating habits, personal hygiene, whether to use cotton underwear, the amount of sun exposure, the wetness of the vaginal area, and sociodemographic characteristics (*Alikhani et al., 2023*). The use of antimicrobial medications, which kill off helpful Lactobacillus bacteria of a normal vaginal microbiota, is a risk factor for vaginal yeast infections. Diabetes, immunosuppressive diseases, genetic predispositions, glucocorticoid use, oral contraceptive use, and hormone replacement therapy are other prominent predisposing factors (*Yadav., 2023*).

Vaginal yeast infection affects approximately 25% of women worldwide, contributing to severe morbidity in around 150 million cases and causing approximately 1.6 million fatalities annually. *Candida* spp., a pertinent opportunistic fungal species, poses a significant threat to public health. While there is no universal consensus categorizing infections caused by *Candida* spp. as sexually transmitted infections (STIs), engaging in risk-taking behaviors and sexual activities plays a substantial role in the development and proliferation of these opportunistic fungi. The *Candida* species, therefore, represents a noteworthy concern due to its potential to cause serious health complications. (*Willems et al., 2020*).

Sodium bicarbonate, or baking soda was used as an early treatment for women who had vaginal yeast infections. Baking soda is one of the non-pharmacological agents that helps in naturally balancing out the PH levels of the vagina. Its alkaline nature helps in killing candida cells that lead to genital yeast infection. This natural vaginal wash helps in speeding up the recovery process with its natural properties (*Kraut et al., 2023*). The nurse plays a vital role in maintaining the health of girls and women who have vaginal yeast infections by helping with early diagnosis and raising awareness of the infection's prevention. Early detection of a vaginal yeast infection helps in women's quick recovery and helps to avoid potential complications. Additionally, the nurse plays an essential role in helping patients access and utilize primary care services to avoid illness by encouraging students to practice good hygiene, wear cotton underwear, refrain from douching, and keep a healthy diet (*Mashatan et al., 2023*).

Significance of the study

In Egypt, the prevalence of vaginal yeast infection is estimated to be between 70 and 75 percent. The chance of developing vaginal yeast infection was twice as high in women under 40 as in older women. Also, there was a four-fold increase in the probability of developing vaginal yeast infection among women's whose first sexual experience occurred before the age of 20. Twenty-five percent of women have vaginal *Candida* microbes (*Abdullah et al., 2020*). Worldwide, vaginal candidiasis is a prevalent ailment affecting women, with over 75% of women reporting one infection at some point in their lives and 40–45% reporting two or more infections. Men can also occasionally develop vaginal candidiasis. Pregnant women, those with compromised immune systems, and diabetics experience vaginal yeast infection more frequently and more severely (*Huang et al., 2023*). Moreover, if left untreated, vaginal yeast infections can lead to various additional health complications. These may include pelvic inflammatory disease, infertility, ectopic pregnancy, pelvic abscess, and spontaneous abortion. Furthermore, the untreated yeast infection may extend to cause skin infections and invasive candidiasis, where the yeast affects other parts of the body such as the blood, heart, bones, and brain (*Abd-Elmoneen et al., 2020*). To address this, women experiencing vaginal yeast infections were provided with instructions to prepare a sodium bicarbonate bath (30–40 g/1 tablespoon of baking soda in 1 liter of filtered water) twice weekly for two to three weeks. In comparison, vaginal yeast infections were treated with a single dosage of Diflucan 150 mg. This proactive approach aimed to mitigate the potential health risks associated with untreated yeast infections and enhance the overall well-being of affected individuals.

(*Gracioli et al., 2023*).

The aim of the study:

The aim of the current study was to evaluate the efficacy of sodium bicarbonate in early management of women suffering from vaginal yeast infection. This aim was achieved through the following objectives:

1-Assess women's knowledge regarding vaginal yeast infection.

2-Evaluate the effect of sodium bicarbonate on relieving signs and symptoms of vaginal yeast infection.

Research hypothesis

Women who apply sodium bicarbonate will have improve of vaginal yeast infection symptoms than those who do not.

Materials and Methods

Research design: A Quasi-experimental research (pre/post-test) design was utilized to conduct this study.

Setting: The study was conducted at the gynecological outpatient clinic in Fayoum General Hospital.

Sampling:

Type of the sample:

A deliberate purposive sampling method was employed, involving 100 women who were divided into two groups. The study group comprised 50 women who received sodium bicarbonate in addition to routine hospital care, while the control group consisted of 50 women who received only routine hospital care. Inclusion criteria were applied, including marital status, and expressed willingness to participate in the study. However, women currently pregnant were excluded from the research.

Sample size: The estimated sample size is 100 women who visit at the previous mentioned setting, at confidence level 95% according to the following equation:

$$n = t^2 \times p (1-p) m^2$$

n = required sample size

t = confidence level at 95% (standard value of 1.96).

p = estimated prevalence of vaginal yeast infection.

m = margin of error at 5% (standard value of 0.05)

Sampling technique: women were recruited from hospital outpatient clinic according to the inclusion criteria till reach the determined sample size. After explanation and obtaining oral consent from the women.

Tools for data collection:

Three tools were used for the current study developed by the researcher based on review of related literatures. Three tools were used for the current study.

Tool (I): A structured interview questionnaire. Developed by researchers after extensive literature, it consists of two parts: **Part I: included data related to** demographic characteristics of the study sample as; age, residence, education level, occupation, family monthly income, smoking. **Part II: included data related to** obstetric history as; gravidity, parity, interval between pregnancy, contraceptive method used, and previous complications during contraceptive method used.

Tool (2): Assessment of Women's Knowledge on Vaginal Yeast Infection (Pre-Posttest):

The researcher developed an assessment tool after an extensive literature review, focusing on six questions related to the definition, causes, symptoms, and prevention methods of vaginal yeast infection. The scoring system assigns a score of (2) for a correct and complete answer and (1) for a correct but incomplete answer. The tool, comprising six questions, assessed participants' responses with a score of (2) for a correct and complete answer and (1) for a correct but incomplete answer. To gauge knowledge levels, a percentage score is computed based on the total score achieved by participants. If the percentage score equals or exceeds 60% of the total score, it indicates **satisfactory** knowledge. Conversely, a percentage score below 60% signifies **unsatisfactory** knowledge.

Tool (3): Follow-Up Assessment Tool for Yeast Infection Symptoms:

The assessment tool was adapted from (Abd El-Razek et al., 2020) and customized by the researcher through a literature

review, the tool aimed to provide a comprehensive follow-up assessment of yeast infection symptoms based on the severity scale, allowing for a nuanced understanding of the participant's reported experiences. To evaluate the severity of self-reported symptoms. The tool comprises three parts: **Part 1: Vaginal Symptoms:** This section consists of three questions focused on assessing vaginal symptoms. **Part 2: Urinary Symptoms:** This segment includes three questions designed to evaluate urinary symptoms. **Part 3: Sexual Symptoms:** The third part encompasses two questions specifically targeting sexual symptoms.

Supportive material:

"Booklet contains instruction about knowledge regarding to efficacy of sodium bicarbonate in early management of women suffering from vaginal yeast infection, this booklet was developed by researcher based on review of literature. It is used to help women increase level of knowledge regarding sodium bicarbonate vaginal wash effect and side effect included data related to vaginal yeast infection symptoms and risk factor and method of prevention and treatment.

Tools validity and reliability:

Tools were reviewed by a panel of three expert professors to ensure applicability, comprehensiveness, understanding and ease of implementation of the tools. Each of the experts was asked to examine tools for content coverage, relevance, clarity, wording, length, format, and overall appearance. Modifications were done according to the expert's comments and recommendations; minor modifications had been made as; rephrasing and rearrangements of some sentences such as the question of definition of vaginal yeast infection the answer was complete and incomplete then modified to correct and in correct. Testing reliability of the proposed tools was done statistically by Alpha Cronbach test which revealed that each of the two tools consisted of relatively homogenous items as indicated by the moderate to high reliability of each tool.

Ethical consideration:

The research approval was obtained from a scientific, ethical committee in the Faculty of Nursing, Helwan University before starting the study. The researcher was obtained oral consent from women. The researcher clarified the aim and objectives of the study to each woman. The researcher was assured confidentiality and anonymity of the subject's data. Women were informed that allowed to choose to participate or not in the study and that they have right to withdrawal from the study at any time.

2. OPERATIONAL DESIGN

Pilot study:

The pilot study was carried out with 10% (10 women) of total sample at selective women to investigate the efficiency, the applicability and clarity of the tools. The women included in the pilot study were not excluded from the total study sample.

Field of work:

This study was carried out at the Fayoum general hospital. The data collection process took place between the beginning of December 10, 2022, and the end of March 30, 2023. The researcher attended the outpatient clinic in Fayoum general hospital Saturday and Sunday of each week from 9:00 am to 1:00 p.m. Data was collected through four phases. The following phases were adopted to fulfill the aim of the current research: preparatory, assessment, implementation, and evaluation phases.

Preparatory phase: During this phase, the researcher reviewed the current, local, and international related literatures of various aspects of the study using books, periodicals journals, magazines, and internet. This helped the researcher to be more acquainted with the study, and with the process of tools' designing. Then tools were designed and tested to be valid and reliable.

Assessment Phase: The researcher introduced herself to the physician and the nurse in the outpatient clinic and met women when enter the outpatient clinic before the examination. At beginning of the interview, the researcher introduced herself to women and explained to the study sample the aim of the study and then the oral consent of the women was obtained. The researcher conducted individual interviews with each woman at an outpatient clinic to complete Tool (I),

comprising three sections. The first part comprised questions about the women's demographic data, the second part included inquiries regarding their obstetric history, and the third part consisted of questions assessing risk factors related to women's hygiene and personal habits concerning vaginal yeast infection. The data collection process typically took 5-10 minutes per participant. Next, each woman was provided with Tool (II) to evaluate their knowledge about vaginal yeast infection and its remedial measures through a pre-posttest assessment. This tool requires approximately 15-20 minutes to complete. Subsequently, Tool (III) was distributed to all women to assess self-reported symptoms, such as vaginal discharge, external vaginal itching, redness, etc., in a pre-posttest manner.

Implementation phase: During this phase, the researcher use a simple Arabic language to suit women's level of understanding, various educational methods and materials were used, including group discussion, demonstration and re-demonstration and a designed booklet. Three sessions were applied about vaginal yeast infection and how to use baking soda to relieve symptoms of vaginal yeast infection. **Each** session composed of (3-5 women/session) at the outpatient clinic's waiting place. At the end of each session, women's questions were answered to correct any misinterpretation. The subsequent session started with feedback about the previous session and the objectives of the new session. **The first session** covered general knowledge about characteristics of normal and abnormal vaginal discharge. Also, knowledge related to vaginal yeast infection as definition, types, signs and symptoms, behaviors and factors predisposing to recurrent vaginal yeast infection, consequences, and complications of the recurrent vaginal yeast infection, preventive measures, and management. The designed booklet was distributed to each woman, which contains instruction about knowledge vaginal yeast infection as (definition, sign and symptoms, risk factor, causes, complication of vaginal yeast infection, treatment, and prevention) and efficacy of sodium bicarbonate in early management of women suffering from vaginal yeast infection. how to apply baking soda to relieve symptoms of vaginal yeast infection. **The second session** concerned instructions about health-promoting lifestyle behaviors that support vaginal health and prevent recurrences of vaginal yeast infection. Regarding nutrition, women instructed to have a continuously balanced diet, modifying unhealthy nutritional behaviors, strict intake of processed and sugar rich foods and carbohydrates, increasing intake of fresh vegetables and fruits, increasing dairy intake. As well as maintaining weight control and reducing obesity. **The third session** included remedial measures that apply sodium bicarbonate to relieve vaginal yeast infection. During the second session, the studied women was trained about how to use sodium bicarbonate to relieve vaginal yeast infection according to the following steps: a) Before using baking soda women should recommended to test the effect on a small patch of skin at least 10 minutes before taking baking soda bath (sensitivity test) b) Sodium bicarbonate was used in a sitz bath or by vaginal irrigation. c) the women must be used in a sitz bath or vaginal irrigation was prepared by adding sodium bicarbonate bath (30–40 g/ 1 tablespoon of baking soda in 1 liter of filtered water) twice weekly for two- three weeks about 10-2- minute one or two time per day for three weeks. Also, sodium bicarbonate is available ready as recommended dose at pharmacies called (*Alka-Maser*) with one pound per packet *Felix*. (2019). d) at the end of second session redemonstration was done to confirm that the women acquired knowledge regarding using of sodium bicarbonate. While the control group received hospital care as; take medication prescribed by physician in outpatient clinic and return for follow-up.

Evaluation phase and follow up:

The evaluation phase and follow-up procedures involved conducting a **pretest** for both the study and control groups to gauge women's knowledge levels and clinical manifestations of vaginal yeast infections Posttest **and follow up** was done for both groups as the following:

Study group: Posttest was done after one week to assess women's knowledge levels regarding vaginal yeast infections after the implementation of the educational session, utilizing tool II (women's knowledge questionnaire), and to evaluate the clinical manifestation of vaginal yeast infection was done weekly through three weeks to monitor effect of using baking soda in relieving signs and symptoms of vaginal yeast infection, using the same pre-test: infection Tool III (clinical manifestation of vaginal yeast infection). Communication with the study group was facilitated via telephone calls, providing instructions on applying sodium bicarbonate and monitoring the alleviation of signs and symptoms of vaginal yeast infection.

Control group: Posttest was done after one week to assess women's knowledge levels regarding vaginal yeast infections, utilizing tool II (women's knowledge questionnaire), and to evaluate the clinical manifestation of vaginal yeast infection

was done weekly through three weeks after receiving standard hospital care to monitor signs and symptoms of vaginal yeast infection, using the same pre-test: infection Tool III (clinical manifestation of vaginal yeast infection). The Telephone communication with the control group involved assessing signs and symptoms after receiving standard hospital care. The evaluation process began with the control group, followed by the study group, to mitigate potential biases.

Administrative design:

Official letters, including the title and aim of the study were issued from the Faculty of Nursing Helwan University, a letter which was issued from Ministry of health approval after ethics committee and submitted to the director of Fayoum General Hospital for conducting the study.

Statistical design:

Data was analyzed using the Statistical Package for Social Science (SPSS) version 22. Qualitative data was presented as numbers and percentages. Relations between different qualitative variables were tested using Chi-square. Test (X2) and Cochran's Q test.

3. RESULTS

Table (1) shows that 44% and 52% respectively, of study and control group were between 25-30 years old. With mean age in the study group was 28.58 ± 4.99 years as compared to control group was 29.88 ± 6.13 years. Furthermore, 38% of the study group can read and write while 30% of the control group cannot read and write. Also, 76% and 66% respectively, of control and study group were housewives.

Table (2): Reveals that, majority of women (80.0% vs. 100.0%) suffer from vaginal discharge at time of recruitment. Regarding the risk factors for occurrence vaginal yeast infection in study groups were frequent had vaginal discharge with odor, frequently use antibiotics during infection, wearing nylon and tight underwear. As compared in control were frequent had vaginal discharge with odor, frequently use antibiotics during infection and drinking soda.

Figure (1): shows that there was a significant regarding level of knowledge post-intervention in study group as compared to control group. About 86% in the study group had satisfactory level of knowledge about vaginal yeast infection as compared to 26% in control group. While their unsatisfactory level of knowledge decreased from 74% in control group to 14% in study group.

Table (3): It was evident that there was a notable enhancement in women's knowledge levels after the intervention was implemented. Prior to the intervention, the majority of women (96.0% and 96.0%) displayed a lack of knowledge concerning vaginal yeast infection, including its definition, causes, risk factors, symptoms, and preventive measures. However, there was a significant shift in the post-intervention control group, with approximately half (52.0%) of the women demonstrating improved awareness on these aspects.

Table (4): shows that, there was statistically significant regarding symptoms relieved after applying soda bicarbonate through three weeks of administration with p-value <0.05.

Table (5) reveals that, there is a statistically significant relationship between total score of study group's knowledge post intervention and total score of risk factors with (p-value<0.05).

Table (1): Distribution of the studied sample regarding their demographic characteristics (N = 100).

Demographic characteristics	Study group		Control group		Chi-square	
	N = 50		N = 50		X2	P-value
	No.	%	No.	%		
Age (years)						
▪ < 20	3	6.0	2	4.0	1.37	0.71
▪ 20-25	12	24	8	16		
▪ 25-30	22	44	26	52		
▪ ≥ 35 years	13	26	14	28		
Mean ± SD yrs.	28.58 ± 4.99		29.88 ± 6.13		T=1.16, p=0.27	

Educational level						
▪ Cannot read and write	10	20	15	30	X=5.81	0.32
▪ Read and write	19	38	14	28		
▪ Preparatory	12	24	11	22		
▪ Primary school	2	4	3	6		
▪ Secondary school	0	0.0	3	6		
▪ High education	7	14	4	8		
Working status						
▪ Working	17	34	12	24	X=1.21	P=0.27
▪ Housewife	33	66	38	76		

Table (2): Distribution of the study sample regarding risk factors (n=100).

Risk factors	Study group N=50				Control Group N = 50			
	Yes		No		Yes		No	
	No	%	No	%	No	%	No	%
▪ Suffering from vaginal discharge before and accompanied by odors	50	100	0	00	40	80	10	20
▪ Take antibiotics frequently during infection	50	100	0	0	38	76	12	24
▪ Have complications with medication	50	100	0	0	10	20	30	80
▪ Eating spicy food	20	40	30	60	10	20	40	80
▪ Drink soda or cola	15	30	35	70	32	64	18	36
▪ Had urinary tract infection	10	20	40	80	28	56	22	44
▪ Wearing cotton underwear cloth	20	40	30	60	24	48	26	52
▪ Washing external genital area from front to back	15	30	35	70	20	40	30	60
▪ Use vaginal douching	10	20	40	80	30	60	20	40
▪ Wear nylon underwear cloth	40	80	10	20	16	32	34	68
▪ Wear tight clothes	35	70	15	30	18	36	32	64
▪ Use plenty perfumed douches	20	40	30	60	28	56	22	44
▪ Use a public restroom	20	40	30	60	24	48	26	52

Table (3): Distribution of the Study Sample “s Knowledge Level about vaginal yeast infection (N=100)

Knowledge of vaginal yeast infection	Study Group N = 50				Control Group N = 50			
	Pre		Post		Pre		Post	
	No	%	No	%	No	%	No	%
Definition of Yeast infection								
▪ I do not Know.	48	96	0	0	48	96	26	52
▪ Incorrect answer	2	4	33	66	0	0	16	2
▪ Correct answer	0	0	17	34	2	4	8	16
Causes of yeast infection								
▪ I do not know.	42	84	0	0	48	96	26	52
▪ Incorrect answer	8	16	9	18	0	0	18	36
▪ Correct answer	0	0	41	82	2	4	6	12
Vaginal discharge of yeast infection								
▪ I do not know.	42	84	0	0	42	84	30	60
▪ Incorrect answer	8	16	6	12	8	16	16	32
▪ Correct answer	0	0	44	88	0	0	4	8
Consistency vaginal discharge regarding vaginal yeast infection								
▪ I do not know.	39	78	0	0	48	96	30	60
▪ Incorrect answer	11	22	6	12	0	0	16	32
▪ Correct answer	0	0	44	88	2	4	4	8

Symptoms of vaginal yeast infection								
▪ I do not know.	46	92	0	0	50	100	20	40
▪ Incomplete answer	4	8	17	34	0	0	26	52
▪ Complete answer	0	0	33	66	0	0	4	8
Method of prevention of vaginal yeast infection?								
▪ I do not know.	47	94	0	0	50	100	20	40
▪ Incorrect answer	3	6	12	24	0	0	26	52
▪ Correct answer	0	0	38	76	0	0	4	8

Figure (1): Distribution of The Study Sample Regarding total knowledge score post-intervention (N=100).

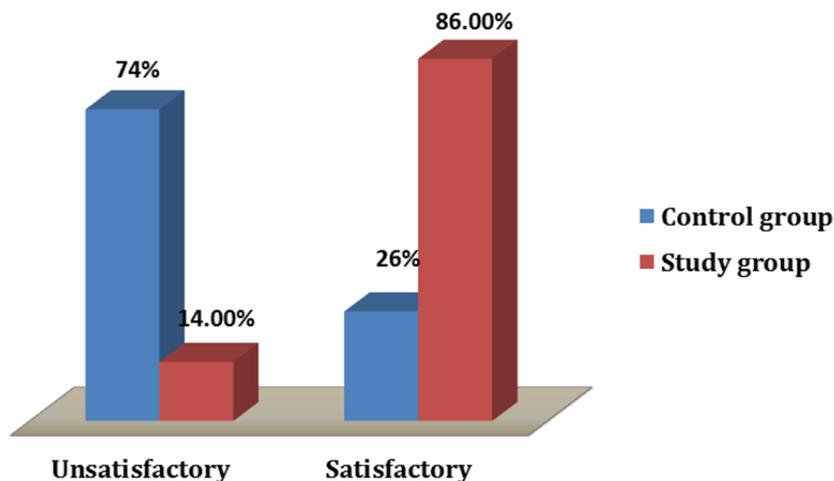


Table (4): Relation between symptoms and signs of study group through Three-week post-Intervention (N=50).

Items	First week		Second week		Third week		ANOVA-test	
	Yes	No	Yes	No	Yes	No	F	Sig.
▪ White vaginal discharge	40(80)	10(20)	15(30)	35(70)	0 (0)	50(100)	0.98	0.001**
▪ Cheesy vaginal discharge	40(80)	10(20)	15(30)	35(70)	10(20)	40(80)		
▪ Burning sensation	35(70)	15(30)	15(30)	35(70)	5 (10)	45(90)		
▪ Vaginal itching	25(50)	25(50)	5 (10)	45(90)	5 (10)	45(90)		
▪ Vaginal redness & edema	20(40)	30(60)	5 (10)	45(90)	10 (20)	40(80)		
▪ Pain during sexual relation	15(30)	35(70)	5(10)	45(90)	5 (10)	45(90)		
▪ Anxiety	15(30)	35(70)	5(10)	45(90)	0 (0)	50(100)		
▪ Lower abdominal pain	15(30)	35(70)	5(10)	45(90)	0 (0)	50(100)		

Using: Anova test (p-value >0.05 NS; *p-value <0.05 S; **p-value <0.01 HS)

Table (5): Relation between study group's total knowledge post-intervention and total risk factors (N=50).

Items	Total risk factors		
	χ^2	p-value	Sig.
Total study group's knowledge post-intervention	5.65	0.02*	S

Using: Chi-square test (p-value >0.05 NS; *p-value <0.05 S; **p-value <0.01 HS)

4. DISCUSSION

Among women of reproductive age, vaginal yeast infections are highly common infections of various kinds have affected two out of every three women at some point in their lives. Glucocorticoids, oral contraceptives, immunosuppressive disorders, diabetes mellitus, genetic predispositions, and hormone replacement treatment are the main risk factors for the occurrence of yeast infection (Wang *et al.*, 2023). Sodium bicarbonate is considered a non-pharmacological agent that helps in early management and helps also natural balance of vaginal ph. level (Ainee, 2020). Therefore, the aim of the current study is to evaluate of sodium bicarbonate in early management of women suffering from vaginal yeast infection. The frame of reference regarding the discussion is as follows; description of the study sample and answer the research hypnosis.

The findings of the current study revealed that, majority of the studied women were in age group 20-35 years for both groups with mean age 28.58 ± 4.99 in study group while 29.88 ± 6.13 in control group. The current result was consistent with Tri Lisnawati. (2021) in a study entitled Etiology, Diagnosis, and Treatment of Leukorrhoea. He showed that the majority belonged to the 21-30 years age group. In contrast, a study done by Ray *et al.* (2022) to assess "Knowledge Regarding Vaginal Candidiasis". They found that, almost half of women in the age group from 16 to 19 years had vaginal yeast infection. In addition, Michael *et al.* (2020) in a study entitled "Knowledge and practice of adolescent females about menstruation and menstruation hygiene visiting a public healthcare in Pakistan". They found that, nearly one third of women in the age group 15 years had yeast infection.

Regarding to the educational level of the studied women, the finding of the present revealed that more than half of the women cannot read and write in the bath groups. Moreover, more than two third of women were live in rural areas in both groups. This result was in the same line with Said *et al.* (2019), in a study entitled "evaluate the education intervention guideline on knowledge and self-care practice for women with vulvovaginitis, in Egypt" who found that less than one quarter of them had a university level of education, more than one half of studied women were lived in rural areas. While, a study done by Gour (2022), to assess "Knowledge Regarding Vaginal Candidiasis" . He found that, majority of the studied women highly educated and live in urban areas. This finding may be due to most women from rural areas and different culture.

Regarding to occupational level, the findings of the current study revealed that, majority of the women in the study sample were housewives, and more than half of them were non-smokers and two-quarters of the women had adequate family monthly income among both groups. Also, this result was consistent with Demir *et al.* (2020) in a study entitled "Analyzing the Relationship between Genital Hygiene Behaviors in Women and Urinary Tract Infection in Any Period of Life". Researcher revealed that more than half of the women in the study group were non-smokers and housewife with insufficient monthly income in both groups. On the other hand, this result is in disagree with Thornhill *et al.* (2022), in study entitled "Monkeypox virus infection in humans across 16 countries in London" showed that majority of studied women worker and positive smoker. From a researcher's point of view, this may be due to lower socioeconomic status, which is known to be associated with a higher incidence of vaginal yeast infection. Low socioeconomic status associated with inadequate hygiene practices, compromised immune system, and insufficient nutritional intake could contribute to this connection.

Regarding to risk factors for occurrence of vaginal yeast infection, the current study reveals that, the main risk factor that aggravate vaginal yeast infection among the study sample were, vaginal discharge accompanied with odors, frequent use of antibiotics, and wear nylon and tight underwear in study group. While in control group add eat spicy food & drink cola or soda. This finding is supported with the results of study performed by Abdelnaem *et al.* (2019) which entitled "Effect of self-care guidelines on knowledge and quality of life among faculty of nursing students with vaginal infection" Their reported that, majority from women suffered from abnormal vaginal discharge. Also, Calik *et al.* (2020) which entitled "Genital Hygiene Behaviors of Women and Their Effect on Vaginal Infections" who showed that, vaginal infection has become a serious vulvovaginal candidiasis, which is common in both developed and developing countries. Study done by Nyirjesy *et al.* (2019), entitled that "Vulvovaginal symptoms and Candida colonization in women with type 2 diabetes mellitus treated with canagliflozin, a sodium glucose co-transporter 2 inhibitor". Researcher found that majority of the women eating sugary meals and drinks daily may increase women's risk of developing vaginal yeast infection. This finding is consistent with a study conducted by Demirağ *et al.* (2020) which entitled "Analyzing the

Relationship Between Genital Hygiene Behaviors in Women and Urinary Tract Infection. They demonstrated that more than two third of the women wearing synthetic or nylon underwear. These results supported with the study done by *Ruiz et al. (2019)* which entitled “Daily genital cares of female gynecologists in Brasileira”. Researcher showed that majority of women wear nylon under wear clothes. The researcher point of view nylon and synthetic lingerie more appealing is a business trend, particularly for younger women’s and the material does not absorb moisture, keeping the perineum wet and increasing the risk of infection. Because cotton underwear is permeable and permits air to circulate around the external genitalia, it is preferred above synthetic materials for underwear.

In addition, a study done by *Felix et al. (2020)*, who entitled “vulvovaginitis, and hygiene habits of women attended in primary health care units of the family”. They found that more than half of the women wearing tight jeans/pants. This may be attributed to the increase in the risk of vaginal yeast infection. However, it is important to note that the perineum can remain wet when wearing synthetic materials, making it more susceptible to yeast infections. From the researcher's point the women indicated that cotton underwear allows more aeration and absorb more moisture, allowing perspiration, the fact that they also wore tight jeans or tight pants often caused a restriction of ventilation and compression of the perineum area, encourage occlusion and friction, which may be harmful, thus negating the beneficial effect of cotton panties.

Also, these results supported with the study done by *Calik et al. (2020)* about, “Genital Hygiene Behaviors of Women and Their Effect on Vaginal Infections in Turkey”. They reported that fifty percentage of studied women used vaginal wipes and between more than fourteen of studied women used sprays douching. This result disagrees with *Jenkins et al. (2021)* that entitled “Is the vaginal cleansing product industry causing harm to women” who showed majority of the study women behavior that increased the risk of developing vaginal yeast infection regarding some vaginal products may have benefits for women’s vaginal health. From the researcher point that there is evidence to show that vaginal lubricants may disturb the vaginal microbiome, there are also some benefits including reducing discomfort, vaginal irritation and mucosal damage after vaginal intercourse and vaginal dryness after menopause.

Level of knowledge regarding vaginal yeast infection, the findings of the current study reveal that more than ninety percent of women had unsatisfactory level of knowledge regarding the definition, causes, color, and consistency of vaginal discharge in instances of vaginal yeast infection and method of prevention in study and control group pre-intervention. After intervention, the level of knowledge was improved in the study group as compared to control group with statistically significant difference. These findings are consistent with a study conducted by *Gudia et al. (2019)* entitled " Effect of an instructional program on knowledge Regarding Vulvovaginal Candidiasis among female university students". Researcher reported that more than two third of the study women had incorrect knowledge regarding vaginal yeast infection. Also, a study done by *Fatuoh et al. (2023)* in their study, "Effectiveness of Nursing Intervention Protocol on Recurrence of Vulvovaginal Candidiasis Infection Associated Pregnancy. They reported that there is a significant improvement in women's knowledge and health behaviors after nursing intervention as compared to group who received routine care. These positive outcomes may be due to successful implementation of a health education program contributed to an enhanced level of knowledge among the women under study.

In the same line, *Malfasari et al. (2019)*, who carried out their study in Egypt to “assess the knowledge of female university students about and examine the effect of instructional program on their knowledge among female university students”. Researcher showed that the women had a poor knowledge in pretest and had a good knowledge about VVC or yeast infection in posttest with statistically significant difference between them p-value ≤ 0.001 . All previous results reflect the importance of supporting all women with knowledge about vaginal yeast infection through educational programs.

Correlation between total knowledge score post-intervention related vaginal yeast infection and total risk factors toward hygiene and personal habit. The current findings showed that, there was a negative significant correlation between study group’s knowledge post-intervention related vaginal yeast infection and risk factors toward hygiene and personal habits (p- value < 0.05). This finding was in harmony with *Michal et al. (2020)*, in Bangladesh. Reported that, there was a negative significant correlation between study group’s knowledge post-intervention related vaginal yeast infection and risk factors suffer from decrease of awareness about reproductive problems and may not feel comfortable in discussing such problems as reported by various studies. From the researcher's point of view the study's results also

highlighted an extremely statistically significant correlation between women's overall attitudes and knowledge. After applying health education programs to improve yeast infection knowledge are helpful for encouraging an optimistic attitude and maintaining safe practices.

Concerning to vaginal yeast infection symptoms associated with vaginal yeast infection at pre and post application of sodium bicarbonate, the current study clarifies that there was improvement in signs and symptoms of vaginal infection after application of baking soda with highly statistically significant difference between pre and after application regarding all symptoms $p\text{-value} \leq 0.001$. These findings agree with the study of *Tao & Ye. (2023)* who reported that, using 5 % sodium bicarbonate solution has proved in the treatment of yeast infection, reduce recurrence of infection, and improved the vaginal pH values of women and reduced the growth of vaginal yeast infection.

These results are similar with a study conducted by *Jude et al., (2020)* who stated that sodium bicarbonate has proven more effective, safe in the treatment of vaginal yeast infection, to avoid recurrence of symptoms. It is recommended to take from two to three times per week, twice a day for 15 min. It recommended for relive vaginal irrigations and itching, 15–30 g of sodium bicarbonate in 500 mL of warm water. This result may be related to acidity level is changed by outside entity yeast, including the yeast *albicans* species, can and will proliferate. Baking soda douche can rapidly change the pH level in the vagina. This finding was in harmony with *Tao & Ye. (2023)* which entitled “Effectiveness of combined use of sodium bicarbonate sitz bath prescription and vaginal nystatin suppository in the treatment of patients with fungal vaginitis” in China. They reported that, about using vaginal sitz bath with 5 % sodium bicarbonate solution, once daily for 14 consecutive days solution, once a day, for 14 consecutive days. Treatment was considered markedly effective if vulva and vaginal itching were significantly mitigated, symptoms of urinary tract irritation and vaginal swelling and bleeding were basically absent, and vaginal secretion showed no mold under microscopic examination. If vulvar and vaginal itching were reduced, and symptoms of urinary tract irritation.

Hayachinda et al. (2022) & Karim et al. (2023), they illustrate that, the use of sodium bicarbonate either in a bath or in vaginal irrigation for the treatment used as alkalinizing agent for the treatment of vaginal yeast infection, vaginal irritation, and vaginal redness & edema. Also, in agreement with *Shao et al. (2019)* entitled, “antifungal activity of sodium bicarbonate against *C. albicans* isolates using the broth microdilution method” who reported that using 5% sodium bicarbonate be effective disinfecting solution for vaginal yeast infection, reducing the *Candida albicans*. In the light of the results, there is an improvement in total knowledge about vaginal infection after intervention. 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 underwear made from synthetic fibers and repeated sexual intercourse, are the major risk factors for occurrence of vaginal yeast infection.

5. CONCLUSIONS AND RECOMMENDATIONS

Conclusions: the findings of the current study concluded that level of knowledge improved after intervention in study group as compared to in control group with statistically significant differences. Also, there is improvement in signs and symptoms of vaginal infection among study group who applying sodium bicarbonate throughout three weeks as compared to group who received routine hospital care with statistically significant differences.

Recommendations:

1. Instructional booklets about vaginal yeast infection to improve knowledge and health belief and vaginal washing with (sodium bicarbonate) solution counteracts vaginal yeast infection, when used in combination with medication should be disseminate in outpatient clinics.
2. Health care professionals should pay attention to the value sodium bicarbonate as a treatment of vaginal infection, besides standard routine care.
3. Increase awareness regarding vaginal infection control should be done in all women at output clinic through educational training.

Further studies:

1. Replicate this study by using larger samples of the population and include more than one hospital with different affiliations in different regions in Egypt to generalize the findings.
2. **Further studies** need to be carried out about the efficiency and efficacy of herbal methods of treatment of vaginal infections.

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