Association of sanitary pads and clothing with vulvovaginitis

Associação de absorventes higiênicos íntimos e vestimentas com vulvovaginites

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ABSTRACT

Introduction: Vulvar occlusion and moisture buildup resulting from the use of sanitary pads, synthetic underwear and/or tight pants are considered risk factors for the development of vulvovaginitis (VV). However, this association is still poorly elucidated. **Objective:** To associate the use of sanitary pads and clothing with the presence of bacterial vaginitis (BV) and vaginal candidiasis (VC). **Methods**: Cross-sectional study aimed at analyzing the use of sanitary pads and clothing in 307 volunteers from 18 to 45 years old, with and without BV and/or VC. A questionnaire comprehending six domains was applied individually to the volunteers, in an outpatient gynecology clinic at a university hospital (University of Campinas, Brazil). This study analyzed three of six domains. Vaginal material was collected for microbiologic diagnosis of BV (Nugent criteria) and VC (Gram stain and culture of the fungus in Saboureaud). Exclusion criteria were: use of antibiotics within 15 days, history of cancer, positive HIV and/or syphilis and immunosuppressive disease. Statistical analysis were made with Fischer and chi-square tests, using the software EPI INFO 0.5. Significance level was set at $p<0.05$. **Results:** In total, 141 (46%) women were diagnosed with VV. The mean age was 32 (±6.8) years and most women were Caucasian (52%), had a steady partner (83%) and were using hormonal contraceptives (64.5%). Women with presence of VV used more panties made of synthetic fabric (10.6% x zero), had more menstrual cycles (72.3 x 55.4%) than those without VV ($p<0.005$ and $p<0.0001$) and showed patterns of sanitary pads similar to those without VV. **Conclusion:** Habits of usage of sanitary pads is not associated with the presence of VV. Presence of menstrual cycle and use of synthetic underwear have been related with greater frequency of VV.

Keywords: vaginitis; bacterial; candidiasis; vulvovaginal; hygiene; absorbent pads; clothing; type of underwear.

RESUMO

Introdução: A oclusão vulvar e o acúmulo de umidade em decorrência do uso de absorventes higiênicos, roupas íntimas sintéticas e/ou calças justas são considerados fatores de risco para o desenvolvimento de vulvovaginites (VV). Contudo, esta associação ainda está mal esclarecida. **Objetivo:** Associar a prática do uso de absorventes higiênicos e vestimentas à presença de vaginose bacteriana (VB) e/ou candidíase vaginal (CV). **Métodos:** Estudo de corte transversal analisou o uso de absorventes higiênicos e vestimentas de 307 voluntárias de 18 a 45 anos, com e sem VB e/ou CV. Um questionário com seis domínios foi aplicado individualmente às voluntárias, nos ambulatórios de ginecologia de um hospital universitário (Unicamp, BR). Este estudo analisou três dos seis domínios. Coletou-se material vaginal para diagnóstico microbiológico de VB (critérios de Nugent) e CV (bacterioscopia corada por Gram e cultura em meio Saboureaud). Critérios de exclusão: uso de antibiótico nos últimos 15 dias, histórico de câncer, HIV+, sífilis e doença imunossupressora. A análise estatística utilizou teste exato de Fischer e qui-quadrado, pelo EPI INF 0.5. O nível de significância considerada foi $p<0,05$. **Resultados:** Do total, 141 (46%) das mulheres foram diagnosticadas com VV. A média de idade foi de 33 (±6,8) anos e a maior parte das mulheres era caucasiana (52%), tinha um parceiro fixo (83%) e utilizava métodos hormonais contraceptivos (64,5%). As mulheres com VV utilizaram mais calcinhas de tecido sintético (10,6% x zero), apresentaram mais ciclos menstruais (72,3 x 55,4%) que aquelas sem VV ($p<0,005$ e $p<0,0001$) e apresentaram hábitos de uso de absorventes semelhantes. **Conclusão:** Os hábitos de uso de absorventes higiênicos não estão associados à presença de VV. Já a presença de ciclos menstruais e uso de calcinhas de tecido sintético se relacionou a maior frequência de VV.

Palavras-chave: vaginose bacteriana; candidíase vulvovaginal; higiene; absorventes higiênicos; vestuário; tipo de calcinhas.

INTRODUCTION

Vulvar epithelial tissue differs from other regions of the human body because of its structure, occlusion, hydration and susceptibility to friction, but as well as other epithelial tissues, its function is to protect the organism from harmful agents through defense cells[1]. However excessive occlusion and humidity in the area of vulva caused by synthetic underwear, tight pants, menstruation and the use of sanitary pads may have a negative influence on the skin barrier and cause changes in temperature and pH of the region, making the vulva susceptible to vulvovaginal diseases[2-4]. The most common types of vulvovaginitis in the reproductive age of women are bacterial vaginitis (BV) and vulvovaginal candidiasis (VC), and they usually manifest as vaginal discharge accompanied by bad odour and itching, respectively[5].

Vaginal discharge — either physiological or caused by vulvovaginitis — is usually disturbing for women, and one of the main reasons of this population's seeking for gynecological care[6]. This is also one of the main factors that lead women to use sanitary pads outside of the menstrual period, the so-called panty liners[7]. Currently, panty liners are widely used by women, regardless of their social group. Around 50% of North-American and North-European females use them in their reproductive age[8]. In Brazil, although these data are only disseminated by non-scientific publications, they reach similar values[7]. Medical-scientific literature, on the other hand, raises a series of questions about the potential risks of long-term use of sanitary pads to women's health[3,9,10].

The most common concern among women is the sanitary pad, which in contact with the vulva increases the local temperature,

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maintain the natural humidity of the area in contact with the skin, and change vulvar or vaginal pH, causing physiological changes that could favor fungus and bacteria growth; therefore, vaginal infections such as vulvovaginal candidiasis (VC) could install much more easier[3]. Runeman et al.[5] performed a study with 58 women used to wear non breathable sanitary pads, with a plastic layer, for three menstrual cycles in between flow days (panty liners). Vulvar temperature, pH and humidity increased significantly compared to women not using them or using breathable types. In another study, the same authors[9] found a large number of aerobic microorganisms in the vulva of women who had used non breathable pads compared to women who had used breathable types or did not use the product.

Just like the sanitary pads, clothing may also cause changes in the genital microbial flora due to humidity and changes in temperature, thus causing alterations in the genital ecosystem and irritations, allergies or discharge[3]. The traditional skirts and dresses have been replaced by jeans, and cotton by synthetic panties, which impairs the ventilation to external genitalia, and it can be worsened by the use of files stocking[11]. Elegbe and Botu[12] reported that women using loose pants had less episodes of VV by *Candida albicans*. Another study made an association of swelling and other morbidities in the female urethral region with the use of tight clothing[13]. Reed[14] concluded that very little is known about the influence of tight clothing on the recurrence of vaginal candidiasis.

Other studies[3,15] have assessed changes in vulvovaginal ecosystem by clothing and sanitary pads and, although results suggest that breathable pads are safe for females' health, the relation between the use of pads and types of clothes with the occurrence of genital infections has not been completely elucidated. The present study was aimed at assessing and comparing the habit of using sanitary pads and certain types of clothes in women with bacterial vaginitis and/or vulvovaginal candidiasis.

METHODS

This is a cross-sectional cohort study performed in a University Hospital (Universidade Estadual de Campinas, Brazil) conducted with 314 women aging 18-45 from March to November, 2013. Women who had used antibiotics in the previous 15 days, who were pregnant, had chronic and degenerative diseases (cancer, diabetes, immunosuppression), diagnosed with syphilis, HIV or hepatitis were excluded from the sample.

A questionnaire about daily habits and intimate care, with 60 questions (I – genital washing; II – use of sanitary pads; III – underwear; IV – genital waxing; V – genital ornaments (piercings and tattoos), and IV – sexual activity) was applied confidentially and individually to women, always by the same researcher. This study analyzed domains I and II. The tool was specifically drawn up for this research, because literature had no other available that was scientifically validated.

After the interview, females were submitted to gynecological examination, with performance of vaginal swab for microbiological assessment. The swab was prepared in a glass slide, stained by the Gram method, and analyzed by optical microscopy. Fungi culture in Agar-Sabouraud growth media was made to identify fungal infections, as well as the Whiff test, and pH measurement using a colorimetric reaction scale (Merck®-Germany) ranging from 0 to 14.

In order to diagnose BV, the criteria by Nugent et al.[16] were applied. To diagnose VC, we considered the presence of white discharge with mycelium or blastopore growing at swab. To assess these data, two main groups were created: women with vulvovaginitis (BV, VC, BV + VC) and women without it. Therefore, females previously undiagnosed and without inflammation at the swab (more than four leukocytes per field boost) composed the control group. Eighteen women refused to participate, and seven were excluded from the sample due to suspicion of endocervicitis (n=3) and desquamative inflammatory vaginitis (n=4).

This study was approved by the Ethics Committee of the Medical Sciences School of UNICAMP (protocol 3816/2013), and all participants signed the informed consent form. Statistical analysis considered frequency, percentage, mean and standard deviation (SD), and the χ^2 and Fischer Exact tests were used to established associations between domains of the questionnaire and vulvovaginitis (BV, VC and both). Significance level was set at $p<0.05$.

RESULTS

Among 307 participants, 166 (54.07%) women were not diagnosed with vulvovaginitis and 141 (45.93%) were: 61 had VC, 72 had BV and 8 had both (VC + BV). Patients' mean age was 33 (±7), mean body mass index (BMI) was 27.1 (±5.5), with mean time of study of 10.2 (±3.3) years. Most females (83%) were married or had a fix partner, used hormonal contraceptive methods (63.5%), and did not smoke (89.3%). Almost half of the sample was composed of white (52.8%) and catholic (51.5%) patients. No statistically significant differences were found between groups as to these variables. Women with vulvovaginitis, total and isolated (VC, BV and both), had more menstrual cycles than the group without it (p=0.0002).

The number of sanitary pads used in the heavier days of the menstrual cycle, use of tampons, use of panty liners, type of pads used in between cycles, vulvar sensitivity according to the patients' referral, and vulvar irritation caused by the sanitary pads were identical in both groups (**Table 1**). Irritations mentioned were: hyperemia, swelling, epithelial desquamation, fissuring and itching (**Table 1**).

Most of the women investigated were used to wearing cotton panties (VC=59%, BV=47.2%, VC + BV=62.5%, without VV=64.5%). However, women presenting vulvovaginitis (10.6%), especially BV (15.3%), were more likely to wear synthetic panties ($p<0.0001$) than those without it (0%). The variables design of the underwear, patient' perception of allergic reactions to synthetic tissues, sensation of genital compression by the clothes, use of tight pants and the number of tissue layers in contact with the vulva at bedtime were similar between groups (**Table 2**).

DISCUSSION

In our study, women with VV had more periods than women without it. Menstrual flow makes women wear more sanitary pads, which may favor the onset of infections. Nevertheless, many other

Table 1 – Gynecological features and the use of sanitary pads in women with and without vulvovaginitis.

Variables	Without VV	With VV	p-value	Types of VV			p-value
	Total (166) n (%)	Total (141) n (%)		VC (61) n (%)	BV (72) n (%)	VC+BV (8) n (%)	a = without VV x VC b = without VV x BV c = without VV x VC+BV
Amenorrhea							
No	92 (55.4)	102 (72.3)	0.002	45 (73.8)	52 (72.2)	5 (62.5)	<0.05 (a.b.c)*
Yes	74 (44.6)	39 (27.7)		16 (26.2)	20 (27.8)	3 (37.5)	
Time spent away from home							
≤5h	61 (36.8)	48 (34)	ns	23 (37.7)	22 (30.6)	3 (37.5)	ns*
6h to 9h	55 (33.1)	52 (36.9)		23 (37.7)	27 (37.5)	2 (25)	
≥10h	50 (30.1)	41 (29.1)		15 (24.6)	23 (31.9)	3 (37.5)	
Number of SP in the heaviest day of flow							
≤3	60 (65.2)	69 (67.6)	ns	29 (64.4)	36 (69.2)	4 (80)	ns*
>3	32 (34.8)	33 (32.4)		16 (35.6)	16 (30.8)	1 (20)	
Use of tampons							
No	84 (91.3)	84 (82.4)	ns	40 (88.9)	40 (76.9)	4 (80)	ns*
Yes	8 (8.7)	18 (17.6)		5 (11.1)	12 (23.1)	1 (20)	
Use of panty liners							
Never	100 (60.2)	86 (61)	ns	41 (67.2)	41 (56.9)	4 (50)	ns*
Sometimes	30 (18.1)	23 (16.3)		10 (16.4)	11 (15.3)	2 (25)	
Always	36 (21.7)	32 (22.7)		10 (16.4)	20 (27.8)	2 (25)	
Type panty liners used							
With plastic layer	30 (18.1)	22 (15.6)	ns	8 (13.1)	13 (18.1)	1 (12.5)	ns*
Without plastic layer	27 (16.3)	20 (14.2)		10 (16.4)	8 (11.1)	2 (25)	
Does not know	9 (5.4)	13 (9.2)		2 (3.3)	10 (13.9)	1 (12.5)	
Sensitivity of vulva							
Normal	80 (48.2)	80 (56.7)	ns	28 (45.9)	47 (65.3)	5 (62.5)	ns*
Sensitive	69 (41.6)	47 (33.3)		27 (44.3)	18 (25)	2 (25)	
Hypersensitive	17 (10.2)	14 (9.9)		6 (9.8)	7 (9.7)	1 (12.5)	
Reaction of vulva to SP							
No	61 (46.6)	51 (42.9)	ns	22 (43.1)	24 (40)	5 (62.5)	ns*
Yes	70 (53.4)	68 (57.1)		29 (56.9)	36 (60)	3 (37.5)	

p-value calculated using χ^2 and Fischer Exact tests*; VV: vulvovaginitis; VC: vaginal candidiasis; BV: bacterial vaginitis; ns: non significant; SP: sanitary pads.

factors change in this situation (hygiene frequency, hormones, less sexual relations) and can also cause changes in the vaginal flora reported in literature[4,17,18]. Sanitary pads are used during period, panty liners are used between them, and these are products widely available and accessible nowadays, including to the poorest sectors of society[3]. The need for comfort (feeling dry and clean) during and after the menstrual cycle is probably the most relevant factor leading 50% of North-American and North-European women to wear sanitary pads. Some other reasons (early discharge, blood leakage even with a tampon in use, urinary incontinence, vaginal flow) also have been reported[8,9]. Also, many women often complain about the excess of humidity and even physiological discharge[6,19].

The literature points menstrual cycles as phases where women get more susceptible to vulvovaginal infections[4,17,18]. Eschenbach et al.[4] performed a study on the mucosa, discharge and vaginal microbiota in three phases of the menstrual cycle of asymptomatic women, and described that the rate of Lactobacillus growth increased between the cycles and, on the contrary, the concentration of different species (other than Lactobacillus) was higher during menstrual flow, which demonstrates that the vaginal microbiota goes through microbiological changes in this phase.

More than half of the women who use sanitary pads, daily or only during flow, reported any type of reaction of the vulva to them. The main complaints were itching, fissuring, swelling and/or hyperemia. The literature holds some questionings about the potential risks of long-term use of sanitary pads to women's health, once there is increase in the temperature of the area, change in vulvar or vaginal pH, and maintenance of humidity, which can favor bacterial and fungus growth, and, therefore, vulvovaginal infections[3,5,8-10,19]. But we found no differences as to this aspect. Maybe it applies to women with recurrent VV, not to those presenting acute episodes, and this requires deep further investigation.

Runeman et al.[19] performed a study with 58 women who used neutral non breathable panty liners (with plastic layer) between three menstrual cycles, and reported that vulvar temperature, pH and humidity increased significantly compared to women who did not use it or used breathable types. Another study by the same authors[9] showed a high rate of aerobic microorganisms in the vulva of women using non breathable panty liners compared to those not using them. Jancovic et al.[18] found a higher incidence of VC in women who were used to wear underwear with cotton lining between menstrual cycles in comparison to those no wearing them (p=0.0001). However, Giraldo et al.[20] did not find significant difference as to the presence of candidiasis or bacterial vaginitis in women using breathable sanitary pads for 75 consecutive days in comparison to the Control Group, composed of women using only cotton underwear in the same period, which suggests that breathable sanitary pads are safe to women's health.

Table 2 – Information about use of underwear by women with and without vaginitis.

Variabless	Without VV	With VV	p-value	Types of VV			p-value
	Total (166) n (%)	Total (141) n (%)		VC (61) n (%)	BV (72) n (%)	VC+BV (8) n (%)	a = without VV x VC b = without VV x BV c = without VV x VC+BV
Fabrics of underwear							
Cotton	107 (64.5)	75 (53.2)	<0.0001	36 (59)	34 (47.2)	5 (62.5)	<0.0001* (b)
Synthetic	0 (0)	15 (10.6)		4 (6.6)	11 (15.3)	0 (0)	
Synthetic with cotton lining	59 (35.5)	51 (36.2)		21 (34.4)	27 (37.5)	3 (37.5)	
Underwear pattern							
Bikini or thong	105 (63.3)	93 (66)	ns	44 (72.1)	45 (62.5)	4 (50)	ns
Thong	24 (14.5)	21 (14.9)		6 (9.8)	12 (16.7)	3 (37.5)	
String	21 (12.7)	14 (9.9)		6 (9.8)	8 (11.1)	0 (0)	
Boxer	16 (9.6)	13 (9.2)		5 (8.2)	7 (9.7)	1 (12.5)	
Allergic reaction to synthetic underwear			ns				ns*
No	101 (63.9)	87 (64.4)		38 (63.3)	45 (64.3)	4 (80)	
Yes	57 (36.1)	48 (35.6)		22 (36.7)	25 (35.7)	1 (20)	
Does the underwear compress the genitalia?			ns				ns
No	147 (88.6)	122 (86.5)		54 (88.5)	62 (86.1)	6 (75)	
Yes	19 (11.5)	19 (13.5)		7 (11.5)	10 (13.9)	2 (25)	
Tight pants							
No	67 (40.4)	46 (32.6)	ns	21 (34.4)	23 (31.9)	2 (25)	ns
Yes	99 (59.6)	95 (67.4)		40 (65.6)	49 (68.1)	6 (75)	
To sleep, they wear							
0 layer	27 (16.3)	23 (16.3)	ns	12 (19.7)	11 (15.3)	0 (0)	ns*
1 layer	75 (45.2)	65 (46.1)		22 (36.1)	40 (55.6)	3 (37.5)	
2 layers	64 (38.6)	53 (37.6)		27 (44.3)	21 (29.2)	5 (62.5)	

p-value calculated using χ^2 and Fischer Exact tests*; VV: vulvovaginitis; VC: vaginal candidiasis; BV: bacterial vaginitis.

It is noteworthy that 59.3% of women chose to wear cotton underwear daily. However, 63.2% wear tight pants very frequently, which could even zero the benefits related to ventilation of cotton underwear[3,13,15]. Cotton underwear is strongly recommended by gynecologists who support that this type of fabrics favors ventilation compared to synthetic ones, and this could contribute positively with the maintenance of the vulvar microbiota[15]. Conversely, these properties are said to be zeroed by the use of tight pants, especially jeans, which prevents ventilation and compress the region, causing local occlusion, friction and ischemia. This type of clothing can potentially change the temperature, humidity and pH of the region[3,13,15].

Data from our study suggests that women with vulvovaginal infections wear more synthetic underwear ($p<0.0001$), in particular those with bacterial vaginitis ($p<0.0001$), and that over 60% of the sample wore tight pants routinely. This was not observed among the cases of candidiasis, which confronts general remarks. This is still a controversial matter in the literature, and, although most studies have not found differences between women of the control group and with candidiasis as to tight clothing and synthetic underwear[13,15], our findings agree with those by Guaschino et al.[21], who found an association of Candida sp. and bacterial vaginitis with the frequent wearing of synthetic underwear and tight pants, among other female habits.

The authors say that the lack of ventilation, obstruction of transpiration, warm environments, vaginal discharge full of bacteria, and the microtraumas caused by the clothes' rubbing on the skin favor microorganism multiplication. This result was not expected though, once synthetic underwear with cotton lining has not been related to changes. We believe that the presence of cotton lining does not change the occlusion caused by synthetic materials. Moreover, we found no significant differences in the number of layers of nightclothing between groups. This non relation between types of nightclothing and vulvovaginitis has been pointed by Heidrich et al.[13].

One can say that the habits of use of sanitary pads are currently related to women lifestyle, for they spend more hours away from home and in environments that do not allow hygiene with running water. Thus, our study suggests that this habit may not be associated with the onset of vaginal candidiasis or bacterial vaginitis in women without other trigger factors. The natural changes that come with period, and the use of non breathable clothing are also associated with acute episodes of vaginal candidiasis, and specially bacterial vaginitis.

The limitations of this study were related to the nature of the sample (free demand on a University Hospital). However, the high rate of women who accepted to take part in the study may actually have balanced this aspect. The tendency to misleading responses in an attempt to give the "right answer" must be considered in the interviews performed in the study. Inaccuracies may have occurred when it came to the number of sanitary pads used in their period's heaviest flow day, type of sanitary pad used (facing uncertainty of their knowledge about the plastic layers of panty liners). However, as the researcher who made the interviews was the same during the entire study, she tried to avoid it.

CONCLUSION

The habit of using sanitary pads is related to the presence of VV. Menstrual cycles, on its turn, and use of synthetic underwear is more frequently related to vulvovaginitis.

Conflict of interests

The authors report no conflict of interests.

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Received on: 06.17.2014
Approved on: 07.17.2014