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Urinary test for detection of human papillomavirus DNA in women with HPV-induced diseases of the lower genital tract

Teste urinário para detecção de DNA do papilomavírus humano em mulheres com doenças do trato genital inferior induzidas pelo HPV

Prueba de orina para la detección del ADN del virus del papiloma humano en mujeres con enfermedades del tracto genital inferior inducidas por VPH

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ABSTRACT

Objective: To evaluate the predictive ability of a urine test in patients with HPV-induced vulvar, vaginal, and cervical pathologies. **Methods:** The study was prospective and descriptive, utilizing quantitative and qualitative analysis. Women with varying diagnoses were evaluated using biopsy and urine tests. **Results:** 87 women were selected and separated into four different groups: the control group (27,6%), the condyloma acuminata group (21,8%), the low-grade intraepithelial lesion group (21,8%), and the high-grade intraepithelial lesion group (28,7%). The results showed that the urinary test had a predictive value of 78,7% when compared to the anatomopathological standard, the biopsy. The high-grade intraepithelial lesion group showed perfect agreement with the urinary test results. The most frequent HPV genotypes identified were HPV16, followed by HPV6, 52, and 53. **Conclusion:** The urinary test proved valuable in HPV DNA investigation, especially in the high-grade intraepithelial lesions group. However, further research is necessary to expand the study, and additional strategies must be employed to enhance women's adherence.

Keywords: Urine test, Liquid biopsy, HPV.

RESUMO

Objetivo: Avaliar a capacidade preditiva de um exame de urina em pacientes com patologias vulvares, vaginais e cervicais induzidas pelo HPV. **Métodos:** Estudo prospectivo e descritivo, utilizando análise quantitativa e qualitativa. Mulheres com diferentes diagnósticos foram avaliadas por meio de biópsia e exame de urina. **Resultados:** Foram selecionadas 87 mulheres, divididas em quatro grupos: grupo controle (27,6%), grupo com condiloma acuminado (21,8%), grupo com lesão intraepitelial de baixo grau (21,8%) e grupo com lesão intraepitelial de alto grau (28,7%). Os resultados mostraram que o exame de urina apresentou valor preditivo de 78,7% quando comparado ao padrão ouro, a biópsia. O grupo com lesão

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intraepitelial de alto grau apresentou concordância perfeita com os resultados do exame de urina. Os genótipos de HPV mais frequentemente identificados foram HPV16, seguido por HPV6, 52 e 53. **Conclusão:** O exame de urina mostrou-se valioso na investigação do DNA do HPV, especialmente no grupo com lesão intraepitelial de alto grau. No entanto, são necessárias mais pesquisas para ampliar o estudo, e estratégias adicionais devem ser empregadas para aumentar a adesão das mulheres.

Palavras-chave: Exame de urina, Biópsia líquida, HPV.

RESUMEN

Objetivo: Evaluar la capacidad predictiva de una prueba de orina en pacientes con patologías vulvares, vaginales y cervicales inducidas por VPH. **Métodos:** Estudio prospectivo y descriptivo mediante análisis cuantitativo y cualitativo. Se evaluaron mujeres con diferentes diagnósticos mediante biopsia y prueba de orina. **Resultados:** Se seleccionaron 87 mujeres y se dividieron en cuatro grupos: grupo control (27,6%), grupo con condiloma acuminado (21,8%), grupo con lesión intraepitelial de bajo grado (21,8%) y grupo con lesión intraepitelial de alto grado (28,7%). Los resultados mostraron que la prueba de orina tuvo un valor predictivo del 78,7% en comparación con el estándar de oro, la biopsia. El grupo con lesión intraepitelial de alto grado mostró una concordancia perfecta con los resultados de la prueba de orina. Los genotipos de VPH identificados con mayor frecuencia fueron VPH16, seguido de VPH6, 52 y 53. **Conclusión:** La prueba de orina demostró ser valiosa para investigar el ADN del VPH, especialmente en el grupo con lesiones intraepiteliales de alto grado. Sin embargo, se necesita más investigación para ampliar el estudio y se deberían emplear estrategias adicionales para aumentar la adherencia de las mujeres.

Palabras clave: Análisis de orina, Biopsia líquida, VPH.

INTRODUCTION

Every year, the availability of effective methods for screening and early detection of different types of cancer increases, yet for women, cervical cancer is one of the leading causes of mortality. In 2020, approximately 604,000 women were diagnosed with cervical cancer worldwide, and around 342,000 died. Cervical cancer is associated with persistent genital infection by certain types of Human Papillomavirus (HPV) (WHO, 2021). Approximately 600 million individuals globally are affected by the HPV (GRAHAMSV, 2017; BRUNI L, et al., 2023) Among the various HPV types, 40 have been linked to infections of the anogenital mucosa (GRAHAM SV, 2017; BRUNI L, et al., 2023; EGAWAN e DOORBARJ, 2017; ASCIUTTO KC, et al., 2017; VAN DER WEELE P, et al., 2017).

The HPV types may be classified according to their high or low oncogenic risk. Low-risk HPVs are those associated with benign genital warts, and high-risk HPVs with cervical, anal, and oral malignancy (VAN DER WEELE P, et al., 2017; CLANNER-ENGELSHOFENBM, 2020; DE SANJOSÉS, 2018; SPURGEONME e LAMBERTPF, 2017) The low-risk HPV types are HPV-6 and HPV-11, while there are 12 high-risk types (CLANNER-ENGELSHOFEN BM, 2020), with types 16 and 18 responsible for approximately 70% of cases of cervical tumors (BRUNI L, et al., 2023; EGAWAN e DOORBARJ, 2017; ASCIUTTO KC, et al., 2017).

In Brazil, the standard procedure for cervical cancer screening is oncotic colpocytology, also known as Pap smear (INCA, 2016). The results of an exfoliative cytology method classify the findings into the Bethesda nomenclature (NAYAR R e WILBUR C, 2017) is currently being used, which classifies lesions into low-grade intraepithelial lesions (LSIL) and high-grade intraepithelial lesions (HSIL)(INCA, 2016; NAYAR R e WILBUR C, 2017).

Another type of lesion analyzed by biopsy that can lead to the investigation of HPV detection is condyloma acuminata (CA) (CHAN MP, 2018). CA, also known as genital warts, is characterized by benign epidermal or mucosal proliferative lesions, most commonly in the vulva, vagina, penis, and perianal regions (MAGALHÃES GM, et al., 2021).The diagnosis is commonly made based on clinical appearance; however, due to histopathological similarities with other papillary lesions or some types of squamous cell cancer, biopsy and targeting for HPV detection is advisable (DOORBAR J, et al., 2015).

HPV is a non-enveloped, circular DNA virus with around 8,000 base pairs, part of the Papillomaviridaefamily (VAN DOORSLAER K, et al., 2018; DOORBAR J, 2012). Its genome is divided into a non-coding region, an early gene coding region, and a late gene coding region (DOORBAR J, 2012). The early gene coding region transcribes six E proteins (E1, E2, E3, E4, E5, E6) involved in viral replication and cell transformation. The E5, E6, and E7 regions are mainly related to the high-risk subtypes of HPV (DONG Z, et al., 2021).

The abnormal results found in Pap smears and the initial course of action are well-defined in clinical practice (WHO, 2021). However, due to the need to collect a cervical-vaginal sample and perform a Pap smear, this approach can be considered an invasive method, associated with discomfort during the gynecological exam, embarrassment, forgetting to make an appointment, fear of pain, fear of cancer, anxiety, as well as other aspects that can hinder collection, such as scarce resources and cultural barriers (DAPONTE A, et al., 2021).

Despite the campaigns developed, millions of women miss out on the opportunity to detect intraepithelial neoplasia at a curable stage because they do not participate in screening programs. Ornskov et al. (2021), reported that only 73% of eligible women participate in the screening program, and half of cervical cancers are diagnosed among non-participants (ORNSKOVD, et al., 2021).

Therefore, developing non-invasive collection methods has advantages in screening programs regarding possible cost reduction and acceptance. Among these methods, using urine as a liquid biopsy has been suggested as an alternative and potentially more favorable method, considering that urine sampling is convenient for women and less invasive (SHIN HY, et al., 2019; HAGIHARAM, et al., 2016).

Urine samples may be collected in a urine bottle like a basic urine test to detect a general or sexually transmitted disease. Géorgios Papanicolaou described, in 1943, that the superficial cell layers of a cervix carcinoma are exfoliated and mixed with secretions from the uterus and cervix, which pass into the vagina and can therefore be recognized in vaginal fluid smears (PAPANICOLAOUGN e MARCHETTIAA, 1943).In this way, the analysis of exfoliated mucus and cellular debris from the genital tract lining the opening of the urethra and the labia minora are washed away with the initial urine flow (VAN KEERS, et al., 2017).

Few studies use confirmed cervical disease to measure the predictive value of urinary tests for detecting low- and high-risk HPV DNA in urine. Given this, the aim of this study was to evaluate the predictive value of the urinary test in detecting HPV DNA to contribute to improving current screening programs for cervical cancer and intraepithelial or condylomatous lesions.

METHODS

Ethics statement and study design

The study protocol was approved by the Research Ethics Committee of the educational institution registered under protocol nº 00144/2021and CAAE nº 42935020.6.0000.5505. All participants who agreed to participate signed the Informed Consent Form. This is a prospective study to validate a urine-based HPV diagnostic test, in a cohort of women, developed between July 2021 and April 2023. The study was conducted at the Center for the Prevention of Gynecological Diseases of the of the educational institution in São Paulo, SP.

Participants

The study included women over the age of 25 years old, without cytological or histological alterations, and diagnosed with condyloma acuminata on the vulva, LSIL and HSIL in the vagina and/or cervix, confirmed by gynecological physical and anatomopathological examination.

The exclusion criteria were pregnancy/lactation, smoking, immunosuppression (i.e., HIV, transplant patients, and women with rheumatological conditions - such as systemic lupus erythematosus (SLE) type 1 Diabetes Mellitus, patients with previous treatment for intraepithelial lesions of the uterine cervix, and

patients in whom it was impossible to collect a sufficient urine volume. All participants were submitted to the procedures established in the routine protocol of NUPREV, then answered a questionnaire and collected a urine sample.

Variables

Data were collected through the application of a questionnaire and the analysis of clinical records and carried out by a single researcher. Clinical and epidemiological data were obtained from the electronic medical records, such as age, parity, number of sexual partners, history of diabetes mellitus, immunosuppression, neoplasms, and result of cervical biopsy.

Data sources/measurement

Biopsies

The pathology department of the Paulista School of Medicine analyzed all the cervical and/or vaginal/vulvar biopsy specimens. The samples were fixed in a 10% buffered formaldehyde solution, then dehydrated in increasing concentrations of ethyl alcohol, diaphonized with xylene, and paraffin-embedded using an automatic tissue processor. Experienced pathologists issued the anatomopathological results following institutional protocols.

Urine collection

Urine samples were collected from each participant following the pathological diagnosis confirmed by the biopsies and before starting the recommended treatment. The urine samples were collected using the Colli Pee®, an FDA-patented device for collecting the first jet of urine, donated by the Novosanis® company.

The patients were instructed do not perform vulvovaginal hygiene before urine collection and the first urine stream (minimum 20 mL) was collected and added to a sterile bottle containing 20 mL of preservation solution. The samples were identified only by the identification number of each participant and stored in a refrigerator (2 - 8°C) for up to 7 days.

The samples were sent to the Molecular Gynecology Laboratory at the educational institution for HPV DNA analysis.

The urine samples collected were divided according to pathologic diagnosis in four groups:

-GROUP 1: patients without cytological or histological alterations.

-GROUP 2: patients with vulvar condylomatosis.

-GROUP 3: patients with low-grade intraepithelial neoplasia (cervix or vagina) confirmed by histopathological analysis.

-GROUP 4: patients with high-grade intraepithelial neoplasia (cervix or vagina) confirmed by histopathological analysis.

HPV DNA testing in urine samples

HPV detection and genotypes were tested by using the INNO-LiPA HPV Genotyping Extra II kit according to manufacturer instructions. The kits were donated by FUJIREBIO Europe® N.V. The kit's methodology is based on reverse hybridization, where part of the L1 region (SPF10 region) of the HPV viral genome is amplified by HPV-specific primers. The resulting biotinylated amplified products are denatured and hybridized with specific oligonucleotide probes. A pair of primers for amplifying the human HLA-DPB1 gene is added to monitor the extraction and quality of the samples. Briefly, all the probes are immobilized as parallel lines on membrane strips. After the hybridization step and thorough washing, streptavidin-conjugated alkaline phosphatase is added, which binds to any previously formed biotinylated hybrids. When the chromogenic substrate is incubated, a purple precipitate is produced, and the results can be interpreted visually on the strip, on which four control lines and 32 sequence-specific DNA probe lines (genotypes) are attached.

The HPV genotypes were detected and classified according to their oncogenic potential as kit instructions: Low Risk (types 6, 11, 40, 42, 43, 44, 54, 61, 62, 67, 81, 83), probably carcinogenic (types 26, 53 ,66 ,70 ,73 ,82) or High Risk (types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68).

Statistical methods

The statistical analysis initially involved summary measures such as mean, median, minimum and maximum values, standard deviation, absolute and relative frequencies (percentage), as well as visual representations including bar charts. Inferential analyses employed to confirm or refute the findings of the descriptive analysis included the extended Fisher's Exact Test (AGRESTI A, et al., 1990) and One-Way Analysis of Variance (ANOVA) with a Fixed Factor (NETER J, et al., 1996).

In all conclusions derived from the inferential analyses, a significance level of alpha equal to 5% was applied. Data were entered into Excel spreadsheets for proper information storage, and statistical analyses were conducted using IBM-SPSS Statistics software, version 24.

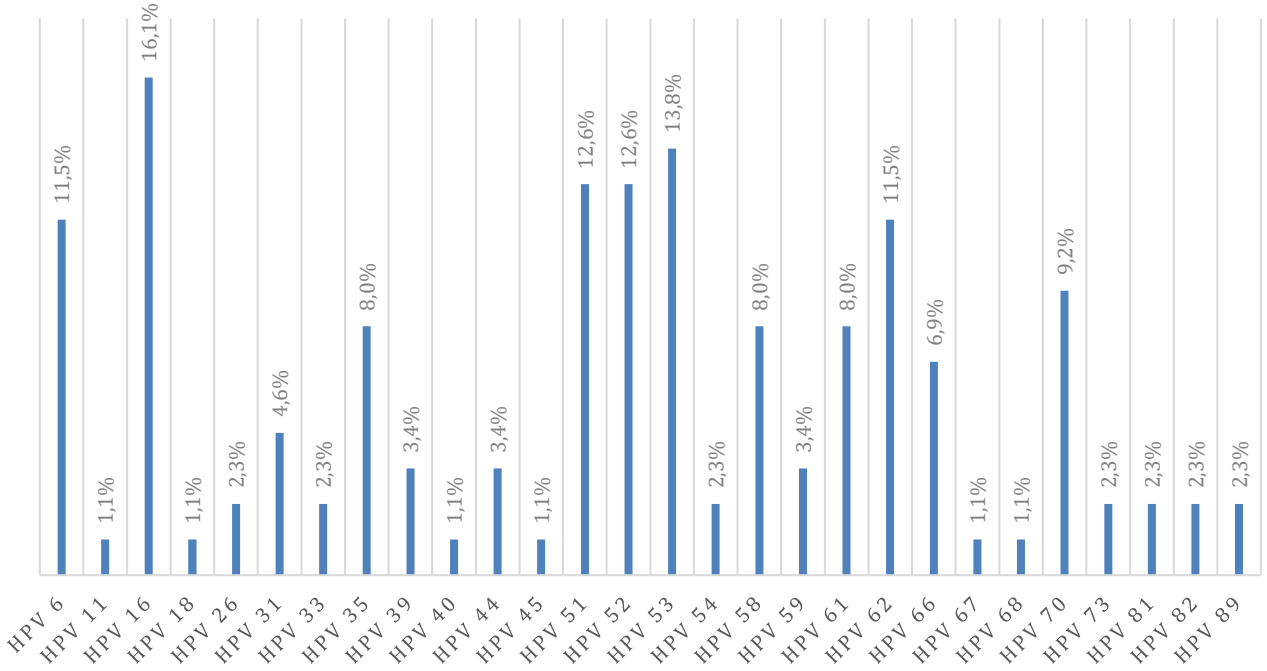
RESULTS

The sample selected for this study consisted of 87 patients, with 24 (27.6%) belonging to the control group, 19 (21.8%) to the condyloma acuminata group, 19 (21.8%) to the low-grade intraepithelial lesion group, and 25 (28.7%) to the high-grade intraepithelial lesion group. Overall, the mean age of patients was 41.2 years, ranging from 25 to 71 years. The "condyloma acuminata" group had a higher mean age compared to the "high-grade intraepithelial lesion" group.

Of the 72 patients who underwent biopsy, 9 (12.5%) presented benign findings not induced by HPV, 20 (27.8%) were diagnosed with condyloma acuminata, 18 (25.0%) had LSIL, and 25 (34.7%) had HSIL. The mean volume of urine collected during the exams performed by these patients was 20.5 mL, ranging from 15 to 25 mL. Most patients (98.9%) reported mild discomfort during urine collection.

Based on **Figure 1**, which summarizes the results of the urinary test for detecting HPV DNA, the most frequently observed HPV type among the patients was HPV 16 (16.1%), followed by HPV 53 (13.8%), HPV 51/52 (12.6%), and HPV 6/62 (11.5%).

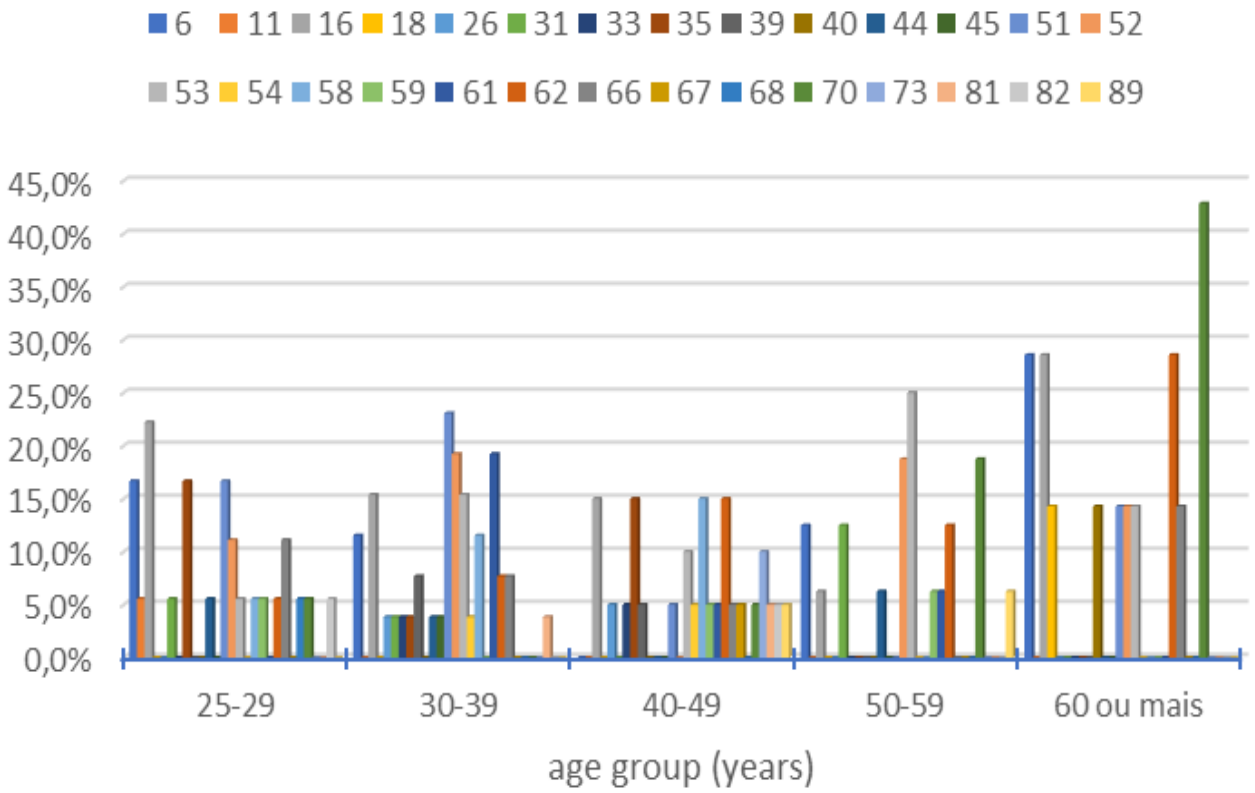
Figure 1 - Results of the urinary teste for detecting HPV DNA in all patients.



Source: Antonio MP, et al., 2026.

In the analysis of age range and the type of HPV detected in the urinary test, we observed that the distribution of the various HPV types was not associated with the patients' age range, except for HPV 70, which was more prevalent in patients over 50 years of age (p=0.005). There was also a trend towards a higher prevalence of HPV 18 (p=0.080) and HPV 40 (p=0.080) in patients aged 60 years or older, although this observation is based on only one case for each viral type (**Figure 2**).

Figure 2 - Distribution of patients according to age group and presence of HPV.



Legend: [b]Extension of Fisher´s exact test. HPV70 p[b]: 0,005.
Source: Antonio MP, et al., 2026.

In the comparison between the groups studied, we observed that the presence of HPV 6 and HPV 70 was higher in the condyloma acuminata group. Additionally, the other subtypes did not show statistical significance. There was a trend toward a higher occurrence of HPV 81 and HPV 89 in the low-grade intraepithelial lesion group.

Analysis various HPV types

To synthesize the results of the various HPV types, five distinct groups were created based on the criteria described by Demarco et al. (2020) e Muñoz et al. (2003): Low risk (HPV 6, 11, 40, 42, 43, 54, 61, 70, 72, 81), Intermediate risk (HPV 26, 44, 62, 67, 68, 73, 82, 89, 53), High risk (HPV 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59), Mixed infection (presence of at least one low-risk HPV concomitant with one or more high-risk HPVs), and Negative.

Based on this categorization, the potential relationship with the control, condyloma acuminata, low-grade intraepithelial lesion, and high-grade intraepithelial lesion groups was further investigated. In **Table 1**, it can be observed that the control group had a higher proportion of the "negative" HPV class (33.3%), while the condyloma acuminata (36.8%) and low-grade intraepithelial lesion groups (42.1%) had a higher prevalence of the "mixed infection" class. Finally, the high-grade intraepithelial lesion group showed a predominance of the "high-risk" HPV class (52.0%) (p=0.074).

Table 1 - Distribution of patients by group and HPV class.

	Control		Condyloma Acuminata		Low-grade lesion LSIL		High-grade lesion HSIL		p[b]
Negative	8	33.3%	2	10.5%	2	10.5%	-	-	0.074
Low risk	3	12.5%	3	15.8%	3	15.8%	1	4.0%	
Intermediate risk	2	8.3%	3	15.8%	2	10.5%	2	8.0%	
High risk	5	20.8%	4	21.1%	4	21.1%	13	52.0%	
Mixed infection	6	25.0%	7	36.8%	8	42.1%	9	36.0%	
Total	24	100.0%	19	100.0%	19	100.0%	25	100.0%	

Legend:[b] Extension of Fisher's exact test.
Source: Antonio MP, et al., 2026.

Accuracy assessment

In evaluating the accuracy of the urinary test for detecting HPV DNA in relation to the presence of disease (condyloma acuminata, low-grade intraepithelial lesion, and high-grade intraepithelial lesion groups), we considered only two possibilities: patients without any type of HPV and patients with one or more of the 28 HPV types. The urinary test demonstrated a sensitivity of 0.937, specificity of 0.333, positive predictive value (PPV) of 0.787, negative predictive value (NPV) of 0.667, and overall accuracy of 0.770 (**Table 2**).

Table 2 - Distribution of patients according to the presence of disease and HPV.

	Control	Disease[a]	Total
No HPV detected	8	4	12
Presence of any HPV type	16	59	75
Total	**24**	**63**	**87**

Legend: [c]condyloma acuminata, low-grade and high-grade intraepithelial lesions.** Sensitivity: 0.937, specificity: 0.333, PPV: 0.78, NPV: 0.667, accuracy: 0.770.
Source: Antonio MP, et al., 2026.

DISCUSSION

Cervical cancer is a preventable and curable condition when detected early and treated appropriately. Cytology-based screening has been successful since its implementation, with histopathological examination considered the gold standard for cancer diagnosis. The World Health Organization has prioritized accelerating the elimination of cervical cancer by introducing HPV DNA testing as a screening method (WHO, 2021). However, low coverage persists in developing and underdeveloped countries.

One of the main reasons for this is the cervical-vaginal sample collection and cytological examination, which are considered invasive methods associated with discomfort, embarrassment, fear of pain, and cancer-related anxiety in women undergoing these procedures (ORNSKOVD, et al., 2021). In the present analysis, the predictive value of urine testing was compared to histopathology, demonstrating the validity of incorporating this test in the HPV screening.

Overall, HPV DNA-based tests offer significant advantages, particularly in identifying high-risk viral types with cancer progression potential. Ducancelle A et al. (2015), using urine samples from 771 women aged 45–65 years who had not undergone Pap smear tests in the past three years, found that 28 HPV-positive cases were identified, leading to cytology testing and confirming three cases of HSIL. In such scenarios, high-risk HPV detection enables targeted follow-up, regardless of cytology as a confirmation method (KHAN MJ, et al., 2015; CHO HW, et al., 2022). Notably, approximately 90% of infected individuals are asymptomatic (SPURGEONME e LAMBERTPF, 2017), reinforcing the relevance of less invasive techniques, such as urine collection, for screening.

An important finding demonstrated in our study was the high positivity rate among patients in the control group (77.7%) compared to the general population, which is approximately 10 to 15% (CLIFFORD GM, et al., 2003). It is worth noting that these patients had unremarkable cytological screening results but were referred to ascolposcopy due to benign abnormalities, such as ectopia, Bartholin gland cyst, endocervicitis, or endocervical polyp, which could represent a selection bias in our sample.

A remarkable aspect observed in the analysis of HPV types detected by urine testing was that, while HPV16 was the most frequently identified subtype, other less commonly reported viral subtypes were detected at high frequencies and were associated with mixed infections. These findings corroborate our results, where HPV16 was the most frequently identified genotype, which is strongly associated with cervical, anal, and oral malignancies, followed by HPV53, HPV51/52, and HPV6/62. The low-risk subgroup is generally associated with benign lesions such as genital warts and condyloma, with approximately 90% of condyloma cases linked to HPV6 and HPV11 (DE SANJOSÉ S, 2018; SPURGEON ME e LAMBERT PF, 2017; INCA, 2016). In our sample, HPV6 and HPV70 were identified in condyloma acuminata cases, while HPV81 and HPV89 were found in the LSIL group.

Another noteworthy finding was the occurrence of infection with more than one genotype, a phenomenon known as coinfection or mixed infection. According to Padilla-Mendoza JR et al. (2020), mixed infections are common in 20–50% of infected women, especially among young women. In our study, mixed infections were particularly frequent in the LSIL group (42.1%), while the high-risk subgroup predominated in HSIL cases (52%). These findings are consistent with De Brot L et al. (2017), who demonstrated that patients with mixed HPV infections tend to exhibit persistent or recurrent LSIL. Furthermore, 40% of women diagnosed with HSIL were infected with high-risk HPV types unrelated to subtypes 16 and 18 (CARRILLO-GARCÍA A, et al., 2014).

However, the relationship between mixed infections and cancer development remains unclear, as it is not yet known whether these infections occur due to affinity between specific HPV types or randomly [34]. Another consideration is that the presence of different viral subtypes may serve as a marker of persistent infection and, potentially, a risk factor for lesion progression. Studies correlating mixed infections have shown that when a low-risk co-infects with a high-risk subtype, the viral load can double, potentially exerting a synergistic effect on oncogenesis (PADILLA-MENDOZA JR, et al., 2020; DE BROT L, et al., 2017; CARRILLO-GARCÍA A, et al., 2014).

The incorporation of urine testing for HPV genotyping is a strategy that warrants detailed evaluation. In our population, 98.9% of women reported only mild discomfort during urine sample collection, suggesting that urine self-collection would be a viable and more acceptable option compared to traditional collection methods. A systematic review of women's perception of self-collection for HPV testing revealed that, among 20 evaluated studies, eight reported a preference for self-collection over clinician-administered collection (NELSON EJ, et al., 2016).

Gibert MJ, et al. (2023) in a study conducted in Spain to validate the acceptance of self-collection compared to conventional collection for HPV analysis, observed no resistance among participants to the methodological change. However, some participants expressed concerns about the reliability of self-collection results compared to those obtained by professionals. Similar results were observed in a study conducted in Colombia, where 98% of the 423 women analyzed reported high acceptance of self-collection (TORRADO-GARCÍA LM, et al., 2020).

In Brazil, molecular biology assays for HPV testing, using self-collection kits distributed through the public healthcare system, have been investigated in various studies. Silveira MF, et al. (2023) evaluated 1,914 women living with HIV under public healthcare services and found high acceptance, a low rate of inadequate samples, and a high prevalence of high-risk HPV in this population. These findings corroborate our results, where HPV16 was the most frequently identified genotype, less than 5% of samples were deemed inadequate, and the technique was highly accepted among participants.

Cho HW, et al. (2022) in a systematic review and meta-analysis, compared the accuracy of HPV tests performed on self-collected urine samples with clinician-collected samples for detecting cervical precancer. Analysis of 21 studies demonstrated that urine-based HPV testing detected more than 79% of HSIL cases and, when performed with PCR-based assays, showed sensitivity comparable to clinician-collected samples.

In the present study, urine testing demonstrated a sensitivity of 93.7%, specificity of 33.3%, positive predictive value (PPV) of 78.7%, negative predictive value (NPV) of 66.7%, and an overall accuracy of 77%.

In comparison, Sachan P, et al. (2018) reported an overall sensitivity of Pap smears for high-grade lesion detection at approximately 70.8%. These findings suggest that urine testing is a viable alternative for detecting HPV infection and could be incorporated as a cervical cancer screening tool.

Among the study's limitations, the use of convenience sampling can be cited, as only women referred to the Gynecological Disease Prevention Center of the Paulista School of Medicine were analyzed. However, regardless of the sampling method, urine testing yielded satisfactory results compared to biopsy findings.

Overall, cervical cancer remains a significant public health challenge. Cytology-based screening has contributed to reducing cervical cancer incidence and mortality worldwide. However, this strategy has limitations, requiring pelvic exams that are invasive, anxiety-inducing, and often uncomfortable for patients, leading to lower acceptance. Furthermore, this examination requires trained healthcare professionals and suitable facilities, increasing costs and restricting access in resource-limited areas.

CONCLUSION

In this context, the combination of urine self-collection and DNA-based HPV screening tests emerges as a promising alternative. This approach could become a valuable tool, especially when accompanied by targeted follow-up for women with risk-indicative results.

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