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Insights into Screening: A Quantitative Study on Exploring the Impact of Pap Smear Analysis on Women's Health

Santhi Venkatapathy[1], Radhika Jayaraman[1]*, Anuradha Murugesan[2], Nithya Venugopal[1], Vasanth Konda Mohan[3], Shyamaladevi Babu*[4]

[1]Department of Anatomy, SRM Medical College Hospital and Research centre, SRMIST, Kattankulathur-603 203, Tamil Nadu, India

[2]Department of Obstetrics & Gynaecology at SRM Medical college Hospital and Research Centre, SRMIST , Kattankulathur-603 203, Tamil Nadu, India

[3]Department of Clinical Pharmacology, SRM Medical College Hospital and Research centre, SRMIST, Kattankulathur-603 203, Tamil Nadu, India

[4]Research, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Kelambakkam-603103, Tamil Nadu, India

* Corresponding author
Dr. Radhika Jayaraman: jradhikakrishnan@gmail.com;
Dr.Shyamaladevi Babu: shyamdevi06@gmail.com; dr.shyamaladevi@care.edu.in

Abstract

Cervical cancer poses a significant global health challenge, with diverse causative factors. According to the National Cancer Registry Programme's data for Tamil Nadu, the estimated prevalence of cervical cancer stood at 36,014 cases, with 8,534 new cases reported in 2023. While various studies have investigated cervical cytology patterns and associated factors, research specific to particular geographic areas and demographic groups is crucial to bridge knowledge gaps and gather context-specific data. In this study, 300 women attending a hospital outpatient department in Chennai were selected. Pap smear samples were collected using Ayre's spatulaand fixed on a glass slide and slide reporting was done according to the New Bethesda III classification system for Reporting cervical cytology. The majority exhibited normal cervical cytology (92%), with bacterial vaginosis, Trichomonas vaginalis, and Candidiasis being common. Atypical squamous cells of undetermined significance (ASCUS) were the most frequent epithelial cell abnormality. Clinical examinations revealed various cervical abnormalities, including chronic cervicitis, cervical erosion, and ulcerative cervix. Age emerged as a significant factor influencing abnormal cervical cytology prevalence, particularly in the 41-50 age groups. The high prevalence of abnormal epithelial cell lesions underscores the importance of regular cervical cancer screening to detect precancerous stages early and prevent invasive cancer development. This study, conducted among women aged 30 to 80 in Chennai, provides valuable insights into cervical health in this population, potentially informing future research and clinical practices in the region.

Key words: Cervical carcinoma; Pap smear; Screening; chronic cervicitis; Bethesda system

1. Introduction

Cervical carcinoma stands as the fourth most common cancer affecting women worldwide and the second leading cause of cancer-related deaths among females in India. According to the Global Cancer Observatory (GLOBOCAN) 2020, there were approximately 604127 new diagnoses of cervical carcinoma, resulting in 341831 deaths in 2020 (Singh*et al*., 2023). A study published in The Lancet in 2021 revealed that India reported the highest number of cervical cancer cases in Asia, followed by China, with 40% of total deaths occurring due to cervical carcinoma, of which 27% were in India and 17% in China (Parikh*et al*., 2023). Recent estimates suggest that among the 3.42 lakh Indian women diagnosed with cervical carcinoma, Uttar Pradesh has the highest number of cases (45,682), followed by Tamil Nadu (36,014), with 8,534 new cases reported in 2023 (available from: https://timesofindia.indiatimes.com/city/chennai/tamil-nadu-second-highest-number-of-men-with-cervical-cancer/articleshow/107394727.cms). According to data from a population-based cancer registry under the National Cancer Registry Programme, Chennai's age-adjusted incidence rate of cervical cancer stands at 14.8 per 100,000 (available from: https://www.thehindu.com/sci-tech/health/over-8500-new-cases-of-cervical-cancer-in-tn-in-2023-says-centre/article67808272.ece). In Tamil Nadu, cervical cancer is the second most common cancer affecting women, particularly those in rural areas with low socioeconomic status (Srivastava et al., 2018).

Unlike many other cancer types, cervical carcinoma is considered a preventable disease, with early detection possible through effective screening programs aimed at identifying precursor lesions (Bal et al., 2012). One such initiative, the Prevention and Screening Innovation Project toward the Elimination of Cervical Cancer (PRESCRIP-TEC), focuses on screening women in middle-income countries and providing treatment to those in need, especially those from hard-to-reach regions (Sultanov et al., 2022). However, implementing accessible health screening programs in rural areas with low socioeconomic status presents a significant challenge in countries like India. Cervical cancer screening guidelines provided by the National Comprehensive Cancer Network (NCCN) recommend various evaluation and treatment methods, including physical examinations, cytology (such as liquid-based cytology or Pap smear), HPV DNA testing, and colposcopy (Dasgupta, 2023; Gavinski and DiNardo, 2023)

The Pap smear, introduced by Dr. George N. Papanicolaou at Cornell Medical College of New York in 1942, remains a cornerstone in cervical cancer screening. The Pap

staining method has undergone several advancements, resulting in improved visualization of cellular morphology (Wentzensen et al., 2021). Pap smear examination, being cost-effective and sensitive, is the most common routine test for primary screening of cervical malignancies. Combining Pap smear with HPV DNA testing can increase sensitivity for early detection of precancerous and cancerous conditions (Dasgupta, 2023). Awareness programs and regular nationwide cervical cancer screening initiatives are essential to educate women about the signs and symptoms of cervical cancer and encourage them to undergo regular screenings (Sachan*et al*., 2018; Sumarmi*et al*., 20221. Training medical and paramedical staff at primary health centers is crucial for increasing awareness and educating women about the benefits of Pap smear screening. A maximum number of cases can be detected accurately through a combination of Pap smear and colposcopy examinations (Akhter *et al*., 2015).

Early diagnosis of cervical carcinoma and its precursor lesions has led to a decline in the disease's mortality rate in recent years, with a 50% reduction in morbidity attributed to regular Pap smear screenings (Praiss et al., 2023). The International Agency for Research on Cancer (IARC) estimates a significant reduction in incidence rates with regular cervical carcinoma screenings, with 5- and 10-year annual screenings resulting in an 84% and 64% reduction in incidence rates, respectively (Ranabhat et al., 1970). Community-based screening programs, particularly through camp approaches, have gained importance in determining the prevalence of precancerous lesions of cervical cancer and associated epidemiological factors, especially in developing countries like India (Mohan and Karthika, 2022). Given this context, this study aims to explore the role of Pap smear and the significance of its cytological pattern in screening for cervical carcinoma.

2. Materials and methods

Research Approach and Design

A prospective study was conducted over one year, from January 2022 to January 2023, within the Department of Obstetrics &Gynaecology at SRM Medical College Hospital and Research Centre, Kattankulathur, Chennai.

Description of Variables

The study encompassed 300 women aged 30 to 80 years. Variables included demographic data such as age, number of children, age at marriage, age at first childbirth, and clinical parameters including symptoms and findings from per vaginal examination.

Setting, Population, and Sample Size:

The study included women presenting with various gynecological complaints at the hospital and women who visited for normal routine check- ups without any complaints were also enrolled in the study. Informed consent was obtained from each participant before enrollment. Exclusion criteria were applied to ensure the study's integrity.

Sampling and Method of Data Collection:

Participants were selected based on inclusion and exclusion criteria. Data regarding demographic and clinical parameters were collected using a structured proforma during face-to-face interviews and clinical examinations.

Development and Description of Tools:

A detailed structured proforma was designed to collect socio-demographic and clinical data. Proper informed consent was obtained from all participants before performing the pap smear procedure.

Criteria for Sample Selection:

Inclusion Criteria:

Inclusion criteria comprised women aged 30 to 80 years presenting with specific gynecological complaints such as watery or whitish vaginal discharge, frequent micturition, abdominal pain, inter-menstrual bleeding, post-coital bleeding, post-menopausal bleeding, low backache, and vulvar itching.

Exclusion Criteria:

Exclusion criteria included prior hysterectomy, pregnancy, menstruating women, unmarried status, unwillingness to participate, previous treatment for cervical dysplasia or carcinoma, vaginal medications, co-morbid conditions like diabetes or hypertension, or other cancer types.

Validity of Tool:

The structured proforma was designed based on established guidelines and validated by experts in the field of gynecology.

Reliability of Tool:

The reliability of the structured proforma was ensured through pilot testing and inter-rater reliability assessment.

Methods of Data Collection:

Data were collected through face-to-face interviews, clinical examinations, and Pap smear procedures.

Clinical examinations and Pap smear procedures

Patients were positioned in lithotomy, and a sterile bivalve Cusco speculum was inserted into the vagina for clear visualization of the uterine cervix. Using a wooden Ayre's spatula, a pap smear was obtained from the cervix near the squamocolumnar junction, rotated 360°, and smeared onto a glass slide. The sample was fixed with absolute alcohol, placed in a Coplin jar, and sent to the Pathology department for Cytopathological evaluation. The glass slides were then stained using the Papanicolaou staining method.

Cytological Interpretation

Cytopathological evaluation was performed by a pathologist following the New Bethesda classification system for reporting cervical cytology 2014. This system categorized epithelial lesions into two main groups: Negative for Intraepithelial Lesions or Malignancy (NILM) and Epithelial Cell Abnormalities, subdivided into squamous cell abnormalities (SCA) and glandular cell abnormalities (GCA). SCA included atypical squamous cells (ASCUS, ASCH), low-grade squamous intraepithelial lesion (LSIL), high-grade squamous intraepithelial lesion (HSIL), and squamous cell carcinoma (SCC). GCA comprised atypical glandular cells, favoring neoplasia, and adenocarcinoma in situ.(Nayar and Wilbur, 2017).

Follow-Up and Ethical Consideration

Patients with abnormal pap smear results (ASCUS, ASCH, LSIL, HSIL) were advised for colposcopic examination. Those with unusual colposcopy findings were recommended for biopsy and subsequent histopathological examination. All procedures were approved by the Institutional Ethics Committee (reference number: 2365/IEC/2021, dated 23/09/2021) in accordance with the 1964 Helsinki Declaration, and informed consent was obtained from all participants.

3. Results

Socio-demographic Characteristics

Table 1 shows the socio-demographic characteristics of included study subjects.Out of the 300 subjects aged 30 to 80 years, the highest proportion belonged to the 41 to 50 age group (41.7%), while the lowest was in the 71 to 80 age group (4%). Among the participants, 82 (27.3%) were primiparous, 210 (70%) were multiparous, and 8 (2.7%) were nulliparous. All subjects were married.

Cytopathological Evaluation

Figure 1 represents the microscopic images of Pap smear and the epithelial cell abnormalities are depicted in Figure 2.Cytopathological evaluation was conducted on all 300 participants. Among these, 2 samples (0.7%) were deemed unsatisfactory for evaluation. Of the 298 subjects with adequate samples, 274 (92%) had normal findings (NILM), with bacterial vaginosis (6.04%), Trichomonas vaginalis (1.7%), and Candidiasis (3.7%) being common. Reactive cellular changes due to inflammation (71.1%) and atrophy (8.4%) were also observed. ASCUS (3.02%) was the most prevalent abnormality, followed by Low-grade squamous intraepithelial lesion (2%). A few cases of ASC-H (1%) and HSIL (0.7%) were identified, along with squamous cell carcinoma (SCC) in 3 subjects (1%) and atypical glandular cell (AGC) abnormalities in 1 subject (0.3%). Abnormal epithelial cell lesions were more frequent in the 41-50 age group.

Clinical Symptoms

Figure 3 shows the chief complaints of the study participants.White vaginal discharge (34.7%) was the most common symptom, followed by vulvar itching (13.7%), frequency of micturition (10.7%), abdominal pain (9.7%), low back ache (9%), post-menopausal bleeding (7%), intermenstrual bleeding (6.3%), and post-coital bleeding (5%). A small percentage (4%) was asymptomatic and visited for routine check-ups.

Clinical Examination

The Clinical appearance of cervix depictsin figure 4.On per vaginum examination, a significant proportion of women had a healthy-looking cervix (43.7%), while others exhibited conditions such as chronic cervicitis (17%), ectropion (13%), cervical erosion (9.3%), ulcerative cervix (8.7%), bulky cervix (5.7%), and cervix bleeding upon touch (2.6%).

4. Discussion

Carcinoma of the uterine cervix represents a significant health challenge in India, ranking second only to breast carcinoma among women. Limited accessibility to screening, vaccination, and effective treatment contributes to the relatively high morbidity and mortality rates associated with cervix cancer in developing nations (Chinchai et al., 2016). Early detection of precancerous lesions is imperative, given the protracted latent phase post-HPV infection, which can extend up to 10-20 years. Alongside HPV infection, various other risk factors influence disease progression. Pap smear screening, often coupled with HPV detection, serves as a critical diagnostic and prognostic tool for cervical cancer, with options including cervical pap smear and Liquid Based Cytology (LBC). Our study underscores the importance of adhering to screening guidelines, initiating at 21 years and maintaining regular screenings every 3 years until 29 years, followed by screenings every 5 years between 30-65 years (Pankaj t al., 2018; Dasgupta, 2023).

Numerous community and hospital-based studies have investigated the prevalence of uterine cervical carcinoma and its precursor lesions in relation to various epidemiological factors. Our analysis revealed whitish discharge per vaginum as the predominant chief complaint, consistent with previous research (Gavinski and DiNardo, 2023; Majid et al., 2022). We observed epithelial cell abnormalities in 8.05% of cases, including 1% exhibiting ASC-H, findings that align with similar studies (Shaki*et al*., 2018; Devi and Salvi, 2020]. Bal *et al* (2012) reported inflammatory smear in 71.3% of cases, LSIL in 2.7%, HSIL in 0.7%, and Squamous cell carcinoma in 1%, mirroring our findings. Similarly, Tejaswini*et al.*(2016) reported comparable rates of inflammatory smear and other abnormalities. Shaki*et al.* (2018) demonstrated high specificity and sensitivity of Pap smear for diagnosing low and high-grade squamous intraepithelial lesions. Consistent with previous analyses by Garg *et al*.,(2021) our study detected 1% cases of Squamous cell carcinoma. Table 2 provides a comprehensive comparison of Pap smear findings across different studies, including our own.

Studies by Verma et al. (2017) and Sonal Jain (2020) shed light on factors such as chronic cervicitis and parity, emphasizing the heightened risk among women with multiple children. Mishra et al.'s (2022) findings underscored the importance of early screening and diagnosis among younger women to prevent progression to cervical cancer. Barriers to screening, as identified by Ashtarian et al., (2017) include lack of education, fear of diagnosis, and financial constraints (Akhter et al., 2013). Prathima's study among HIV-

positive women highlighted the necessity for extensive cervical cancer screening due to the high occurrence of HPV infections (Prathima et al., 2022).

The incidence of disease appears more prevalent among lower socioeconomic status groups, attributed to factors like limited education and varied nutritional status. Low and middle-income countries carry a higher disease burden, emphasizing the need for comprehensive screening coverage (Sharma et al., 2023). Ethnic disparities within the Indian population, alongside inadequate screening and awareness programs, contribute to the elevated prevalence of cytological abnormalities. Our study underscores the urgent need for public awareness campaigns and early detection efforts, especially among vulnerable socioeconomic groups.

This research provides valuable insights into the cervical health status of women in Chennai. Despite a high level of education among women, the presence of epithelial cell abnormalities at 8.05% is concerning, indicating a lack of awareness about accessible screening methods like the pap test. This trend is particularly alarming as many women only seek diagnosis at advanced disease stages, leading to unfavorable outcomes and recurrent cases. Implementing HPV vaccination programs before sexual activity, ideally between ages 9-14, offers a promising strategy for primary prevention. With annual increases in cervical cancer incidence rates, urgent public awareness campaigns are needed to promote early detection and screening services. Developing various health education models can help increase early diagnoses and emphasize the importance of cervical health, especially among older age groups.

5. Conclusion

In conclusion, our study underscores the significance of cervical cancer screening programs in identifying precursor lesions and reducing the burden of cervical carcinoma. The prevalence of epithelial cell abnormalities observed underscores the importance of early detection and intervention. Additionally, our findings highlight the need for comprehensive education and awareness initiatives, particularly among lower socioeconomic status groups, to address barriers to screening and improve access to healthcare services. By prioritizing screening and implementing targeted interventions, we can mitigate the impact of cervical cancer and improve outcomes for women in our communities.
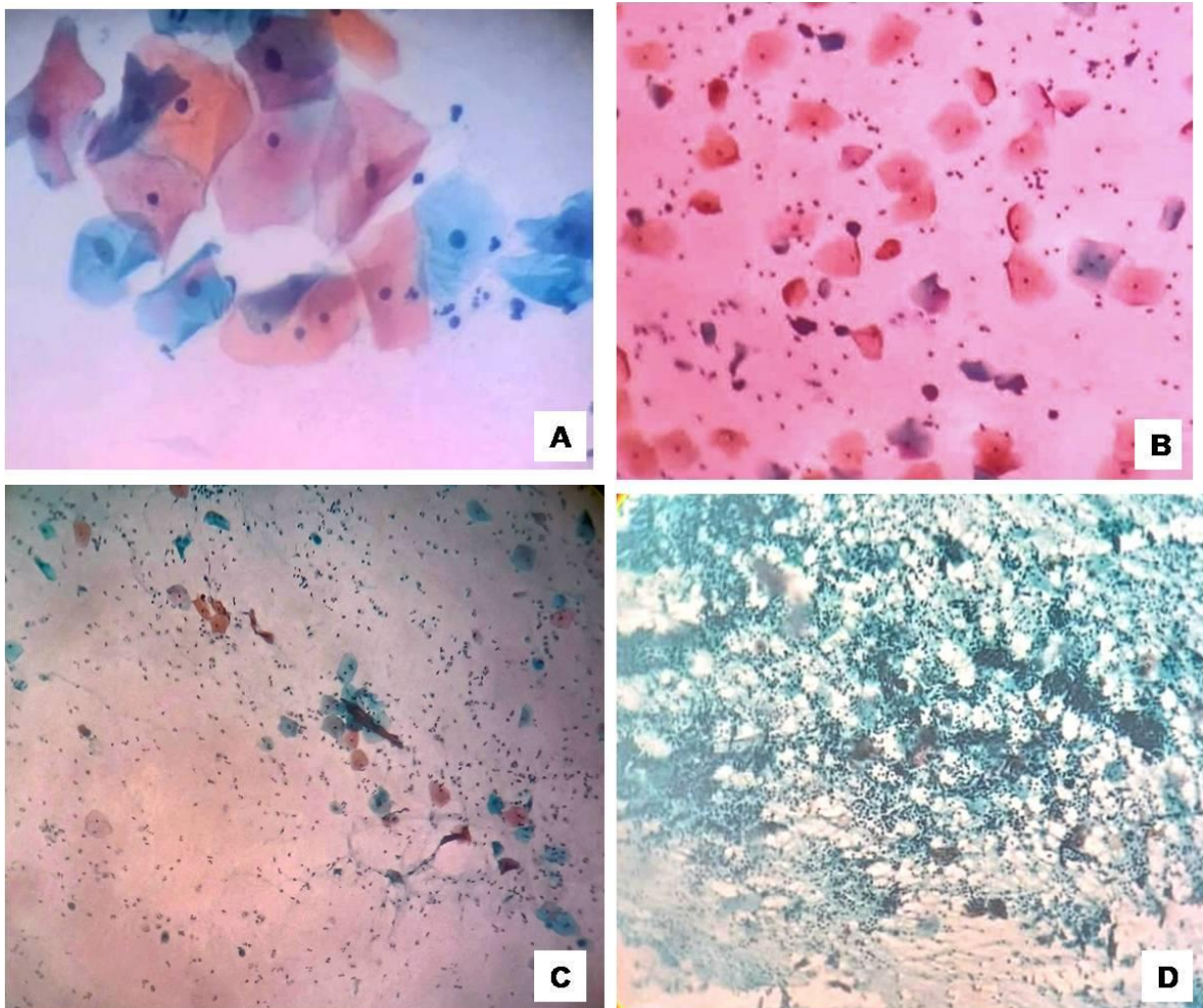
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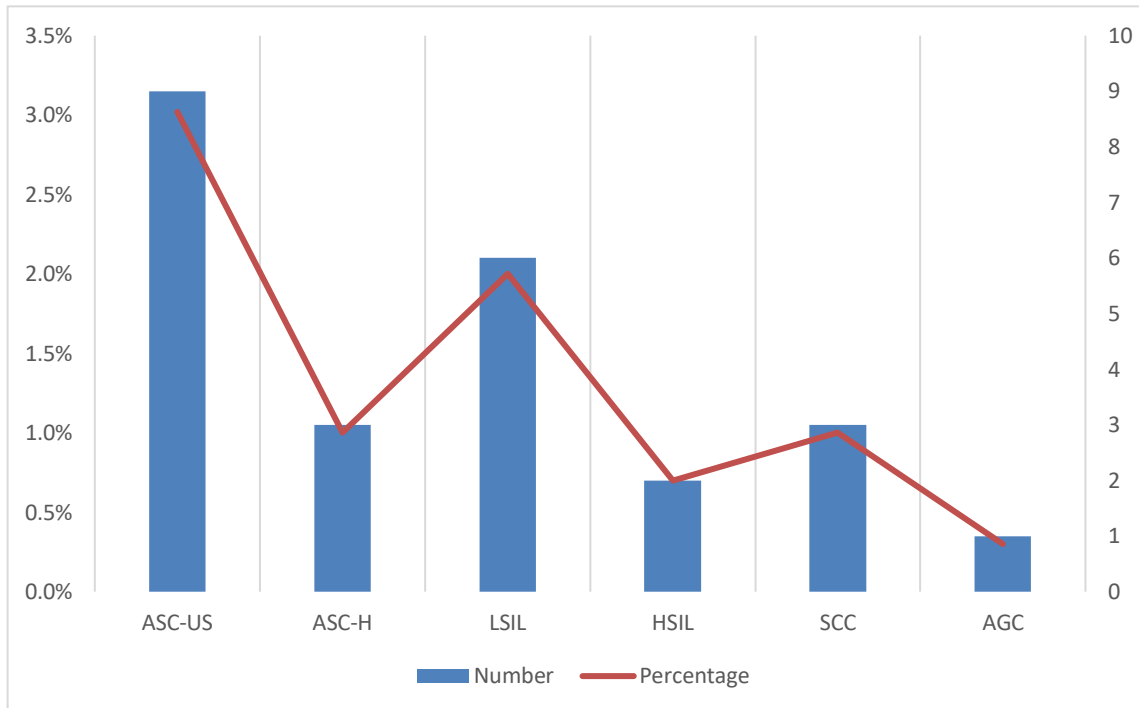
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Figure.1. Cytopathology reports of Pap smear (A) Normal Pap smear, (B) Inflammatory smear, (C) Atypical squamous cells of undetermined significance (ASCUS), (D) Atypical squamous cells that cannot rule out high‑grade lesion (ASCH).

Figure.2. Epithelial cell abnormalities: ASC-US-Atypical squamous cells of undetermined significance, ASC-H-Atypical squamous cells that cannot rule out high‑grade lesion, LSIL - Low grade squamous intraepithelial lesion, HSIL - High grade squamous intraepithelial lesion, SCC - Squamous cell carcinoma, AGC – Atypical Glandular cell
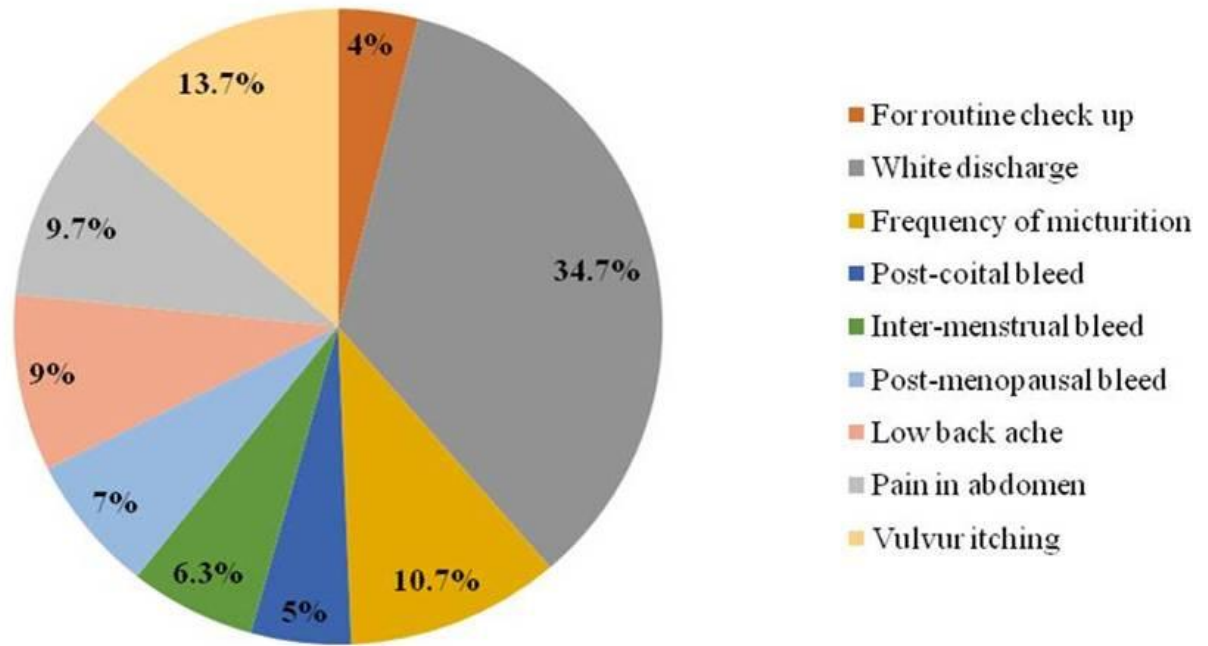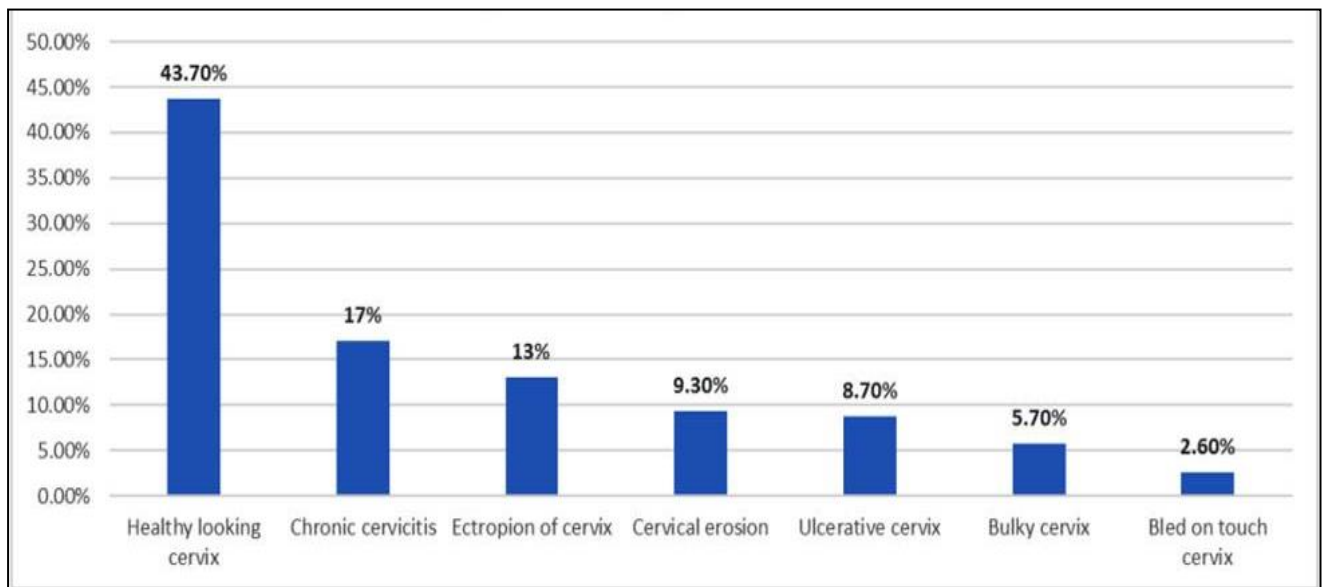
Figure.3. Clinical symptoms

Figure.4. Clinical appearance of Cervix

Table 1: Socio demographic factors

Socio-demographic factors	No. of Participants (n)	Percentage
Age group(Years)		
30-40	78	26%
41-50	125	41.7%
51-60	54	18%
61-70	31	10.3%
71-80	12	4%
Marital Status		
Married	300	100%
Unmarried	Nil	Nil
Parity status		
Nulliparous	8	2.7%
Primiparous	82	27.3%
Multiparous	210	70%
Education		
Literate	280	93.3%
Illiterate	20	6.7%

Table 2: Comparison of Pap smear report of other studies with present study

Author name	Inflamma tory	ASC-US	ASC-H	LSIL	HSIL	SCC
Shaki et al.,	23.8%	4%	1%	6.8%	6%	2.3%
Kumari et al.,	10.76%	1.86%	0.13%	0.13%	2.52%	6.51%
Devi and Salvi	58.52%	4.51%	1%	2.4%	3.69%	0.4%
Nisar and Banday	42%	5%	4%	3.5%	1%	1%
Pankaj et al.,	25.66%	2.09%	0.26%	1.53%	0.93%	0.20%
Verma et al.,	32.5%	1%	0%	5.5%	2.5%	0%
Garg et al.,	64.54%	1.82%	0.3%	2.42%	0.3%	0.91%
Mandakini et al.,	57.48%	4.12%	-	0.1%	0.1%	0.7%
Bal et al.,	71.3%	0.3%	-	2.7%	0.7%	1%
Tejeswiniand Premalatha	76.9%	2.38%	-	0.95%	1.43%	0.48%
Present study	71.1%	3.02%	1%	2%	0.7%	1%

ASCUS- Atypical squamous cells of undetermined significance

ASC-H- Atypical squamous cells that cannot rule out high‑grade lesion

LSIL- Low grade squamous intraepithelial lesion

HSIL- High grade squamous intraepithelial lesion

SCC- Squamous cell carcinoma