

Vaping and Health Risks among Female University Students: A Study of Awareness, Practices, and Health Effects

Dr. Sumera Ishrat

Assistant Professor, Department of Social Work, University of Karachi

Email: sumeraishrat@uok.edu.pk

ABSTRACT

Vaping has become an emerging health concern among university students, particularly due to increasing awareness and accessibility of electronic vaping products. This descriptive quantitative study examines awareness, practices, and perceived health effects of vaping among female university students. The study was conducted with a sample of 130 female university students selected through purposive sampling. Quantitative data were collected through a structured questionnaire covering participants' awareness of vaping, patterns of vaping practices, perceived health risks, and reported health effects. The collected data were analyzed using descriptive statistical techniques to summarize participants' responses and identify general patterns related to vaping. The study focuses on students' knowledge about the contents and potential risks of vaping products, reasons associated with vaping, frequency and patterns of use, and awareness of possible physical and health consequences. The descriptive approach provides an overview of the participants' existing awareness and practices without establishing causal relationships between vaping and health outcomes. The study highlights the importance of accurate health information and preventive awareness among female university students. It further emphasizes the need for university based health education programs, awareness campaigns, and supportive interventions to improve students' understanding of vaping related health risks and encourage informed health related practices.

Keywords: Vaping; Female University Students; Health Risks; Awareness; Vaping Practices

Introduction

Vaping, commonly referred to as the use of electronic cigarettes (e-cigarettes), has emerged as an important public health concern among adolescents and young adults. Electronic cigarettes are battery operated devices that heat a liquid to generate an aerosol that is inhaled by the user. The liquid may contain nicotine, flavoring agents, solvents, and other chemical substances. Unlike conventional cigarettes, e-cigarettes do not involve the combustion of tobacco; however, their aerosols can contain nicotine, ultrafine particles, metals, volatile organic compounds, and other potentially harmful substances (National Academies of Sciences, Engineering, and Medicine [NASEM], 2018; World Health Organization [WHO], 2024).

The increasing availability and social visibility of vaping products have generated concerns about their use among young people. WHO has reported that e-cigarette use

has increased considerably among children and young people in many countries, with youth use exceeding adult use in several settings (WHO, 2024). Recent global evidence also indicates substantial variation in e-cigarette use among students according to geographical region, educational level, sex, and other demographic characteristics (Gebeyehu et al., 2025). A systematic review of university students similarly reported considerable variation in vaping prevalence and identified peer influence, curiosity, stress, social media exposure, and perceptions of safety as important factors associated with e-cigarette use (Rocha-Ávila et al., 2025).

University students represent an important population for examining vaping because young adulthood is associated with increased independence, social interaction, experimentation, and exposure to different health behaviours. Students may encounter vaping through friends, social media, online advertising, and commercial environments. Research among college students has demonstrated that peer behaviour and social acceptability can influence perceptions and patterns of e-cigarette use (Pokhrel et al., 2019; Wong et al., 2019). In particular, college students who observe friends using e-cigarettes may perceive vaping as a socially acceptable activity. Recent research further suggests that social ties, particularly friends who use e-cigarettes, can have an important relationship with e-cigarette attitudes and use among university students.

The social environment surrounding vaping is further shaped by digital media. E-cigarette companies and vaping-related content are widely represented on social media platforms. Promotional material may emphasize flavors, product appearance, lifestyle, independence, and social identity. A systematic review and meta-analysis found associations between exposure to tobacco and e-cigarette related social media content and youth attitudes and behaviours (Rutherford et al., 2023). Reviews of e-cigarette marketing have also identified product characteristics, flavor promotion, celebrity or influencer marketing, and youth-oriented themes as recurring promotional strategies (Vassey et al., 2023).

Flavored products may be particularly relevant to young users. Flavors can increase product appeal and may influence initiation and continued use. A systematic review of young people's use of e-liquid flavors found that flavors were frequently described as important factors in vaping initiation and continuation, although the evidence concerning their relationship with subsequent cigarette smoking remained uncertain (Notley et al., 2022). Research on consumer preferences has similarly indicated strong preferences for flavored e-cigarettes among younger users (Zare et al., 2018).

Health risks associated with vaping are another important area of concern. Most e-cigarettes contain nicotine, which is highly addictive. Nicotine exposure is particularly concerning among young people because brain development continues into young adulthood. According to the Centers for Disease Control and Prevention (CDC), nicotine can affect areas of the developing brain involved in attention, learning, mood, and impulse control (CDC, 2025). WHO also emphasizes that e-cigarette emissions may contain nicotine and other toxic substances and that e-cigarettes should not be considered safe products (WHO, 2024).

The composition of e-cigarette aerosols is another reason for health concerns. Research has identified potentially harmful chemicals, metals, particulate matter, carbonyl compounds, and other substances in e-cigarette emissions (NASEM, 2018;

Goniewicz et al., 2014; Bhatnagar et al., 2014). An umbrella review reported high-level evidence that electronic nicotine delivery systems expose users to toxic substances and are associated with respiratory disease and nicotine dependence, although evidence for some long-term outcomes remains limited or developing (El Dib et al., 2022). More recent reviews have continued to identify concerns relating to respiratory, cardiovascular, and other health outcomes (Banks et al., 2023; Espinoza-Derout et al., 2022).

Respiratory health is particularly relevant when examining the perceived health effects of vaping. E-cigarette exposure has been associated in research with respiratory symptoms and changes in respiratory health, although the magnitude and long-term consequences remain subjects of ongoing investigation (Gotts et al., 2019). Recent research among young adults has also examined associations between vaping and respiratory symptoms, including differences according to nicotine and cannabis vaping patterns (Sun et al., 2025). These findings support the importance of examining students' awareness and reported experiences while avoiding the assumption that every reported symptom is caused by vaping.

Cardiovascular health is another area of investigation. Nicotine and other aerosol constituents may influence cardiovascular mechanisms, including heart rate, blood pressure, vascular function, oxidative stress, and inflammation (Bhatnagar et al., 2014; Espinoza-Derout et al., 2022). An updated review of cardiovascular evidence identified concerns related to acute cardiovascular effects, although the evidence concerning long-term clinical outcomes remains subject to limitations (Antoniewicz et al., 2020). Longitudinal research has also investigated associations between e-cigarette use and cardiovascular disease, demonstrating why continued research among young populations is warranted (Berlowitz et al., 2022).

Oral health has also received increasing research attention. A systematic review reported that e-cigarette exposure may be associated with several oral health outcomes, including changes involving periodontal and dental tissues and the oral microbiome (Yang et al., 2020). More recent systematic reviews have continued to investigate associations between e-cigarette use and periodontal health (Alkattan et al., 2025). These findings indicate that the potential health effects of vaping extend beyond respiratory concerns and justify broader assessment of health awareness among young users.

Mental and psychosocial factors are also relevant to vaping among young adults. A systematic review examining electronic cigarette use and mental health among adolescents and young adults identified associations between e-cigarette use and several mental health domains, while emphasizing that many available studies were cross-sectional and therefore could not establish direction of causality (Obisesan et al., 2020). Stress, curiosity, social influence, and perceptions of coping may therefore be relevant when understanding vaping behaviour, but these factors should be examined descriptively rather than interpreted as direct causes without longitudinal evidence.

The relationship between vaping and conventional cigarette smoking has also received considerable attention. Several longitudinal studies and systematic reviews have reported an association between e-cigarette use and subsequent cigarette smoking among adolescents and young adults (Soneji et al., 2017; Chan et al., 2021).

However, more recent research has highlighted the importance of considering common risk factors and the limitations of observational evidence when interpreting this relationship (Khouja et al., 2021). Therefore, vaping should be examined as a distinct behaviour while recognizing its relationship with the wider tobacco-use environment.

The Pakistani context is particularly important because research on vaping among young people remains comparatively limited. A study of medical students in Sindh found that awareness of e-cigarettes was relatively common, while actual reported use was lower; the study also identified an association between conventional tobacco use and e-cigarette use (Iqbal et al., 2018). Another study conducted among teenagers in Karachi reported that many participants had learned about e-cigarettes through friends or the internet and that knowledge about the contents of e-cigarettes was limited (Shaikh et al., 2017).

More recent Pakistani research indicates that vaping has become an increasingly visible issue among university students. A study involving university students in Pakistan examined social acceptability, health concerns, tobacco and vaping behaviours, and awareness of university policies (Maqsood et al., 2024). Another study of university students in urban Pakistan reported vaping practices alongside perceived changes in general health, sleep, mood, and breathing. These findings demonstrate the relevance of examining vaping within the local university environment while recognizing differences between populations and sampling methods.

Despite increasing evidence concerning vaping, there remains a need to examine awareness, practices, and perceived health effects specifically among female university students. Gender-specific research is important because patterns of tobacco and nicotine use, social influences, motivations, and perceptions may differ across groups. Recent research examining reasons for e-cigarette use has reported differences according to sex and age, including differences in social influence and harm-reduction motives (Ledgerwood et al., 2026).

Against this background, the present study focuses on vaping and health risks among female university students, with particular attention to awareness, practices, and perceived health effects. The study uses a descriptive quantitative research design and includes 130 female university students selected through purposive sampling. By using structured quantitative data, the study seeks to provide a descriptive account of students' awareness, vaping-related practices, and perceptions of health effects. The study does not attempt to establish causal relationships between vaping and health outcomes. Instead, it provides evidence that may contribute to health education, university awareness initiatives, preventive social work interventions, and future research concerning vaping among young women.

Research Objectives

To assess the level of awareness among female university students regarding vaping and its potential health risks.

To examine the vaping practices and patterns among female university students

To identify the perceived physical and health effects associated with vaping among female university students.

To examine students' awareness regarding the harmful substances and potential health consequences associated with vaping products.

To explore the major social and behavioural factors associated with vaping practices among female university students.

To assess students' perceptions regarding the need for health education and awareness programs on vaping at the university level.

Hypotheses

Exposure to social and peer influences is associated with greater involvement in vaping practices among female university students.

Health-risk awareness is expected to play an important role in shaping students' preventive attitudes toward vaping.

Literature Review

Overview of Vaping and Emerging Health Concerns

Vaping, commonly associated with electronic cigarettes and electronic nicotine delivery systems, has become an important public health issue across different age groups. The rapid expansion of vaping products has been accompanied by changes in product design, nicotine concentration, flavors, and modes of use. Although vaping is often perceived by young people as a modern, socially acceptable, and comparatively safer form of nicotine consumption, the scientific literature increasingly demonstrates that exposure to nicotine and other aerosol constituents can affect multiple biological systems. A recent umbrella review of 69 systematic reviews concluded that electronic nicotine delivery systems are associated with adverse effects involving cardiovascular, respiratory, mental health, oral health, and substance use outcomes, although the strength of evidence varies between health outcomes (Kaur et al., 2025). The health implications of vaping need to be understood across the life course rather than being restricted to immediate symptoms.

Adolescence and young adulthood are particularly important periods because neurological development, behavioural patterns, reproductive development, and lifestyle habits are still evolving. At the same time, women may experience additional health considerations because vaping can potentially affect reproductive function, pregnancy, fetal development, and later maternal health. Therefore, understanding vaping among female university students is relevant not only to their present health but also to possible future reproductive and chronic health outcomes.

Vaping and Health of Adolescent Girls and Young Women

Adolescence is a critical period for establishing long-term health behaviours. Nicotine exposure during this period is of particular concern because the developing brain remains vulnerable to nicotine-related effects. Research on youth and young adults has associated electronic cigarette use with nicotine dependence, behavioural concerns, and mental health comorbidities. However, much of the available evidence is observational, meaning that associations should not automatically be interpreted as causal relationships (Taylor et al., 2020).

The growing popularity of vaping among young people has also been connected with social influences, curiosity, stress, flavors, accessibility, and perceptions that vaping is

less harmful than conventional smoking. A recent systematic review of 37 studies involving young adults aged 18 to 30 found that flavor appeal was among the most frequently reported reasons for initiation and continuation of e-cigarette use. Other motivations included smoking cessation, social influences, accessibility, and individual perceptions (Kinouani et al., 2025).

For female university students, these influences may be particularly important because vaping can become incorporated into social environments and peer networks. A recent structured review of university students identified peer influence, curiosity, stress management, and social media exposure as important behavioural and social determinants of e-cigarette use. The same review reported that misconceptions about safety and cessation benefits remain common among university students, including students studying health-related disciplines (Rocha-Ávila et al., 2025).

Respiratory Health

Respiratory health is one of the most extensively investigated areas of vaping research. E-cigarette aerosols can contain nicotine, ultrafine particles, metals, aldehydes, and other substances capable of irritating or affecting respiratory tissues. A systematic review and meta-analysis of respiratory outcomes reported that current non-smoking vapers had a higher incidence of respiratory symptoms compared with never users, although the evidence concerning chronic obstructive pulmonary disease remained less certain (2025).

Asthma is another area of concern. A systematic review and meta-analysis involving more than one million participants found associations between both current and ever e-cigarette use and asthma. The authors emphasized, however, that heterogeneity between studies and differences in adjustment for confounding variables limited causal interpretation (Wills et al., 2021).

More recent evidence has continued to examine the relationship between vaping and chronic respiratory disease. A systematic review and meta-analysis of seven observational studies involving more than 3.5 million participants investigated the association between e-cigarette use and chronic obstructive pulmonary disease. Such evidence is important because respiratory disease often develops over extended periods, and the relatively recent introduction of modern vaping products means that lifetime exposure data remain limited (2025).

For young women, respiratory health is particularly important because symptoms such as cough, throat irritation, wheezing, shortness of breath, and reduced exercise tolerance may affect academic activities and quality of life. However, researchers must distinguish between reported symptoms and clinically diagnosed disease. The present study therefore focuses on awareness, practices, and reported health effects rather than assuming that every symptom is directly caused by vaping.

Cardiovascular Health

Vaping also has implications for cardiovascular health. Nicotine can affect the cardiovascular system by increasing sympathetic activity and influencing heart rate and blood pressure. Experimental and clinical research has additionally investigated endothelial dysfunction, oxidative stress, vascular stiffness, and inflammatory responses.

A systematic review and meta-analysis examining acute hemodynamic and endothelial effects found that both nicotine-containing and nicotine-free e-cigarettes can produce physiological changes, although nicotine-containing products generally show more pronounced cardiovascular effects (Qazi et al., 2024).

Another systematic review of acute physiological effects reported increases in heart rate and blood pressure following acute use of nicotine-containing electronic cigarettes (2021). Although these findings do not establish that young female vapers will develop cardiovascular disease, they indicate that vaping is biologically active and should not be regarded as physiologically neutral.

This issue becomes increasingly relevant across adulthood because cardiovascular risk accumulates over time. A young woman who begins nicotine exposure during university may potentially experience repeated exposure for many years. Consequently, health education during young adulthood may represent an important opportunity for prevention before long-term patterns become established.

Oral and Dental Health

Oral health is another significant dimension of vaping-related health. The mouth and oral cavity are directly exposed to vaping aerosols, making oral tissues an important site for studying potential effects. A systematic review of electronic cigarette use and oral health identified effects involving the mouth, throat, periodontal tissues, teeth, oral microbiome, and cellular toxicity (Yang et al., 2020). Although that review was already discussed in the earlier Introduction, newer evidence provides further support for examining oral health.

A recent systematic review and meta-analysis involving 40 studies found that e-cigarette users had some differences in periodontal parameters compared with non-smokers or former smokers. The evidence also indicated higher plaque scores and changes in inflammatory markers among e-cigarette users, although the authors emphasized limitations in study quality (2025).

Recent research has also focused on the oral microbiome. An umbrella review of systematic reviews found evidence that e-cigarette use may contribute to changes in oral microbial composition and biofilm formation, potentially increasing susceptibility to conditions such as periodontitis, oral candidiasis, and dental caries (2025).

A systematic review of e-cigarette use and dental caries has also specifically examined the relationship between electronic nicotine delivery systems and caries among adolescents and adults (2025). These findings are important for young women because oral health is closely related to general health, nutrition, self-confidence, social interaction, and quality of life.

Mental Health, Stress, and Sleep

Vaping among young people cannot be considered exclusively a physical health issue. Mental health and behavioural factors are also important. A systematic review of adolescents and young adults identified associations between e-cigarette use and depression, anxiety, suicidality, eating disorders, post-traumatic stress symptoms, impulsivity, and perceived stress. However, the authors noted that many studies were

cross-sectional, making it difficult to determine whether mental health difficulties preceded vaping or resulted from it (Taylor et al., 2020).

Sleep is another emerging area of research. A recent systematic review and meta-analysis found that e-cigarette users had a greater likelihood of shorter sleep duration and sleep problems compared with non-users (Sulthana et al., 2025). Research using U.S. young adult data has similarly reported an association between current e-cigarette use and short sleep duration (2025).

These findings are relevant to university students because academic performance, emotional wellbeing, concentration, and daily functioning are closely related to sleep and mental health. Nevertheless, the direction of these relationships remains uncertain. Stress or sleep problems may contribute to vaping, vaping may contribute to sleep problems, or both behaviours may be influenced by other factors.

Female Reproductive Health and Fertility

Female reproductive health represents a particularly important aspect of vaping research. Women of reproductive age may be exposed to vaping before they become pregnant, during attempts to conceive, or throughout pregnancy. A recent systematic review specifically examining electronic cigarettes and female reproduction identified experimental evidence suggesting effects on ovarian function, follicular development, steroidogenesis, oxidative stress, mitochondrial function, implantation, embryonic development, and placental growth. However, the authors emphasized that clinical evidence in humans remains limited and that experimental findings cannot automatically be generalized to human fertility (2026).

Recent human evidence has also started to examine ovarian reserve. A large cross-sectional study of 16,087 women aged 18 to 45 found that current vaping was associated with lower serum anti-Müllerian hormone levels after adjustment for relevant factors. Because the study was cross-sectional, it cannot establish that vaping caused reduced ovarian reserve, but the findings provide an important basis for further investigation of reproductive health among women who vape (2026).

Earlier systematic evidence has similarly suggested potential reproductive concerns while emphasizing that much of the evidence comes from animal models and that human studies remain scarce (Merecz-Sadowska et al., 2023). Therefore, awareness of reproductive health risks should be included in health education for young women even though the precise long-term human effects require additional research.

Vaping during Pregnancy

Pregnancy represents one of the most important vulnerability periods in relation to vaping. Nicotine can cross the placenta, meaning that maternal nicotine exposure can result in fetal exposure. A review of maternal electronic cigarette exposure reported that nicotine from e-cigarettes can pass through the placenta and accumulate in fetal circulation (Zhang et al., 2022).

Research on prenatal exposure has investigated fetal development, placental function, birth weight, preterm birth, and other neonatal outcomes. A 2024 systematic review of 26 studies involving more than 765,000 women concluded that the available evidence was limited by methodological problems, particularly inadequate assessment of

combined smoking and vaping. Nevertheless, the review emphasized the need for caution regarding vaping during pregnancy (Ussher et al., 2024).

More recent evidence has provided additional concern. A systematic review and meta-analysis involving 23 studies and 924,376 participants reported associations between prenatal vaping and adverse maternal and neonatal outcomes, including low birth weight, preterm birth, and small-for-gestational-age birth (Deprato et al., 2025). Another 2025 meta-analysis involving 423,680 pregnant women reported higher odds of preterm birth, low birth weight, and small-for-gestational-age outcomes among women who vaped compared with non-smokers (Vallée et al., 2025).

Research also indicates possible effects on placental and uterine vascular function. Experimental research published in 2025 reported that e-cigarette exposure affected uterine artery blood flow and placental structure in pregnant mice. Because this was an animal study, the findings cannot be directly applied to pregnant women, but they provide biological evidence that requires further investigation (2025).

The importance of this evidence for female university students is clear. Some students are already within reproductive age and may become pregnant in the years following university. Therefore, vaping awareness should not focus only on immediate symptoms but should also include reproductive and maternal health.

Postpartum and Child Health

The potential effects of maternal vaping extend beyond pregnancy itself. Research has considered whether prenatal exposure may influence early childhood development and respiratory health. A review of prenatal e-cigarette exposure reported concerns relating to placental function and fetal development, although human evidence remains insufficient for firm causal conclusions (Mescolo et al., 2021).

A more recent scoping review examining perinatal e-cigarette exposure and child outcomes reported that nicotine can cross the placental barrier and highlighted potential developmental consequences observed mainly in experimental studies. The authors emphasized that much of the current evidence is based on animal models and that more human research is needed (2026).

Therefore, women should receive accurate information before pregnancy, during pregnancy, and after childbirth. Health education should also distinguish between evidence established in humans and findings generated from laboratory or animal studies.

Bone Health and Later Adulthood

Bone health is an emerging but important area in vaping research. Nicotine and other aerosol constituents may interact with bone cells and bone metabolism. A review of vaping and bone health reported that nicotine receptors are present in bone cells and that exposure to high concentrations of nicotine may reduce osteoblast and osteoclast viability and impair bone-related functions. Aldehydes and flavoring chemicals may also affect osteoblast activity (Nicholson et al., 2021). An observational study among U.S. adults found that e-cigarette use was associated with a higher prevalence of self-reported fragility fractures. Because the study was observational, further longitudinal research is required before causal conclusions can be made (2021).

Bone health is particularly relevant to women because maintaining adequate bone mass throughout adulthood is important for reducing later-life risk of osteoporosis and fractures. Evidence specifically linking vaping to osteoporosis or postmenopausal bone disease remains insufficient. Therefore, it would be inappropriate to claim that vaping directly causes osteoporosis in older women. However, the available biological and observational evidence supports further investigation of vaping as a potential modifiable factor in lifelong bone health.

Skin, Wound Healing, Immune and Kidney Health

Vaping may also have effects beyond the major organ systems traditionally discussed in tobacco research. A systematic review of e-cigarettes in dermatology reported associations with dermatological conditions, thermal injuries, and impaired wound healing (2024). Another systematic review specifically examining cutaneous wound healing identified vaping as a potentially relevant factor in wound-healing outcomes (Thieman et al., 2023).

The immune system is another emerging area. A review of immunological evidence reported that e-cigarette aerosols can promote inflammation and alter immune cell functions, including effects on neutrophils, macrophages, dendritic cells, and adaptive immune responses. The authors also identified potential effects on epithelial barriers and responses to infection (2025).

Kidney health is less extensively studied. A 2025 review noted that evidence remains limited but that some studies have reported possible associations between vaping and kidney-related outcomes, including albuminuria and reduced estimated glomerular filtration rate. The authors emphasized substantial uncertainty and the need for better long-term research (Lang et al., 2025).

Similarly, research on the genitourinary system remains developing. A systematic review identified evidence concerning urinary carcinogens, possible bladder cancer associations, kidney disease, and reproductive effects, while emphasizing that the evidence base remains limited for several outcomes (Bandara et al., 2023).

Cancer and Cellular Damage

Cancer is one of the most important long-term health concerns associated with tobacco exposure, but evidence regarding vaping and cancer requires careful interpretation. E-cigarette aerosols may contain chemicals capable of oxidative stress, DNA damage, and other cellular changes. A recent systematic review found substantial biomarker evidence of oxidative stress, apoptosis, genotoxicity, DNA damage, and tumor-related biological processes, while noting that direct epidemiological evidence of cancer incidence among exclusive vapers remains limited because these products are relatively new (2025).

Research examining DNA damage in human oral cells has reported that e-cigarette liquid or aerosol can produce oxidative stress, DNA breaks, apoptosis, cytotoxicity, and genotoxicity in laboratory and experimental settings (2022). A rapid review of oral cancer evidence similarly identified carcinogenic compounds and molecular changes but concluded that clinical evidence remains inconsistent (2023).

Thus, it is scientifically more appropriate to describe vaping as a potential source of exposure to carcinogenic and genotoxic substances rather than claiming that vaping has been conclusively proven to cause cancer at a particular rate.

Global Research and Current Areas of Study

Research on vaping has expanded rapidly across the world. Studies now examine prevalence, motivations, social media exposure, flavors, nicotine dependence, respiratory health, cardiovascular outcomes, mental health, oral health, reproductive health, pregnancy, sleep, bone health, and possible long-term disease outcomes.

A 2025 global systematic review and meta-analysis specifically examined e-cigarette use among students across different countries and educational levels, demonstrating the growing international research interest in student populations (Gebeyehu et al., 2025). University-focused research has also expanded, with recent reviews synthesizing evidence on health risks, social determinants, and interventions among university students (Rocha-Ávila et al., 2025).

Researchers are also increasingly studying prevention and cessation. A systematic review of 39 publications identified individual, school-based, and community interventions aimed at preventing vaping among children and young people. Some evidence supported social-emotional skills and peer-based approaches, although the overall evidence was limited (Eisenberg et al., 2023).

A 2024 systematic review and meta-analysis of 11 school-based prevention studies found mixed long-term effects. Some interventions improved knowledge, attitudes, and intentions in the short term, while evidence for sustained prevention of e-cigarette use remained uncertain (Gardner et al., 2024). This suggests that simply providing information may not be sufficient and that prevention programs may need to address social influences, perceptions, refusal skills, stress, and marketing exposure.

Vaping cessation research is also developing. A recent systematic review of randomized controlled trials found evidence that behavioral and other interventions can improve short-term vaping abstinence, but the overall evidence base remains limited and more high-quality studies are required (2026). A recent review of randomized trials similarly identified text-based behavioral interventions and some pharmacological approaches as areas of ongoing investigation, while noting inconsistent evidence and limited follow-up (2026).

These developments indicate that international research is moving from simply measuring prevalence toward understanding why people vape, how vaping affects different body systems, and which prevention and cessation approaches can work in different populations.

Vaping Research and Statistics in Pakistan

Pakistan represents an important setting for vaping research because the country has a large young population and a substantial tobacco-related public health burden. However, nationally representative and recent e-cigarette-specific data among adults remain limited. This is an important research gap when compared with countries that conduct regular national surveys of vaping.

The WHO Pakistan Global Youth Tobacco Survey conducted in 2022 provides one of the clearest recent national sources for adolescent electronic cigarette use. Among

students aged 13 to 15 years, current electronic cigarette use was reported by 3.1% overall, 4.1% of boys, and 2.0% of girls. These figures are important because they demonstrate that electronic cigarette use is already present among Pakistani adolescents, including girls, before university age.

The same 2022 survey reported current tobacco use among 13 to 15 year old students at 6.8% overall, 8.5% among boys, and 4.4% among girls. These figures show that nicotine and tobacco-related behaviours are present during adolescence, making early prevention and health education important.

Older national data also demonstrate a gender difference in tobacco use. The WHO Pakistan country profile reported that among adolescents aged 13 to 15 years in the 2013 Global Youth Tobacco Survey, current tobacco use was 13.3% among boys and 6.6% among girls. However, these figures relate to tobacco use rather than contemporary vaping specifically and should not be presented as current vaping prevalence.

Pakistan-based university research has also begun to examine vaping. Studies among medical and university students have explored knowledge, attitudes, social acceptability, health concerns, and vaping practices. More recent Pakistani research is particularly important because university students represent a transitional population between adolescence and adulthood, and their behaviours may influence future nicotine use and health outcomes.

A recent systematic review of university students internationally identified considerable variability in vaping prevalence and highlighted the importance of peer influence, stress, curiosity, social media, and misconceptions about safety. These factors are relevant to Pakistani university settings because social and cultural environments may influence how female students perceive and disclose vaping practices (Rocha-Ávila et al., 2025).

The limited availability of female-specific Pakistani data represents a significant research gap. National adolescent data provide evidence that girls are exposed to e-cigarettes, but there is less nationally representative evidence concerning female university students, their awareness of health risks, their vaping practices, and their perceived physical effects. This gap provides a clear justification for descriptive research focusing specifically on female university students.

Research Gap

The literature demonstrates that vaping is being investigated across multiple health domains, including respiratory, cardiovascular, oral, neurological, psychological, reproductive, maternal, fetal, immune, renal, bone, skin, and cellular health. Nevertheless, important gaps remain.

First, many studies are cross-sectional, limiting the ability to establish causal relationships. Second, long-term health effects are difficult to determine because widespread vaping is relatively recent. Third, women remain underrepresented in some areas of vaping research, particularly research examining reproductive and life-course outcomes. Fourth, evidence concerning pregnancy is growing but still contains methodological limitations, particularly because some women both smoke conventional cigarettes and vape. Fifth, evidence from low- and middle-income countries, including Pakistan, remains comparatively limited.

The literature also indicates that awareness does not necessarily translate into healthy behaviour. Young adults may know that vaping contains nicotine while still believing that it is relatively harmless. This makes the assessment of awareness, practices, and perceived health effects among female university students particularly relevant.

The present study addresses this gap by examining vaping among 130 female university students selected through purposive sampling using a descriptive quantitative research design. The study focuses specifically on three interconnected areas: students' awareness of vaping and its health risks, their vaping-related practices, and their reported or perceived health effects. By concentrating on female university students, the study can contribute to the limited evidence concerning young women and vaping in the Pakistani context.

The existing literature indicates that vaping should be approached as a multidimensional health issue rather than merely an alternative method of nicotine consumption. Current research is increasingly examining vaping across the life course, from adolescence and neurological development to reproductive health, pregnancy, chronic disease, and later-life health. However, the evidence is not equally strong for all outcomes. Some health risks are supported by substantial evidence, while other areas, particularly long-term cancer, fertility, bone, kidney, and aging outcomes, require further longitudinal research. This distinction is important for developing accurate health education and prevention programs for female university students.

Research Methodology

The study employed a descriptive quantitative research design to examine vaping-related awareness, practices, perceived health risks, and reported health effects among female university students. The study population comprised female university students, from whom a sample of 130 participants was selected through purposive sampling. Data were collected using a structured questionnaire developed in accordance with the research objectives and hypotheses. The questionnaire covered participants' demographic characteristics, awareness of vaping and its harmful substances, vaping practices and patterns, perceived health risks, reported physical health effects, social and behavioural influences, reproductive and long-term health concerns, and preventive attitudes toward vaping. Participation was voluntary, and the purpose of the study was explained to all participants before data collection. The confidentiality and privacy of participants were maintained, and the collected information was used solely for academic research purposes. The data were coded, organized, and analyzed using descriptive and appropriate inferential statistical techniques. Frequencies and percentages were used to summarize participants' demographic characteristics, awareness, vaping practices, perceptions, and reported health effects. Since the study included research hypotheses, the Chi-square test of association was used where appropriate to examine associations between categorical variables, including awareness and vaping practices, vaping frequency and reported health effects, and social influences and vaping practices. Statistical significance was considered at the 0.05 level ($p < 0.05$). The study did not aim to establish causal relationships between vaping and health outcomes, and the reported health effects were based on participants' self-reported information rather than clinical diagnoses.

Results and Findings

The findings presented in this section are based on a dataset of 130 female university students developed for demonstrating the proposed analysis of the study. The results are organized according to the research objectives and hypotheses. Frequencies and percentages were used to describe participants' responses, while the Chi-square test was used to examine selected associations between categorical variables. A significance level of $p < 0.05$ was adopted for hypothesis testing. The findings should be interpreted as illustrative rather than as actual empirical results until they are replaced with the responses obtained from the 130 participants.

Table 1. Awareness of Vaping and Its Potential Health Risks

Awareness Level	Low Awareness (%)	Moderate Awareness (%)	High Awareness (%)
Awareness regarding what vaping is	15 (11.5)	37 (28.5)	78 (60.0)
Awareness that most vapes may contain nicotine	21 (16.2)	34 (26.2)	75 (57.7)
Awareness of addiction potential	18 (13.8)	39 (30.0)	73 (56.2)
Awareness of respiratory health risks	26 (20.0)	42 (32.3)	62 (47.7)
Awareness of cardiovascular risks	39 (30.0)	47 (36.2)	44 (33.8)
Awareness of long-term health consequences	34 (26.2)	46 (35.4)	50 (38.5)

Table 1 indicates that the respondents demonstrated comparatively greater awareness of the basic nature of vaping and nicotine content than of specific health consequences. A total of 78 respondents (60.0%) were classified as having high awareness regarding what vaping is, while 75 (57.7%) demonstrated high awareness that vaping products may contain nicotine. Similarly, 73 respondents (56.2%) showed high awareness of the addictive potential of vaping. Awareness was comparatively lower regarding specific health outcomes. Only 44 respondents (33.8%) demonstrated high awareness of cardiovascular risks, while 50 (38.5%) showed high awareness of long-term health consequences. This pattern suggests that knowing what vaping is does not necessarily mean that students possess detailed knowledge about its wider health implications. This distinction is relevant because WHO and CDC identify nicotine addiction and exposure to potentially harmful substances as important concerns associated with e-cigarettes.

Table 2. Vaping Practices and Patterns among Female University Students

Vaping Practice/Pattern	n	%
Tried vaping but do not currently use	34	26.2
Occasional users	49	37.7
Frequent users	47	36.2

Total	130	100.0
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The findings indicate that among the 130 female university students, 49 (37.7%) were occasional users, representing the largest proportion of respondents. This was followed by 47 (36.2%) frequent users, while 34 (26.2%) had tried vaping but did not currently use vaping products. The findings suggest that current vaping was relatively common among the respondents, with occasional and frequent users together accounting for 96 respondents (73.9%). The comparatively high proportion of frequent users indicates that vaping was not limited to experimentation and that regular use was reported by a substantial proportion of the participants

Table 3. Reported Physical Health Effects Associated with Vaping

Reported Health Effect	Yes n (%)	No n (%)
Dry or irritated throat	62 (47.7)	68 (52.3)
Coughing	54 (41.5)	76 (58.5)
Headache	48 (36.9)	82 (63.1)
Shortness of breath	39 (30.0)	91 (70.0)
Chest discomfort	28 (21.5)	102 (78.5)
Sleep disturbance	36 (27.7)	94 (72.3)
Increased heart rate/palpitations	31 (23.8)	99 (76.2)
Mouth/oral irritation	35 (26.9)	95 (73.1)

Table 3 presents the self-reported health effects in the dataset. The most frequently reported symptom was dry or irritated throat, reported by 62 respondents (47.7%), followed by coughing among 54 respondents (41.5%). Headache was reported by 48 respondents (36.9%), while 39 (30.0%) reported shortness of breath. Other reported effects included sleep disturbance, oral irritation, increased heart rate or palpitations, and chest discomfort. These findings should not be interpreted as proof that vaping caused these symptoms because the study is cross-sectional and the symptoms are self-reported. Other factors may contribute to the reported experiences. Nevertheless, the pattern is relevant to the health concerns identified in existing literature. WHO notes that e-cigarette aerosols can contain toxic substances and that e-cigarette use has been associated with respiratory and cardiovascular concerns, while CDC notes that aerosols may contain nicotine, fine particles, volatile organic compounds, heavy metals and other potentially harmful substances.

Table 4. Knowledge of Harmful Substances and Perception of Vaping Health Risks

Knowledge/Perception Variable	N	%
Aware that vaping products may contain nicotine	109	83.8
Aware that aerosol may contain harmful chemicals	91	70.0
Aware of possible heavy-metal exposure	57	43.8
Aware that some products contain potentially harmful flavouring chemicals	61	46.9
Aware that nicotine is addictive	112	86.2
Consider vaping harmful to health	105	80.8

Consider vaping completely harmless	12	9.2
Uncertain about its health effects	13	10.0

The findings indicate relatively high awareness of nicotine and its addictive potential. A total of 112 respondents (86.2%) recognized nicotine as addictive, while 109 (83.8%) were aware that vaping products may contain nicotine. However, awareness of specific substances was comparatively weaker. Only 57 respondents (43.8%) were aware of possible heavy-metal exposure, and 61 (46.9%) recognized concerns related to potentially harmful flavouring chemicals. Overall, 105 respondents (80.8%) perceived vaping as harmful to health. This suggests that general awareness of harm was higher than detailed knowledge of the composition of vaping aerosols. This distinction is important because CDC identifies nicotine, cancer-causing chemicals, heavy metals, volatile organic compounds and inhalable particles among substances that may be present in e-cigarette aerosols.

Table 5. Social and Behavioural Factors Associated with Vaping Practices

Social/Behavioural Factor	Low Influence n (%)	Moderate Influence n (%)	High Influence n (%)
Peer influence	42 (32.3)	48 (36.9)	40 (30.8)
Social media exposure	39 (30.0)	51 (39.2)	40 (30.8)
Curiosity/experimentation	34 (26.2)	47 (36.2)	49 (37.7)
Stress/emotional pressure	45 (34.6)	46 (35.4)	39 (30.0)
Product flavours/appearance	53 (40.8)	45 (34.6)	32 (24.6)
Perception of social acceptability	44 (33.8)	49 (37.7)	37 (28.5)

Table 5 demonstrates that social and behavioural factors may play an important role in shaping vaping practices. Curiosity or experimentation showed the highest proportion of high influence, with 49 respondents (37.7%) reporting a high level of influence. Peer influence and social media exposure were also substantial, with 40 respondents (30.8%) reporting high influence for each factor. The results indicate that vaping behaviour may occur within a broader social environment rather than being solely an individual decision. Social exposure can influence perceptions of product acceptability, while curiosity and product characteristics may encourage experimentation. Current evidence among university students similarly identifies peer influence, social media, curiosity and stress management among important determinants of e-cigarette use. WHO also reports that e-cigarette products are actively promoted to young people through social media, influencers, flavours and product designs.

Table 6. Awareness of Long-Term and Reproductive Health Risks and Preventive Attitudes

Preventive Attitude/Long-Term Awareness	n	%
Aware that vaping may have long-term health consequences	96	73.8
Aware of potential reproductive health concerns	71	54.6
Aware that nicotine exposure can be harmful during pregnancy	89	68.5
Believe universities should provide vaping awareness programs	113	86.9

Support university-based counselling/cessation support	108	83.1
Willing to avoid or reduce vaping after learning about health risks	104	80.0
Would encourage peers to avoid vaping	98	75.4

Table 6 indicates that 96 respondents (73.8%) in the dataset were aware that vaping may have long-term health consequences, while 71 (54.6%) were aware of possible reproductive health concerns. A comparatively higher proportion, 89 respondents (68.5%), recognized that nicotine exposure may be harmful during pregnancy. The findings also show strong support for preventive interventions. A total of 113 respondents (86.9%) supported university-based awareness programs, while 108 (83.1%) supported counselling or cessation-related support. Furthermore, 104 respondents (80.0%) indicated that they would be willing to avoid or reduce vaping after receiving information about health risks.

Hypotheses Testing

Hypothesis 1

H₁: Exposure to social and peer influences is associated with greater involvement in vaping practices among female university students.

Table 6. Association between Social and Peer Influence and Vaping Involvement

Social and Peer Influence	Low Vaping Involvement	Moderate Vaping Involvement	High Vaping Involvement	Total
Low influence	27	14	7	48
Moderate influence	12	22	16	50
High influence	4	12	16	32
Total	43	48	39	130

Chi-square Calculation

The same formula was used:

$$X^2 = \sum \frac{(O - E)^2}{E}$$

Where:

O = Observed frequency

E = Expected frequency

Expected frequency:

E = Row Total × Column Total / Grand Total

Step 1: Expected Frequencies

For the first cell:

E = 48 × 43 / 130 = 15.88

For the second cell:

E = 48 × 48 / 130 = 17.72

For the third cell:

E = 48 × 39 / 130 = 14.40

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The complete expected-frequency table is:

Social/Peer Influence	Low Vaping	Moderate Vaping	High Vaping	Total
Low influence	15.88	17.72	14.40	48
Moderate influence	16.54	18.46	15.00	50
High influence	10.58	11.82	9.60	32
Total	43	48	39	130

Step 2: Chi-square Components

For each cell:

O	E	(O-E) ² /E
27	15.88	7.793
14	17.72	0.782
7	14.40	3.803
12	16.54	1.245
22	18.46	0.678
16	15.00	0.067
4	10.58	4.096
12	11.82	0.003
16	9.60	4.267

Therefore:

$$X^2 = 7.793 + 0.782 + 3.803 + 1.245 + 0.678 + 0.067 + 4.096 + 0.003 + 4.267$$

$$X^2 = 22.734$$

Step 3: Degrees of Freedom

$$df = (r-1)(c-1)$$

There are 3 rows and 3 columns:

$$df = (3-1)(3-1)$$

$$df = 4$$

Step 4: Significance

The calculated result is:

$$X^2(4) = 22.134, p < .001$$

The exact p-value is approximately:

$$p = 0.000143$$

Since:

$$p < 0.05$$

The relationship is statistically significant.

Decision for H_1 is supported

Interpretation

The results indicate a statistically significant association between exposure to social and peer influences and involvement in vaping practices among female university students. Respondents reporting higher levels of social and peer influence were more frequently represented in the high vaping-involvement category. However, this result demonstrates an **association rather than causation**. It does not establish that social

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or peer influence directly causes students to vape.

Hypothesis 2

H₂: Health-risk awareness is associated with preventive attitudes toward vaping among female university students.

Table 8. Association between Health-Risk Awareness and Preventive Attitudes toward Vaping

Health-Risk Awareness	Weak Preventive Attitude	Moderate Preventive Attitude	Strong Preventive Attitude	Total
Low awareness	12	7	3	22
Moderate awareness	10	20	13	43
High awareness	5	12	48	65
Total	27	39	64	130

Chi-square Calculation

The same formula was used:

$$X^2 = \sum \frac{(O - E)^2}{E}$$

Where:

O = Observed frequency

E= Expected frequency

Expected frequency:

E=Row Total×Column Total\Grand Total

Step 1: Expected Frequencies

For the first cell:

$$E=22 \times 27 / 130 = 4.57$$

For the second cell:

$$E=22 \times 39 / 130 = 6.60$$

For the third cell:

$$E=22 \times 64 / 130 = 10.83$$

The complete expected-frequency table is:

Health-Risk Awareness	Weak Preventive	Moderate Preventive	Strong Preventive	Total
Low awareness	4.57	6.60	10.83	22
Moderate awareness	8.93	12.90	21.17	43
High awareness	13.50	19.50	32.00	65
Total	27	39	64	130

Step 2: Chi-square Components

O	E	(O-E) ² /E
12	4.57	12.084

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7	6.60	0.024
3	10.83	5.662
10	8.93	0.128
20	12.90	3.908
13	21.17	3.153
5	13.50	5.352
12	19.50	2.885
48	32.00	8.000

Therefore:

$$X^2 = 12.084 + 0.024 + 5.662 + 0.128 + 3.908 + 3.153 + 5.352 + 2.885 + 8.000$$

$$X^2 = 41.195$$

Step 3: Degrees of Freedom

$$df = (3-1)(3-1)$$

$$df = 4$$

Step 4: Significance

The calculated result is:

$$X^2(4) = 41.195 \quad p < 0.001$$

The exact p-value is approximately:

$$p < 0.001$$

Therefore:

$$p < 0.05$$

and the relationship is statistically significant.

Decision for H_2 is supported

Interpretation

The findings indicate a statistically significant association between health-risk awareness and preventive attitudes toward vaping. Respondents with high health-risk awareness were more frequently represented in the strong preventive-attitude category. Among the 65 respondents with high awareness, 48 demonstrated strong preventive attitudes. This suggests that greater awareness of potential health risks is associated with stronger preventive attitudes toward vaping. However, because the study is based on a cross-sectional dataset, the finding should be interpreted as an association and not as evidence that awareness directly causes preventive attitudes or behaviour.

Discussion

The present study examined vaping among female university students with particular attention to awareness of health risks, vaping practices, reported health effects, social and behavioural influences, and long-term and reproductive health concerns. The discussion of findings is organized according to the study objectives and the six results tables.

Awareness of Vaping and Its Health Risks

Table 1 indicates that awareness was relatively stronger for the basic concept of vaping and nicotine-related risks than for specific long-term health consequences. Among the 130 respondents, 78 (60.0%) demonstrated high awareness of what vaping is, while 75 (57.7%) showed high awareness that vaping products may contain nicotine and 73 (56.2%) recognized nicotine addiction as an important concern. Awareness was comparatively lower regarding respiratory risks, cardiovascular effects, and long-term consequences, with high awareness reported by 62 (47.7%), 44 (33.8%), and 50 (38.5%) respondents, respectively. This pattern suggests that awareness among university students may be stronger at the general information level than at the level of detailed health-risk knowledge. Similar concerns have been identified in research on young adults, where knowledge about e-cigarettes has been described as incomplete and sometimes influenced by perceptions of product appeal, modernity, and social acceptability (Martínez et al., 2020). Evidence from college student research also indicates that students may recognize e-cigarettes but have less consistent understanding of their health risks and addictive potential (Romijnders et al., 2018). In Pakistan, a study of medical students in Sindh similarly found relatively high awareness of e-cigarettes, but actual use and perceptions varied according to tobacco-related behaviours (Syed et al., 2018). The relatively lower awareness of cardiovascular and long-term consequences in the present findings is important because scientific evidence indicates that e-cigarette exposure can affect several physiological systems. Reviews have identified potential respiratory, cardiovascular, neurological, and toxicological concerns, while emphasizing that the full long-term consequences remain under investigation (Gotts et al., 2019; National Academies of Sciences, Engineering, and Medicine [NASEM], 2018). Thus, the findings support the study objective concerning health-risk awareness and indicate the importance of moving beyond simple recognition of vaping toward more detailed understanding of its possible consequences.

Vaping Practices and Patterns

Table 2 presents the vaping practices of the 130 female university students included in the study. The findings indicate that 39 respondents (30.0%) had never used vaping products, while 24 (18.5%) had tried vaping but were not currently using these products. Furthermore, 34 respondents (26.2%) reported occasional vaping, whereas 33 (25.4%) reported frequent use. Collectively, 91 respondents (70.0%) had some experience with vaping, including previous and current use. Among these 91 respondents, curiosity was the most frequently reported reason for vaping, accounting for 29 respondents (31.9%), followed by peer influence among 25 (27.5%) and stress among 22 (24.2%). Flavours, perceptions of vaping as less harmful, and social media were also identified as contributing factors. These findings suggest that vaping practices among the respondents may be associated with a combination of personal curiosity, social influences, and individual perceptions. The presence of both occasional and frequent users further highlights the variation in vaping behaviour among female university students. These patterns are consistent with the wider literature, which identifies multiple motivations for e-cigarette use among young adults, including curiosity, social influences, product characteristics, perceived

benefits, and smoking-related motivations (Gendall et al., 2020). Similarly, a systematic review of adults aged 18 to 30 identified flavours and sociocultural factors as important influences on vaping initiation and continued use (Muller et al., 2025). Overall, the findings highlight the importance of understanding the social and individual factors associated with vaping when developing university-based awareness and prevention initiatives. The role of curiosity in the present findings is particularly relevant to university students because the transition into higher education can increase exposure to new social environments, products, and peer behaviours. Research among college students has found that friends' use and curiosity can be important reasons for initiating vaping (Leavens et al., 2019). Therefore, the present findings support the objective concerning vaping practices by demonstrating that experimentation and continued use may occur within a broader social and behavioural environment.

Reported Physical Effects of Vaping

Table 3 presents the physical effects reported by respondents. Dry or irritated throat was the most frequently reported symptom, affecting 62 students (47.7%), followed by cough in 54 (41.5%), headache in 48 (36.9%), shortness of breath in 39 (30.0%), oral irritation in 35 (26.9%), sleep disturbance in 36 (27.7%), palpitations in 31 (23.8%), and chest discomfort in 28 (21.5%). The relatively high reporting of throat irritation and cough is consistent with evidence that vaping aerosols can affect the respiratory tract. Gotts et al. (2019) reviewed evidence concerning respiratory effects and identified biological mechanisms through which e-cigarette aerosol constituents may affect airway and pulmonary function. Longitudinal research among young adults has also reported associations between e-cigarette use and the subsequent development of respiratory symptoms, including wheezing (Xie et al., 2022). Similarly, a large study of adolescents and young adults found that more frequent e-cigarette use was associated with bronchitic symptoms and shortness of breath (McConnell et al., 2021). The oral symptoms observed in Table 3 also have relevance. Systematic reviews have reported possible associations between e-cigarette use and changes in oral tissues, periodontal health, oral microbiota, and other oral outcomes, although the certainty and quality of evidence vary across studies (Yang et al., 2020; Alwafi & Abuljadayel, 2025). The reported symptoms in this study should therefore be interpreted as self-reported experiences rather than clinically confirmed effects. Because the present study is based on cross-sectional data, the findings cannot establish that vaping caused these symptoms. Nevertheless, their presence supports the study objective of examining perceived or reported health effects among female university students.

Knowledge of Harmful Substances and Perceptions of Risk

Table 4 demonstrates relatively high recognition of nicotine and general harmfulness. A total of 109 respondents (83.8%) identified nicotine as a component of vaping products, while 91 (70.0%) recognized the presence of harmful chemicals. However, recognition of heavy metals and potentially harmful flavouring chemicals was lower, at 57 (43.8%) and 61 (46.9%), respectively. Importantly, 112 respondents (86.2%) recognized nicotine as addictive, and 105 (80.8%) considered vaping harmful overall.

These findings suggest an important distinction between general risk awareness and detailed knowledge of product composition. Students may understand that vaping is not completely harmless without knowing the range of substances that may be present in aerosols. Research has identified nicotine, particulate matter, carbonyl compounds, metals, flavouring chemicals, and other substances as relevant components or contaminants of e-cigarette aerosols (NASEM, 2018; Gotts et al., 2019). WHO has likewise emphasized that e-cigarette aerosols can contain nicotine and other toxic substances and that some products marketed as nicotine-free may still contain nicotine (World Health Organization [WHO], 2024). The high recognition of nicotine addiction in the present findings is particularly relevant because nicotine dependence can influence continued use. The literature indicates that nicotine exposure is important in understanding dependence among young people and young adults, while the developing brain may be particularly vulnerable to nicotine exposure (U.S. Department of Health and Human Services, 2016). Therefore, the findings linked to the third study objective indicate that basic awareness of nicotine and harmfulness may be relatively strong, whereas knowledge of specific chemical exposures requires further attention.

Social and Behavioural Factors Associated with Vaping

Table 5 highlights the role of social and behavioural factors. Peer influence was reported at low, moderate, and high levels by 42 (32.3%), 48 (36.9%), and 40 (30.8%) respondents, respectively. Social media showed a similar pattern, while curiosity was reported at a high level by 49 (37.7%) respondents. Stress, flavour and appearance, and social acceptability were also identified as relevant factors. The findings are consistent with research emphasizing the social context of vaping among university students. Leavens et al. (2019) found that friends' vaping was among the leading reasons reported by college students for JUUL use. Similarly, research using a reasoned action framework found that social norms were associated with college students' intentions to use e-cigarettes (Mantey et al., 2019). Earlier research also demonstrated that college students could overestimate peer tobacco use and perceive emerging tobacco products as relatively socially acceptable (Berg et al., 2015). Social media may further reinforce these perceptions. A systematic review and meta-analysis found that exposure to tobacco-related content on social media was associated with lower risk perceptions and increased use-related outcomes among young people, while exposure to e-cigarette content was also associated with use, although the pooled evidence was less conclusive (Rutherford et al., 2023). Other reviews have documented promotional themes involving flavours, youth-oriented imagery, influencers, lifestyle, independence, and positive representations of vaping (McCausland et al., 2022). The importance of social and behavioural factors is therefore relevant to the social environment of university students. Prevention efforts that focus only on individual knowledge may not fully address social norms, peer behaviour, curiosity, product appeal, and digital exposure. The findings in Table 5 consequently complement the hypothesis-testing results by providing descriptive evidence about the broader context in which vaping behaviour may occur.

Long-Term and Reproductive Health Awareness

Table 6 shows that 96 respondents (73.8%) reported awareness of long-term consequences, while 71 (54.6%) expressed awareness of reproductive health concerns and 89 (68.5%) recognized that nicotine exposure during pregnancy may be harmful. A particularly high proportion, 113 respondents (86.9%), supported university awareness programmes, while 108 (83.1%) supported counselling or cessation-related support. The relatively lower awareness of reproductive health issues compared with general long-term health risks is noteworthy in a study focused specifically on female university students. Reproductive health is an important dimension because many students are within the reproductive age group, even when pregnancy is not an immediate concern. Evidence concerning vaping during pregnancy has increasingly reported potential adverse maternal and neonatal outcomes, although the magnitude of risk and the independent effects of vaping remain subjects of continuing research (Moir et al., 2024; Vallée et al., 2025). Recent systematic evidence has also raised concerns about possible effects on female reproductive function, while emphasizing that clinical evidence remains limited and that much of the available evidence comes from experimental studies (2026). The relatively strong support for university awareness programmes and counselling in Table 6 is consistent with the preventive dimension of the study. Health education may be particularly valuable when awareness of general harm exists but detailed knowledge of specific risks is less developed. The findings therefore support the objective concerned with long-term and reproductive health awareness and indicate that respondents recognized a role for educational and supportive interventions within the university environment.

Hypothesis Testing and Interpretation of H_1

The first hypothesis proposed that greater social and peer influence would be associated with greater vaping involvement. Table 1 shows a statistically significant association between social/peer influence and vaping involvement, $X^2(4) = 22.734$, $p = .000143$. Since the p-value is below the predetermined significance level of .05, the null hypothesis of no association is rejected for this dataset and H_1 is supported. The cross-tabulation provides a meaningful pattern behind the statistical result. Among respondents with low social/peer influence, 27 were in the low vaping-involvement category, compared with only 7 in the high-involvement category. In contrast, among those with high social/peer influence, 16 respondents were classified as having high vaping involvement, while only 4 were in the low-involvement category. This distribution indicates that higher levels of social and peer influence were accompanied by greater representation in the higher vaping-involvement category. This finding corresponds with previous research showing that peer norms and social networks are relevant to e-cigarette attitudes and behaviours among university students. Leavens et al. (2019) identified friends' vaping as an important reason for use among college students, while Mantey et al. (2019) found that social norms were associated with intention to use e-cigarettes. More recent research has continued to identify friends as an important social influence on e-cigarette attitudes and use among college and university students (2025). The present finding therefore provides a statistically significant pattern that is consistent with the broader literature, although it should not be interpreted as evidence of causation because the current dataset is cross-sectional.

Integration of Findings with the Study Objectives

Taken together, the six tables provide evidence for the major dimensions identified in the study objectives. First, the findings show that respondents had relatively good general awareness of vaping and nicotine but less consistent knowledge of specific cardiovascular, respiratory, chemical, and long-term risks. Second, vaping practices varied considerably, with curiosity, peer influence, stress, flavours, perceived lower harm, and social media appearing among the reported reasons for use. Third, physical symptoms such as throat irritation and cough were commonly reported, although these self-reported findings cannot establish causality. Fourth, respondents demonstrated stronger recognition of nicotine and general harmfulness than of specific substances such as heavy metals and flavouring chemicals. Fifth, social and behavioural factors appeared to form an important context around vaping. Finally, awareness of long-term and reproductive health risks was present but not uniform, while support for university awareness programmes and counselling was comparatively high. The hypothesis tests strengthen this descriptive interpretation. H1 showed a statistically significant association between social/peer influence and vaping involvement, while H2 showed a statistically significant association between health-risk awareness and preventive attitudes. These two relationships correspond closely with the conceptual focus of the study: vaping is situated within a social environment, while awareness may be related to preventive attitudes. Nevertheless, neither finding should be interpreted as proof of a causal pathway.

Implications of the Findings

The findings have implications for university-based health education and social work practice. The results suggest that prevention programmes should not focus exclusively on providing general information. They may also need to address peer norms, social acceptability, curiosity, social media exposure, perceived benefits, and misconceptions about product safety. Evidence from college student research supports the relevance of social norms and peer environments in shaping vaping-related attitudes and intentions (Berg et al., 2016; Mantey et al., 2019). The relatively high support for university awareness programmes and counselling in Table 6 further indicates that respondents recognized the value of institutional support. Universities may therefore consider combining educational sessions with counselling, peer-led awareness activities, screening, referral mechanisms, and health communication. For social work, this provides an opportunity to address vaping through preventive education, individual counselling, peer support, family and community engagement, and advocacy for healthier campus environments. The findings suggest that vaping among female university students should be understood as a multidimensional issue involving knowledge, personal experiences, social influence, behavioural motivations, perceived health risks, and preventive attitudes. The statistically significant results for H1 and H2 indicate that social/peer influence was associated with vaping involvement and health-risk awareness was associated with preventive attitudes in the dataset. These findings are broadly compatible with existing literature on social norms, risk perceptions, health knowledge, and vaping among young adults. At the same time, the interpretation should remain appropriately cautious. The dataset consists of 130 respondents and was developed for demonstrating statistical analysis. Consequently,

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the percentages, chi-square values, and relationships reported here do not constitute empirical evidence about all female university students. Future empirical research using probability or well-justified sampling, validated measurement instruments, and larger samples could provide stronger evidence regarding the prevalence, determinants, and health-related consequences of vaping among female university students.

Conclusion

The present study aimed to examine vaping among female university students by assessing their health-risk awareness, vaping practices, reported health effects, knowledge of harmful substances, social and behavioural influences, and awareness of long-term and reproductive health concerns. Overall, the findings suggest that vaping represents a multifaceted concern within the university setting, where individual knowledge and experiences interact with social influences and perceptions of risk. Although respondents generally recognized nicotine addiction and the harmful nature of vaping, variation in knowledge concerning specific health, chemical, and reproductive risks indicates that general awareness does not necessarily reflect comprehensive understanding.

The findings also demonstrate that vaping behaviour occurs within a broader social and behavioural context. Curiosity, peer influence, stress, product characteristics, perceived harm, and social media were among the factors reported by respondents, while several physical symptoms were also reported among those with vaping experience. These findings provide a broader understanding of vaping beyond simple patterns of use and highlight the relevance of both personal and environmental factors when considering prevention among university students.

The statistical analysis further identified significant associations between social and peer influence and vaping involvement, and between health-risk awareness and preventive attitudes. These results support the study hypotheses within the analysed dataset and indicate that both the social environment and level of health awareness are relevant dimensions of the issue. However, the observed relationships should be understood as associations rather than evidence of causation.

In conclusion, the study highlights the need for a comprehensive response to vaping within university environments, combining accurate health education with counselling, social support, peer-based prevention, and reproductive health awareness. Such an approach can address not only students' knowledge but also the social and behavioural circumstances surrounding vaping. As the study was based on sample of 130 respondents, its findings are illustrative and should be validated through empirical research involving actual university students, larger samples, validated measures, and appropriate longitudinal designs.

Recommendations

Strengthen university awareness programmes focusing on vaping risks, nicotine addiction, and less understood long-term and reproductive health consequences.

Establish accessible counselling services to support students who vape and provide guidance for prevention and cessation.

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Develop peer-based interventions to address peer influence, social acceptance, curiosity, and misconceptions surrounding vaping.

Use evidence-based social media campaigns to counter misleading information and promote accurate health messages among university students.

Promote further empirical research using larger samples, validated instruments, and longitudinal designs to examine vaping behaviour and related health outcomes.

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