

RESEARCH ARTICLE

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Enhancing Testicular Cancer Prevention Among University Students: A Health Belief Model and Social Support Intervention

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Abstract

Background and objective: Testicular cancer poses a significant health concern for young adults, particularly university students, who often lack tailored interventions. Drawing on the Health Belief Model and a social support strategy, this study implemented an innovative educational program to empower male university students with knowledge and promote proactive engagement in testicular cancer self-examination practices. **Material and method:** A quasi-experimental research design was utilized in this study. The study participants consisted of 350 male individuals aged 18-25, corresponding to the final academic year (fourth year). The educational intervention for the post-test phase group consisted of seven 50 to 60-minute training and education sessions designed to enhance knowledge and promote preventive behaviors related to testicular cancer. Various statistical tests, such as Chi-square tests, independent t-tests, Mann-Whitney tests, and Repeated Measurement ANOVA, were systematically employed to unravel meaningful insights and determine the statistical significance of observed trends. **Results:** The findings showed significant improvements post-intervention in knowledge, perceived susceptibility, severity, benefits, self-efficacy, cues to action, social support, and testicular self-examination performance. **Conclusion:** The study underscores the effectiveness of the intervention in promoting preventive behaviours against testicular cancer among university students, laying the groundwork for future educational initiatives.

Keywords: Health Belief Model- social support strategy- testicular cancer- university students

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Introduction

Testicular cancer (TC) is the most common cancer in men, particularly affecting individuals aged 15 to 34 years, with a growing incidence [1]. It is estimated that one in 500 men will develop TC before the age of 50, and nearly a quarter will die from the disease [2]. The prevalence of TC has been on the rise in various countries, such as Canada, the United States, Nordic countries, and England, since the mid-20th century, with the exception of children under 14 years old, who show less variation over time [3].

Between 1994 and 2013, the Saudi Cancer Registry (SCR) recorded 1004 cases of TC in adult Saudis, indicating a consistent and significant increase in incidence, reaching an annual rate of 94 cases by 2013. Unfortunately, research on the survival outcomes of TC in Saudi Arabia has been limited [4]. There has been a notable rise in TC incidence among Saudi adults, accompanied by a 5.4% mortality rate over a decade. Longer survival rates have been associated with specific age groups, seminomatous germ cell tumors, and lower tumor stages.

Around 30 to 40% of TC patients report experiencing vague pain and heaviness in the lower abdomen, scrotum,

or perineum [5]. Approximately one-tenth of patients exhibit significant symptoms related to TC [6]. Clinical signs of TC, influenced by the metastatic stage of the disease and its impact on surrounding tissues, become apparent in around one-tenth of patients [7].

Despite advancements in therapy, TC remains a significant cause of cancer-related mortality in young men aged 18 to 50 [8]. Treatment options, such as surgery, radiation, and chemotherapy, either alone or in combination, have achieved a cure rate exceeding 90% for TC patients [9]. The stage of cancer at the time of diagnosis is a crucial factor influencing TC outcomes, as emphasized by Zhang et al. [10].

Unfortunately, many men tend to delay seeking medical help due to lack of awareness or dismissing secondary symptoms, such as injury, nodal issues, feeling unwell, discomfort, and heaviness in the scrotum [11]. This delay often results in a delayed initial diagnosis [12], leading to 50 to 88% of affected men progressing to the metastatic stage with severe adverse effects and a high mortality rate [13].

Regular testicular examination, whether self-conducted or by a healthcare professional, can aid in the

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early detection of TC before symptoms become apparent. Historically, medical professionals have encouraged adult males to familiarize themselves with and perform testicular self-examination (TSE) [14]. During TSE, the testicle is gently held between the thumb, index, and middle fingers. Any observed abnormalities, such as hardness, a lump, or painless swelling, should be carefully noted and monitored [12]. It is recommended to conduct TSE regularly, ideally once a month, for effective monitoring and early detection [15].

Effective implementation of preventive measures relies on raising public awareness, understanding symptoms and risk factors, and regular self-examination of the testes [16]. Emphasizing the simplicity and cost-effectiveness of TSE, the American Cancer Society advocates for its inclusion as a fundamental aspect of routine cancer prevention. This recommendation is based on the importance of increasing awareness about TC among all men post-puberty [17].

University students are a pivotal demographic for research, given their future roles as healthcare professionals responsible for promoting preventive health habits and educating patients on self-evaluations [18]. Studies by Ahmed et al. [19] and El Mezayen and AbdEl-Hay [20] have highlighted a lack of understanding and awareness of TC and testicular TSE among university students. In response, essential health education programs aimed at promoting TSE behavior among nursing students emphasize education and knowledge enhancement [21]. The efficacy of such programs hinges on the selected health education model, with the Health Belief Model (HBM) standing out as particularly valuable. The HBM, a prominent theoretical framework in health behavior research, offers insights into and predicts individuals' health-related behaviors [22, 21, 23]. According to the HBM, individuals are more likely to adopt specific health behaviors, such as TSE, if they believe that doing so will reduce their risk of developing a condition and if the perceived benefits outweigh the costs, discomfort, and barriers. Studies on TC suggest that the HBM is a suitable framework for examining awareness and behaviors among young men [22, 20, 21, 23].

Social support encompasses the assistance provided by others to an individual, contributing to their sense of value, respect, likability, and belonging to a social group with associated responsibilities and bonds. Analyzing the behaviors of professionals, family members, and friends allows for a comprehensive exploration of how various sources can offer social support [24]. To date, no published study has investigated the impact of a health education program integrating both the HBM and the concept of social support for university students regarding TC and TSE in Saudi Arabia. Therefore, this study aimed to assess the effects of TC health education programs on the knowledge and behaviors of male university students.

Materials and Methods

A quasi-experimental research design was utilized in this study, incorporating both pre- and post-test phases to evaluate the impact of a health education program on TC awareness and behaviors among male university students.

The research was conducted within the dormitories of Prince Sattam Bin Abdulaziz University in Alkharj, Saudi Arabia, spanning from May to September 2023. This specific location was selected to provide a realistic depiction of the target population—male university students. Prince Salman Bin Abdulaziz University, located in Al-Kharj, offers a diverse array of academic programs, rendering it a conducive environment for examining the effects of health education across various disciplines.

The study participants consisted of 350 male individuals aged 18-25, corresponding to the final academic year (fourth year). Inclusion criteria were meticulously outlined, necessitating that participants be male students residing in university dormitories, aged between 18 and 25, and devoid of any prior history of testicular cancer. The sample size determination employed Yamane's simplified sampling procedure, initially estimating 320 participants and ultimately gathering 350 responses, showcasing the precision and flexibility inherent in the quasi-experimental methodology. To enhance the internal validity of the quasi-experimental study, the sample selection process involved a proportionate stratified random approach from each dormitory, ensuring a comprehensive representation of the diverse student population.

Data Collection Tools

The data collection instruments utilized in this study comprised questionnaires that were developed and validated by Akar and Bebis [25], McClenahan et al. [26], and Avcı and Altinel [22]. The questionnaire consisted of five distinct sections and was administered anonymously to safeguard participant confidentiality. The initial section included six questions focusing on personal characteristics such as age, marital status, smoking habits, TSE practices, and family history of testicular cancer.

The subsequent segment of the research centered on assessing knowledge levels, employing a structured scoring system to quantify participants' comprehension. This section featured ten questions, each utilizing a binary scoring method. A correct response ("yes") was allocated one point, while an incorrect or uncertain response ("no" or "no idea") received zero points. This scoring approach offered a clear and objective means of evaluating participants' knowledge on various aspects related to testicular cancer. Additionally, by including a question on the sources of information accessed by respondents, the study delved deeper into understanding the informational channels influencing participants' awareness. Through this precise scoring system, the research not only gauged the depth of participants' knowledge but also enabled a nuanced analysis of the sources shaping their understanding of testicular cancer, providing a comprehensive perspective on the factors influencing knowledge acquisition within the target population.

The third section of the questionnaire meticulously examined participants' perceptions through the constructs of the HBM. This segment featured a detailed scoring system tailored to each construct. For example, perceived vulnerability, consisting of 5 questions, was scored on a scale of 5 to 25, while perceived severity, with 10

questions, had a scoring range of 10 to 50. Similarly, perceived benefits (6 to 30), perceived barriers (9 to 45), cues to action (5 to 25), and motivation (6 to 30) each had specific scoring ranges. This meticulous scoring method allowed for a thorough evaluation of participants' responses and facilitated an in-depth analysis of their perceptions across different dimensions of the HBM.

Continuing with methodological precision, the fourth part of the questionnaire evaluated social support constructs through five questions, each rated on a five-point Likert scale. Participants could indicate their level of agreement or disagreement on a scale from "completely agree" (score of 5) to "completely disagree" (score of 1). These precise scores provided a quantitative measure of participants' perceptions of social support, enabling researchers to discern subtle nuances in their attitudes. The incorporation of detailed and customized scoring systems throughout the questionnaire enhances the study's ability to derive nuanced insights into participants' health beliefs, social support, and related constructs, contributing to a comprehensive understanding of the factors influencing their behaviors and decisions.

The fifth and final section of the questionnaire focused on testicular self-examination, utilizing a concise "yes or no" format. This section included five key questions prompting participants to self-report their engagement in testicular self-examination practices. For instance, participants were asked, "Do you perform testicular self-examination at least once a month?" The scoring system for this section was straightforward, ranging from 0 to 5 based on the number of affirmative responses. Presenting all results as percentages added clarity to the findings, offering a comprehensive overview of participants' knowledge, beliefs, and behaviors related to TC and self-examination. By concluding with this targeted assessment, the study not only assessed participants' self-reported practices but also provided a practical and easily interpretable metric to summarize the prevalence of positive behaviors, contributing to a holistic understanding of the impact of the educational intervention on participants' actions and awareness.

Content validity and reliability

After undergoing a comprehensive validation process that included exploratory factor analysis, quantitative validity criteria, and assessments of face and content validity, the questionnaire was refined and finalized for the main study. The face validity evaluation conducted with an initial group of 35 university students, along with input from specialists in urology, cancer, and health promotion, significantly contributed to enhancing the instrument's appropriateness and relevance.

The exclusion of the pilot group of 35 students from subsequent phases of the study ensured that the questionnaire's effectiveness was independently assessed in the main sample, mitigating potential biases or familiarity effects. The rigorous validation process instilled confidence in the questionnaire's ability to accurately measure constructs related to TC awareness and behaviors among male university students, paving the way for the successful implementation of the educational

intervention and subsequent data collection.

The research tool utilized in this study underwent a rigorous reliability assessment, employing Cronbach's alpha calculation to determine its internal consistency. The resulting overall reliability coefficient of 0.89 indicates a high level of reliability in measuring the intended constructs. Moreover, specific reliability coefficients were computed for various constructs within the questionnaire, demonstrating consistently high internal consistency across all domains. Particularly notable are the reliability coefficients for individual constructs such as perceived susceptibility (0.85), perceived severity (0.82), perceived benefits (0.80), perceived barriers (0.86), cues to action (0.85), self-efficacy (0.88), and social support (0.85). These values collectively suggest that the research tool reliably captures targeted aspects of participants' attitudes and beliefs.

In addition to the reliability assessment, the study incorporated a robust evaluation of the impact of an educational intervention. Both pre-test and post-test groups participated in the study, completing the questionnaire before and three months after the intervention. This longitudinal approach involving participants throughout the research process enhances the study's capacity to observe changes in knowledge, beliefs, and behaviors concerning TC and self-examination over time. By utilizing a pre-test and post-test design, researchers gain a comprehensive understanding of the effectiveness of the educational intervention, enabling them to identify significant alterations in participants' perspectives and behaviors following the intervention period. The combination of a reliable research tool and a well-structured longitudinal evaluation approach positions this study as a robust contribution to enhancing awareness and practices related to testicular cancer.

Procedure

The educational intervention for the post-test phase group consisted of seven 50 to 60-minute training and education sessions designed to enhance knowledge and promote preventive behaviors related to testicular cancer. The sessions utilized various educational methods, including group discussions, lectures, instructional posters, question-and-answer sessions, film screenings, and PowerPoint presentations. The program was developed collaboratively by an oncologist specializing in health education and health promotion and five public health professionals.

The training sessions covered different aspects of TC awareness and prevention. The first session provided an overview of testicular cancer, symptoms, consequences, and diagnosis, focusing on perceived susceptibility, severity, and cues to action. The second session explored the prevalence, risk factors, and causes of testicular cancer, emphasizing reported susceptibility and severity. In the third session, a 50-year-old man with TC shared insights into the disease, its risk factors, symptoms, and side effects, emphasizing perceived susceptibility, severity, and cues to action. The fourth session focused on TSE and preventive measures, addressing perceived benefits and barriers. The fifth session emphasized self-efficacy

in applying preventive behaviors for testicular cancer. The sixth session highlighted the importance of social support in facilitating TSE performance, involving family members and health professionals. The seventh session focused on group discussions, peer influence, and a review of prior sessions, providing educational leaflets to participants covering all constructs.

These educational sessions were conducted weekly for 10 groups of 35 students in the university hostel, totaling 350 students during the post-test period. Participants received a manual after the sessions, and a WhatsApp group was established for ongoing information sharing. To maintain engagement, the post-test phase group received weekly text messages on TC to promote sustained focus on preventive behaviors and knowledge retention.

Ethical Considerations

Stringent ethical considerations were meticulously addressed throughout this research endeavor. Participants were provided with a comprehensive briefing on the study’s significance, the importance of their participation, and the overarching goals of the project. Prior to their involvement, written consent was diligently obtained from each participant, emphasizing the voluntary nature of their participation. The study received formal approval from the Standing Committee of Bioethics Research (SCBR) at Prince Sattam Bin Abdulaziz University, with the assigned approval number (SCBR-148/2023) confirming its ethical clearance. To protect the privacy and confidentiality of participants, a solemn commitment was made to handle their information with the utmost discretion.

A key ethical consideration was the inclusion of every participant, spanning both pre-test and post-test groups, throughout the entire research duration. This unwavering commitment to inclusivity not only enhances the study’s reliability but also ensures that the findings accurately represent the entire participant cohort. The ethical considerations, including informed consent, institutional approval, and privacy assurances, highlight the research’s dedication to upholding ethical standards from inception to conclusion, reinforcing the credibility and integrity of the study.

Statistical Analysis

The extensive dataset collected for this research underwent a rigorous and sophisticated statistical analysis using the Statistical Package for the Social Sciences (SPSS) version 26. Various statistical tests, such as Chi-square tests, independent t-tests, Mann-Whitney tests, and Repeated Measurement ANOVA, were systematically employed to unravel meaningful insights and determine the statistical significance of observed trends. A stringent significance threshold of 0.05 was adhered to, ensuring a high standard of statistical scrutiny.

Results

Table 1 presents a detailed overview of the personal characteristics of the study participants. The age distribution reveals that 55.7% of individuals are under 20 years old, while 44.3% are aged 20 and above. The

age range spans from 18 to 25 years, with a mean age of 20.8±13.5 and a median of 22.0. The majority of participants are unmarried (92.8%), reflecting the focus on university students. Regarding academic performance, 24% scored below 2.5 GPA, 48% fell within the range of 2.5 – 3.74, and 28% achieved a GPA of 3.75 or higher. In terms of TSE performance, 20% reported engaging in TSE, while 80% did not. Smoking habits were reported by 52.8% of participants, and a family history of TC was identified in 8.3% of cases. These detailed personal characteristics provide valuable insights into the study population and lay the foundation for interpreting the intervention results.

Majority obtained their information from social media (58%). Other source were TV/Radio (20%), Health Campagin (9%), Family and frind (6%), and Health care providers (7%).

The comprehensive analysis presented in Table 2 compares mean scores before and after the educational intervention among 350 male university students, highlighting the positive impact of the health education program. Significant improvements in knowledge, perceived susceptibility, severity, benefits, barriers, self-efficacy, motivation, and cues to action were observed post-intervention. The increase in knowledge, supported by t-Test and P-values (pre: 12.61±2.35, post: 15.01±1.56, t-Test: 70.21, P ≤ 0.001), underscores the program’s effectiveness in enhancing participants’ understanding of testicular cancer. Additionally, reductions in perceived

Table 1. Distribution of Studied Sample According to Personal Characteristics (n=350)

Personal Characteristics	n	%
Age		
<20	195	55.7
20+	155	44.3
Range	18-25	
Mean± SD	20.8±13.5	
Median	22	
Marital Status		
Married	25	7.2
Unmarried	325	92.8
Last GPA (out of 5):		
<2.5	84	24
2.5 – 3.74	168	48
≥ 3.75	98	28
TSE Performance		
Yes	75	20
No	275	80
Smoking habits		
Yes	185	52.8
No	165	47.2
Family history of TC		
Yes	29	8.3
No	321	91.7

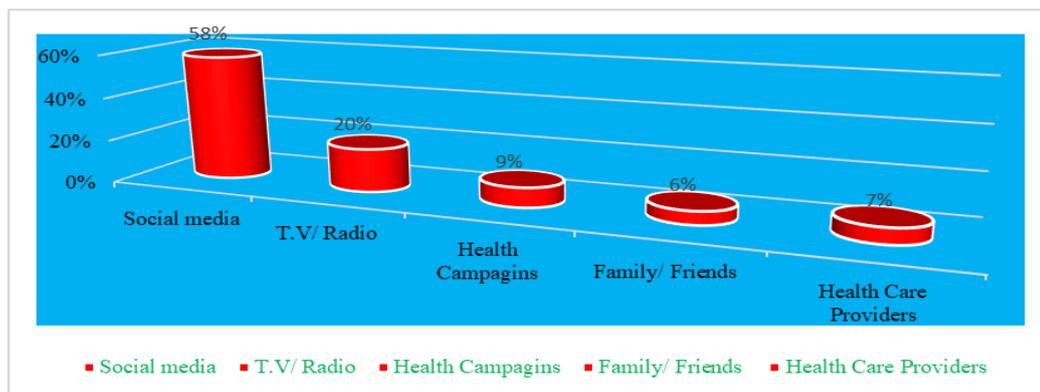


Figure 1. Sources of Information about Testicular Cancer and Testicular-Self-Examination.

Table 2. Comparison of the Knowledge and Health Belief Model Dimensions' Mean Scores before and Following the Educational Intervention (n=350).

Parameter	Pre Mean and SD	Post Mean and SD	t-Test	P-value
knowledge	12.61±2.35	15.01±1.56	70.21	≤0.001
Perceived susceptibility	21.17±2.66	29.34±2.13	46.13	≤0.001
Perceived severity	18.30±2.16	21.87±2.64	107.19	≤0.001
Perceived benefits	20.51±2.16	26.14±2.10	32.89	≤0.001
Perceived barriers	12.34±2.74	9.21±2.14	85.54	≤0.001
Perceived self-efficacy	9.85±1.04	10.06±1.21	117.56	≤0.001
Perceived motivation	18.29 ± 4.52	31.90 ± 4.68	73.97	≤0.001
Cues to action	26.18 ± 4.24	62.46 ± 4.51	56.47	≤0.001

barriers (pre: 12.34±2.74, post: 9.21±2.14, t-Test: 85.54, $P \leq 0.001$) and increases in perceived benefits (pre: 20.51±2.16, post: 26.14±2.10, t-Test: 32.89, $P \leq 0.001$), self-efficacy (pre: 9.85±1.04, post: 10.06±1.21, t-Test: 117.56, $P \leq 0.001$), and motivation (pre: 18.29 ± 4.52, post: 31.90 ± 4.68, t-Test: 73.97, $P \leq 0.001$) highlight a positive shift in attitudes towards TSE and preventive behaviors. These statistically significant findings underscore the success of the quasi-experimental study in positively influencing participants' knowledge and health beliefs, emphasizing the importance of tailored health education interventions in promoting preventive behaviors related to testicular cancer.

Table 3 presents a comprehensive analysis of the mean scores related to TSE performance and perceived social support before and after the intervention among the 350 male university students. The results highlight the significant positive impact of the health education program not only on participants' knowledge and health beliefs, as demonstrated in Table 2, but also on their practical application of TSE and perceived social support. The substantial improvement in mean scores for both perceived social support (pre: 13.54 ± 3.21, post: 22.20 ± 3.12,

t-Test: 70.21, $P \leq 0.001$) and TSE performance (pre: 3.25 ± 1.32, post: 8.25 ± 1.75, t-Test: 46.13, $P \leq 0.001$) indicates a positive shift in participants' behavior and their perceived support from social networks. These results not only validate the intervention's effectiveness in enhancing theoretical knowledge and health beliefs but also underscore its tangible impact on the adoption of preventive behaviors, specifically testicular self-examination. The findings support the inclusion of social support constructs in health education programs to promote positive behavioral changes among university students, highlighting the comprehensive success of the quasi-experimental study in influencing both cognitive and practical aspects of TC prevention.

Table 4 outlines the results of the multiple linear regression model designed to identify the most predictive factors for HBM and social support construct scores among the 350 male university students. The model incorporates intervention, education level, and a constant term. The intervention, representing the combined impact of the health education program integrating HBM and SSC, exhibits a significant positive effect on the combined HBM and SSC scores (Unstandardized Coefficient =

Table 3. Comparison of the Mean TSE Performance Scores before and after the Intervention with the Social Support Construct Scores (n=350).

Parameter	Pre Mean and SD	Post Mean and SD	t-Test	P Value
Perceived social support	13.54±3.21	22.20±3.12	70.21	≤0.001
TSE performance	3.25±1.32	8.25±1.75	46.13	≤0.001

Table 4. Best Fitting Multiple Linear Regression Model for the Health Belief Model and Social Support Construct Score (n=350)

Variables	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Constant	60.05	3.46		17.34	<0.001	53.2	66.9
Intervention (HBM and SSC)	8.71	2.18	0.32	3.991	<0.001	4.4	13.03
Education	-9.16	4.7	-0.16	-1.947	0.054	-18.46	0.14

HBM, Health Belief Model; SSC, Social Support Construct; r-square, 0.77; Model ANOVA: F, 9.86, p<0.001

8.71, Standardized Coefficient = 0.32, t-test = 3.991, p-value < 0.001). This highlights that participation in the educational intervention resulted in a substantial increase in overall scores related to HBM and social support construct, underscoring the program's efficacy in positively influencing participants' perceptions and support systems.

Furthermore, the variable for education level shows a negative impact on the combined scores, although it does not reach statistical significance at the conventional 0.05 level (Unstandardized Coefficient = -9.16, Standardized Coefficient = -0.16, t-test = -1.947, p-value = 0.054). The R-square value of 0.77 indicates that the model accounts for a substantial portion of the variance in the combined HBM and SSC scores. The overall significance of the model, as demonstrated by the ANOVA result (F = 9.86, p < 0.001), reinforces its ability to predict the combined scores based on the selected variables. These results emphasize the pivotal role of the intervention in shaping participants' perceptions and support systems concerning TC prevention, supported by the robust statistical outcomes in the regression analysis (Figure 1).

Discussion

Educating young males about TC poses significant challenges due to the limited data on their knowledge levels. Previous studies [26-28, 21] have explored TSE using the HBM and social support constructs, underlining the importance of addressing this issue for cancer prevention and early disease management.

This study aimed to assess the impact of an educational intervention based on HBM and social support on TSE behaviors among university students. The findings unveiled a significant enhancement in the participants' knowledge about TC and TSE from the pre-test to the post-test phase. The lower initial knowledge levels in the pre-test were attributed to the young age of the majority of university students, many of whom were under twenty. It's worth noting that a substantial number of respondents were from non-medical colleges, indicating a greater interest in scientific fields than healthcare. Moreover, the reliance on social media as the primary source of information for over half of the participants was observed, potentially exposing them to inaccurate or false information.

In conclusion, the quasi-experimental research design used in this study, with pre and post-test phases, revealed valuable insights about the effectiveness of an educational intervention based on HBM and social support

in enhancing TSE among male university students at Prince Sattam Bin Abdulaziz University in Saudi Arabia. Moreover, the study highlighted positive changes in HBM constructs, demonstrating a comprehensive shift in participants' attitudes towards TSE.

The impact of the intervention extended to social support, showcasing a notable improvement in scores and cues to action. Various educational methods, including lectures, discussions, films, and interactive sessions, played a crucial role in engaging participants and fostering a supportive environment. The results emphasized the success of the educational intervention and its broader implications for cancer prevention strategies. Furthermore, the study suggests the importance of multifaceted interventions that incorporate social dynamics to create lasting changes in behavior and attitudes towards preventive health practices, recognizing the pivotal role of social support in promoting health-related behaviors.

Implications of the study

This study offers recommendations for advancing TC prevention among university students. Educational institutions should integrate targeted health education programs into their curricula, utilizing various methods such as lectures, discussions, and interactive sessions, including digital platforms and social media. Furthermore, collaboration between healthcare providers and university health services is crucial to ensure that routine health check-ups for male students include discussions about testicular health and self-examination. Ongoing research is needed to assess the long-term sustainability and effectiveness of similar programs in diverse settings. Continuous monitoring and evaluation will provide insights for refining educational strategies and tailoring interventions to specific demographic groups, promoting a broader culture of health awareness and preventive care among young adults.

Limitations of the study

While this study offers valuable insights into the effectiveness of the educational intervention, it's important to acknowledge several limitations. The findings may not be universally applicable, as they are derived from a specific cultural and educational context in Saudi Arabia. The reliance on self-reported data for TSE performance introduces the possibility of response bias, and the lack of a control group limits the ability to establish a direct causal relationship. Additionally, the relatively short follow-up period does not allow for a comprehensive

assessment of the intervention's long-term impact. Future research should address these limitations to advance our understanding of effective strategies for promoting testicular health awareness among young adults.

Author Contribution Statement

All authors made substantial contributions to all of the following: A.I made conception and design of the study; acquisition of data; or analysis and interpretation of data; D.Z made the drafting the article, revising it critically for important intellectual content, A.I Wrote the paper and edition. All the authors revised and agreed publication

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Data Availability

The data collected during this study are available upon reasonable request.

Conflict of interest

None.

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