

ORIGINAL RESEARCH

KNOWLEDGE AND UPTAKE OF TOWARDS TETANUS TOXOID VACCINATION AMONG FEMALE STUDENTS AT HADHRAMOUT UNIVERSITY, YEMEN

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ABSTRACT

Background: Maternal and neonatal tetanus remains a significant public health challenge in Yemen. While vaccinating women of childbearing age is crucial for eliminating the disease, tetanus vaccination uptake remains low in Yemen. Therefore, this study aimed to assess the knowledge and uptake of tetanus toxoid vaccination among female students at Hadhramout University, Yemen.

Methodology: A descriptive cross-sectional study was conducted across seven faculties from January 1 to June 30, 2025. A multi-stage sampling method was used to select the students. Data were collected through structured interviews using a pre- tested questionnaire.

Results: The study enrolled 384 female students (mean age: 23.02 ± 1.5 years). Although 83.6% were aware of the vaccine and 63.8% had a moderate level of knowledge, actual uptake was low. Only 45.6% had received at least one dose, and only 10.4% had completed the recommended five-dose schedule. The primary barriers to vaccination were vaccine unavailability (39.2%), lack of awareness regarding its importance (25.4%), and fear of side effects (20.1%).

Conclusion: Despite moderate awareness, tetanus toxoid vaccination uptake among female university students is critically low. The high percentage of unvaccinated students highlights an urgent need for targeted education campaigns to address barriers and emphasize vaccine importance, aligning with World Health Organization recommendations for women of reproductive age.

Keywords: Knowledge, Utilization, Tetanus, Vaccination, Female Students, Yemen.

Introduction

Tetanus is an acute, non-contagious, fatal bacterial disease caused by toxins produced by the bacterium *Clostridium tetani*, which is found in many environments.¹ It affects the central nervous system, and despite being entirely preventable by vaccination using a toxoid vaccine, neonatal tetanus (NT) remains one of the leading causes of death worldwide, including Yemen.² Despite the availability of a highly effective vaccine, the World Health Organization (WHO) estimates that women die annually from tetanus, representing more than 5% of maternal deaths, and that 30,000 women contract tetanus annually.³ Maternal tetanus (MT) is defined as tetanus during pregnancy or within 6 weeks of the end of pregnancy, while neonatal tetanus (NT) affects newborns during their first month of life whose mothers have not been vaccinated against it.⁴

In 1989, the Forty-Second World Health Assembly called for the elimination of NT through the immunization of pregnant women and women of reproductive age (15–45 years) as a key strategy for preventing NT, along with promoting clean delivery practices and postpartum care.⁵⁻⁶ The vaccination schedule consists of five doses of tetanus toxoid vaccine administered over a specific period. Once completed, the vaccination is expected to provide lifelong protection for both mother and newborn.⁷

Despite the inclusion of tetanus toxoid vaccination in Yemen's Expanded Programme on Immunization (EPI) since 1977, and despite the availability of an effective and inexpensive tetanus vaccination, Yemen still lags far behind in vaccination coverage.⁸ The WHO estimates that as of June 2024, 10 countries had not achieved the goal of eliminating NT.⁹⁻¹⁰ Yemen is among the five remaining countries in the Eastern Mediterranean Region [EMR] that have not achieved the global elimination target set by the WHO.¹⁰ In 2018, more than 64% of all documented NT cases in the EMR occurred in Yemen. Yemen is also among 24 countries where neonatal NT is a public health threat.¹⁰⁻¹¹ Maternal vaccination coverage in Yemen, primarily focused on tetanus toxoid immunization for pregnant women and women of childbearing age, remains critically low and insufficient. Years of ongoing conflict have heavily fractured the health infrastructure, leaving Yemen as one of the few countries in the region yet to achieve the global elimination targets for maternal and neonatal.¹²

In Yemen, maternal and neonatal tetanus mortality remains a significant public health challenge. Awareness is a powerful tool for addressing health issues, as knowledge directly influences the uptake of vaccines and social health programs. In this context, university students can play a pivotal role in disseminating critical information regarding tetanus and the importance of immunization, particularly among women and girls of reproductive age. However, there is a profound lack of research evaluating tetanus vaccination among female university students in Yemen. Therefore, this study investigated the level of knowledge and vaccine uptake among female students at Hadhramaut University. To our knowledge, this is the first study of its kind conducted among female university students in the Hadhramaut Governorate and Yemen at large.

Materials and methods

This is a descriptive cross-sectional study conducted at Hadhramout University in Al-Mukalla city, the capital of Hadhramout Governorate, Yemen. The target population consisted of all Yemeni female students at Hadhramout University who were available during the study period from 1st /January/ to 30th /June/ 2025.

The sample size was determined using the formula for cross sectional¹³ study as shown below:

$N = Z^2pq/d^2$, where, N = sample size

Z = standard normal deviate at 95% CI (1.96),

p = proportion of the characteristic in the population (p = 50%) q = complimentary probability = 1 – p (1 – 0.5 = 0.5) d = maximum sample error allowed (level of precision) at 95% confidence limit 0.05 Therefore, the required sample size was 384 female students.

A multi-stage sampling method was used. In the first stage, to address the lower density of female students in certain disciplines and ensure an adequate sample size, a comprehensive census of female student enrollment for the 2024–2025 academic year was obtained from the Admissions and Registration Department. Consequently, a purposive sampling method was employed to select seven out of twelve colleges characterized by the highest female student enrollment. This approach guaranteed the statistical viability of the study's sample. The selected institutions included the Colleges of: Arts, Education, Women, Computing and Information Technology, Nursing, Law, and Administrative Sciences. In the second stage, one department was randomly selected from each of the seven colleges. From these selected departments, the final academic level was determined using purposive sampling (assuming that the female students had completed their vaccinations or received multiple doses of the tetanus vaccination during their undergraduate studies). In the third stage, the sample size (384) was proportionally distributed according to the proportion of female students in the selected departments within each college. Simple random sampling was applied to select students from each department in the selected colleges. In colleges where there were not enough female students at the selected academic level, the next academic level was selected to complete the student selection process for that college.

Data were collected through face-to-face interviews using a structured pre-tested questionnaire. The researchers developed the questionnaire after reviewing relevant recent literature and consulting with experts in the field. It included the following sections: The first section of the questionnaire contained questions about participants' sociodemographic characteristics (age, college name, department, marital status, and place of residence). The second section included

questions about participants' knowledge of the tetanus vaccination. The third section included questions about participants' uptake of tetanus vaccination (whether they had received it, the number of doses, and the reasons for not receiving or completing the vaccination course).

The questionnaires were initially designed in English, then translated into Arabic (the local language), and finally translated back into English to ensure their validity. Each interview lasted approximately 25 to 35 minutes. A pilot study of the questionnaire was conducted with 20 Yemeni female students from two colleges affiliated with Hadhramaut University, who were not included in the main study. The results of this pilot study were used solely to verify the validity and clarity of the questions, estimate the time required to complete the questionnaires, and identify potential difficulties and how to address them. Necessary adjustments were made based on the responses.

To assess internal consistency and reliability, Cronbach's alpha was utilized to examine the average correlation among knowledge items. The pre-test questionnaire yielded an alpha coefficient of 0.7 for the knowledge domain. The accuracy and completeness of the collected data were verified, then coded and entered into SPSS version 20.

Initially, descriptive statistics were used to display the frequencies and percentages of categorical variables. Quantitative variables were expressed as mean $\pm$ standard deviation. Knowledge scores were assessed using a scoring system as follows: one point was awarded for each correct answer, and zero points for an incorrect or unknown answer. The overall knowledge score ranged from 0 to 10 and was categorized as follows: High knowledge: $>$ mean + standard deviation; Moderate knowledge: from mean - standard deviation to mean + standard deviation; Low knowledge: $<$ mean - standard deviation.

Ethical Approval:

Ethical approval for the study protocol and questionnaire was obtained from the Research and Ethics Review Committee at Hadhramout University. A letter was sent to the deans of the seven selected colleges to facilitate the data collection process. The team adhered to ethical confidentiality standards throughout their participation. Individual interviews only commenced after obtaining informed consent, explaining the study objectives to the participant, and confirming that the collected information would be used exclusively for scientific research purposes.

Results

The study included 384 female students aged 20 and 30 years, with a mean age of 23.02 ± 1.5 years. Most participants were aged 20-24 years, single, and residents of Al-Mukalla city (90.1%, 89%, and 90.6%, respectively) (Table 1).

Table 1. Sociodemographic characteristics of the study participants (N= 384)

Characteristics	Frequency	Percentage
Age group in Years		
20 - 24	346	90.1
25-30	38	9.9
Mean age $\pm$ SD*	23.02 ± 1.5	
Marital status		
Single	342	89.0
Married	36	9.4
Widowed	3	0.8
Divorced	3	0.8
Place of residence		
Al Mukalla city	348	90.6
Outside Al-Mukalla city	36	9.4

* Standard Deviation

Table 2 shows the students' knowledge of the tetanus vaccine. Most students (83.6%) had heard of the tetanus vaccine, with school/university being the main source of information (64.1%), followed by relatives or friends (30.2%). Most participants correctly recognized that the tetanus vaccination is intended primarily to prevent rather than treat tetanus (92.7%). Most students considered the tetanus vaccine safe and believed that it could be administered during pregnancy without complications (65.9% and 75.3%, respectively). In addition, 75.3% believed that the tetanus vaccine was available free of charge. However, knowledge of the recommended target groups and vaccination schedule was limited. Only 26.8% identified women of childbearing age as a target group, while 22.3% identified both mothers and newborns. Most students (81.2%) did not correctly identify the total number of doses recommended during the reproductive years. Although 65.1% knew that tetanus vaccine doses should be administered at specific intervals rather than all at once, only 18.8% correctly identified five doses as the recommended total.

Based on the scoring system described in the Methods section, 63.8% of students had a moderate level of knowledge, 20.3% had a high level of knowledge, and 15.9% had a low level of knowledge.

Table 2. Distribution of students according to their knowledge of different aspects of the tetanus vaccination (N= 384)

Knowledge items	Response	Frequency	Percentage
Heard about tetanus vaccine	Yes	321	83.6
	No	63	16.4
Source of information*	School/University	246	64.1
	Relatives /Friends	116	30.2
	Social media	59	15.4
	Health workers	56	14.6
The purpose of the tetanus vaccine is:	To treat tetanus	13	3.4
	To prevent tetanus	356	92.7
	I don't know	15	3.9
The tetanus vaccine is considered safe	Yes	289	75.3
	No	38	9.9
	Don't know	57	14.8
Target group for tetanus vaccine*	Pregnant women only	152	29.4
	Newborn only	162	31.2
	Both mother and newborn	116	22.3
	Children <5 years	56	10.7
	Women of childbearing age (15 to 45 years)	139	26.8
	I don't know	118	22.7
Tetanus vaccine during pregnancy may lead to:	Birth defects	53	13.8
	Miscarriage	8	2.1
	No complications	253	65.9
	I don't know	70	18.2
Total doses of tetanus vaccine during female reproductive years	One	34	8.9
	Two	15	3.9
	Three	60	15.6
	Four	60	15.6
	Five	72	18.8
	I don't know	143	37.2
The recommended tetanus vaccine doses should be given:	At the same time	23	6

Knowledge items	Response	Frequency	Percentage
The tetanus vaccine availability	At specific time intervals	250	65.1
	Don't know	111	28.9
	Free	283	75.3
	Expensive	48	10.9
	Don't know	53	13.8
Total mean knowledge score $\pm$ SD		7.27 $\pm$ 2.6	

* Participants selected more than one response

Regarding vaccination uptake, fewer than half of the participants (45.6%) reported receiving at least one dose of tetanus vaccine, whereas 41.9% reported receiving no doses and 12.5% were unsure whether they had received the vaccine. Among the 175 students who reported receiving at least one dose, 47.4% had received one dose, 23.4% two doses, 15.4% three doses, 3.4% four doses, and 10.4% all five doses.

The main reasons for not receiving or completing tetanus vaccination were vaccine unavailability at the facility (39.2%), lack of awareness of its importance (25.4%), and fear of side effects such as pain associated with the injection (20.1%) (Table 3).

Table 3. Uptake of the tetanus vaccine among study participants (N = 384)

Questions	Frequency	Percentage
Have you ever received any tetanus vaccination?		
Yes	175	45.6
No	161	41.9
I don't know	48	12.5
If Yes: How many tetanus vaccine doses have you received? (N= 175)		
One dose	83	47.4
Two doses	41	23.4
Three doses	27	15.4
Four doses	6	3.4
Five doses	18	10.4
Reasons for not receiving or completing the tetanus vaccination? *		
Unavailability at the facility	143	39.2
lack of awareness of its importance	93	25.4
Fear of side effects (injection/pain, etc.)	74	20.1
Didn't decide yet	56	15.3

*Participants selected more than one response.

Discussion

The present study found that most female students had heard of tetanus vaccination, with school or university serving as the main source of information. This finding highlights the potential role of educational institutions in disseminating health information. Relatives and friends were the second most commonly reported source, whereas social media and healthcare workers were less frequently reported. This finding is consistent with a study among female students at Kabul University, which also identified schools and universities as the main sources of information about tetanus vaccination, followed by family and friends.¹⁴ However, the finding differs from studies conducted in Sudan, Bangladesh, and Nigeria, where

family members, television and healthcare workers, respectively, were reported as major sources of information.¹⁵⁻¹⁷ Differences in information sources may reflect variations in study populations, settings, and access to health information.

In the present study, approximately two-thirds of students had a moderate level of knowledge about tetanus vaccination. Because studies specifically focusing on female university students from Yemen and neighboring Arab countries are lacking, comparisons were made with studies conducted among female university students in other developing countries. The findings were broadly consistent with studies from Bangladesh¹⁶, Kabul¹⁴, Nigeria¹⁷, eastern Ethiopia¹⁸, and Pakistan¹⁹, where moderate knowledge was reported among many female students. In contrast, studies from Iraq²⁰ and Nigeria²¹ reported poor or limited knowledge and misconceptions regarding tetanus vaccination. The low level of knowledge in many countries may stem from various factors affecting students' information and awareness, but the most significant of these relate to the type of vaccination provider, information sources, and other barriers. However, numerous studies confirm that mothers' willingness to receive the tetanus vaccine depends on women of childbearing age being aware of its benefits, as a lack of information often leads to hesitation, impacting successful vaccination rates.²²⁻²⁴

Although awareness of tetanus vaccination was relatively high, important gaps were identified in specific areas of knowledge. In particular, only 26.8% of students identified women of childbearing age as a target group, and only 18.8% correctly identified five doses as the recommended number. These findings suggest that general awareness does not necessarily translate into adequate knowledge of the vaccination schedule or target population. Similar results have been reported in other studies where participants lacked sufficient knowledge about the target group and the total number of tetanus vaccine doses.^{16,17,19}

More importantly, the moderate level of knowledge did not correspond to low vaccination uptake. Less than half of the participants had received at least one dose, and only 10.4% of those who had received vaccination reported completing all five doses. This gap between knowledge and uptake suggests that factors other than knowledge may play an important role in vaccination behavior. The tetanus vaccination rate recorded in this study is higher than the average recorded in a previous study conducted on Yemeni women of reproductive age.¹² Our findings are consistent with those of other studies conducted in developing countries, which have indicated low tetanus vaccination rates among female university students^{16,17,19,25,26} and among women of reproductive age.^{22-24,27-29} Previous studies in low- and middle-income countries have shown that women's knowledge of tetanus vaccines is a key factor in determining vaccine acceptance or vaccine hesitancy.²⁶⁻³⁰ However, the fact that a significant number of female students remain unvaccinated underscores the need for continued awareness and education campaigns to overcome obstacles to tetanus vaccination. Furthermore, focused community awareness regarding the importance of vaccinating all women of reproductive age, as recommended by the WHO, is undoubtedly more important than detailed, specific knowledge about the vaccine.

The principal barriers reported by participants were vaccine unavailability, lack of awareness of its importance, and fear of side effects. These findings are consistent with studies conducted among female students in other developing-country settings.^{14-16,17,21,31} The findings support the need for targeted health education for female university students, particularly regarding the groups eligible for tetanus vaccination, the recommended dosing schedule, vaccine safety, and the importance of completing the vaccination course. At the same time, interventions should address health-system barriers, particularly vaccine availability

Conclusions

The study demonstrated low uptake of tetanus vaccination among female students at Hadhramout University. Although most participants had a moderate overall level of knowledge, important gaps remained regarding the target groups and the recommended number and timing of vaccine doses. The main barriers to receiving or completing vaccination were vaccine unavailability, lack of awareness of its importance, and fear of side effects. Targeted health-education campaigns should be developed for female university students to emphasize the importance, safety, and effectiveness of tetanus vaccination and to provide clear information about the recommended vaccination schedule for women of reproductive age. Vaccination services should also be made accessible and consistently available to women of childbearing age. A vaccination record or

certificate should be provided and maintained to facilitate documentation of received doses. Future studies should examine the factors influencing tetanus toxoid immunization compliance among public and private university female students in Yemen.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, information on tetanus vaccination coverage among female university students in Yemen is limited, which restricted comparisons with previous studies. Second, vaccination status was self-reported because vaccination cards were not available. Therefore, recall bias may have affected the accuracy of reported vaccination histories, particularly for doses received during adolescence. Third, the sampling approach may limit the representativeness of the study population because only selected colleges, departments, and academic levels at Hadhramout University were included. Consequently, the findings may not be generalizable to all female students at Hadhramout University or to female university students in other Yemeni universities.

Acknowledgment

The authors extend their sincere thanks to the fourth-year nursing students at Hadhramout University for the 2024-2025 academic year for their great help in data collection. Special thanks to the female students of Hadhramout University for agreeing to participate in the study.

Financial support and sponsorship

Nil.

Conflict of Interest statement:

The authors declare that there is no conflict of interest regarding the publication of this paper.

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