Research Article

Normal Variations in Episodes and Duration of Nocturnal Penile Tumescence Among Iranian Men: A Descriptive Analytical Study

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Abstract

Background: Erectile dysfunction (ED) in men is a significant issue that can profoundly impact personal relationships, mood, and overall quality of life. The nocturnal penile tumescence (NPT) test is a valuable tool for distinguishing between psychological and physiological causes of ED. The normal values of the NPT test are a subject of debate across various racial groups. Therefore, there is a need to conduct a study in the Middle East region to establish standard norms for NPT.
Objectives: The aim of this study is to investigate the results of the NPT test in sexually healthy Iranian men.
Methods: This descriptive study involved the examination of 30 sexually healthy Iranian volunteers using the iranian erection analyzer over a period of two nights. In this study, a NPT episode was defined as radial rigidity exceeding 70%. The frequency and duration of these episodes were documented and subjected to analysis.
Results: The average number of tumescence episodes per participant on the first and second nights was observed to be 1.73 ± 0.82 and 1.9 ± 0.66 episodes, respectively. The average duration of each tumescence episode on the first and second nights was found to be 16.04 ± 7.7 and 22.08 ± 6.85 minutes, respectively. A statistically significant difference in tumescence duration was noted between the two nights (P < 0.001), with the second night showing higher values. Furthermore, it was determined that 83.4% of sexually healthy men experienced 1 to 2 episodes of tumescence during the night.
Conclusions: The findings of this study indicate that the majority of sexually healthy Iranian men experience 1 to 2 episodes of NPT with rigidity surpassing 70% overnight, with an average duration of 16 to 22 minutes per episode. Additionally, the study suggests that relying on a single-night NPT test may be inadequate for an accurate assessment.

Keywords: Diagnosis, Erectile Dysfunction, Impotence, Nocturnal Penile Tumescence

1. Background

Erectile dysfunction (ED), a condition marked by the recurrent inability to achieve or sustain an erection firm enough for sexual intercourse, is a widespread problem that impacts men (1). The causes of ED can range from vasculogenic, neurogenic, anatomical, hormonal, pharmaceutical, to psychological factors (2). Psychological factors are predominantly observed in young men, with occurrences reported in 13 - 85% of individuals under 40 years old and 40% of those above 40 years old (3-6). Notably, around 45% of all ED cases can be attributed to psychological factors (7).

A thorough assessment involving a physical examination and detailed patient history can effectively identify a significant number of ED patients, particularly those with organic causes, eliminating the necessity for additional diagnostic procedures (8). However, some patients may underestimate the severity of their ED, inaccurately assessing the duration and rigidity of their erections (8). Therefore, it is essential to utilize objective methods for evaluating penile erection and rigidity. The nocturnal penile tumescence (NPT) test is a valuable tool in this regard. Nocturnal penile tumescence testing, a non-sexual physiological occurrence, mimics the mechanism of erection seen during sexual stimulation. Importantly, NPT tests are

less influenced by psychological factors since emotions like anxiety are typically absent during sleep (9). Erection during rapid eye movement (REM) sleep is universally observed in sexually healthy men of all ages (10).

A comprehensive evaluation of NPT involves the measurement of penile circumference, electroencephalography, and the consistent assessment of axial penile rigidity. Axial rigidity is crucial for successful vaginal penetration (9). In 1985, Bradley et al. introduced the RigiScan device, which provides a continuous measurement of tumescence and penile radial rigidity simultaneously (11).

The RigiScan device is particularly valuable for individuals concerned about the impact of psychological factors on their ED (12, 13). It is important to recognize that while the RigiScan device is highly sensitive in differentiating organic ED from psychological ED, complementary techniques such as Color Doppler ultrasound evaluation, cavernosometry, and the injection of a vasodilator drug (papaverine) are necessary for a definitive diagnosis (14, 15).

Defining ED requires careful consideration of the most robust erection episode. A penile erection that maintains at least 70% radial rigidity for over 10 minutes is indicative of normal erectile function (7). Despite the widespread use of the RigiScan device, a precise and standard definition of the normal values of the NPT test has not yet been provided, and different criteria for normal erection have been proposed (14, 16-18). For instance, Hatzichristou et al. suggested ≥ 60% rigidity as normal (16), whereas Benet et al. considered an episode with ≥ 70% rigidity, even for 5 minutes, as normal (17). This difference in results may be caused by racial differences.

It is important to highlight the absence of research conducted among Iranian men, leading to uncertainty in defining standards for normal erectile function in this population. The results of the NPT test in Iranian courts can have implications on judicial decisions.

2. Objectives

Therefore, there is a need to establish criteria for normal NPT through the analysis of healthy individuals in Iran. This study aims to fill the gap in research and provide clarity on what constitutes normal erectile function in Iranian men, which could have significant implications for both medical and legal contexts.

3. Methods

3.1. Study Population

The participants in the current study were healthy men with normal sexual functions. This study was conducted from May 2022 to April 2023 at Shohada-e Tajrish Hospital. The inclusion criteria were male participants aged 20 years or older, currently in a sexual relationship, with no history of sexual or erectile issues, and an IIEF-5 questionnaire score of 22 or higher. Exclusion criteria included existing psychological conditions (such as depression and generalized anxiety), medications affecting penile erection, and sleep disorders causing reduced REM sleep phases.

3.2. Study Design

This study was a descriptive analytical single-center study, conducted in a referral hospital in Tehran, Iran. The study's sample size consisted of 30 volunteers. These participants were evaluated using an Iranian erection analyzer device, manufactured by Hursun-Saman-Pars company, similar to the RigiScan device, across two consecutive nights from the beginning of sleep until morning awakening (mean duration of 495 minutes). Their data were carefully recorded.

During the one-week examination period, the participants were asked to abstain from consuming alcohol and any kind of medications. All enrolled individuals completed the International Index of Erectile Function-5 (IIEF-5) Questionnaire, with a requirement that their score be 22 or higher. The participants lived in a secluded environment during the study period.

The study was conducted over two nights. Radial rigidity greater than 70% was considered an episode. Informed consent was obtained from each patient. This study was approved by the ethics committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.MSP.REC.1401.069).

3.3. Outcome Assessment

The main outcome of this study is to examine the frequency and duration of erection episodes during sleep in healthy Iranian individuals using the Iranian erection analyzer device. The secondary outcomes are to explore how factors such as age and BMI may influence the duration of erection episodes during sleep.

3.4. Statistical Methods

The obtained data were analyzed using SPSS statistical software for Windows, version 29. Quantitative data were described with mean ± SD. Comparisons were made using the Wilcoxon signed-rank test for non-normal variables and paired *t*-tests for normal variables. The Shapiro-Wilk test was used to check the normality of the data. Qualitative data were displayed as frequency (percentage), and comparisons were made using the chi-square test. A significance level of 0.05 was considered statistically significant.

4. Results

In this study, 30 male volunteers aged 21 - 59 years participated, with an average age of 34.73 ± 9.13 years and a mean Body Mass Index (BMI) of 24.76 ± 2.93. All participants underwent examination using an Iranian erection analyzer device on two consecutive nights.

Given the strong correlation (approximately 90%) between erectile episodes at the tip and base of the penis, data from the base were utilized for analysis in this study. The results revealed that the mean number of erectile episodes per individual during the first night was 1.73 ± 0.82, with an average duration of 16.04 ± 7.7 minutes per episode. On the second night, the mean number of erectile episodes per individual was 1.9 ± 0.66, with an average duration of 22.08 ± 6.85 minutes per episode.

There was no significant difference in the mean number of erectile episodes per individual between the first and second nights (P = 0.167). However, there was a significant difference in the mean duration of erectile episodes between the two nights, with the duration being longer on the second night (P < 0.0005) (Table 1).

Participants were divided into two age groups: Those under 30 years old (26.7% of the sample) and those over 30 years old (73.3%). Additionally, the participants were categorized based on their BMI into two groups: Above 25 (19 cases) and below 25 (11 cases).

When comparing the number of tumescence episodes between individuals under 30 years old and those over 30 years old, no significant differences were found on the first night (P = 0.778) or the second night (P = 0.618). Additionally, no significant differences were found in the number of tumescence episodes between the participants with different BMIs on the first night (P = 0.181) and the second night (P = 0.529) (Table 2).

To compare the duration of tumescence episodes between individuals under 30 years old and those over 30 years old, no significant differences were found on the first night (P = 0.219) or the second night (P = 0.629). Likewise, no significant differences were found in the duration of tumescence episodes between participants based on BMI on the first night (P = 0.064) or the second night (P = 0.200) (Table 3).

5. Discussion

In the study, 30 men without reported sexual problems, aged between 21 and 59, were monitored for two consecutive nights using an Iranian erection analyzer device in isolated rooms. The results revealed that sexually healthy men experienced one or more episodes of NPT, with a mean duration ranging from 16 to 22 minutes. While there was no significant difference in the number of NPT episodes between the first and second nights, the mean duration of NPT episodes on the second night was significantly higher. This suggests that examining patients over two consecutive nights may provide more accurate insights into NPT patterns. The study also found that factors like BMI values and age groups did not have a significant impact on the duration or number of NPT episodes.

Different studies have reported varied results regarding the normality of the results obtained from the RigiScan device due to the diverse conditions and ethnicities examined. A similar study conducted in Greece in 1998 by Hatzichristou et al. involved the examination of 12 sexually healthy men using the RigiScan device for three consecutive nights. It was postulated that participants may not feel entirely comfortable during the initial night, potentially leading to distorted results, suggesting that one night of data collection may not be adequate. The results obtained from the first night in conjunction with the second night, or the second night combined with the third night, yielded similar outcomes when compared to the results obtained from three consecutive nights, indicating that two nights of monitoring are sufficient (16). This particular study demonstrated that if an individual experiences at least one erection episode with radial rigidity exceeding 60% lasting for a duration longer than 10 minutes, it is considered a normal response (16).

Benet et al. in the United States reported a normal episode as 70% radial rigidity lasting 5 minutes (17). In various other studies, a normal response was defined as

Table 1. Tumescence Episodes Number and Duration on the First and Second Night

Variables	Mean ± Standard Deviation	P-Value
Number of tumescence episodes		
1st night	1.73 ± 0.828	0.167
2nd night	1.90 ± 0.662	
Duration of tumescence episodes		
1st night	16.0417 ± 7.70843	< 0.0005
2nd night	22.0833 ± 6.85702	

Table 2. The Mean Number of Tumescence Episodes During the First and Second Night, Categorizing Participants Based on Their age and Body Mass Index (BMI)

Variables	Number of Participants	Mean Number of Tumescence ± Standard Deviation	P-Value
1st night			
BMI < 25	19	1.5789 ± 0.8154	0.181
BMI > 25	11	2.0000 ± 0.7385	
Age < 30	8	1.7500 ± 0.6614	0.778
Age > 30	22	1.7273 ± 0.8624	
2nd night			
BMI < 25	19	1.8421 ± 0.6699	0.529
BMI > 25	11	2.0000 ± 0.6030	
Age < 30	8	2.0000 ± 0.5000	0.618
Age > 30	22	1.8636 ± 0.6938	

having at least one episode with rigidity above 70% sustained for a minimum of 10 minutes ([14], [19]). In another clinical study, base stiffness of 55 - 60% and tip stiffness of 50% were reported to be sufficient for normal erectile function ([20]).

When evaluating a patient's sexual function, it is crucial to assess both penile rigidity and penile tumescence because it is possible for a man to have normal penile tumescence but not be able to achieve or maintain the rigidity required for intercourse ([21], [22]). This issue is particularly common in men with vascular insufficiency, where there may be adequate tumescence without sufficient hardness. In this study, penile radial rigidity exceeding 70% was considered indicative of a NPT episode.

Additionally, it is important to recognize that the RigiScan device may yield false negative results in approximately 10 - 20% of cases. This is due to the fact that the device does not monitor factors such as sleep quality or body movements, which can potentially influence the outcomes obtained from the assessment ([9]).

Obesity is a significant global health concern and is associated with metabolic disorders collectively known as metabolic syndrome ([23]). Both animal and human studies have provided evidence supporting the link between obesity and ED. A 14-year prospective study demonstrated that obesity is an independent risk factor for male ED ([24]). Additionally, an animal study conducted on rats indicated that obesity could lead to ED through vascular damage ([25]). However, the current study did not find any variation in the duration or frequency of NPT between individuals of normal weight and those who were overweight or obese. Nevertheless, we recommend evaluating this factor in a population with a wider range of BMI values.

Research has also shown that as individuals age, the number and duration of NPT episodes tend to decrease. Most men over the age of 60 may not experience full erections during sleep, even if they and their partners engage in regular intercourse ([26]). Similarly, a study involving 65 married men aged 45 to 74 years noted a significant decline in both the number and duration of NPT episodes with increasing age ([27]). However, in the present study, there was no discernible difference in the frequency or duration of NPT episodes between individuals below the age of 30 and those over the age of

Table 3. The Duration of Tumescence Episodes During the First and Second Night, Categorizing Participants Based on Their age and Body Mass Index (BMI)

Variables	Number of Participants	Mean Duration of Tumescence (Minute) ± Standard Deviation	P-Value
1st night			
BMI < 25	19	17.9167 ± 8.35760	0.064
BMI > 25	11	12.8030 ± 5.32646	
Age < 30	8	12.0833 ± 2.08928	0.219
Age > 30	22	17.4811 ± 8.51244	
2nd night			
BMI < 25	19	23.3772 ± 6.69827	0.200
BMI > 25	11	19.8485 ± 6.84976	
Age < 30	8	20.7292 ± 7.16082	0.629
Age > 30	22	22.5758 ± 6.84730	

30, which may be due to the lack of older men in this study.

5.1. Limitations

The main limitation of the current study is the relatively small sample size, which may limit the generalizability of the findings. The need for healthy volunteers to participate and cultural constraints regarding discussions about sexual activity and placing the device in the genital area may have further impacted the sample size. As a result, the study's outcomes may not be broadly applicable to all races and ethnic groups in Iran. Conducting multi-center studies with larger sample sizes that encompass diverse racial backgrounds could yield more precise results.

Furthermore, the study's range of BMI was restricted, and individuals with morbid obesity were not included. This exclusion could potentially impact the findings, as obesity is a known risk factor for ED.

Additionally, participants were hospitalized in an isolated room in the urology department. The limited availability of equipment prevented the use of a portable erection analyzer to track NPT episodes at home. This limitation could restrict the insights gained from the study, as natural sleeping environments may influence NPT patterns.

5.2. Conclusions

This study aimed to investigate the NPT pattern and penile rigidity among 30 sexually healthy Iranian men over two consecutive nights using an Iranian erection analyzer device. The study found differences in NPT test results between the first and second night, indicating the inadequacy of evaluating NPT patterns in just one night. Among sexually healthy Iranian men, it was observed that over 80% experienced only 1 or 2 NPT episodes with radial rigidity exceeding 70%. The average duration of each NPT episode ranged from 16 to 22 minutes. Interestingly, the study did not find age or BMI to significantly impact NPT patterns in this population. Overall, this study contributes to enhancing our understanding of normal sexual function in Iranian males through NPT evaluation. The findings provide insights into the normal NPT patterns among sexually healthy Iranian men.

Footnotes

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