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Reproductive behavior and erectile dysfunction in the undergraduate university students: cross-sectional study

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Abstract

Background: Very little is known about erectile function (EF) and its associated predictors in the university students. The aim was to quantify the prevalence and some associated predictors of EF in a large sample of the university students from the largest National University in Kazakhstan. **Methods**: At Kazakh National University, 1556 male students aged 16 to 23 years filled in anonymous self-administered web-based questionnaire on their sexual and reproductive behavior, including the International Index of Erectile Function (IIEF-5) in 2023. We report age-specific prevalence of erectile dysfunction (ED), defined as IIEF-5 below 22 and the association of IIEF-5 score with selected predictors in adjusted regression models. **Results**: At least one sexual intercourse was reported by 1306 (84%) students with the first coitus at the median age 17 (interquartile range (IQR) 17; 19) years; and 10% students reported only one ever intercourse. The median number of partners in the preceding 12 months was 1 (IQR 1; 2), but 27% reported they planned to have a child in the next 2 years (100% of 16–17-year-old and 0% of 19–20-year-old students). IIEF-5 score ranged from 21 to 25 (median 25, IQR 21; 25), and was negatively associated with age, independent of ethnicity, place of residence, number of partners and other predictors. No ED was reported by 63% (N = 827), whereas mild ED prevalence was 37% (N = 479) among students who had at least one intercourse. **Conclusions**: The overall prevalence of ED was very low and associated with age. Preventive interventions in place are likely efficient, but future research should focus on previously unmeasured sexual behavior attributes.

Keywords

Intercourse; IIEF-5; Regression; Young adults

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Comportamiento reproductivo y disfunción eréctil en estudiantes universitarios de pregrado: estudio transversal

Resumen

Antecedentes: Se sabe muy poco sobre la función eréctil (FE) y sus predictores asociados en los estudiantes universitarios. El objetivo fue cuantificar la prevalencia y algunos predictores asociados de FE en una gran muestra de estudiantes universitarios de la Universidad Nacional más grande de Kazajstán. **Métodos**: En la Universidad Nacional de Kazajstán, 1556 estudiantes varones de entre 16 y 23 años completaron un cuestionario anónimo autoadministrado en la web sobre su comportamiento sexual y reproductivo, incluido el Índice Internacional de Función Eréctil (IIEF-5) en 2023. Informamos la prevalencia específica por edad de disfunción eréctil (DE), definida como IIEF-5 por debajo de 22 y la asociación de la puntuación IIEF-5 con predictores seleccionados en modelos de regresión ajustados. **Resultados**: Al menos una relación sexual fue reportada por 1306 (84%) estudiantes con el primer coito a la mediana de edad de 17 años (rango intercuartil (IQR) 17; 19) años; y el 10% de los estudiantes informaron solo una relación sexual. La mediana del número de parejas en los 12 meses anteriores fue de 1 (IQR 1; 2), pero el 27% informó que planeaba tener un hijo en los próximos 2 años (100% de estudiantes de 16 a 17 años y 0% de estudiantes de 19 a 20 años). La puntuación del IIEF-5 varió de 21 a 25 (mediana 25, IQR 21; 25) y se asoció negativamente con la edad, independientemente de la etnia, el lugar de residencia, el número de parejas y otros predictores. El 63% (N = 827) no reportó disfunción eréctil, mientras que la prevalencia de disfunción eréctil leve fue del 37% (N = 479) entre los estudiantes que tuvieron al menos una relación sexual. **Conclusiones**: La prevalencia general de disfunción eréctil fue muy baja y se asoció con la edad. Las intervenciones preventivas implementadas probablemente sean eficientes, pero las investigaciones futuras deberían centrarse en atributos de comportamiento sexual previamente no medidos.

Palabras Clave

Relaciones sexuales; IIEF-5; Regresión; Adultos jóvenes

1. Introduction

Young adulthood, including the time of the ending second decade is known for active socialization, when young adults interact with a lot of people during studies, engage in sports [1] and acquire their first sexual experience. Sexual behavior of university and college students has been widely characterized in plenty of studies across the world [2–9], including even paraphilia [10] and the use of phosphodiesterase-5 inhibitors [11, 12]. These studies consistently demonstrate some differences in sexual behavior and their predictors of males compared to females, the gap in knowledge on the use of contraceptives and condoms as well as sexually-transmitted diseases. These differences may have some correlation with age, social background and socioeconomic status. Because at this age most students will unlikely get married, the change of partners is somewhat likely. Furthermore, knowledge and experience of that age will likely determine sexual behavior in a later age [13]. Taken together, sexual attitudes, behavior and future family planning make a complex interplay of predictors, usually contrasting for males and females.

Despite many publications of sexual behavior, attitudes and their predictors in the population of college and university students, very few have described erectile function (EF) in males of this age. Most published studies quantify EF with self-administered questionnaires elucidating the scores of erectile dysfunction (ED), and the International Index of Erectile Function, which is easy to use across most populations, is a widely used tool in many of them, making the studies easy to compare. In the groups of young adults, ED is usually characterized with regard to age and the use of phosphodiesterase-5 inhibitors [11, 12], but young adults is quite a heterogenous group with a wide age span. To the best of our knowledge, only a very few studies have specifically addressed EF in the university students [11, 12, 14]. EF has consistently demonstrated strong association with the quality of life [15]; therefore, ED is this sample can significantly impact everyday life and the quality of study.

In addition, we found no studies of sexual and reproductive behavior and their association with EF from Central Asian countries. Hence, we planned this study to quantify the prevalence and some associated predictors of EF in a large sample of the university students from the largest National University in Kazakhstan with a purpose to plan preventive strategies for the future.

2. Materials and methods

2.1 Study design and sample

This was a cross-sectional survey of the students of the largest university in the Republic of Kazakhstan, located in the largest city, Almaty. Al-Farabi Kazakh National University hosts 16 schools of all levels, including undergraduate, graduate and PhD, as well as postdoc programs with a wide array of fields. Those include chemistry, physics, language studies, history, biology and biotechnology, international relations, business and economics, geography, philosophy, legal studies, information technology, journalism and medicine. The university occupies a large campus downtown, and the overall numbers of students in all programs exceeds 25,000 people.

Students were invited to participate through the central web-based platform. Inclusion criteria were undergraduate level of study, personal initiative and consent to participate and male sex. Subjects with uncontrolled chronic conditions, including diabetes, hypertension, metabolic conditions that required treatment and other groups of similar diseases were considered non-eligible for the study, and the former were exclusion

criteria. Data were collected in September–November 2023 through Google web-forms.

2.2 Questionnaire

The questionnaire was anonymous and consisted of four parts and was self-administered, web-based in either Russian or Kazakh. These sections included basic demographics (ethnicity, year of birth, place of origin (urban *vs.* rural) and school within the university), sexual and reproductive health, erectile function questionnaire and general quality of life. In addition, we also asked students about their past medical history in one question. Sexual and reproductive health was assessed with a previously used and validated questionnaire available from the UNFPA report (https://kazakhstan.unfpa.org/ru/publications), Sociological Study of the Adolescents' Reproductive Health Aged 15–19. For our study, we only selected questions related to males, and these included questions on the age of first coitus, number of partners in the preceding 12 months, overall number of partners, ever conception, ever abortions, place and time of abortions, ever sexually-transmitted disease, awareness of the ways of transmission, symptoms and treatment, a few questions on (human immunodeficiency virus) HIV, including awareness, the frequency of condom use. There were 109 questions from all sections in total.

We measured ED with the International Index of Erectile Function (IIEF-5) scale. The IIEF-5 scale has five questions assessing EF, orgasmic function, sexual appetite, sexual satisfaction, and general satisfaction. This instrument has been validated in a large number of studies and demonstrated excellent internal consistency. IIEF-5 score ranges from 5 to 25 corresponding to five ED categories: severe ED (5–7 points), moderate ED (8–11 points), mild to moderate ED (12–16 points), mild ED (17–21 points), and no ED (22–25 points).

2.3 Statistical analysis

The primary outcome in this study was the prevalence of ED assessed as the frequency of students exhibiting IIEF-5 score below 22 in the subgroup of those who ever had at least one sexual intercourse in the lifetime. This prevalence was reported overall and stratified for each included age. Apart from prevalence, we also assessed EF as a summary score of IIEF-5 and treated it as a continuous variable in the analyses. First, we tested all included variable for normality using Shapiro-Wilk text and found them mostly non-normally distributed. Therefore, we used only non-parametric tests, including χ^2 test for univariate analyses of binary variables, such as the prevalence of ED. For that, data were grouped into contingency tables. Whenever continuous variables were analyzed in the univariate comparisons, we used either Mann-Whitney U-test for two groups or Kruskall-Wallis test for more than 2 groups.

In addition to comparing groups with each other, we also tested the association of IIEF-5 score with age first in the crude linear regression and reported beta-coefficient for the predictor with its 95% confidence interval (CI). Other predictors were also tested in the crude models and those found significantly associated with the IIEF-5 score were then included in the adjusted for each other models. We first tested multicollinearity and failed to find any. Moreover, these regression models were run in a group who had at least one sexual intercourse and included only 18-, 19- and 20-year-old students, because no variance with regard to IIEF-5 score was identified in ages and 17, given that they all scored 25. We decided to run two adjusted models of IIEF-5 score as a dependent variable. Model one for age as a major predictor was adjusted for ethnicity, urban residence and the number of partners in the last 12 months, whereas expanded Model 2 was additionally adjusted for coituses "sometimes" *vs.* "only once" and sex with more than one partner in the last 12 months (both binary variables). All teste were considered significant when *p*-value was below 0.05 and all tests were completed in NCSS (National Council for the Social Studies) 2024 (Utah, USA).

3. Results

Out of 1556 students who were included in the analysis, 1306 (84%) reported at least one intercourse, and this prevalence was significantly greater in those students who constantly lived in the city (N = 384, 88%) compared to students from the countryside (N = 922, 83%). Moreover, we found significant differences in the prevalence of any intercourse when comparing ethnic origin of students. Thus, most ever-intercourse was found in Russians (N = 306, 94%), followed by Kazakhs (N = 841, 84%) and "Other origin" (N = 231, 69%). However, the age at a time of an interview was also different between ethnicities, being greater in "Other origin" (median 19 years) compared to two other groups (median 18 years) (Kruskall-Wallis $p < 0.001$). Hence, when adjusted for age at a time of an interview, Russians were more likely to ever experience an intercourse compared to other groups ((odds ratio) OR: 14.2; 95% CI: 1.6–128.5). We hereinafter analyze and compare only those students who reported to have at least one intercourse in their lifetime (N = 1306).

There were no students on the studied sample who had "regular" or even "often" intercourses. Table 1 shows that most students by the time of the study have already sexual experience more than once. Moreover, more than half of the studied sample claimed more than one partner in the preceding year, and the difference between ages showed a trend of significant increase of such students with advancing age. We also observed a dramatic drop in the number of students planning to have a child in the next 2 years with advancing age and a year of study.

In general, we observed excellent erectile function in the studied sample with the IIEF-5 tool. We found high IIEF internal consistency in our study, and Cronbach's α for this tool equaled 0.90. IIEF score ranged from 21 to 25 (median 25, IQR 21–25) indicative of the least problems with erection in the students within this study. In the age group 16–17 years, no students scored their EF below 25. With advancing age, we found some reduction of IIEF score. Thus, in students aged 18, there were only 43 students (8%) with IIEF score 21, 8 more students (1%) with score 23, whereas the remining had 25. In those aged 19, 320 students (95%) scored 21 and the remaining 18 scored 25. Finally, in the group of 20-year-olds, all 116 students scored their EF with 21. Hence, no ED was found in 63% of students (N = 827), whereas mild ED with IIEF-5 score 21 was reported by 37% of students (N = 479).

TABLE 1. Baseline characteristics of the studied sample with stratification into ages of those with at least one intercourse in the lifetime (N = 1306).

Indicator	Age, yr					
	Overall (N = 1306)	16 (N = 40)	17 (N = 240)	18 (N = 572)	19 (N = 338)	20 (N = 116)
Age of the first coitus, yr*	17 (17–19)	16 (16–16)	17 (17–17)	17 (17–18)	19 (19–19)	19 (19–19)
The frequency of intercourses, N (%)*						
Sometimes	1171 (90)	40 (100)	240 (100)	455 (80)	320 (95)	116 (100)
Only once	135 (10)	0 (0)	0 (0)	117 (20)	18 (5)	0 (0)
Ever conceived, N (%)*	778 (60)	0 (0)	80 (33)	453 (79)	168 (50)	77 (66)
More than one partner in the last 12 months, N (%)*	876 (67)	0 (0)	200 (83)	347 (61)	218 (64)	111 (96)
Number of partners in the last 12 months, N (%)*	1 (1; 2)	2 (-)	1 (1; 1)	1 (1; 3)	1 (1; 2)	1 (1; 1)
Planning to have a child in the next 2 years, N (%)*	354 (27)	40 (100)	240 (100)	74 (13)	0 (0)	0 (0)

*Note: age of the first coitus as a continuous variable is presented as median with the corresponding interquartile range; *: $p < 0.05$ from either 2 × 5 tables χ^2 test (binary variables) or Kruskall-Wallis test (continuous variables).*

When only 18–20 years students were selected, we found a negative association of IIEF score with age (beta: −2.34; 95% CI: −2.44–−2.33).

Because there was no variance of IIEF score in the age group 16–17 years, we ran the following models to test the associations of selected predictors in the group 18–20 years (N = 1026). Univariate regression models elucidated some significant association of "Other ethnicity" (beta: −1.30; 95% CI: −1.64–−0.97), urban residence (beta: −0.43; 95% CI: −0.69–−0.16), coituses "sometimes" *vs.* "only once" (beta: −0.56; 95% CI: −0.92–−0.21), sex with more than one partner in the last 12 months (beta: 0.68; 95% CI: 0.44–0.94) and even the number of partners in the preceding 12 months (beta: 0.47; 95% CI: 0.36–0.58) with the IIEF score. Multivariate adjusted models explained much of variability (R^2: 0.68–0.70) and confirmed decrease in IIEF score (EF worsening) with advancing age from 18 to 20. Moreover, we found some protective effect of Kazakh ethnicity (greater IIEF score, better EF) and urban residence (Table 2). Although statistically significant, also in mode complex Model 2, the magnitude of effect of all variables but age was not so pronounced.

4. Discussion

This is the first study from Central Asia which quantified EF in very young males of the undergraduate university age. We now demonstrated that only mild ED was the least IIEF-5 score 21 was found in 37% of students, whereas the majority (63%, N = 827 of those who ever had at least one sexual intercourse) exhibited no ED. The overall IIEF-5 score significantly decreased from age 16 to age 21 in those who ever had a sexual intercourse (84% of enrolled students ever had sexual experience), and in the multivariate adjusted modelling, age was the strongest predictor of IIEF-5 score. The effects of other significant predictors, such as the number of partners in the preceding 12 months, were very low.

There are very few studies portraying EF in such young population in the very beginning of their sexual life. Other studies have elucidated inconsistent results both with regard to the overall prevalence and the predictors of ED. The prevalence of ED in a wider group of middle-aged men can vary dramatically and can exceed 50%, and numerous studies in this group have identified a wide array of predictors, mostly concentrated on psychological attributes. Studies in adults aged around 20 years are far less prevalent. Surprisingly, high ED prevalence, including cases of mild and moderate ED, can also be found in the university students [14]. This latter study from Peru found that no ED could be confirmed in only 45% of students, and mild to severe ED was found in 11% of students, and they explained such high prevalence with stressors that worsened EF, such as somatization, interpersonal sensitivity, and depression), believed to be relevant in this life stage due to academic exigence and potential uncertainty in life. Furthermore, some association of ED with poor sleep was demonstrated. Other published studies have revealed some ED in the age group above 20 years [16], but those were not necessarily university students; thus, direct comparison may not sound reasonable.

Evidence from other studies in the university students is scarce, but another way to consider ED is the use of phosphodiesterase-5 inhibitors. In one of such studies from Ethiopia, these medications were used by almost 6% of students, and ED verified with a longer version of IIEF tool, IIEF-15, was found in almost 8% students [12]. Almost twice more college students ever used the medication in Brazil (15%) [11]. Our questionnaire did not consider the use of phosphodiesterase-5 inhibitors, thus making it impossible to assess the ED in this context. Taken together, these data suggest that very young adults cannot be considered a population with no ED problems even at this age, and wider research and educational interventions may be needed to address the problem in this population.

TABLE 2. Multivariate regression analysis of selected predictors with IIEF-5 score.

	Model 1 (R^2 = 0.68)	Model 2 (R^2 = 0.70)
Age	−2.38 (−2.49; −2.28)	−2.51 (−2.62; −2.40)
Number of partners in the last 12 months	0.10 (0.03; 0.16)	0.34 (0.21; 0.46)
Ethnicity: Kazakh	0.36 (0.21; 0.52)	0.26 (0.10; 0.42)
Urban *vs.* rural	0.58 (0.42; 0.73)	0.68 (0.53; 0.84)

Note: beta coefficients for each predictor are shown as the mean value with the corresponding 95% confidence interval. Model 1 is adjusted for each shown predictor. Model 2 is adjusted for each shown predictor and additionally for coituses "sometimes" vs. "only once" and sex with more than one partner in the last 12 months.

Reasons behind ED in young adults should be further investigated. Some association was found for poor sleep, which acts as one of the most pronounced problems in students associated with increasing academic demand, and reading and completing assignments can sometimes be possible when sleep time is reduced. Mechanism behind ED in subjects with poor sleep quality may be related to testosterone suppression [17], but not direct evidence on that from the college and university students has been reported elsewhere. A wide range of organic pathology, including endocrine, neurological and cardiovascular diseases can also come into play, but the prevalence of these conditions in the young population as a reason for ED was found as low as 15% [18]. Furthermore, selected medications, like beta-blockers [19], antidepressants, non-steroidal anti-inflammatory drugs, neuroleptics and antiepileptics can be associated with poor ED and should be considered in all young adults with the symptoms [20]. Finally, a significant decrease of IIEF-5 score in our study from age 16 to 21 needs further deeper analysis in future studies. This could be due to either the first sexual experience being of poor quality or the experiences at later ages being negatively affected by additional pathologies.

Because ED in young adults is believed to be predominantly of a psychogenic origin [20], those psychological triggers and risk factors should be thoroughly investigated and addressed in the young population. Our sample showed very high IIEF-5 score overall, indicative of no moderate or severe ED, which does not raise concerns over the psychological triggers. Nevertheless, gradually decreasing IIEF-5 score with time prompt timely prevention in this young population, and this should include comprehensive educational interventions on medications' side effects, the importance of sufficient sleep duration, timely conflict management, engagement in regular physical activity, psychostimulants' avoidance, building interpersonal communications and other. The implications of our study arise from understanding the need to preserve sexual and mental health and timely ED recognition and treatment. Thus, we believe that university students should be persistently screened for sexual health and erectile function and whenever needed, professional counseling must be offered.

Large sample size, which included all years of study of all schools at the largest national university is a strength of our analysis. Cross-sectional design, elucidating only associations and making causality verification impossible is the limitation of our study. In addition, our questionnaire only included selected sexual behavior and experience questions and a very narrow range of basic demographic characteristics, when many known predictors of ED from other studies were omitted is another limitation. Furthermore, our analysis was completely built on self-reported measures, and none of outcomes in this study including erectile function could be objectively verified with ancillary tests and examination. Another limitation is possibly low potential of ED verification tools, such as IIEF-5 in young population, including students, because IIEF-5 performance in the population of young men who just started their sexual experience has been poorly studied. Finally, we limited our analysis to only one institution located in only one largest city of Kazakhstan, making our findings' generalizability impossible for the rest of the country, including remote provinces.

5. Conclusions

In conclusion, this first study of all years of undergraduate students of the largest national university in Kazakhstan has demonstrated rapidly evolving sexual behavior throughout years of study. The overall prevalence of ED was unexpectedly low overall and compared to other countries, but early prevention of future EF deterioration should still be initiated already at this age. We also conclude that reproductive behavior of this age group is not as homogenous as it is usually believed to be. Finally, higher rates of ED in students from rural regions highlights the apparent disparity in sexual reproductive behavior in a more vulnerable socioeconomic group of rural residents.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

MS and DV—designed the research study. MS—performed the research. DV—analyzed the data; wrote the manuscript. Both authors contributed to editorial changes in the manuscript. Both authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Committee on Bioethics of the Kazakhstan's Medical University "KSPH" (approval IRB-A287 dated 28 November 2022), and given that the study was designed as a web-based anonymous survey, participation in a survey was considered as a signed.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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