PEYRONIE'S DISEASE

A Population-Based Study of Peyronie's Disease in Turkey: Prevalence and Related Comorbidities

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ABSTRACT

Introduction: Peyronie's disease (PD) prevalence varies between 0.39% and 20% and studies on PD prevalence are limited.

Aim: This study aims to determine the prevalence of PD in males aged ≥30 years in Turkey and to evaluate etiological factors associated with it.

Methods: The study was conducted in 12 regions of Turkey according to the Eurostat Nomenclature of Territorial Units for Statistics 1 classification and included 1,208 patients. Survey questionnaires including questions about demographic features and basic health status as well as about diagnosis and etiology of PD were put forth to the volunteers who agreed to participate in the study. Diagnosis of probable PD was established by evaluating the questionnaires. Patients with a diagnosis of congenital penile curvature were excluded from the group with PD. Chi-square test, Fisher's exact test, and Mann-Whitney *U* test were used.

Main Outcome Measure: The primary outcome analyzed in this article was the prevalence rate of PD in Turkey and the associated comorbidities.

Results: The prevalence of PD was determined as 5.3%. The rates of participants with PD were found to be the highest in the 50−59 years group (27%) and in the North-East Region (20%). Compared with participants without PD, participants with PD were older (median: 52 interquartile range [41−64] vs 45 [37−55]; $P < .001$) and the rates of smokers (73% vs 60.9%; $P = .036$) and those having diabetes mellitus (17.5% vs 9.2%; $P = .045$), hypertension (14.3% vs 6.9%; $P = .041$), and heart failure were higher (7.9% vs 2.5%; $P = .027$). Male with PD symptoms preferred their partners on top during sexual intercourse (15.2% vs 34.1%; $P < .001$). This is the first study to evaluate premature ejaculation prevalence and related comorbidities with face-to-face interviews.

Conclusion: The prevalence of PD was 5.3% in Turkey. Besides advanced age, smoking, position of sexual intercourse, and presence of comorbidities especially diabetes mellitus, hypertension, and heart failure were the factors associated with PD prevalence. **Kadioglu A, Dincer M, Salabas E, et al. A Population-Based Study of Peyronie's Disease in Turkey: Prevalence and Related Comorbidities. Sex Med 2020;8:679−685.**

Key Words: Peyronie's Disease; Prevalence; Adult Males; Etiological Factors

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INTRODUCTION

Peyronie's disease (PD) is a fibrotic disease occurring in men accompanied by pain, penile curvature, palpable plaques, and possible erectile dysfunction (ED).[1−3]

Despite the fact that the exact nature of PD remains a therapeutic dilemma, associations with several comorbidities such as diabetes,[4,5] obesity,[6] hypertension (HT),[7] dyslipidemia,[6] smoking,[8] low levels of testosterone,[9] and pelvic surgery have been reported. PD might be accompanied by collagen disorders such as tympanosclerosis, Lederhosen syndrome, and Dupuytren's contracture (DC).[10]

Studies regarding PD epidemiology are limited in number and PD prevalence rates demonstrate a broad variance. A limitation of epidemiological studies is the discrepancy of patients' perception and diagnosis of the physician.[11,12] In cross-sectional prevalence studies, PD prevalence rates were reported to be between 0.39% and 20.3%.[3,6,8,13–22] This broad spectrum of results may be a result of methodological distinctions and the variety of manifestations. To our knowledge, this is the first study which meticulously investigates both the prevalence of PD in a general male population and its association with possible comorbidities and sexual behaviors of participants via face-to-face interviews.

The purpose of this population-based study is to determine the prevalence of PD in Turkey, investigate patients' comorbidities and sexual behaviors as PD etiological factors, and compare sociodemographic data and sexual dysfunction between PD patients and healthy males.

MATERIALS AND METHODS

A field survey was conducted involving male volunteers between the ages of 30 and 80 years under European Union Statistics Foundation Classification Level 1 (Nomenclature of Territorial Units for Statistics 1) to determine PD prevalence in Turkey.[23] The study was carried out in 12 provinces: Adana, Ankara, Balıkesir, Bursa, Erzurum, İstanbul, İzmir, Kayseri, Malatya, Mardin, Trabzon, and Zonguldak. Male participants who accepted to participate in the study and answered all the questions were included in the study. Volunteers who refused to participate, did not answer all of the questions, and did not speak Turkish were excluded from the study.

The study protocol was reviewed and approved by our local ethics committee (Institutional Review Board Number: 2017-545). This study was conducted in accordance with the Declaration of Helsinki.

A total of 1,186 volunteers were included in the study to find the prevalence of PD in the adult male population in Turkey within a CI of 95% with a precision degree of 2%. The design effect was considered to be 2 to amend any possible error as a result of stratification. The distribution of the participants was determined according to the population density in the regions. The study was carried out in settlements determined via the method of cluster sampling under age groups of the field survey and experienced pollsters were assigned to fieldwork.

A questionnaire designed by PD researchers was given to volunteers who agreed to participate in the study. This questionnaire was made up of 4 parts. In the first part, there were queries on the demographic statistics of the participants; in the second, there were questions about diagnosis of PD (pain, palpable plaque, curvature); in the third, there were questions regarding additional diseases—questions on etiology; and in the 4th part, there were questions about sexual intercourse habits of the volunteers. Patients with a diagnosis of congenital penile curvature were excluded from the group with PD. The remaining characteristics of the patients with and without PD (demographics, additional diseases, ED) were compared.

Statistical Methods

Data were analyzed using the PASW Statistics 18.0 for Windows program. Descriptive statistics were expressed as numbers and percentages for categorical variables, and as mean, SD, median, and minimum−maximum for numerical variables. The numerical variables were investigated using Kolmogorov-Smirnov test to determine whether they were normally distributed. For categorical variables, Chi-square test was used in 2 groups and multiple comparisons when Chi-square condition was met and continuity correction, Fisher's exact test was used for multiple comparisons when Chi-square condition was not met. For comparison of 2 independent groups, Mann-Whitney U test was used for non-normally distributed numerical variables. A type I error level of less than 5% was used to infer statistical significance.

RESULTS

This study included 1,208 men who were older than 30 years and spread through 12 regions in Turkey. PD symptoms were identified in 63 men and so the prevalence of PD was determined to be 5.3% (63/1,208). Out of 1,208 participants, 4.8% were suffering from penile pain, 5.3% from penile curvature, 4.8% from penile plaque, and 4.6% from not being able to perform sexual intercourse. In 26.9% (17/63) of the men with PD, all 3 symptoms were present simultaneously.

The northeastern region had the highest rate of PD prevalence (20.0%); results of the remaining regions are shown in Tables 1 and 2. Demographic data of the subjects are summarized in Table 1. The average age of those participating in the study was 47 ± 12 years. Mean body mass index of men and their partners were 26.44 ± 3.94 and 24.44 ± 4.17 kg/m^2, respectively; 37.2% of the partners of volunteers were obese.

The highest PD prevalence percentage was observed between the ages of 50 and 59 years (27%; $P < .001$). In terms of associated comorbidities, patients with PD were observed to be older (52 vs 45 years; $P < .001$) with higher rates of smoking (73% vs 60.9%; $P = .036$), diabetes mellitus (DM) (17.5% vs 9.2%; $P = .045$), HT (14.3% vs 6.9%; $P = .041$), and heart failure (7.9% vs 2.5%; $P = .027$) (Table 1).

Analysis of etiological factors revealed that a higher percentage of PD patients was exposed to trauma during sexual intercourse (1.1% vs 12%; $P < .001$), had more sexual partners ($P = .012$), and the body mass index of their partners was higher (24.32 ± 4.05 vs 27.05 ± 5.97; $P = .028$) compared to the control groups. Besides, males with PD symptoms preferred female on top sexual positions at higher rates than their control counterparts (34.1% vs 15.2%; $P < .001$). Also, higher dissatisfaction rates of sexual intercourse were described by patients with PD (53.7% vs 77.4%; $P < .001$) and a high rate of ED of

Table 1. Characteristics of the participants with and without PD

	N	With PD	N	Without PD	*P*
Age (years), median (Q1–Q3)	63	52 (41–64)	1,119	45 (37–55)	**<.001***
Age groups (years), n (%)					
30–39	63	13 (20.6)	1,119	379 (33.9)	**<.001†**
40–49		14 (22.2)		294 (26.3)	
50–59		17 (27.0)		252 (22.5)	
60–69		9 (14.3)		146 (13.0)	
≥70		10 (15.9)		48 (4.3)	
Regions, n (%)					
West Anatolia	63	4 (6.3)	1,119	114 (10.2)	**.005‡**
Northeast Anatolia		6 (9.5)		24 (2.1)	
East Black Sea		2 (3.2)		39 (3.5)	
West Black Sea		3 (4.8)		64 (5.7)	
Central East Anatolia		4 (6.3)		44 (3.9)	
Central Anatolia		0 (0.0)		49 (4.4)	
Southeast Anatolia		7 (11.1)		83 (7.4)	
Mediterranean		12 (19.0)		141 (12.6)	
Aegean		5 (7.9)		163 (14.6)	
Istanbul		7 (11.1)		226 (20.2)	
East Marmara		10 (15.9)		110 (9.8)	
West Marmara		3 (4.8)		62 (5.5)	
BMI, median (Q1–Q3)	63	26.99 (23.15–29.41)	1,077	25.95 (24.06–28.4)	.260*
Obesity, n (%)	63	14 (22.2)	1,077	166 (15.4)	.150†
Smoking status, n (%)	63		1,105		
Smoker		46 (73.0)		673 (60.9)	**.036†**
Ex-smoker		12 (19.0)		197 (17.8)	
Never smoked		5 (7.9)		235 (21.3)	
Comorbidity, n (%)					
Diabetes mellitus	63	11 (17.5)	1,119	103 (9.2)	**.045†**
Hypertension	63	9 (14.3)	1,119	77 (6.9)	**.041‡**
Heart failure	63	5 (7.9)	1,119	28 (2.5)	**.027‡**
Atherosclerosis	63	5 (7.9)	1,119	54 (4.8)	.237‡
Hyperlipidemia	63	1 (1.6)	1,119	10 (0.9)	.454‡
Hyperuricemia (gout)	63	0 (0.0)	1,119	1 (0.1)	-
Rheumatoid arthritis	63	0 (0.0)	1,119	4 (0.4)	-
Psoriasis	63	0 (0.0)	1,119	6 (0.5)	1.000‡
Urethritis	63	0 (0.0)	1,119	2 (0.2)	-
Kidney/urinary stone disease	63	2 (3.2)	1,119	23 (2.1)	.389‡
Benign prostate hyperplasia	63	0 (0.0)	1,119	13 (1.2)	1.000‡
Previous operation, n (%)	62	29 (46.8)	1,095	397 (36.3)	.095†
Urinary catheterization for any reason, n (%)	62	11 (17.7)	1,085	113 (10.4)	.071†

BMI, body mass index; PD = Peyronie's disease.
*Mann-Whitney *U* test.
†Chi-square test.
‡Fisher's exact test.

57.4% was demonstrated in patients with PD. Intravaginal ejaculation latency time (IELT) was found to be significantly lower in the group with PD (IELT < 1 min: 5.3% vs 25.5%; $P < .001$). Interestingly, the rate of coincidence of DC and PD in the patient group was 28.8% (Table 3).

DISCUSSION

Epidemiological and etiological data of any disease are essential requirements for physicians to inform their patients about the disease. Since disease cause and potential prevention measures are the 2 most frequent inquiries from patients, recognizing the relation of the disease with comorbidities and sexual habits of the patients would greatly aid us in briefing and advising our patients.

The exact prevalence of PD may be challenging to estimate because males may either exaggerate or hide complaints about their sexuality.[18] In studies of prevalence, disparities in age, geographical regions, socioeconomic situations, and assessment

Table 2. Distribution of Peyronie's disease prevalence by geographical regions

Region	Prevalence (%)	
West Anatolia	3.4	0.005***
Northeast Anatolia	20	
East Black Sea	4.8	
West Black Sea	4.5	
Central East Anatolia	8.3	
Central Anatolia	0	
Southeast Anatolia	7.6	
Mediterranean	7.8	
Aegean	2.9	
Istanbul	3	
East Marmara	8.3	
West Marmara	4.6	

of co-existing diseases may cause a variance in PD prevalence.[24] Also, because populations are assessed in various milieus (groups, hospitals, etc), different results might emerge.[2]

The prevalence of PD in Turkey was determined to be 5.3% which was calculated from the combined data from 12 different regions. The participants were interviewed face-to-face by questioners. This rate is within the spectrum of previously published rates of prevalence (range: 0.39−26%, Table 4). As expected, PD most frequently occurred between the ages of 50 and 59 years and an association of PD with DM, HT, and heart disease was demonstrated.

The first study on the prevalence of PD was carried out in 1991[13] by Lindsay et al and 388 (0.39%) PD cases in a population of 100,000 were reported in this study. In the Koln prevalence study performed in 8,000 males, PD prevalence, proven with the presence of palpable plaque, was reported to be 3.2%.[14] In another population-based prevalence study carried out online in Australia, 1,782 male participants answered questions and PD prevalence was found to be 19.9%[18]

The risk of PD increases with advancing age and in this study, the median age of PD patients was 52 years. In the prevalence study carried out by Sommer et al, PD most frequently occurred in the age group between 50 and 59 years.[14] The average age of PD patients ranged between 48.3 and 59.6 years in other previously reported studies[13,14,16−18] and our median age is in conformity with the literature.

PD prevalence has been observed most frequently in the northeastern region of Turkey (20%). This is probably due to the higher prevalence of DM in the Eastern Anatolia Region (18.2%) when compared to other regions since DM has an association with PD.[25] The frequency of PD was determined to be lower in some regions (eg, Central Anatolian Region) and this might be related to the embarrassment and diffidence common in the Central Anatolian Region.

M disrupts penile blood flow and increases penile abnormalities in comparison to men without PD or any other risk factor.[4] There is in vitro and in vivo evidence that bolsters the idea that DM causes the emergence and progress of fibrosis in various organs. From studies reported in the literature, the relation between PD and DM was observed to be between 18.3% and 32.2%.[5,14,19] In this study, DM is observed in 17.5% of the patients with PD and this is a significantly higher rate than the one in patients without PD.

Vascular diseases such as HT and dyslipidemia result in a hypoxic microenvironment in erectile tissues and this causes abnormal wound recovery and exacerbation of fibrotic cascade.[26] PD-HT coexistence is observed in different studies with a range of 14.7−27.2%.[7,13] In this prevalence study, the coexistence rate of PD and HT was 14.3%. The rates of DM and HT in this study were reported to be in accordance with the literature.

There is a significant relationship between smoking and PD. In a prevalence study carried out in Italy, PD prevalence was found to be 7.1% and multivariate analysis showed a significant correlation between smoking and PD (odds ratio = 4.6; 95% CI: 1.506−14.287).[8] In our study, the rate of smoking in the 2 groups was detected to be 73% and 60.9%, respectively ($P = .036$).

PD pathophysiology has been associated with increased fibrotic inclination[27,28] and the rate of DC occurrence in PD patients has been reported to be between 22% and 39%.[13,21,29] As expected in our study, the rate of co-incidence of PD and DC was reported to be 28.8%.

In the analysis of questions which assess the sexual situation of patients with the occurrence of PD, it was observed that sexual satisfaction and erectile capacity were lower in the PD group. In accordance with questions matching the 4th and 5th questions in the Sexual Encounter Profile-4 and International Erectile Function Index (IIEF-Q4 and IIEF-Q5), the rate of erection problems in the group diagnosed with PD was 57%. The incidence rate of ED in the natural course of PD was reported to be between 40% and 58% and this was consistent with the result obtained in this study.[30] The fear of patients that they will cause further damage to their penises decreases the satisfaction they get from sexual intercourse.

Premature ejaculation (PE) is one of the most common sexual health problems. PE prevalence in Turkey has been reported to be 20%.[31] In this study, the ejaculation latency time of men with PD was observed to be shorter. While 25.5% of the participants in the group with PD reported IELT values below 1 min, this rate was found to be 5.3% in the healthy group. This high PE prevalence may be related to the presence of sensory nerve fibers in the inflammation site in PD patients.[32]

When questioned about their preferred sexual position to assess the possible effect of repetitive trauma, woman on top was the preferred position choice of men with PD. In the woman on top position, the cumulative effect of repetitive penile trauma due to perineal collision might be a cause of PD which was

Table 3. Analysis of questions related to Peyronie's disease

	While your penis is flask do you feel any lump or hard tissue under penile skin?				
	N	No	N	Yes	*P*
Q13. Do these complaints in your sexual organ prevent you to have sexual intercourse? (Yes), n (%)	910	21 (2.3)	49	23 (46.9)	<.001
Q14. Can you fully open and close your pinky and ring finger (your 4th and 5th fingers)? (Yes), n (%)	1,108	1,040 (93.9)	56	33 (58.9)	<.001
Q15. Is there a hardening or thickening that is formed later in your palm or plantar? (Yes), n (%)	1,094	54 (4.9)	52	15 (28.8)	<.001
Q16. Did you ever have a trauma to your penis due to straining or blow during sexual intercourse? (Yes), n (%)	1,086	12 (1.1)	50	6 (12)	<.001
Q17. When did you have your first sexual intercourse? Mean ± SD					
Median (Q1–Q3)	984	17.67 ± 3.33 18 (15–19)	46	17.48 ± 3.69 16.5 (15–18)	.197
Q18. How many sexual partners did you have in total? Mean ± SD					
Median (Q1–Q3)	741	16.88 ± 95.87 4 (2–10)	34	42.82 ± 139.73 8 (4–18)	.012
Partner BMI Mean ± SD					
Median (Q1–Q3)	580	24.32 ± 4.05 23.88 (21.79–26.15)	25	27.05 ± 5.97 24.49 (22.49–31.11)	.028
Q19. In the last 5 years, did your partner have a gynecological disease that prevented sexual intercourse? (Yes), n (%)	1,050	45 (4.3)	52	5 (9.6)	.081
Q20. In the last 5 years, did your partner have any disease that may cause vaginal discharge? (Yes), n (%)	1,041	42 (4)	53	4 (7.5)	.276
Q21. What's your favorite sexual position with your current partner? (Yes), n (%)	936	142 (15.2)	44	15 (34.1)	.001
Female on top					
Male on top		794 (84.8)		29 (65.9)	
Q23. During sexual intercourse how many minutes does it take to ejaculate after you enter? n (%)					
Below 1 min	1,026	54 (5.3)	51	13 (25.5)	<.001
1–2 min		168 (16.4)		9 (17.6)	
2–5 min		407 (39.7)		15 (29.4)	
Above 5 min		397 (38.7)		14 (27.5)	
Q24. Are you satisfied with your sexual intercourse duration? (Yes), n (%)	881	682 (77.4)	41	22 (53.7)	<.001
Q25. Do you have difficulty in erection that prevents sexual intercourse? (Yes), n (%)	1,053	124 (11.8)	54	31 (57.4)	<.001
Q26. Can you keep your erection until you complete sexual intercourse? (Yes), n (%)	1,053	919 (87.3)	54	24 (44.4)	<.001

suggested to happen because of microtrauma. It is thought that the penis may be exposed to more trauma with the female on top sexual position.

One limitation of this study was primarily the lack of a validated questionnaire for PD; however, a questionnaire compliant with the content of a validated one (Peyronie's Disease Questionnaire) was used. Also, the questionnaire was prepared by combining and integrating similar questionnaires used in previous major prevalence studies.

Table 4. Prevalence studies of Peyronie's disease in the literature

	Patient population	Prevalence %
Shindel et al 2017[21]	With Dupuytren contracture	26
Arafa et al 2007[19]	Diabetic patients with erectile dysfunction	20.3
Chung et al 2018[18]	Web based—general population	19
Dibenedetti et al 2011[16]	General population	0.5–13.1
Stuntz et al 2016[17]	General population	0.7–11
Mulhall et al 2004[15]	Men screened for prostate cancer	8.9
El-Sakka 2006[6]	Patients with erectile dysfunction	7.9
La Pera et al 2001[8]	General population	7.1
Askari et al 2019[22]	Diabetic patients	3.8
Rhoden et al 2001[20]	Men older than 50 years undergoing prostate cancer screening	3.7
Schwarzer et al 2001[3] Sommer et al 2002[14]	General population	3.2
Lindsay et al 1991[13]	General population	0.39

Another limitation might be the fact that despite the process maintaining privacy, some participants shied away from replying some questions during the face-to-face interview. In some regions (eg, Central Anatolian), more embarrassed patients also affected the prevalence rates. Finally, no age and comorbidity adjustments were performed because these 2 groups were compared as a whole.

CONCLUSION

This is the first study carried out by employing face-to-face interviews with participants, reporting PD prevalence in accordance with geographical regions and etiological factors. At the end of the study, the PD prevalence of 5.3% in Turkey was found to be compliant with other prevalence studies carried out earlier. When the associated factors were examined, it was observed that DM, HT, smoking, and the position of sexual intercourse are related to PD. This study has contributed to improving the awareness of PD in the society, and may enable more men to obtain the necessary diagnosis and treatment for PD.

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REFERENCES

1. Smith CJ, McMahon C, Shabsigh R. Peyronie's disease: the epidemiology, aetiology and clinical evaluation of deformity. **BJU Int 2005;95:729-732.**
2. Chung E, Ralph D, Kagioglu A, et al. Evidence-based Management Guidelines on Peyronie's disease. **J Sex Med 2016;13:905-923.**
3. Schwarzer U, Sommer F, Klotz T, et al. The prevalence of Peyronie's disease: results of a large survey. **BJU Int 2001;88:727-730.**
4. Kendirci M, Trost L, Sikka SC, et al. Diabetes mellitus is associated with severe Peyronie's disease. **BJU Int 2007;99:383-386.**
5. Kadioglu A, Tefekli A, Erol B, et al. A retrospective review of 307 men with Peyronie's disease. **J Urol 2002;168:1075-1079.**
6. El-Sakka AI. Prevalence of Peyronie's disease among patients with erectile dysfunction. **Eur Urol 2006;49:564-569.**
7. Usta MF, Bivalacqua TJ, Jabren GW, et al. Relationship between the severity of penile curvature and the presence of comorbidities in men with Peyronie's disease. **J Urol 2004;171:775-779.**
8. La Pera G, Pescatori ES, Calabrese M, et al. Peyronie's disease: prevalence and association with cigarette smoking. A multicenter population-based study in men aged 50-69 years. **Eur Urol 2001;40:525-530.**
9. Cavallini G, Biagiotti G, Lo Giudice C. Association between Peyronie disease and low serum testosterone levels: detection and therapeutic considerations. **J Androl 2012;33:381-388.**
10. Qian A, Meals RA, Rajfer J, et al. Comparison of gene expression profiles between Peyronie's disease and Dupuytren's contracture. **Urology 2004;64:399-404.**
11. Sullivan J, Moskovic D, Nelson C, et al. Peyronie's disease: urologist's knowledge base and practice patterns. **Andrology 2015;3:260-264.**

12. LaRochelle JC, Levine LA. A Survey of primary-care physicians and urologists regarding Peyronie's disease. **J Sex Med 2007; 4:1167-1173.**
13. Lindsay MB, Schain DM, Grambsch P, et al. The incidence of Peyronie's disease in Rochester, Minnesota, 1950 through 1984. **J Urol 1991;146:1007-1009.**
14. Sommer F, Schwarzer U, Wassmer G, et al. Epidemiology of Peyronie's disease. **Int J impotence Res 2002;14:379-383.**
15. Mulhall JP, Creech SD, Boorjian SA, et al. Subjective and objective analysis of the prevalence of Peyronie's disease in a population of men presenting for prostate cancer screening. **J Urol 2004;171:2350-2353.**
16. Dibenedetti DB, Nguyen D, Zografos L, et al. A population-based study of Peyronie's disease: prevalence and treatment patterns in the United States. **Adv Urol 2011;2011:282503.**
17. Stuntz M, Perlaky A, des Vignes F, et al. The prevalence of Peyronie's disease in the United States: a population-based study. **PloS one 2016;11:e0150157.**
18. Chung E, Gillman M, Rushton D, et al. Prevalence of penile curvature: a population-based cross-sectional study in metropolitan and rural cities in Australia. **BJU Int 2018;122-(Suppl 5):42-49.**
19. Arafa M, Eid H, El-Badry A, et al. The prevalence of Peyronie's disease in diabetic patients with erectile dysfunction. **Int J Impot Res 2007;19:213-217.**
20. Rhoden EL, Teloken C, Ting HY, et al. Prevalence of Peyronie's disease in men over 50-y-old from Southern Brazil. **Int J impotence Res 2001;13:291-293.**
21. Shindel AW, Sweet G, Thieu W, et al. Prevalence of Peyronie's disease-Like symptoms in men presenting with Dupuytren contractures. **Sex Med 2017;5:e135-e141.**
22. Askari M, Mohamad Mirjalili SA, Bozorg M, et al. The prevalence of Peyronie's disease in diabetic patients -2018- Yazd. **Diabetes Metab Syndr 2019;13:604-607.**
23. Kara Y, Köne A. Measuring social Sustainability of NUTS-1 level regions in Turkey; 2015.
24. Mulhall JP, Schiff J, Guhring P. An analysis of the natural history of Peyronie's disease. **J Urol 2006;175:2115-2118.**
25. Satman I, Omer B, Tutuncu Y, et al. Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. **Eur J Epidemiol 2013;28:169-180.**
26. El-Sakka AI, Hassoba HM, Pillarisetty RJ, et al. Peyronie's disease is associated with an increase in transforming growth factor-beta protein expression. **J Urol 1997;158:1391-1394.**
27. Hinman F Jr. Etiologic factors in Peyronie's disease. **Urologia internationalis 1980;35:407-413.**
28. Williams JL, Thomas GG. The natural history of Peyronie's disease. **Proc R Soc Med 1968;61:876-877.**
29. Bjekic MD, Vlajinac HD, Sipetic SB, et al. Risk factors for Peyronie's disease: a case-control study. **BJU Int 2006; 97:570-574.**
30. Bekos A, Arvaniti M, Hatzimouratidis K, et al. The natural history of Peyronie's disease: an ultrasonography-based study. **Eur Urol 2008;53:644-650.**
31. Serefoglu EC, Yaman O, Cayan S, et al. Prevalence of the complaint of ejaculating prematurely and the four premature ejaculation syndromes: results from the Turkish Society of Andrology Sexual Health Survey. **J Sex Med 2011;8:540-548.**
32. Wiggins A, Farrell MR, Tsambarlis P, et al. The penile Sensitivity Ratio: a Novel Application of Biothesiometry to assess Changes in penile Sensitivity. **J Sex Med 2019;16:447-451.**