TÜBİTAK

Original Article

Turk J Med Sci
2012; 42 (3): 539-544
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E-mail: medsci@tubitak.gov.tr
doi:10.3906/sag-1103-32

A new anthropometric measurement of penile length and its relation to second and fourth digital lengths

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Aim: The development of digits is under the control of Hox genes, which also control the differentiation of the urogenital system. In the present study we evaluated the association between penile length and lengths of the second and fourth digits.

Materials and methods: In this study, 1028 Turkish male primary school children from the Eastern Mediterranean Region of Turkey were included. Weight and height measurements were obtained in order to calculate the body mass index (BMI). Flaccid and stretched length of the penis was measured. The lengths of the second and fourth digits of the right hands were measured. Statistical analyses were performed with descriptive statistics and Pearson correlation analysis.

Results: A significant correlation was found between the following parameters: the length of the second digit with flaccid and stretched length of the penis ($r = 0.166$ and $r = 0.276$, respectively; $P < 0.01$); and the length of the fourth digits with flaccid and stretched length of the penis ($r = 0.174$ and $r = 0.287$, respectively; $P < 0.01$). No significant correlation of 2D:4D ratio was found with flaccid and stretched length of the penis ($r = –0.013$; $P = 0.668$, $r = –0.018$; $P = 0.565$, respectively).

Conclusion: The positive correlations in our study are a novel finding and may have further clinical implications.

Key words: Penis size, digit length, somatometric parameter

Penis uzunluğu ile ikinci ve dördüncü parmak uzunluğu ilişkisini gösteren yeni bir antropometrik ölçüm

Amaç: Ürogenital sistem farklılaşmasını kontrol eden Hox genleri parmakların gelişimini de kontrol etmektedir. Bu çalışmada penis uzunluğu ile ikinci ve dördüncü parmakaların uzunlukları arasındaki ilişki değerlendirildi.

Yöntem ve gereç: Bu çalışmaya doğu akdeniz bölgesindeki ilkokul çağındaki toplam 1028 Türk erkek çocuğu dahil edilmiştir. Vücut kitle indeksini hesap edebilmek için ağırlık ve uzunlukları ölçülmüştür. Penis uzunlukları gevşek ve gerilmiş halde ölçülmüştür. Sağ el ikinci ve dördüncü parmakların uzunlukları ölçülmüştür. İstatiksel ölçümler deskriptif istatistik ve Pearson korrelasyon analizi ile yapılmıştır.

Bulgular: Aşağıdaki karşılaştırmalar arasında anlamlı korelasyon tespit edilmiştir: ikinci parmak uzunluğu ile gevşek ve gerilmiş penis uzunluğu ($r = 0,166$ and $r = 0,276$, sırasıyla; $P < 0,01$); dördüncü parmak uzunluğu ile gevşek ve gerilmiş penis uzunluğu ($r = 0,174$ and $r = 0,287$, sırasıyla; $P < 0,01$). 2D:4D oranı ile gevşek ve gerilmiş penis uzunluğu arasında anlamlı korelasyon bulunmamıştır ($r = –0,013$; $P = 0,668$, $r = –0,018$; $P = 0,565$).

Sonuç: Sonuç olarak, çalışmamızdaki pozitif korelasonlar yeni bir bulgudur ve içerisinde daha başka klinik anlamlar içerebilir.

Anahtar sözcükler: Penis boyutu, parmak uzunluğu, somatometrik ölçümler

Received: 11.03.2011 – Accepted: 05.06.2011

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Introduction

In daily clinical practice, clinicians like urologists and endocrinologists usually have to deal with young patients complaining about the unsatisfactory size of their penises. This problem is generally seen in adolescents. It is suggested that the size may affect sexual satisfaction and fertility potential (1).

Any disorder regarding abnormal genital development, such as micropenis, can be diagnosed by physical examination. Micropenis is diagnosed as a disorder that is normal in terms of configuration and function. However, it is more than 2.5 standard deviations (SD) smaller than the mean length (2-4), which may be subjected to international differences (5-9).

There may be a relationship between the prenatal production of testicular androgen and the length of the digits, which may be indirectly affected by *Hox* genes. These genes also control the differentiation of urogenital system (10,11).

Previous reports have suggested that patterns of digit formation may be related to gonad function (12-14).

Therefore, our aim was to investigate the relationship between the penile length and lengths of the second (2D) and fourth digits (4D). We also aimed to evaluate the penile size in terms of height, weight, and body mass index. To the best of our knowledge, this is the first study investigating the association between the penile length and lengths of digits in such a large sample.

Materials and methods

The study was conducted after obtaining permission from the ethics committee of the Medical School, Mustafa Kemal University. The study was conducted in 2009 and 1028 Turkish male primary school children living in Hatay were enrolled in the study. Initially, weight and height measurements were taken for calculating the body mass index (BMI). All examinations were performed in warm conditions by the same physician (MD). Lengths of the penis as well as the second and fourth fingers were evaluated by the measurement method of Spyropoulos et al. and Manning et al. (1,12). Flaccid penile length was measured as the distance between the penopubic skin junction and the tip of the glans in the flaccid and the nonstretched state of the penis. The point of the penopubic junction was determined by the line that was determined by gently handling the penis dorsally. The stretched penile length was determined from the penopubic junction to the tip of the glans penis by placing the end of a straight-edge ruler gently against the pubic ramus and applying traction along the length of the phallus to the point of increased resistance-an easily appreciated end point (1). The lengths of the second and fourth fingers were measured directly on the ventral surface of the right hand from the basal line of the finger to the tip (12). All measurements were performed twice using a millimetric ruler and mean values were recorded.

The data were analyzed using SPSS for Windows, version 14.0 (SPSS Inc. Chicago, Illinois, United States). Correlation (Pearson) and regression analyses were performed.

Results

Anthropometric parameters were measured for all subjects as mean ± standard deviation (Table 1). The mean age of the individuals was 8.60 ± 1.32 years (range 6 to 11 years). The mean height, weight, and BMI were calculated as 129.39 ± 9.25 cm, 26.73 ± 6.20 kg, and 27.33 ± 1.80 kg/m^2, respectively. The mean length of the second and fourth fingers, and the 2D (Digit):4D ratio of the right hand were 53.17 ± 4.79 mm, 55.78

Table 1. Antropometric parameters measured in the study group.

	Age	Length of flaccid penis (mm)	Length of stretched penis (mm)	Length of second finger (mm)	Length of fourth finger (mm)	Height (cm)	Weight kg	BMI kg/m^2	2D:4D
Mean	8.60	24.91	44.70	53.17	55.78	129.39	26.73	27.33	0.95
Standard deviation	1.32	6.30	9.11	4.79	4.96	9.25	6.20	1.80	0.04

± 4.96 mm, and 0.95 ± 0.04, respectively; whereas the mean flaccid and stretched lengths of the penis were 24.91 ± 6.30 mm and 44.70 ± 9.11 mm, respectively.

Results of the correlation analysis revealing the relation among the variables are shown in Table 2. A significant correlation was found between the following parameters: the length of the second digit with flaccid and stretched length of the penis (r = 0.166 and r = 0.276, respectively; P < 0.01); and the length of the fourth digits with flaccid and stretched length of the penis (r = 0.174 and r = 0.287, P < 0.01; respectively). No statistical correlation of 2D:4D ratio was found with flaccid and stretched length of the penis.

The relations between the lengths of stretched and flaccid penis in relation with age and 2D, 4D dimensions are presented in Figures 1a-d.

It was found that there was a positive and significant correlation of stretched and flaccid penile length with age and the length of second and fourth digits. However, there was no significant correlation between 2D:4D ratio and stretched and flaccid penile length according to age.

Multiple regression analysis was performed with 2D, 4D, BMI, and age as independent variables and flaccid penis length as dependent variable. The model for predicting flaccid penis length was statistically significant and linear. Age, BMI, and 4D were found to be significant in predicting flaccid penis length. However, 2D was found to be insignificant in anticipating flaccid penis length. It was observed that 7.8% of the change in flaccid penis length was due to variables like 2D, 4D, BMI, and age (Table 3).

In the multiple regression analysis (where 2D, 4D, BMI, and age were independent variables and stretched penis length was dependent variable), age, BMI, and 4D were found to play a significant role in predicting stretched penis length. In addition 2D was found to be insignificant in anticipating stretched penis length. These 4 variables corresponded to 9.0% of the total variables related to stretch penis length (Table 3).

Discussion

Testosterone directly affects the penile development. The ratio of serum testosterone/estrogen levels is important in terms of the prenatal regulation of the male genital system differentiation. There is a strong expression of *Hox* genes in the genital bud. Penis development is affected by the prenatal testicular androgen production (15). Therefore, mutation regarding *Hox* genes causes anatomical abnormality in genitalia and fingers, which is called as hand–foot–genitalia syndrome (10,11). As there is a common genetic structure, investigating fingers and penis together makes sense. The measurement of penile length is also essential in other conditions including the diagnosis of micropenis (pituitary and hypothalamic disorders), anatomic abnormalities of the penis, defining the diseases requiring penile-lengthening procedures, and investigating the results of medical or surgical treatment of the penis (16).

Apart from fingers, many authors think that the size of a man's penile length can be estimated by evaluating the other parts of his body. Previous reports in developmental medicine could provide us with predictive clues about the relationship between the length of certain extremities or digits and penile size. Shah and Christopher revealed that there was no correlation between the length of penis and shoe size. Therefore, they criticized the common belief in which shoe size is related with the length of penis (17).

Table 2. Partial correlation coefficients (r) among penile length, second and fourth digit length, height, weight, and BMI (controlling for age).

	Flaccid penis	Stretched penis	Second finger	Fourth finger	2D:4D ratio	BMI
Stretched penis	0.713**					
Second finger	0.166**	0.276**				
Fourth finger	0.174**	0.287**	0.882**			
2D:4D ratio	-0.013	-0.018	0.270**	-0.213**		
BMI	-0.021	0.137**	0.650**	0.667**	-0.014	
Age	0.118**	0.238**	0.610**	0.604**	0.027	0.600**

**P < 0.01

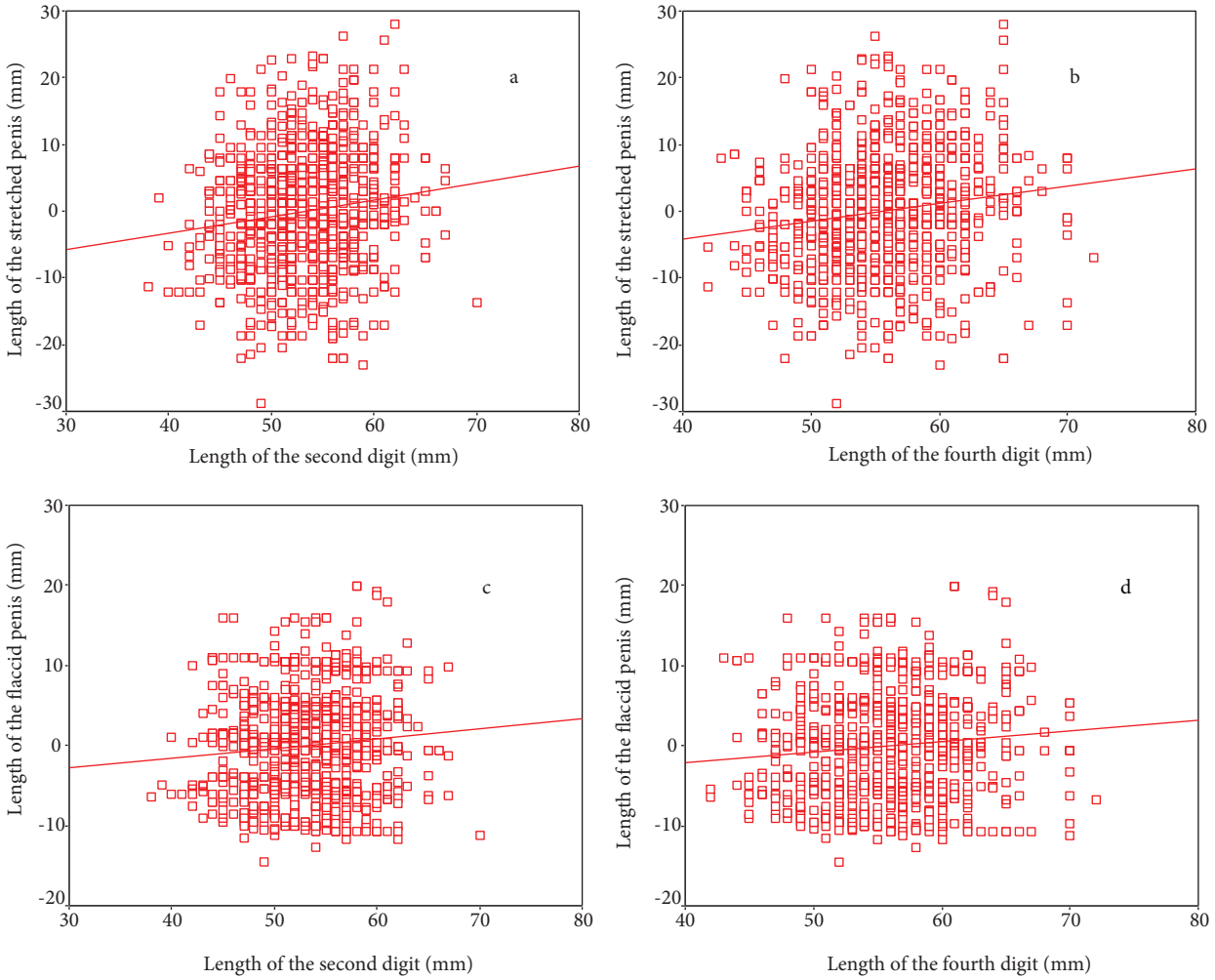

Figure 1. a- Positive correlations between second digit and stretched penis lengths, b- Positive correlations between fourth digit and stretched penis lengths, c- Positive correlations between second digit and flaccid penis lengths, d- Positive correlations between fourth digit and flaccid penis lengths.

Spyropoulos et al. preferred to perform the estimation related to penis size by measuring the index finger length (1). It was pointed that there was a significant relationship between the digit and penile lengths. This was the first study investigating the relationship between the length of digits and penile size in the literature. Nevertheless, their sample was not sufficiently large and no assessment was performed about the fourth digit. Therefore, it was proposed that larger scale research should be carried out.

In another study, it was reported that the ratio of 2D:4D changes according to gender and it may be used as a predictive parameter of fertility, and the expression of a number of adult disorders (12,18). In another study, the low 2D:4D ratio was found to be associated with high sperm counts, high serum testosterone levels, and increased fertility. Additionally, high 2D:4D ratios were correlated with low sperm counts, and low testosterone and high estrogen levels (13,19). The 2D:4D ratios were also revealed to be related with some adult onset disorders, such as breast cancer (20,21). Moreover, patients with congenital adrenal hyperplasia have low 2D:4D ratios compared to controls (15,22). Recent reports on 2D:4D ratio were summarized by Manning (14).

As reported in previous studies, it is obvious that there is a significant relationship between penile and digit lengths. In the current report, our study has a larger sample in comparison to Spyropoulos et al.'s work (1). We also investigated the relation

Table 3. Multiple linear regression analysis results with stretched and flaccid penis lengths as dependent variables.

Constant: 26.43		Stretched penis		
Independent variable	Standardized regression coefficients (beta)	t	P	95% Confidence interval
2D	0.10	1.59	0.111	–0.046 to 0.448
4D	0.21	3.33	0.001	0.170 to 0.655
Age	0.11	2.75	0.006	0.237 to 1.417
BMI	–0.16	–3.77	0.000	–1.248 to –0.394
Constant:25.71		Flaccid penis		
Independent variable	Standardized regression coefficients (beta)	t	P	95% Confidence interval
2D	0.10	1.67	0.094	–0.025 to 0.320
4D	0.23	3.51	0.000	0.134 to 0.472
Age	0.08	1.97	0.048	0.003 to 0.826
BMI	-0.30	-7.00	0.000	–1.362 to –0.766

between both the lengths of the second and fourth digits and penile length. Similar to the study by Spyropoulos et al., we performed our study in the Mediterranean region and the length of the second digit was correlated with penile length. In addition, we measured the length of the fourth digit. It was found that the length of the fourth finger was statistically correlated with both flaccid and the stretched penile sizes. In the light of the report by Manning et al., we evaluated whether there is a relation between 2D:4D ratio and flaccid and stretched length of the penis. However, we could not find a significant correlation. This difference may be due to the mean age of our study population. Since body development is not fully completed in children, a possible correlation between mature digits and penis could not be achieved in a pediatric age group. However, the similarity in the results of both studies could be due to the regions in which the measurements were carried out. Living in the Mediterranean region for these studies samples may have a role as an etiological factor.

Previous reports in the literature have no standardization about evaluation techniques preventing one from obtaining accurate results (23,24). In these studies, measurements were generally self-recorded or made by more than one doctor (23). Voracek et al. reported that the data for analysis should be based on averages from at least 2 measurements (25). In the current study, all measurements were performed by the same physician (MD) at least twice. We think that the strict appliance of measurement principles by the same person will provide more correct results as in our study.

In previous reports, despite the several observed correlations between penile dimension and somatometric parameters, either positive (height) or negative (weight, BMI, W/H ratio, shoe size), no meaningful relationship was persuasive enough to set up predictive variables (17). In our study, weight and BMI significantly correlated with the length of stretched penis.

In another study, Ponchietti et al. investigated the relationship between penile measurements (length, circumference at the midshaft) and other somatometric parameters, such as height, weight, and BMI (26). They observed that the penile dimensions were highly correlated with height and weight of the subjects. However, digits were not included in comparisons.

In conclusion, to the best of our knowledge, this is the first report revealing a significant correlation between the penile size and digit lengths. Additionally, the current study population is the largest sample examined to date. Based on our findings, we think that the relationship between penile and digit lengths could be a developmental link leading to new clinical applications.

References

1. Spyropoulos E, Borousas D, Mavrikos S, Dellis A, Bourounis M, Athanasiadis S. Size of external genital organs and somatometric parameters among physically normal men younger than 40 years old. Urology 2002; 60: 485-9; discussion 90-91.
2. Aaronson IA. Micropenis: medical and surgical implications. J Urol 1994;152: 4-14.
3. Smith DP, Rickman C, Jerkins GR. Ultrasound evaluation of normal penile (corporeal) length in children. J Urol 1995; 154: 822-24.
4. Elder JS. Abnormalities of the genitalia in boys and their surgical management. In: Walsh PC, Retik AB, Vaughan ED, Wein AD, editors. Campbell's Urology. Saunders: Philadelphia; 2002. p.2340-42
5. Ozbey H, Temiz A, Salman T. A simple method for measuring penile length in newborns and infants. BJU Int 1999; 84: 1093-94.
6. Boas M, Boisen KA, Virtanen HE, Kaleva M, Suomi AM, Schmidt IM et al. Postnatal penile length and growth rate correlate to serum testosterone levels: a longitudinal study of 1962 normal boys. Eur J Endocrinol 2006; 154: 125-29.
7. Wang CH, Lin WD, Bau DT, Tsai CH, Liu DC, Tsai FJ. Penile length of normal boys in Taiwan. Acta Paediatr Taiwan 2006; 47: 293-96.
8. Perovic SV, Djordjevic ML. Penile lengthening. BJU Int 2000; 86: 1028-33.
9. Son H, Lee H, Huh JS, Kim SW, Paick JS. Studies on self-esteem of penile size in young Korean military men. Asian J Androl 2003; 5: 185-89.
10. Kondo T, Zakany J, Innis JW, Duboule D. Of fingers, toes and penises. Nature 1997; 390: 29.
11. Mortlock DP, Innis JW. Mutation of HOXA13 in hand-foot-genital syndrome. Nat Genet 1997; 15: 179-80.
12. Manning JT, Scutt D, Wilson J, Lewis-Jones DI. The ratio of 2nd to 4th digit length: a predictor of sperm numbers and concentrations of testosterone, luteinizing hormone and oestrogen. Hum Reprod 1998; 13: 3000-04.
13. Manning JT, Barley L, Walton J, Lewis-Jones DI, Trivers RL, Singh D et al. The 2nd:4th digit ratio, sexual dimorphism, population differences, and reproductive success: evidence for sexually antagonistic genes? Evol Hum Behav 2000; 21: 163-83.
14. Manning JT. The finger book: Sex, behaviour and disease revealed in the fingers. London: Faber & Faber; 2008.
15. Okten A, Kalyoncu M, Yaris N. The ratio of second- and fourth-digit lengths and congenital adrenal hyperplasia due to 21-hydroxylase deficiency. Early Hum Dev 2002; 70: 47-54.
16. Sengezer M, Ozturk S, Deveci M. Accurate method for determining functional penile length in Turkish young men. Ann Plast Surg 2002; 48: 381-85.
17. Shah J, Christopher N. Can shoe size predict penile length? BJU Int 2002; 90: 586-87.
18. Manning JT, Taylor RP. Second to fourth digit ratio and male ability in sport: implications for sexual selection in humans. Evol Hum Behav 2001; 22: 61-9.
19. Manning JT, Pickup LJ. Symmetry and performance in middle distance runners. Int J Sports Med 1998; 19: 205-9.
20. Manning JT, Baron-Cohen S, Wheelwright S, Sanders G. The 2nd to 4th digit ratio and autism. Dev Med Child Neurol 2001; 43: 160-64.
21. Manning JT, Leinster S. 2nd to 4th digit ratio and age at presentation of breast cancer. Breast 2001; 10: 355-57.
22. Brown WM, Hines M, Fane BA, Breedlove SM. Masculinized finger length patterns in human males and females with congenital adrenal hyperplasia. Horm Behav. 2002; 42: 380-86.
23. Wessells H, Lue TF, McAninch JW. Penile length in the flaccid and erect states: guidelines for penile augmentation. J Urol 1996; 156: 995-97.
24. Bondil P, Costa P, Daures JP, Louis JF, Navratil H. Clinical study of the longitudinal deformation of the flaccid penis and of its variations with aging. Eur Urol 1992; 21: 284-86.
25. Voracek M, Manning JT, Dressler SG. Repeatability and interobserver error of digit ratio (2D:4D) measurements made by experts. Am J Hum Biol 2007; 19: 142-46.
26. Ponchietti R, Mondaini N, Bonafe M, Di Loro F, Biscioni S, Masieri L. Penile length and circumference: a study on 3,300 young Italian males. Eur Urol 2001; 39: 183-86.