KJU
Korean Journal of Urology

www.kjurology.org
DOI:10.4111/kju.2010.51.3.208

Sexual Dysfunction/Infertility

Is the Index Finger and Ring Finger Ratio (2D:4D) Reliable Predictor of Semen Quality?

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Purpose: The purpose of this paper is to test the validity of hypothesis that the index finger and ring finger ratio (2D:4D) is related with men's semen quality.
Materials and Methods: We set two groups of healthy young male student (mean age 23.9) who have different 2D:4D ratio from different departments of Chosun University. One group consists of 26 men whose 2D:4D ratio is higher than 1 (mean 1.06), and the other group consists of 33 men whose 2D:4D ratio is lower than 1 (mean 0.94). Their semen was collected by masturbation and examined.
Results: A comparative analysis revealed that there is no relation between semen quality and the 2D:4D ratio. The group of 2D:4D $\geq$ 1 showed a semen volume of 3.66±1.64 ml, on the other hand, the group of 2D:4D $<$ 1 showed a semen volume of 3.73±1.40 ml. No statistical correlation was found (p=0.82). The view of sperm count and motile sperm in single ejaculated semen also showed no statistically significance with 2D:4D ratio (p=0.84, p=0.43, respectively).
Conclusions: The 2D:4D ratio has no statistically significant correlation with the semen quality of health young male. Thus, measurements of finger length cannot be a reliable indicator of semen quality and testicular function.

Key Words: *Fingers; Semen analysis*

Article History:
received 21 October, 2009
accepted 8 January, 2010

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This article was supported by scholarship foundation of Chosun University (2007).

INTRODUCTION

For generations, the estrogen like or anti-androgen like environmental factors have been assumed to play an important role in the degeneration of men's semen quality [1]. Also correctable congenital factors such as cryptochidism [2], varicocele [3] and uncorrectable acquired factors such as testicular and scrotal injury [4] are known to have an influence on semen quality. With these, the hypothesis that makes a decision on men's semen quality is suggested according to genetic information in the embryogenetic process. It is based on the *HOX* genes (*HOXa* to *HOXd*) which plays a role in the differentiation of genital buds and have an influence on the development of finger and prenatal androgen [5]. Accordingly, many investigators tried to reveal the relationship between the index finger and ring finger ratio and the masculation aspect, sex role and semen quality [6-8]. Manning et al have compared the index finger to ring finger ratio (2D:4D ratio) with semen quality and testosterone concentration, and they reported that the group of high 2D:4D ratio has low semen quality and testosterone concentration [9,10]. However, this has been refuted by a subsequent research performed by Bang et al and Firman et al who presented that it has no association with 2D:4D ratio and semen quality [11,12]. Then, we conducted a study to confirm that the 2D:4D ratio cannot be a predictable factor of semen quality of healthy young men.

MATERIALS AND METHODS

From November 2008 to January 2009, we measured the finger length of 264 male students majoring in various subjects in different departments at Chosun University. We found 31 students whose index finger is longer than the ring finger or of the same length. Out of the 31 students, two refused to participate and one had a medical disease. Experimental group consisted of 28 men while control group consisted of 33 volunteers out of 231 healthy young men. The participants of both group were all single, healthy, and had no problems in ejaculation and sex life. We excluded inappropriate candidates through history taking and physical examination. Excleded candidates

were those who had a history of cryptochidisms, varicoceles, or testicular injury which can have an influence on semen analysis as well as those who had burns or trauma on hands that can have an influence on finger length. Finger lengths were measured by physicians from department of rehabilitation. After putting ventral surface of right hand on the paper and drawing an outline of the hand, the length between basal crease and finger tip was measured with verniercalifers. This process was repeated by two physicians at the same time. When the results were different, we used the means of the two measured values. With these results, the index finger and ring finger ratio was calculated (2D:4D).

Semen sample was obtained by masturbation. We advised all participants to lead ascetic life more than 48 hours before semen sampling. The semen samples were collected in a silent room that is away from the consultation room and these samples were collected for 3 days. After semen was put in a sterile vial, it was sent to the department of clinical pathology and analyzed within 30 minutes of semen collection. In conformity with normal criteria of sperm count by WHO protocol [13], we defined the normal range of semen quality as follows: the concentration of spermatozoa is more than $2.0x10^6$, the normal motile sperm is rapid forward movement, (grade a) is more than 25 percent or the sum of rapid movement, and slow movement spermatozoa (grade a+b) is greater than 50 percent.

For the descriptive statistics, numerical value of semen index was indicated with Mean±SD (standard deviation) and SPSS (ver. 12.0) for windows was used to perform all statistical analyses. The variables such as finger ratio, semen volume, sperm count and quantity was analyzed by Mann-Whitney test, and Spearman correlation analysis was done and p-value < 0.05 was considered to indicate a statistical significance.

RESULTS

Mean age of all subjects was 23.9 (21-28), and the difference in age was not considerable between two groups (24.07 and 23.81). No subjects complained of symptoms like post-ejaculate discomfort or pain. The average semen volume of group of 2D:4D ratio of more than 1 is 3.66±1.64 ml, and the group of 2D:4D ratio of less than 1 is 3.73±1.40 ml. The semen volume of the group of 2D:4D < 1 seemed to have a smaller amount, but it was not statistically significant (p=0.82). Each total sperm count in semen was 98.68±66.57 ($x10^6$/ml) and 94.39±56.92, respectively. Thus, it showed almost no difference (p=0.84). Each ratio of motile sperm was 63.93±19.53% and 60.30±19.92%, respectively. It seemed that the amount of motile sperm is greater in the group whose 2D:4D ratio is higher, but it also has no statistically significance (p=0.43) (Table 1). Each group had two oligospermias whose semen volume < 1 ml and a total sperm count $< 1x10^6$/ml where it did not make much difference between two groups. Spearman examination with a correlation analysis indicated that all semen volume, sperm count, and motile sperm ratio with finger ratio showed no statistical significance (p=0.696, p=0.749, p=0.323) (Table 2). The scatter plot also showed there is no correlation between the finger ratio and the semen value (Fig. 1).

DISCUSSIONS

Many studies are attempting to identify the relationship between finger ratio and personal habitus, sex roles, sex hormone status and ability of fertility in conjunction with *HOX* gene during fetal development. These studies have been based on the hypothesis that a comparative study of the length of index finger and ring finger can predict personal habitus, sex roles, sex hormone status and ability of

TABLE 1. Semen quality between 2D:4D ≥ 1 and 2D:4D < 1

	2D:4D ≥ 1 (n=28)	2D:4D < 1 (n=33)	Z	p-value
	Mean±SD	Mean±SD		
Semen volume (ml)	3.66±1.64	3.73±1.40	0.224	0.822
Sperm count ($x10^6$/ml)	98.68±66.57	94.39±56.92	0.195	0.845
Motile sperm (%)	63.93±19.53	60.30±19.92	0.785	0.432

Values are given as Mean±SD in Mann-Whitney test. Z is the proper stats of Mann-Whitney test.

TABLE 2. Semen quality between 2D:4D ≥ 1 and 2D:4D < 1

	Finger ratio	Semen volume	Sperm count	Motile sperm
Finger ratio	1.000	−0.051 (p=0.696)	0.042 (p=0.749)	0.129 (p=0.323)
Semen volume		1.000	0.748 (p=0.000)	0.477 (p=0.000)
Sperm count			1.000	0.480 (p=0.000)
Motile sperm				1.000

p-values are given by Spearman rank order correlation.

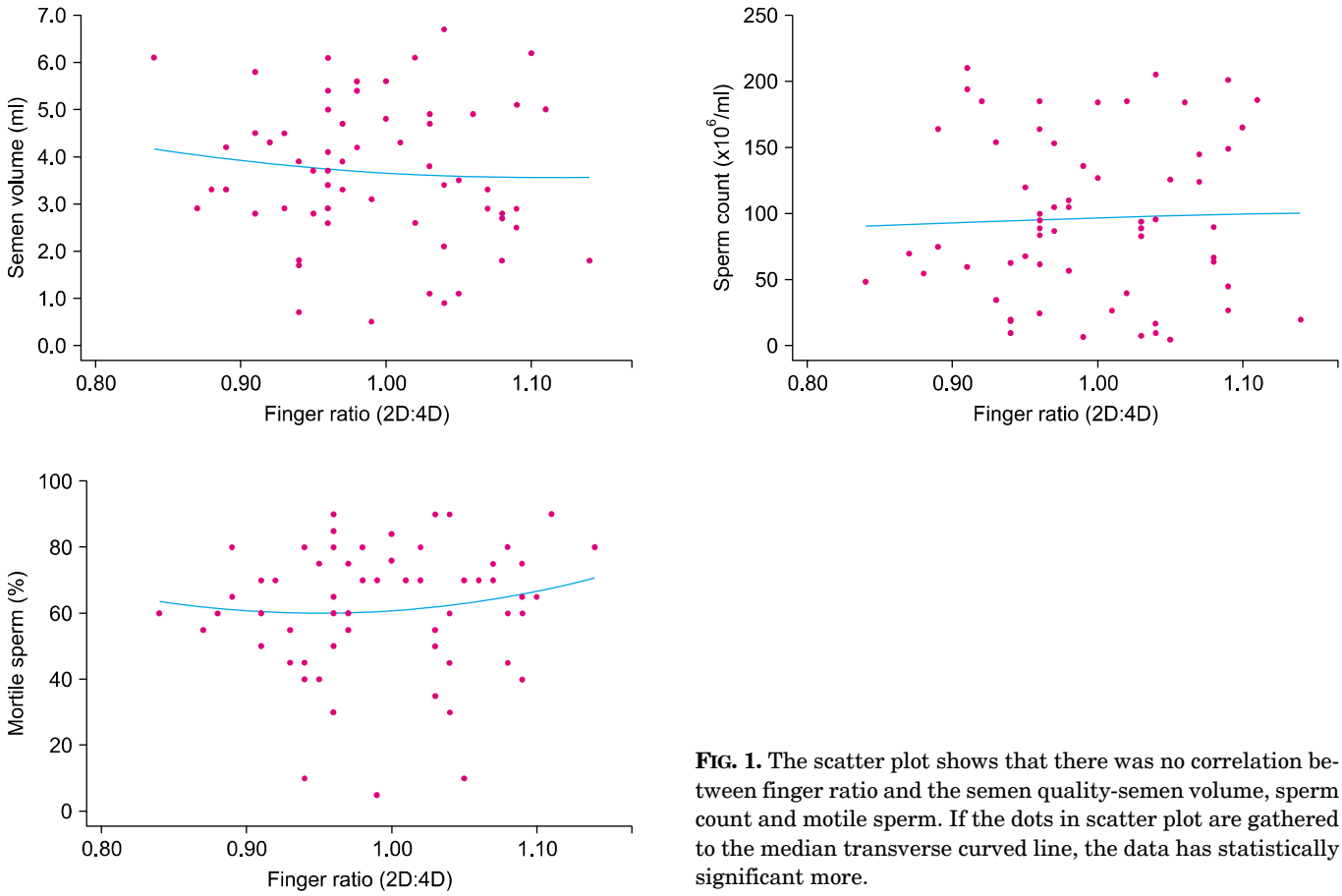

FIG. 1. The scatter plot shows that there was no correlation between finger ratio and the semen quality-semen volume, sperm count and motile sperm. If the dots in scatter plot are gathered to the median transverse curved line, the data has statistically significant more.

fertility in adulthood, and many studies have presented their correlations [8,9,14-16]. However, many studies also rebutted these results by their respective findings [11,12,17-19].

Manning et al have found a significant negative relationship between digit ratio and semen quality for 52 men [9]. However, the subject pool from which men were drawn was a non-random sample of the male population. They suggested that a similar study conducted by Baker et al [20] who reported a comparable correlation between body asymmetry and sperm numbers, and a seemingly random population in regard to their fertility was based on a better representation of the general population. The subject group used by Baker et al [20] consisted of 34 undergraduate university students, ranging in age from 19 to 22 years. Our study correctly identified the traits that were revealing of developmental instability through finger ratio, and showed that developmental instability may indeed be associated with poor semen quality in the general population.

Previous studies about finger ratio, sex hormone, and semen quality had been carried out measuring finger ratio in randomized group and comparing dependent variables [9-12]. But in our study, we first grouped the people by the finger ratio and analyzed the semen and comparing them with each group. It may be the most direct way to find the difference in semen quality between two groups.

Manning et al have presented the negative relationship between the 2D:4D ratio and sperm number, motility and testosterone concentrations [9,10]. In contrast, we have a comparable sample size and found no significant associations between 2D:4D ratio and semen quality such as the amount, number and motility of sperm. These results are similar to the previous studies of Bang et al and Firman et al [11,12]. Manning et al had a subset of oligospermic males, which reduced the overall mean sperm numbers and this may account for the significant relationship between sperm number and 2D:4D ratio in their study [9]. On the other hand, our study has no meaningful oligospermic males and has no difference of sperm amount in each group. Although infertile men may have high 2D:4D ratios, our data show that men with high 2D:4D ratio do not necessarily have abnormal semen. Thus, the 2D:4D ratio is unlikely to be of general predictive value for men's semen quality.

This study shows that the influence of finger ratio is minimal in the estimation of semen quality. This means that a more influencing factor to the quality of semen may be found in the daily living, hormone like factor, surrounding environment and the way of sex life and so on [1]. Furthermore, even under the condition of low semen quality, if the sperm's shape and motility are good, a successful fertilization is possible [21]. So it can be fallacious to predict infertility to males with a high 2D:4D ratio. These findings led us to conclude that a large scale study will be helpful

to demonstrate correlations between the finger ratio and semen quality. Also, a study with infertility groups is necessary to clarify the relation between the finger ratio and infertility.

CONCLUSIONS

In conclusion, this study demonstrated that there are no associations between 2D:4D ratio and the semen quality in healthy young adult men. However, since the controversy is still afoot over this subject of relation between finger ratio and semen quality, we need a larger scale study that requires a greater comparative study design.

Conflicts of Interest

The authors have nothing to disclose.

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