

Correlation of 2D:4D Ratio, Vital Lung Capacity and Self-reported Athletic Ability in Women

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Introduction

Exposure to prenatal androgens (foremost, testosterone) is essential for sexual differentiation and has profound, permanently masculinizing effects on human neural circuitry and peripheral tissues, which partly cause a variety of behavioral, cognitive, and health-related human sex differences seen in postnatal life. One prenatal testosterone marker is the second-to-fourth digit ratio (2D:4D ratio). It has been suggested that the 2D:4D ratio may be correlated to some measurement of physical fitness and that some athletes differ statistically from non-athletes based on their 2D:4D ratio. Studies have pointed to a link between 2D:4D ratio and physical measurements such as cardiovascular output, V_{O2max} , athletic ability, and running speeds.

Methods

Data was collected from FGCU students enrolled in A&P 1 and 2 during the Spring 2015 semester. Participation was voluntary and data was collected using an anonymous survey. The survey collected anthropometric (height, weight, and waist circumference) and physiologic data (vital lung capacity). Vital capacity was measured using a dry spirometer. Students were asked to answer 14 questions overall among them "Are you actively involved in a team or individual athletic activity?" and "Which sport is your favorite activity?" Participants were asked to rate their level of athletic ability on a scale of 1-5, with 5 being the highest. The right and left hands of participants were photocopied and the copies attached to their survey. The length of index (2D) and ring (4D) fingers were measured (in mm) using digital Vernier calipers. Each hand was measured twice independent of each other and the measurements were averaged.

Results

2D:4D Ratio and Vital Capacity (VC)

The average vital capacity for all female survey participants (n=192), was 2578ml with a low of 1000 ml, a high of 5500 ml and a standard deviation of 695. The average 2D:4D ratio for the left hand was slightly smaller (0.967) than the ratio for the right hand (0.975), but this difference was not statistically significant.

Table 1: Vital capacity and 2D:4D ratio of left and right hand

Vital Capacity [ml]			
Avg	Min	Max	SD
2574	1000	5500	691
2D:4D Ratio Left Hand			
Avg	Min	Max	SD
0.967	0.900	1.055	0.029
2D:4D Ratio Right Hand			
Avg	Min	Max	SD
0.975	0.911	1.058	0.030

Charts plotting vital capacity against the 2D:4D ratio for either hand doesn't show any correlation as indicated by the flat trendline in diagrams 1 and 2.

Diagram 1. 2D:4D Ratio Left Hand and Vital Capacity [ml]

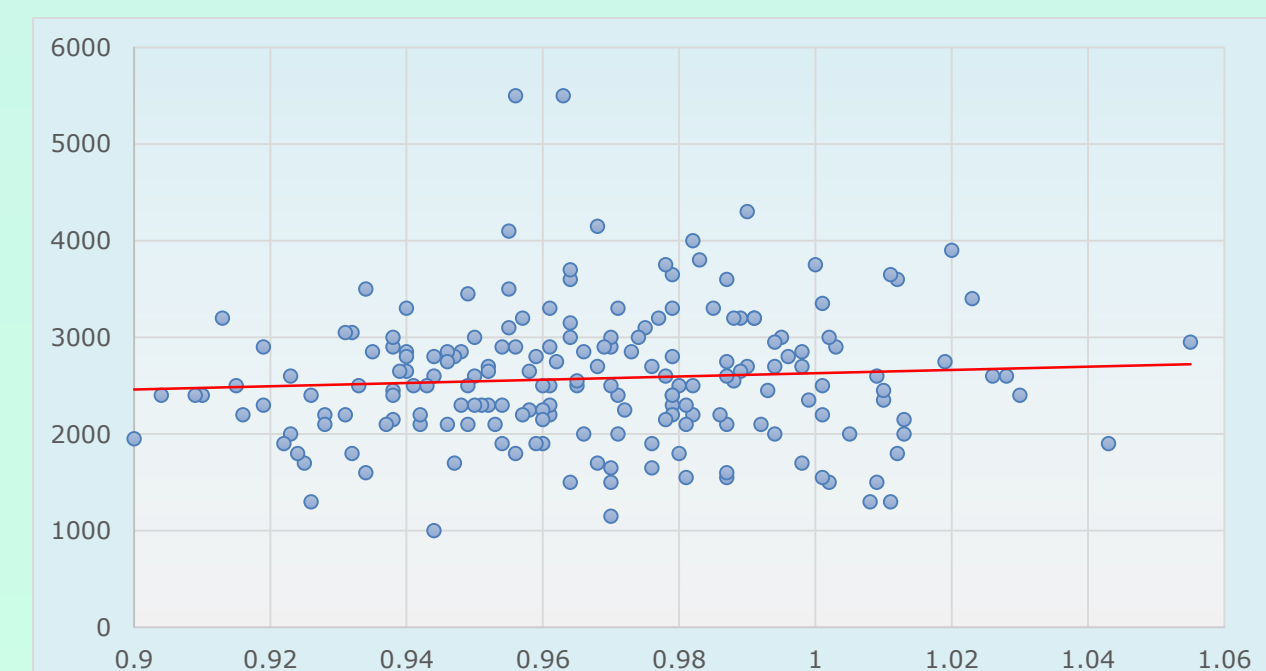
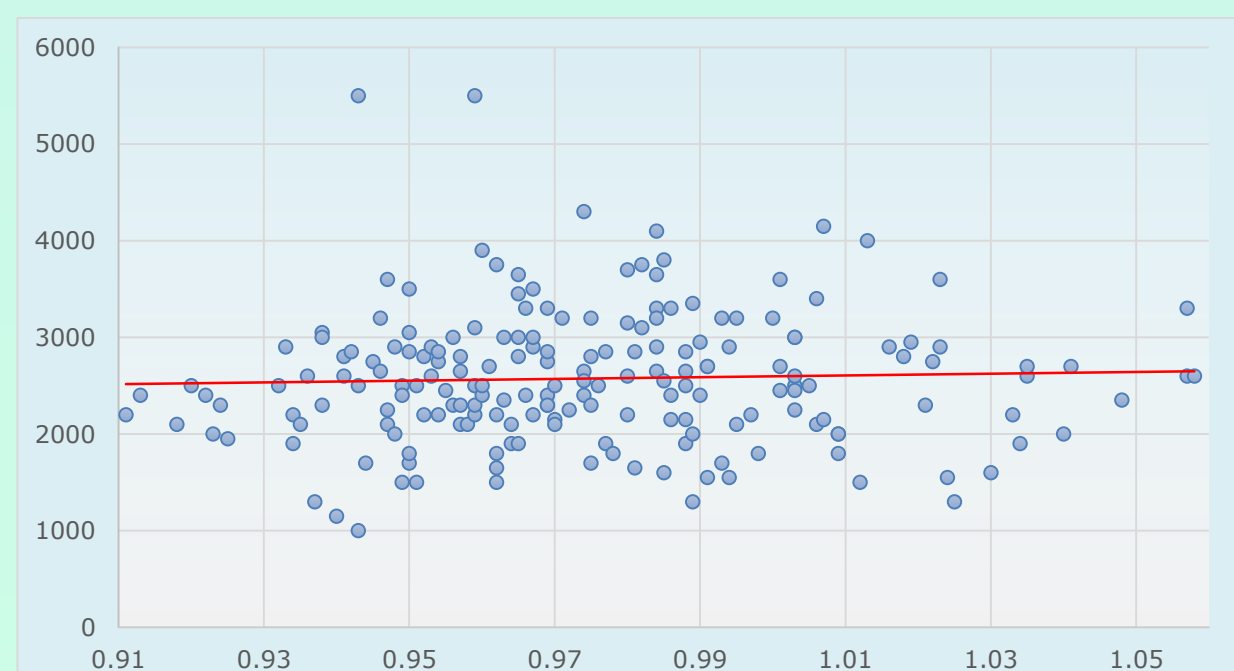


Diagram 2. 2D:4D Ratio Right Hand and Vital Capacity [ml]



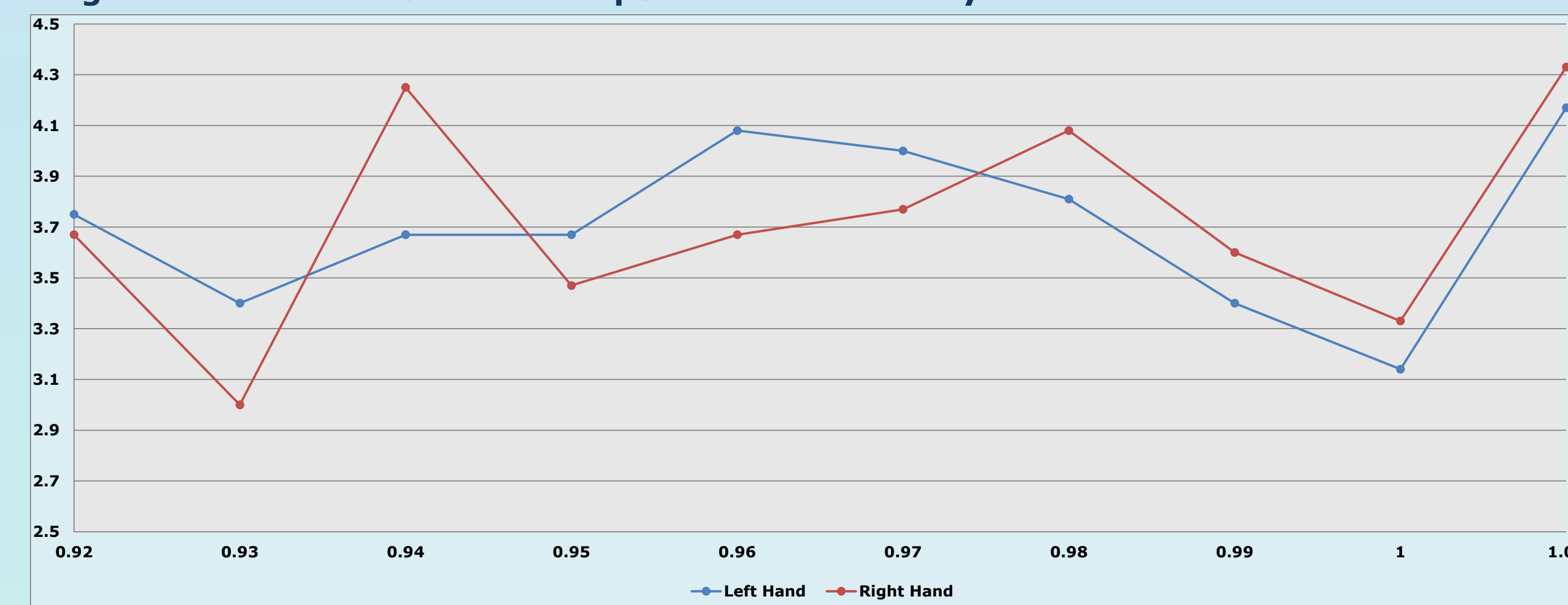
2D:4D Ratio and Self-reported Athletic Ability

Ninety four female participants ranked their athletic ability in our survey on a 1-5 scale (1 = beginner, 2 = below average, 3 = average, 4 = above average, 5 = very good). Based on the self-reported athletic ability, no trend line was evident between self-reported athletic ability and 2D:4D ratio for left or right hand, as the data was scattered.

Table 2. 2D:4D ratio and self-reported athletic ability

2D:4D Ratio	Average Self-reported Athletic Ability Left Hand	Average Self-reported Athletic Ability Right Hand
0.92	3.75	3.67
0.93	3.4	3
0.94	3.67	4.25
0.95	3.67	3.47
0.96	4.08	3.67
0.97	4	3.77
0.98	3.81	4.08
0.99	3.4	3.6
1.00	3.14	3.33
1.01	4.17	4.33

Diagram 3. 2D:4D ratio and self-reported athletic ability



2D:4D Ratio and Vital Capacity in Athletically Active Women

Of 192 participants in the study 189 individuals marked "Yes" or "No" to current participation in team or individual athletic activity, which served as our total sample. The average right-hand 2D:4D digit ratio for female participants who answered "Yes" or "No" to athletic activity (n=189), was 0.975 with a low of 0.911 and a high of 1.058. Participants who answered "Yes" to athletic activity (n=79; 41.8%) had an average 2D:4D of 0.975 (low = 0.913; high = 1.057), while participants who answered "No" to athletic activity (n=110; 58.2%) had an average 2D:4D of 0.975 (low = 0.911; high = 1.058).

The corresponding numbers for the left-hand 2D:4D ratios were 0.967 (low = 0.900; high = 1.055) for the total sample, 0.969 (low = 0.909; high = 1.055) for participants who responded "Yes", and 0.966 (low = 0.900; high = 1.043) for participants who responded "No".

The participants were not limited to only one sport but were asked to specify sports in which they were active in, as well as their favorite sports. Four participants answered "Yes", but didn't give a favorite sport. The most commonly mentioned favorite sports were volleyball (n=17), basketball (n=9), running (n=9), soccer (n=8), swimming (n=7), cheerleading (n=6), and softball (n=6).

Right-hand 2D:4D ratios in the sample that answered "Yes" to athletic activity and specified one or more favorite athletic activities (n=75; 39.7%) from highest to lowest were as follows: Running (0.983), basketball (0.978), volleyball (0.976), cheerleading (0.975), swimming (0.966), soccer (0.964), and softball (0.941).

The corresponding left-hand 2D:4D ratios in showed a slightly different order, although participants that indicated running as their favorite still had the highest, i.e., most female ratio and softball players the lowest, i.e., most male ratio.

Diagram 4. 2D:4D Ratio Left Hand

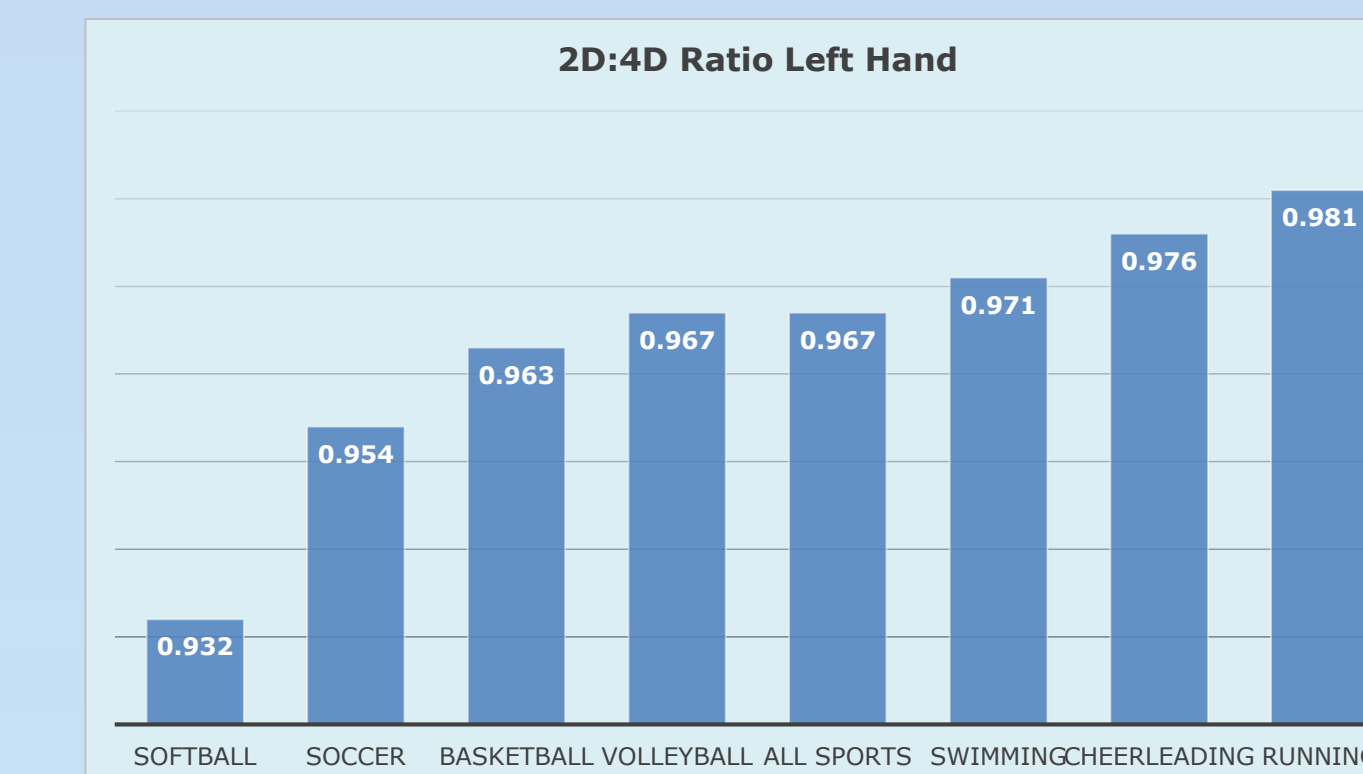
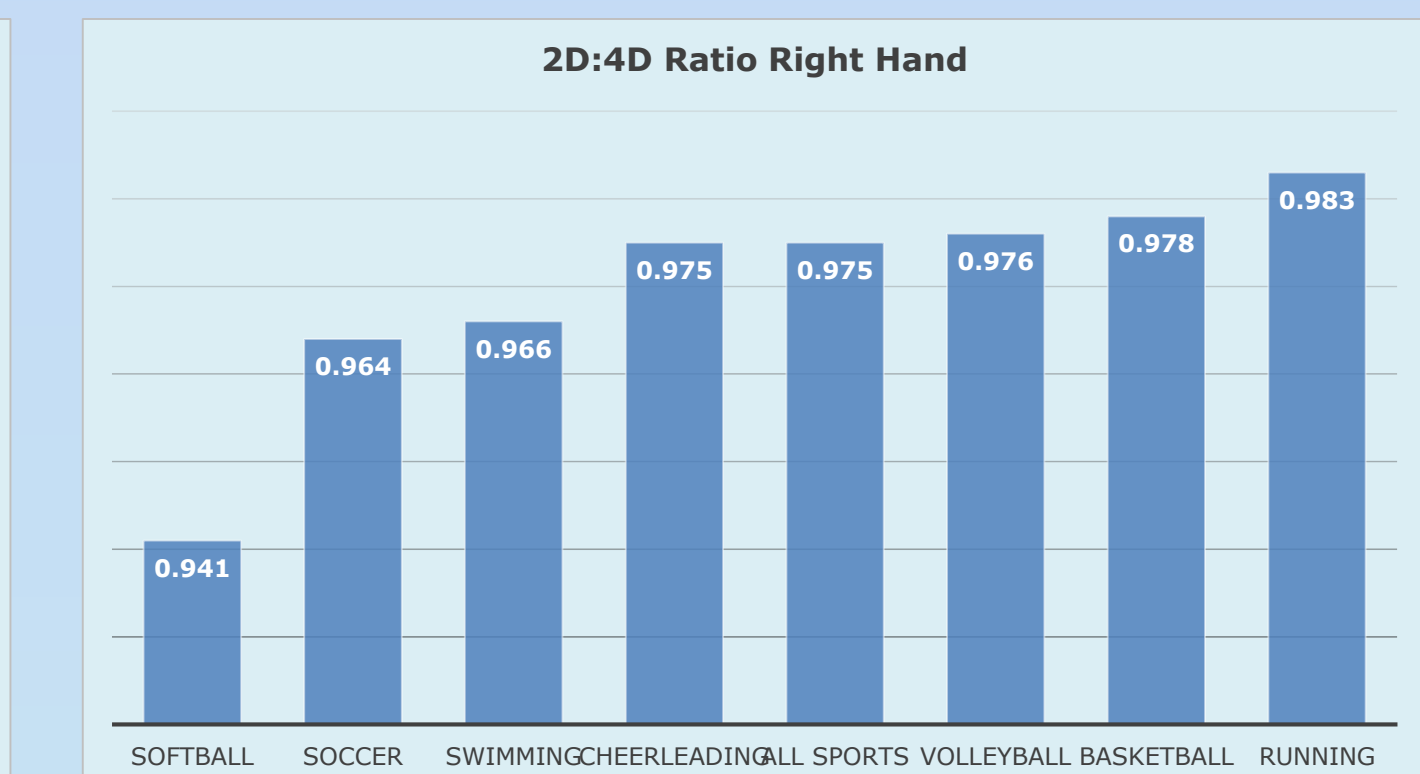


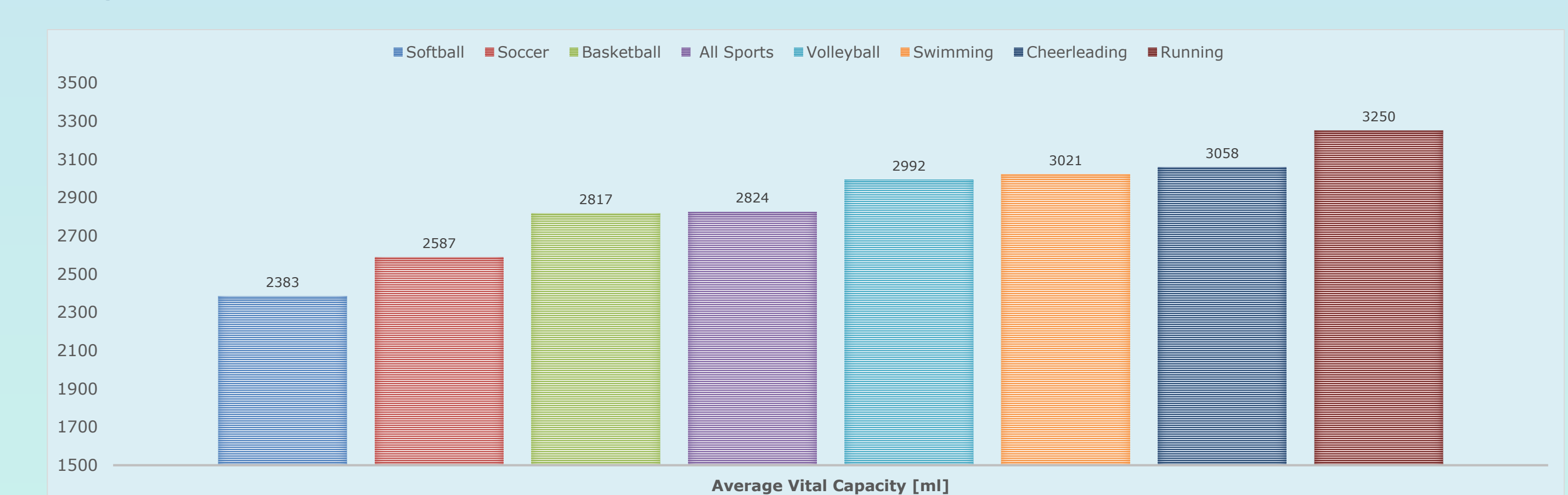
Diagram 5. 2D:4D Ratio Right Hand



The average vital capacity for participants who answered "Yes" (n=79) was 2824ml (low = 1300ml; high = 5500ml) and 2401ml (low = 1000 ml; high = 5500ml) for those who answered with "No". Because of the way the data were collected this difference cannot be considered statistically significant.

Average vital capacities for the participants that answered "Yes" to athletic activity and specified a sport (n=75), from highest to lowest were as follows: Running (3250ml), cheerleading (3058ml), swimming (3021ml), volleyball (2992ml), basketball (2817ml), soccer (2587ml), and softball (2383ml).

Diagram 6. Vital Capacities of Athletically Active Women



Discussion

Based on the results of our study there is no correlation between left- and right-hand 2D:4D ratio and vital capacity. However, this could be different for a larger sample and a different way of measuring vital capacity. Many reported vital capacities were rather low, indicating that study participants didn't perform the measurement correctly. Still, a higher 2D:4D ratio may predict a higher vital capacity. This was true for participants that answered "Yes" to athletic activity and participated in one of the most common sports of our sample.

We found that athletes exhibiting a lower average 2D:4D ratio showed a lower average vital capacity and vice versa. Softball and soccer players had the lowest average 2D:4D ratios while also showing the lowest average vital capacities. However, the sample size was small and the trend therefore cannot be generalized. Compared to runners, who had the highest average 2D:4D and vital capacity, soccer and softball players tend run a lot in relatively short, burst-like sprints while runners rely more on their respiratory and cardiovascular systems to perform, thus requiring larger vital capacities.