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Research paper

Investigation of the relationship of the morphometric measurements of the hands and fingers with the personality traits of leadership

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Abstract

Background: The hand is a functionally critical organ at the distal end of the upper extremity. Also, the creases in the hands and the digital flexion creases on the fingers are the important external anatomical landmarks.
Objectives: There are no studies found in the literature, linking solely the leadership personality traits with the anthropometric measurements of the hand.
Methods: This descriptive study was to investigate the relationship between the 44 anthropometric measurements about hand, and the leadership personality traits in young adults from both genders.
Results: When the leadership frames were compared by the scores, human resource leadership scores were significantly higher in the females. The charismatic leadership frame scores positively correlated with the parameters in males; including the breadth of the right hand, the breadth of the left hand, the index finger length of the left hand, and the distal phalanx length of the index finger on the left hand. The transformational leadership score was positively correlated with the left hand width and with the distal phalanx of the index finger on the left hand. In females, it was found out that the frames of human leadership and charismatic leadership correlated negatively with the length of the right thumb.
Conclusions: According to the results of our study, we concluded that the breadth of the hand and the measurements of the thumb and the index fingers can provide opinion on leadership personality traits.

Keywords: *Hand; Fingers; Leadership Traits.*

1. Introduction

The hand is a functionally critical organ at the distal end of the upper extremity [1]. The fingers in the distal areas of the hand are referred by the standard anthropological formula; where 1 stands for the thumb, 2 for the index finger , 3 for the middle finger (dactylion) , 4 for the ring finger, and 5 for the pinky finger (digit); therefore, the fingers are called 1D, 2D, 3D, 4D, and 5D respectively [2].
The creases in the hands (joint lines) and the digital flexion creases on the fingers are the important external anatomical landmarks of the skinfolds during the movement of the hands. These folding points are useful for hand measurements [2], [3].
In the literature, there are many anthropometric studies about the hand. By using various anthropometric measurements, these studies investigated several themes including gender estimation, asymmetry, dominant hand, hand aesthetics; body height estimation based on hand parameters, finger length ratios, and population and genetic differences [4 - 10].
The size of the hands and fingers are associated with ethnic and gender differences [10]. The shapes and parts of the hands and fingers constitute an important indicator of the individual developmental characteristics occurring in the fetal and postnatal periods [11], [12]. Because the hand is always in sight, it is a symbol of beauty and character [13], [14] like the aesthetically important facial region. The size of the hand is not only associated with the gender and the body proportions of persons, but it is also associated with the occupation and the cultural background of the individual [7].
There was only one study investigating the relationship between the facial anatomy and the leadership traits in the personality [15]. The anthropometric studies of the hand in the literature are based on the general personality traits [16], [17] and the occupational status [18]. Besides these studies are less in number; there are no studies found in the literature, linking solely the leadership personality traits with the anthropometric measurements of the hand.
The aim of this study was to investigate the relationship between the anthropometric measurements and the leadership personality traits in young adults from both genders, who did not perform any occupation.

2. Materials and methods

This descriptive study included a total of 229 students of Bolu Abant Izzet Baysal University in Turkey, who were in the age range from 18 to 23 years. The mean age was 20.07±1.54 years. The measurements were performed on 127 female and 102 male students. The eligible individuals were informed about the study and their written consents were obtained. The Ethics Committee of Bolu Abant Izzet Baysal University approved the study protocol (Decision No: 2018/66).
The Leadership Orientation Scale, developed by Lee G. Bolman and Terrence E. Deal, was used in the study in order to evaluate the leadership traits of individuals. The validity and reliability study of this scale was conducted by Mahce Dereli in 2003 in our country [19]. The scale comprises 32 items and 4 sub-dimensions of leadership, which are the Leadership in Structural, Human Resource Leadership, Political Leadership, and Symbolic Leadership. The responses are scored on a 5-point Likert scale as follows: "Never=1 points", "Rarely= 2 points", "Sometimes=3 points", "Frequently=4 points", "Always=5 points". Each sub-dimension of the leadership orientation frames is scored individually. Total scores in the following ranges of 0-10 points, 11-20, 21-30, and 31-40 points are considered to indicate a poor, an average, a good, and a very good leadership respectively. Each sub-dimension of the orientation frames can be scored 8 as a minimum and a maximum of 40 points can be achieved [19].
In addition, the age and the dominant hand of the participants were recorded.
The eligibility criteria for the participants were as follows:
Inclusion criteria: The individuals should be in the age range from 17 to 24 years, should perform no occupations, should not take part in sports or talent activities requiring the use of the hands; should not have any congenital anomalies, structural deformities, hand injuries, osteoarthritis, or history of trauma and fractures, should not have undergone surgery in this region, and should volunteer to participate in the study.
Exclusion criteria: Not being in the age range of 17-24 years, performing any occupations, taking part in sports or talent activities that require the use of the hands; having congenital anomalies, structural deformities, hand injuries, or osteoarthritis; having a history of trauma or fractures, having undergone surgery in these regions, and not volunteering to participate in the study.
Measurements
A total of 44 parameters were measured, comprising 22 parameters in each hand. The hand and finger measurements of the hand and fingers were made with a 0-150 mm Baker Digital Calliper with a reading accuracy of 0.01 mm. The measurements were performed by the same investigator each time on both the right and left hands. The distance between the digital creases of the fingers, namely haustra digiti, was measured on the lateral sides of the crease ends on the fingers in flexion [3]. The remaining parameters of the study were measured when the participants were in the sitting position with the forearm placed in supination at a 90-degree angle, as the dorsum of the hand was in contact with the table and the shoulder was in the neutral position.
Descriptions and abbreviations of the parameters measured in the study:

- Finger length measurement: The length between the tip of the finger and the nearest digital crease closest to metacarpophalangeal joint on the palmar face of the hand was measured for each digit (D). Length of the fingers were recorded as follows: $D1_{right}$, $D2_{right}$, $D3_{right}$, $D4_{right}$, $D5_{right}$, $D1_{left}$, $D2_{left}$, $D3_{left}$, $D4_{left}$, $D5_{left}$. Care was exercised to place the thumb in the adduction, being parallel and adjacent to the other fingers.
- Haustra digiti proximalis, medialis, and distalis: As haustra digiti were categorized as proximal, medial, and distal for each finger; a total of 28 parameters were measured including both hands [3].
- Hand Length Measurement: The hand length has measured as the distance between the mid-point of the inter-styloid line and dactylion [2].
- Hand Width Measurement (Hand Breadth): The widest distance between the head of the second metacarpal bone (metacarpal radiale) and the head of the fifth metacarpal bone (metacarpal ulnare) was measured [2].
- Palm Length: The palm length was measured as the distance between the middle point of the distal transverse crease of the wrist and the most proximal flexion crease of the middle finger [2].

Statistical Analysis
Mean±standard deviation was applied to show the descriptive statistics in the study. Investigating the differences between hands and finger scales and types of leadership according to the clusters, Student-t and Mann-Whitney tests were conducted. As for the correlation between types of leadership and hands and fingers scales Pearson and Spearman correlational tests were applied. In order for the statistical analysis, IBM SPSS Statistics 22.0 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.) Software were utilized. $p<0.05$ was taken as the critieria of a significant difference in statistical interpretations. The evaluation could not be performed because it is not enough left-handed.

3. Results

This study included volunteering students of Bolu Abant Izzet Baysal University, consisting of 102 male (Group 1) and 127 female (Group 2) individuals for the purpose of investigating the association of the leadership traits with a total of 44 bilaterally taken measurements from fingers and hands of all participants. The comparison of the measured values of the hands and fingers demonstrated that all values were significantly higher in males compared to those measured in the females (Table 1).
When the leadership frames were compared by the scores, there were no statistically significant differences in the structural leadership, political leadership, and symbolic leadership between the groups; however, human resource leadership scores were significantly higher in the females (Table 2).
The comparison of the leadership frames by the hand and finger measurements revealed that the charismatic leadership frame scores positively correlated with the following parameters in Group 1; including the breadth of the right hand (p: 0.033; rho: 0. 212), the breadth of the left hand (p: 0.011; r: 0.251), the index finger length of the left hand (p: 0.043; r: 0.200), and the distal phalanx length of the index finger on the left hand. The transformational leadership score was positively correlated with the left hand width (p: 0.011; r: 0.251) and with the distal phalanx of the index finger on the left hand (p: 0.027; r: 0.218) (Table 3).
When the same evaluation was performed in Group 2, it was found out that the frames of human leadership and charismatic leadership correlated negatively with the length of the right thumb (p: 0.030; rho: -0.192, and p: 0.002; rho: -0.269, respectively). The charismatic leadership frame also showed a negative correlation with the length of the left thumb (p: 0.011; rho: -0.26) (Table 4).

Table 1: The Comparison of the Measured Values of the Hands And Fingers in Males and Females.

	MALES			FEMALES				
	Minimum	Maximum	Mean±Std. Deviation	Minimum	Maximum	Mean±Std. Deviation	Z/F	p
D1R	54.67	76.40	65.98±4.53	50.70	76.70	59.07±3.93	9.893*	<0.001
D1L	54.06	78.80	65.09±4.79	50.22	76.53	59.56±3.69	8.585*	<0.001
D2R	60.68	81.95	72.49±4.44	56.25	81.60	67.56±4.14	1.330°	<0.001
D2L	58.82	83.48	72.46±4.37	56.85	81.27	67.14±4.035	2.006°	<0.001
D3R	52.47	90.06	78.31±4.96	64.03	84.87	73.27±4.025	8.121*	<0.001
D3L	60.49	90.97	78.75±4.98	7.90	84.82	72.57±7.072	8.379*	<0.001
D4R	61.58	84.09	72.99±4.35	57.14	78.82	67.41±3.85	1.683°	<0.001
D4L	61.92	84.20	73.25±4.05	50.24	78.70	67.25±4.385	0.234°	<0.001
D5R	50.20	82.24	60.74±4.49	44.63	65.10	55.29±3.70	8.740*	<0.001
D5L	50.44	72.44	60.87±4.01	47.20	69.04	55.72±3.842	0.170°	<0.001
HLENGTHR	167.00	215.29	187.89±8.49	155.07	201.17	175.95±7.61	0.920°	<0.001
HLENGTHL	169.49	209.83	188.42±8.37	76.53	272.45	175.85±14.57	9.313*	<0.001
HWIDTHR	75.44	102.91	84.68±4.80	60.19	84.35	74.84±4.24	0.910°	<0.001
HWIDTHL	72.84	100.61	84.03±4.86	60.02	94.05	74.69±4.73	0.911°	<0.001
HPALMR	93.99	120.80	107.50±5.41	74.52	116.04	98.90±5.54	9.895*	<0.001
HPALML	92.35	120.88	107.59±5.49	78.84	117.50	99.99±4.87	9.314*	<0.001
D1PROXL	25.22	40.87	32.59±3.59	22.45	39.24	30.87±2.85	9.574°	<0.001
D1DISTL	25.030	38.990	33.52±2.25	22.460	36.770	29.93±1.99	0.924°	<0.001
D2PROXL	19.32	35.02	25.31±2.64	18.86	30.76	23.78±2.17	4.634*	<0.001
D2MEDL	17.19	28.25	23.04±2.19	16.93	28.81	21.47±2.11	0.183°	<0.001
D2DISTL	21.87	32.84	27.01±1.87	21.12	29.72	24.43±1.59	9.466*	<0.001
D3PROXL	21.81	35.89	27.30±2.59	20.14	32.43	25.37±2.14	5.790*	<0.001
D3MEDL	21.060	32.480	26.32±2.16	19.540	39.320	24.30±2.39	6.881*	<0.001
D3DISTL	21.84	34.00	28.09±2.01	21.05	31.94	25.45±1.88	0.045°	<0.001
D4PROXL	18.17	30.87	24.12±2.27	16.58	31.77	22.19±2.03	6.496*	<0.001
D4MEDL	18.75	28.73	24.24±1.99	18.76	28.10	22.21±1.89	7.333*	<0.001
D4DISTL	20.20	33.27	27.72±2.07	16.54	31.64	24.80±2.02	9.326*	<0.001
D5PROXL	12.92	28.91	19.96±2.46	12.61	27.72	17.98±2.22	6.233*	<0.001
D5MEDL	11.040	23.240	18.63±1.90	10.380	24.890	17.04±1.97	6.447*	<0.001
D5DISTL	19.60	72.73	25.50±5.03	18.48	25.88	22.41±1.66	9.342*	<0.001
D1PROXR	25.64	42.42	33.64±3.58	22.17	40.96	30.81±3.19	2.241°	<0.001
D1DISTR	24.80	39.17	34.41±2.22	20.32	36.01	30.61±2.15	10.475*	<0.001
D2PROXR	17.84	35.89	25.08±2.82	18.97	37.41	23.82±2.41	3.849*	<0.001
D2MEDR	17.62	29.07	22.96±2.05	16.18	29.19	21.53±2.09	0.168°	<0.001
D2DISTR	22.610	31.600	26.79±1.88	21.360	30.580	24.76±1.61	7.766*	<0.001
D3PROXR	19.79	34.56	26.85±2.45	16.03	31.07	25.25±2.19	1.003°	<0.001
D3MEDR	5.950	34.960	26.05±3.02	18.790	30.380	24.42±2.03	5.752*	<0.001
D3DISTR	21.84	32.41	27.81±2.14	5.36	30.85	25.33±2.42	8.298*	<0.001
D4PROXR	19.53	31.37	23.89±2.33	15.27	27.00	21.80±2.08	1.762°	<0.001
D4MEDR	18.780	30.050	23.77±2.11	17.440	28.680	21.94±1.86	6.555*	<0.001
D4DISTR	20.20	32.56	27.67±2.12	16.48	30.91	25.10±1.81	8.761*	<0.001
D5PROXR	14.22000	29.90000	19.97±2.31	11.84000	26.32000	18.42±2.07	5.113*	<0.001
D5MEDR	14.49	21.63	17.91±1.59	11.50	20.83	16.34±1.72	0.166°	<0.001
D5DISTR	20.46	28.97	25.32±1.63	18.89	26.67	22.92±1.57	0.252°	<0.001

D: Digit, R: Rigth, L: Left, H: Hand.

Table 2: The Comparison of the Leadership Frames by the Scores in Males and Females

	MALES			FEMALES				
	Minimum	Maximum	Mean±Std. Deviation	Minimum	Maximum	Mean±Std. Deviation	Z/F	p
StLF	17.0	40.0	30.23±4.57	18.0	40.0	30.47±4.41	0.069*	0.945
HSLF	17.0	39.0	31.97±4.39	22.0	40.0	33.51±3.78	2.623*	0.009
PLF	16.0	37.0	26.87±4.55	16.0	38.0	27.25±4.84	0.532*	0.595
SyLF	15.0	37.0	27.59±4.49	12.0	39.0	27.95±5.24	1.384°	0.241

StLF: Structural leadership frame, HSLF: Human source leadership frame PLF: Political leadership frame,
SyLF: Symbolic leadership frame

Table 3: The Comparison of the Leadership Frames by the Hand and Finger Measurements in Males

MALES	StLF		HSLF		PLF		SyLF	
	r/rho	p	r/rho	p	r/rho	p	r/rho	p
D1R	0.026	0.795	0.023	0.820	0.190	0.056	0.067	0.506
D1L	0.105	0.293	0.151	0.131	0.199	0.045	0.200	0.043
D2R	0.047	0.637	0.098	0.327	0.083	0.408	0.068	0.500
D2L	0.024	0.813	0.093	0.351	0.044	0.663	0.018	0.855
D3R	0.107	0.284	0.082	0.412	0.009	0.925	0.005	0.962
D3L	0.069	0.491	0.057	0.567	0.006	0.956	0.066	0.511
D4R	0.024	0.813	0.048	0.635	0.041	0.684	0.007	0.945
D4L	0.025	0.803	0.70	0.485	0.068	0.494	0.001	0.991
D5R	0.036	0.716	0.105	0.291	0.083	0.409	0.023	0.819
D5L	0.014	0.893	0.130	0.193	0.035	0.724	0.052	0.605
HLENGTHR	0.002	0.987	0.150	0.132	0.134	0.180	0.103	0.304
HLENGTHL	0.037	0.709	0.071	0.479	0.054	0.588	0.025	0.805
HWIDTHR	0.090	0.369	0.110	0.270	0.182	0.068	0.212	0.033
HWIDTHL	0.125	0.211	0.121	0.227	0.251	0.011	0.251	0.011
HPALMR	0.170	0.087	0.056	0.576	0.020	0.841	0.012	0.908
HPALML	0.096	0.337	0.008	0.937	0.014	0.892	0.069	0.488
D1PROXL	0.008	0.937	0.022	0.825	0.083	0.410	0.005	0.959

D1DISTL	0.071	0.480	0.091	0.365	0.135	0.175	0.105	0.292
D2PROXL	0.020	0.841	0.100	0.317	0.092	0.358	0.130	0.194
D2MEDL	0.081	0.416	0.004	0.966	0.027	0.791	0.031	0.757
D2DISTL	0.049	0.622	0.107	0.284	0.218	0.027	0.226	0.022
D3PROXL	0.094	0.350	0.018	0.855	0.137	0.170	0.133	0.184
D3MEDL	0.117	0.242	0.009	0.927	0.004	0.968	0.010	0.922
D3DISTL	0.165	0.097	0.063	0.528	0.011	0.915	0.009	0.925
D4PROXL	0.017	0.867	0.035	0.727	0.079	0.432	0.080	0.426
D4MEDL	0.112	0.261	0.024	0.809	0.013	0.897	0.097	0.333
D4DISTL	0.026	0.795	0.036	0.723	0.100	0.316	0.113	0.256
D5PROXL	0.048	0.632	0.085	0.393	0.009	0.932	0.083	0.407
D5MEDL	0.155	0.120	0.025	0.806	0.009	0.932	0.050	0.617
D5DISTL	0.024	0.810	0.035	0.728	0.114	0.253	0.087	0.383
D1PROXR	0.016	0.873	0.064	0.521	0.149	0.134	0.025	0.801
D1DISTR	0.022	0.826	0.060	0.551	0.085	0.397	0.126	0.208
D2PROXR	0.012	0.904	0.091	0.362	0.037	0.712	0.010	0.924
D2MEDR	0.051	0.611	0.131	0.188	0.064	0.512	0.002	0.981
D2DISTR	0.018	0.855	0.136	0.172	0.123	0.218	0.064	0.523
D3PROXR	0.017	0.868	0.139	0.165	0.062	0.533	0.141	0.158
D3MEDR	0.015	0.881	0.089	0.373	0.148	0.138	0.118	0.238
D3DISTR	0.090	0.366	0.14	0.888	0.172	0.083	0.110	0.269
D4PROXR	0.004	0.966	0.110	0.272	0.062	0.535	0.002	0.984
D4MEDR	0.151	0.131	0.159	0.111	0.005	0.961	0.150	0.131
D4DISTR	0.085	0.397	0.072	0.473	0.035	0.729	0.081	0.419
D5PROXR	0.038	0.708	0.033	0.742	0.016	0.872	0.003	0.973
D5MEDR	0.052	0.604	0.059	0.554	0.050	0.620	0.002	0.987
D5DISTR	0.071	0.481	0.013	0.895	0.074	0.460	0.029	0.772

StLF: Structural leadership frame, HSLF: Human source leadership frame PLF: Political leadership frame
SyLF: Symbolic leadership frame

Table 4: The Comparison of the Leadership Frames by the Hand and Finger Measurements in Females

FEMALES	StLF r/rho	p	HSLF r/rho	p	PLF r/rho	p	SyLF r/rho	p
D1R	0.014	0.876	0.192	0.030	0.185	0.037	0.269	0.002
D1L	0.065	0.465	0.148	0.097	0.173	0.051	0.226	0.011
D2R	0.096	0.281	0.029	0.744	0.002	0.986	0.016	0.856
D2L	0.049	0.585	0.001	0.991	0.020	0.820	0.074	0.411
D3R	0.096	0.282	0.034	0.702	0.007	0.940	0.040	0.654
D3L	0.008	0.925	0.011	0.902	0.021	0.811	0.041	0.651
D4R	0.044	0.624	0.073	0.416	0.002	0.981	0.017	0.851
D4L	0.133	0.135	0.073	0.417	0.096	0.284	0.049	0.582
D5R	0.150	0.092	0.113	0.205	0.002	0.978	0.031	0.729
D5L	0.133	0.135	0.074	0.406	0.091	0.308	0.86	0.335
HLENGTHR	0.027	0.763	0.021	0.816	0.019	0.829	0.049	0.587
HLENGTHL	0.036	0.687	0.060	0.503	0.046	0.604	0.006	0.943
HWIDTHR	0.047	0.598	0.082	0.360	0.103	0.249	0.118	0.185
HWIDTHL	0.073	0.412	0.018	0.844	0.041	0.646	0.053	0.556
HPALMR	0.155	0.081	0.034	0.702	0.034	0.701	0.043	0.633
HPALML	0.128	0.151	0.024	0.785	0.035	0.699	0.094	0.291
D1PROXL	0.078	0.381	0.102	0.253	0.081	0.365	0.076	0.396
D1DISTL	0.038	0.673	0.043	0.633	0.006	0.944	0.020	0.828
D2PROXL	0.111	0.213	0.009	0.922	0.012	0.892	0.030	0.739
D2MEDL	0.060	0.506	0.016	0.854	0.019	0.835	0.085	0.343
D2DISTL	0.140	0.117	0.003	0.976	0.063	0.483	0.067	0.454
D3PROXL	0.118	0.185	0.035	0.700	0.022	0.803	0.043	0.629
D3MEDL	0.088	0.324	0.101	0.259	0.002	0.891	0.069	0.441
D3DISTL	0.126	0.158	0.039	0.661	0.000	0.999	0.052	0.561
D4PROXL	0.117	0.189	0.053	0.557	0.036	0.688	0.066	0.458
D4MEDL	0.070	0.433	0.107	0.230	0.052	0.562	0.095	0.289
D4DISTL	0.033	0.711	0.105	0.238	0.081	0.368	0.042	0.643
D5PROXL	0.138	0.122	0.027	0.761	0.011	0.898	0.080	0.369
D5MEDL	0.063	0.485	0.032	0.723	0.098	0.272	0.169	0.058
D5DISTL	0.064	0.475	0.051	0.569	0.023	0.797	0.014	0.878
D1PROXR	0.098	0.274	0.140	0.117	0.092	0.303	0.106	0.235
D1DISTR	0.005	0.954	0.160	0.072	0.045	0.616	0.119	0.181
D2PROXR	0.141	0.115	0.059	0.508	0.031	0.726	0.003	0.970
D2MEDR	0.051	0.571	0.033	0.714	0.047	0.601	0.114	0.202
D2DISTR	0.127	0.154	0.013	0.884	0.085	0.342	0.077	0.389
D3PROXR	0.031	0.730	0.043	0.635	0.130	0.144	0.103	0.251
D3MEDR	0.131	0.143	0.047	0.604	0.038	0.671	0.048	0.595
D3DISTR	0.175	0.049	0.006	0.946	0.012	0.898	0.015	0.867
D4PROXR	0.152	0.089	0.071	0.427	0.014	0.879	0.113	0.205
D4MEDR	0.097	0.277	0.083	0.351	0.042	0.642	0.062	0.487
D4DISTR	0.098	0.273	0.009	0.924	0.023	0.800	0.005	0.951
D5PROXR	0.169	0.057	0.132	0.138	0.018	0.838	0.024	0.789
D5MEDR	0.030	0.742	0.155	0.082	0.008	0.926	0.080	0.370
D5DISTR	0.164	0.065	0.033	0.715	0.034	0.702	0.087	0.329

StLF: Structural leadership frame, HSLF: Human source leadership frame PLF: Political leadership frame
SyLF: Symbolic leadership frame

4. Discussion

Being introduced in the first half of the nineteenth century; the concept of “leadership” is a complex phenomenon with several descriptions that have been made for many years. A significant difference exists between a "leader ”and a "manager", indicating that leaders are interested in the spiritual dimension of the work they do and they lead the employees in believing them, while managers are involved in organizing and following-up the daily tasks. Therefore, people rarely need a leader when they are happy. On the other hand, jeopardized working conditions of the employees being subject to instant changes indicate that these people need a leader in charge [19].

The concept of leadership has been described in different ways throughout the years. By the end of the 1940s it was suggested that leadership is inherited. Several researchers including Bolman, who categorized the concept of leadership into four types as structural, human resources, political, and symbolic; proposed that a leader should be intelligent, good looking, and skilful in using the language [19].

The hands are the parts of the body that are mostly in sight, having a considerable aesthetical significance. While hand surgeons focus on the function, patients consider the appearance of the hands important, supporting the antique point of view proposing that function and beauty are synonymous. While a long and thin hand is considered as an indicator of grace, a wide dorsum of the hand makes it look shorter than it is [7].

There is a developmental of gender difference with the development of the urogenital system and fingers. Mutations in the Homeobox gene cause sterility and malformations in the fingers. Therefore, it has been determined that the 2D:4D ratio is definite starting from the early stages of development and that it is negatively correlated with fetal testosterone and positively correlated with fetal estrogen [10].

Kretschmer categorized the structure of the hands based on the body constitution as the ectomorphic type characterized by thin hands with long fingers, as the mesomorphic type characterized by a coarse and broad structure but with well-balanced proportions, and as the endomorphic type characterized by a large dorsum of the hand and short conically shaped fingers [7].

Anthropometry is a discipline of science that studies the size, weight, and the structural proportions of the human body or the skeleton. It assigns numbers to the most distal structures on the hands, which are the fingers, starting from 1 to 5, consecutively starting from the thumb and ending in the pinky finger [2].

In humans, mice, baboons, gorillas, and chimpanzees; the length of the second finger (2D, index finger) is shorter than the fourth finger (4D, ring finger) in males compared to those in females. In females, the second finger is longer than the fourth finger [16].

Paul et al. conducted a study and determined that the lower 2D:4D ratio in women is associated with advantages in sports activities [20].

In the literature, there are several morphological studies about the effect of gender differences on the absolute length of the fingers, reporting that men have longer fingers and that sexual dimorphism is observed mostly in the length of the middle finger. Both the total and the phalangeal breadth of the index finger is significantly different between the two genders. Compared to women, men have the widest phalangeal and digital breadth along with a high soft tissue index in all age groups [2]. Furthermore, the intrinsic muscles of the hand and the tendons are visible in men even in the relaxed position of the hand; however, tendons become visible in women only during flexion and extension [7].

There are several studies in the literature, investigating whether a morphological asymmetry exists in either right-handed or left-handed individuals. Kosif et al. reported that the fifth finger was longer in left-handed women whereas there was not a significant difference in men [6]. In a similar study, Martin et al. reported that the second and the left fingers were longer in the left-handed men and right-handed women [21].

It is observed that personality features are different by the gender groups and there are three different approaches proposed to explain these differences. The biological approach bases gender differences on biochemical foundations and variations in the X-chromosomes. The sociocultural approach states that social and cultural factors create differences via social role models and culturally stereotyped expectations. The third approach, the biosocial approach, takes the environmental and biological factors into consideration together and explains the differences based on the combination of both of these factors. Furthermore, it is stated that some of the reported gender differences result from measuring biases [16].

It is known that sex hormones affect psychological and behavioral characteristics of individuals. Manning has reported that the ratio of the index finger to the ring finger is affected by the prenatal sex hormones and is related to a variety of physiological, psychological and behavioral features. According to these reports; there is a relationship between the length of the index finger and the level of the estrogen hormone in the female gender, and there is a relationship between the length of the ring finger and the testosterone hormone in the male gender [17].

Aksu et al. conducted a study using Melbourne Decision Making Scale, Schutte Emotional Intelligence Scale, Work Environment Stress Scale, Empathy Scale, and Five Factor Personality Inventory tests. Based on the findings in the right hand, the authors reported that the group with higher testosterone levels was found to have higher scores in both careful decision-making and openness to novelty compared to the group with high estrogen levels. Similar to the findings of the right hand; based on the left hand measurements, the group with higher testosterone levels had higher scores in emotion evaluations and commitments to responsibilities compared to the group with higher estrogen levels. The investigators in the same study also observed that; compared to the group with higher estrogen levels, the group with higher levels of testosterone had higher scores in careful decision-making, conscientiousness, responsibility/commitment, analytical thinking, and sensitivity [17].

Within the frame of the Five Factor Personality Inventory, the correlations of the 2D:4D ratio with the personality traits was demonstrated in both genders. It was reported that the 2D:4D ratio was weakly and positively correlated with extroversion, positively correlated with uncertainty avoidance; negatively associated with dominance, assertiveness, openness, sincerity, excitement seeking, and aggression; and negatively correlated with excitement seeking based on breaching traffic rules. Another definite and similar result of the study was that emotional stability was positively correlated with the finger length ratios in both hands in both groups. However, various studies revealed variable results in the agreeableness and experience openness factors in the Five Factor Personality Inventory. A study investigating the relationship between the finger length ratios and agreeableness reported a similarly positive correlation between these two parameters, whereas, another study reported a negative correlation. The latter study emphasized that the result obtained in this study was interesting because the results were contrary to the expectations. Similarly, another study reported a positive correlation between the finger length ratios and openness to experiences in the whole group, meaning that increased levels of estrogen was associated with increased levels of openness to new experiences. However, another study reported a negative and weak correlation between these factors [16].

In our study, we investigated the relationship between the anatomical features of the hand and leadership personality traits by administering a 32-question survey with four sub-dimensions, which were namely the structural leadership, human leadership, transformational leadership, and charismatic leadership. The statistical analyses revealed that all measurements in the hands and fingers had significantly higher values in males.

In males, charismatic leadership scores were positively correlated to the breadth of the right and left hand, the length of the index finger of the left hand, and the length of the distal phalanx of the index finger of the left hand. The transformational leadership score was positively correlated with the left hand width and the length of the distal phalanx of the index finger of the left hand. In females, it was found that human leadership and charismatic leadership were negatively correlated with the length of the thumb of the right hand. Charismatic leadership was also found to be negatively correlated with the length of the thumb on the left hand.

5. Conclusion

Currently, there are no studies available, scientifically associating the leadership personality traits with the anatomical features of the hand. According to the results of our study, we concluded that the breadth of the hand and the measurements of the thumb and the index fingers can provide opinion on leadership personality traits. We hope that we have provided new data, contributing to several disciplines in science including anatomy, psychiatry, surgery, visual arts, human resources departments, information technology, forensic medicine, and anthropology.

References

[1] S. Gurcan, S. Adıyaman. Elin anatomisi ve kineziyolojisi. Turkiye Klinikleri J PM&R-Special Topics 1.1 (2008) 1-9.
[2] T. Kanchan, K. Krishan. Anthropometry of hand in sex determination of dismembered remains - A review of literature. Journal of Forensic and Legal Medicine 18 (2011) 14-17. https://doi.org/10.1016/j.jflm.2010.11.013.
[3] R. Kosif, M. Dıramalı, S. Sertel Meyvacı. Distances of palmar flexion creases (haustra digiti) and digital formulae in right and left handed people. Int J Morphol 33.1 (2015) 173-177. https://doi.org/10.4067/S0717-95022015000100028.
[4] A.K. Agnihotri, B. Purwar, N. Jeebun. Determination of sex hand dimensions. Internal J of Forensic Science 2.1 (2006) 12-24.
[5] R.A. Lazenby. Identification of sex from metacarpals: effect of side asymmetry. J Forensic Sci 39 (1994) 1188-94. https://doi.org/10.1520/JFS13704J.
[6] R. Kosif, M. Dıramalı. Comparison of all hand digit length ratios in left- and right-handed individuals. Turk J Med Sci 42.3 (2012) 545-552.
[7] R.G. Jakubietz, M.G. Jakubietz, D. Kloss, J.G. Gruenert. Defining the basic aesthetics of the hand. Aesth Plast Surg 29 (2005) 546-551. https://doi.org/10.1007/s00266-005-0100-6.
[8] A.K. Abdel-Malek, A.M. Ahmed, S.A. El-Sharkawi, N.A. El-Hamid. Prediction of stature from hand measurements. Forensic Science International 46.3 (1990) 181-7. https://doi.org/10.1016/0379-0738(90)90304-H.
[9] M. Voracek, L.M. Loibl. Scientometric analysis and bibliography of digit ratio (2D:4D) research, 1998–2008. Psychological Reports 104.3 (2009) 922-56. https://doi.org/10.2466/PR0.104.3.922-956.
[10] J.T. Manning, A. Stewart, P.E. Bundred, R.L. Trivers. Sex and ethnic differences in 2nd to 4th digit ratio of children. Early Human Development 80 (2004) 161-168. https://doi.org/10.1016/j.earlhumdev.2004.06.004.
[11] J.T.J. Brons, H.P. van Geijin, P.D. Bezemer, J.P.J. Nauta, N.F. Arts. The fetal skeleton; ultrasonographic evaluation of the normal growth. Reprod Biol 34 (1990) 21-36. https://doi.org/10.1016/0028-2243(90)90004-K.
[12] N.E. Budorick, D.H. Pretorius, D.D. Johnson, M.K. Tartar, K.V. Lou, T.R. Nelson. Three-dimensional ultrasound examination of the fetal hands: normal and abnormal. Ultrasound Obstet Gynecol 12 (1998) 227–234. https://doi.org/10.1046/j.1469-0705.1998.12040227.x.
[13] S.R. Coleman. Hand rejuvenation with structural fat grafting. Plast Reconstr Surg 110 (2002) 1731. https://doi.org/10.1097/00006534-200212000-00017.
[14] J.R. Wendt. Distal, dorsal superior extremity plasty. Plast Reconstr Surg 106.1 (2000) 210-213. https://doi.org/10.1097/00006534-200007000-00040.
[15] T. Baki. Fasiyal anatomi ile liderlik kişilik özelliği arasındaki ilişkinin araştırılması [Mastery Thesis]. Bolu: Bolu Abant İzzet Baysal University, Health Sciences Institute; 2019.
[16] A. Tatar, H.E. Özmen, F. Aksu. Genç Kadınlarda Eldeki 2./4. Parmak uzunluk oranına göre kişilik özellikleri profilinin incelenmesi. Nobel Med 13.1 (2017) 39-47. https://doi.org/10.25203/idd.300765.
[17] F. Aksu, A. Tatar, S. Türkmen, S. Çelikli, A. Çelik, S. Tetik. Paramediklerde psikolojik değerlendirme ve eldeki 2/4 parmak oranının kişilik yapısı ile ilişkisi. DEÜ Tıp Fakültesi Dergisi 24.1 (2010) 11-18.
[18] C.H. Wagner. The pianist's hand: anthropometry and biomechanics. Ergonomics 31.1 (1988) 97-131. https://doi.org/10.1080/00140138808966651.
[19] M. Dereli. A Survey research of leadership styles of elementary school principals [Mastery Thesis]. Ankara: Middle East Technical University, Educational Sciences Institute; 2003.
[20] S.N. Paul, J.L. Hunkin, S. Vivekanandan, T.D. Spector. The Big Finger: the second to fourth digit ratio is a predictor of sporting ability in women. Br J Sports Med 40 (2006) 40: 981-983. https://doi.org/10.1136/bjsm.2006.027193.
[21] J.T. Martin, D.A Puts, S.M. Breedlove. Hand asymmetry in heterosexual and homosexual men and women: relationship to 2d:4d digit ratios and other sexually dimorphic anatomical traits. Arch Sex Behav 37 (2008) 119–132. https://doi.org/10.1007/s10508-007-9279-8.