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ORIGINAL ARTICLE

Quantitative anatomy of the extensor digiti minimi muscle in the growing human fetus

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Mateusz Badura et al., Fetal extensor digiti minimi parameters

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ABSTRACT

Introduction: Age-specific reference intervals for the extensor digiti minimi muscle (EDMM) in the human fetus may be relevant in the detailed evaluation of the musculoskeletal systems with potential relevant aspects for surgical treatment. The aim of the study was to examine the age-specific reference intervals and growth dynamics of the EDMM in relation to its length, width, projection surface area and volume.

Materials and methods: The examined material included 70 human formalin-fixed fetuses of both sexes (37♀, 33♂) aged from 17 to 29 weeks. With the use of anatomical dissection every EDMM was visualized, recorded in a form of JPG formats and analyzed by the digital image analysis system and statistical methods.

Results: No variability of the EDMM was found. All the morphometric parameters of the EDMM revealed neither sex nor laterality differences. With fetal age most linear parameters of the EDMM concerning its examined lengths and widths increased in accordance with natural logarithmic functions. The only two exceptions to this referred to the belly width of EDMM measured at its mid-length and the tendon width of EDMM measured proximal to the extensor retinaculum of wrist, which both followed square root functions. The projection surface areas of the EDMM followed natural logarithmic functions, while the volumetric growth of the EDMM was proportionate to fetal age.

Conclusions: The variability of the EDMM in the human fetus is minimal. The morphometric data of the EDMM represents age-specific reference intervals of clinical significance. Morphometric parameters of the EDMM reveal neither sex nor laterality differences. The EDMM displays three different growth dynamics: from gradual growth deceleration according to both natural logarithmic functions (total length of the muscle and its tendons, belly length, tendon lengths, belly width at its origin, tendon width at its insertion, and projection surface areas) and square root functions (belly width at its mid-length and tendon width in the pre-retinacular segment) to a proportionate growth (total volume).

Keywords: extensor digiti minimi muscle; growth dynamics; fetal development; human fetus

INTRODUCTION

The extensor digiti minimi muscle (EDMM) represents a slender fusiform muscle positioned in the superficial layer of posterior antebrachial extensors between the extensor digitorum and extensor carpi ulnaris muscles [1, 2]. The EDMM is extended between the lateral epicondyle of humerus and the proximal phalanx of little finger. It originates from the common extensor tendon at the lateral epicondyle of humerus as one of the seven extensors of forearm: four lateral and three superficial posterior antebrachial extensors. A narrow belly of the EDMM is continuous with its long tendon, which passes deeply to the extensor retinaculum of wrist through the fifth extensor compartment of wrist. Its insertion contributes to the dorsal digital expansion of the little finger that is part of the extensor expansion of hand [1–8].

The EDMM adducts the little finger and extends the metacarpophalangeal and proximal interphalangeal joints of the little finger. Besides, it participates in both wrist extension at the radiocarpal joint and forearm extension at the elbow joint [1–3, 9, 10].

After reviewing the medical literature we did not manage to find any morphometric data of the EDMM in human fetuses. Thus, with the use of such objective methods as digital image analysis and statistics we assumed to quantitatively analyze the size of EDMM in the human fetus at the age range of 17 to 29 weeks of gestation, so as to endow the professional literature with novel numerical data and growth dynamics of the EDMM of potential clinical significance in human fetuses.

In the present study we aimed to comprehensively perform the quantitative analysis of the EDMM in the growing human fetus with relation to its:

1. potential variability that may considerably influence its morphometric parameters,
2. morphometric parameters: belly length and width, tendon length and width, muscle projection surface area, and volume,
3. potential right-left and male-female differences in all examined parameters, and
4. growth patterns for all the examined parameters.

MATERIALS AND METHODS

The study material comprised 70 fetuses (33 males and 37 females) aged between weeks 17 and 29 of gestation, derived from spontaneous miscarriages and preterm deliveries, and collected at our Department of Normal Anatomy. The present examinations were ethically approved by the Bioethics Committee of the Ludwik Rydygier Collegium Medicum in Bydgoszcz, part of the Nicolaus Copernicus University in Bydgoszcz (KB/67/2019). Fetal ages were determined on the crown-rump length. Table 1 presents the characteristics of the study group, categorized by the age and number of fetuses examined.

Anatomical dissection was performed in both upper limbs, so as to expose the right and left EDMMs. Subsequently, each EDMM was photographed using a Canon EOS 70D(W) camera, and afterwards the images were subject to morphometric analysis using the NIS Elements AR 3.0 software and digital image analysis. The following 14 parameters were measured for each EDMM (Fig. 1A–C):

1. belly length of EDMM — measured from its origin to its end,
2. tendon length of EDMM proximal to the extensor retinaculum of wrist — measured from the beginning of the tendon to the proximal margin of the extensor retinaculum of wrist,
3. tendon length of EDMM subjacent to the extensor retinaculum of wrist — measured from the proximal to distal margin of the extensor retinaculum of wrist,
4. tendon length of EDMM distal to the extensor retinaculum of wrist — measured from the distal margin of the extensor retinaculum of wrist to the tendon insertion,
5. total tendon length of EDMM,
6. total length of EDMM,
7. belly width of EDMM measured at its origin,
8. belly width of EDMM measured at its mid-length,
9. tendon width of EDMM — measured proximal to the extensor retinaculum of wrist (pre-retinacular segment),

10. tendon width of EDMM — measured distal to the extensor retinaculum of wrist (post-retinacular segment),
11. total projection surface area of EDMM,
12. projection surface area of EDMM belly,
13. projection surface area of EDMM tendon, and
14. total volume.

All numerical data was subject to statistical analysis with the use of STATISTICA 13.1. The results obtained from the performed measurements were subject to statistical analysis. Because of the normal distribution of numerical data our results have been presented as means and standard deviations (SD). The Shapiro–Wilk test was used to assess the distribution of variables, while homogeneity of variance was examined using Fisher's test. In order to compare right-left means and male-female means the t-Student test for dependent variables and the *t*-Student test for independent variables were respectively used with one-way analysis of variance. The growth patterns for the examined parameters were analyzed using non-linear and linear regression analysis. The growth dynamics of best fit was unequivocally characterized and selected by the greatest value of its coefficient of determination (R^2). The relationship between variables was assessed using Pearson's correlation coefficient. Statistically significant differences were considered at $p < 0.05$.

RESULTS

In the material under examination we found no variability of the EDMM. This means that in all the fetuses studied the EDMMs were visualized with their typical origin, course and insertion, and without extra muscle slips.

Means and standard deviations of the examined parameters of the EDMM have been presented in Tables 1–3. The statistical analysis of all the examined morphometric parameters of the EDMM demonstrated neither sexual nor bilateral differences ($p > 0.05$). As a result, we could compute only one growth pattern for each morphometric parameter (Tables 2–5, Figs. 2, 3), thus considerably enhancing their evidence values.

The total length, belly length and three tendon lengths of the EDMM — measured at three points: proximal, subjacent and distal to the extensor retinaculum of wrist – increased according to the natural logarithmic models: $y = -142.406 + 61.876 \times \ln(\text{Age}) \pm 3.371$ ($R^2 = 0.85$), $y = -71.593 + 30.303 \times \ln(\text{Age}) \pm 1.976$ ($R^2 = 0.80$), $y = -70.812 + 31.573 \times \ln(\text{Age}) \pm 2.452$ ($R^2 = 0.74$), $y = -5.592 + 2.376 \times \ln(\text{Age}) \pm 0.297$ ($R^2 = 0.52$), $y = -12.888 + 5.618 \times$

ln(Age) ± 0.658 (R^2 = 0.55), and y = –53.113 + 22.309 × ln(Age) ± 1.574 (R^2 = 0.77), respectively.

The belly width of EDMM measured at its origin and its tendon width distal to the extensor retinaculum of wrist increased in accordance with the logarithmic regressions, as follows: y = –4.976 + 2.035 × ln(Age) ± 0.221 (R^2 = 0.59) and y = –2.550 + 1.034 × ln(Age) ± 0.104 (R^2 = 0.62), respectively. The belly width of EDMM measured at its mid-length, and its tendon width proximal to the extensor retinaculum of wrist increased according to the square root functions: y = –3.336 + 1.010 × sqrt(Age) ± 0.245 (R^2 = 0.62) and y = –2.223 + 0.652 × sqrt(Age) ± 0.155 (R^2 = 0.63), respectively.

The three projection surface areas of the whole EDMM, its belly and tendon computed natural logarithmic functions: y = –334.068 + 125.288 × ln(Age) ± 4.665 (R^2 = 0.92), y = –216.594 + 82.738 × ln(Age) ± 4.799 (R^2 = 0.82) and y = –104.887 + 39.062 × ln(Age) ± 1.624 (R^2 = 0.91), respectively. The volumetric growth of the whole EDMM followed the linear model: y = – 0.178 + 0.010 × Age ± 0.007 (R^2 = 0.95).

DISCUSSION

In order to comprehensively discus the EDMM the following 3 aspects were successively highlighted: variability of EDMM, morphometric parameters of EDMM in fetuses and morphometric parameters of EDMM in adults.

Variability of EDMM

The EDMM may sporadically be absent [1]. This may be explained by its fusion with either the extensor digitorum muscle or the extensor carpi ulnaris muscle [ ]. In the present study the EDMM was present in all the fetuses studied.

Furthermore, the variability of EDMM may also be restricted to its tendon alone. The tendon of EDMM may be duplicated and typically runs alongside the tendon of extensor digitorum muscle destined for the little finger. Infrequently, the tendon of EDMM may also be extended to the ring finger that is typical of many primates, including orangutans. By studying upper limbs from 100 human cadavers, Suwannakhan et al. [11] distinguished five anatomical patterns of the EDMM. The EDMM was absent on the right side (1%), presented a duplicated tendon (75%) or a single tendon (16%) or a triple tendon (4%). In 4% of cases, a single tendon of the EDMM was initially divided and finally united. In the fetal material under examination we found the tendon of EDDM to be constantly bifurcated.

Numerous authors — including Abdel-Hamid et al. [12], El-Badawi et al. [13], Celik et al. [14], Hirai et al. [15], and Dass et al. [16] — consistently reported the EDMM to usually send off more than one tendon. Celik et al. [166] found a bifurcated tendon of the EDMM in 48 out of 54 (88.9%) autopsied upper limbs in adults. According to von Schroeder and Botte [17], throughout its course a single tendon of the EDMM occurred in one case (2.2%), while bifurcated or triple tendons referred to 59.1% and 6.8% of cases, respectively. In 31.9% of cases these authors found the primary single tendon to be finally divided. It is noteworthy mentioning that von Schroeder and Botte [17] described one case of an extremely occasional triple tendon configuration of EDMM, in which two tendons merged into the dorsal digital expansion of the little finger, while the third tendon contributed to the dorsal digital expansion of the ring finger [12–17].

In studying autopsied adults and fetuses Palatty et al. [18] found the tendon of EDMM in the whole group to be single in 9 cases (18%), double or triple in 40 cases (80%) and absent in 1 case (2%). Of note, there were considerable differences in the number of these tendons between adults and fetuses. In adults the single tendon of EDMM occurred in only 2 cases (6%), a double tendon in 23 cases (77%) and a triple tendon in 5 cases (17%). In fetuses a single tendon of EDMM was found in 7 cases (35%), a double tendon in 12 cases (60%), while its lack in only 1 case (5%).

Hirai et al. [15] examined the arrangement of tendons of EDMM in 548 upper limbs in autopsied adults. In their course proximally to the extensor retinaculum of wrist, the tendons of EDMM were permanently singular. After passing under the extensor retinaculum of wrist a single tendon of EDMM was still present in only 52 cases (9.5%), while double or triple tendons of EDMM referred to 479 (87.5%) and in 17 (3%) cases, respectively.

According to the medical literature, the maximal number of tendons in the EDMM reached four. The only exception to this is a finding by Ozturk et al. [19] based on 43 autopsied fetuses aged 17 to 40 weeks. These authors described one case of EDMM, which gave rise to as many as five tendons: one tendon inserted onto the ring finger, while the remaining four tendons inserted to the little finger [12, 13, 16, 17, 19–24].

Morphometric parameters of EDMM in fetuses

In the present study we found the growth patterns of EDDM to follow three different types of functions. With fetal age most linear parameters of the EDMM concerning its examined lengths and widths increased in accordance with natural logarithmic functions. The only two exceptions to this referred to the belly width of EDMM measured at its mid-length and the tendon width of EDMM measured proximal to the extensor retinaculum of wrist, which both followed square root functions. The projection surface areas of the EDMM followed natural logarithmic functions, while the volumetric growth of the EDMM was proportionate to fetal age.

In the fetal material under examination, the two belly widths of EDMM measured at its origin and mid-length displayed different growth dynamics. The mean belly width of the belly of EDMM at its origin increased from 0.71 to 2.03 mm, following the logarithmic function: $y = –4.976 + 2.035 \times \ln(Age) \pm 0.221$ ($R^2 = 0.59$). Simultaneously, the mean belly width of EDMM measured at its mid-length still grew from 0.74 to 2.05 mm, however it did generate the square root function: $y = –3.336 + 1.010 \times sqrt(Age) \pm 0.245$ ($R^2 = 0.62$).

Regarding the tendon of EDMM, we would like to emphasize different growth patterns of its widths in the preretinacular and retinacular segments. Its mean tendon width in the pre-retinacular segment increased from 0.64 to 1.36 mm, following the square root function: $y = –2.223 + 0.652 \times sqrt(Age) \pm 0.155$ ($R^2 = 0.63$). On the other hand, its mean tendon width in the retinacular segment increased from 0.36 to 0.88 mm, in accordance with the logarithmic regression: $y = –2.550 + 1.034 \times \ln(Age) \pm 0.104$ ($R^2 = 0.62$).

According to Pallaty et al. [18], a tendon width of EDMM ranged from 0.5 to 1.94 mm in male fetuses and from 0.67 to 1.89 mm in female fetuses, with no fetal age determination. To our opinion however, this numerical data may be of low evidence value, not being correlated with fetal ages.

Morphometric parameters of EDMM in adults

Pallaty et al. [18] reported that the tendon width of EDMM in adults to range from 0.8 to 4 mm in males, and from 0.95 to 3.34 mm in females. Celik et al. [14] found a single tendon of EDMM in autopsied adults to be 1.92 mm in width and 1.32 mm in thickness. Furthermore, in cases with 2 or 3 tendons of the EDMM, the wider tendons were found on the radial side of the little finger with 2.52 ± 0.92 mm on the right and 2.55 ± 0.61 mm on the left, when compared to the ulnar side of the little finger with tendon widths of 2.32 ± 0.59 mm on the right and 2.54 ± 0.60 mm on the left. When present, the third tendon of EDMM destined for the ring finger was both narrowest of the three — with 0.80 ± 0.31 mm on the right and 1.39 ± 0.34 mm on the left — and simultaneously the thickest one with the value of 2.43 ± 1.12 mm. With only one or two tendons of EDMM, their thickness was comparable: on the radial side: 1.33 ± 0.25 mm in the right hand and 1.16 ± 0.35 mm in the left hand, and on the ulnar side: 1.55 ± 0.55 mm in the right hand and 1.21 ± 0.28 mm in the left hand.

CONCLUSIONS

1. The variability of the EDMM in the human fetus is minimal.
2. The morphometric data of the EDMM represents age-specific reference intervals of clinical significance.
3. Morphometric parameters of the EDMM reveal neither sex nor laterality differences.
4. The EDMM displays three different growth dynamics: from gradual growth deceleration according to both natural logarithmic functions (total length of the muscle and its tendons, belly length, tendon lengths, belly width at its origin, tendon width at its insertion, and projection surface areas) and square root functions (belly width at its mid-length and tendon width in the pre-retinacular segment) to a proportionate growth (total volume).

Article information and declarations

Ethics statement

The present examinations were ethically approved by the Bioethics Committee of the Ludwik Rydygier Collegium Medicum in Bydgoszcz, the Nicolaus Copernicus University in Bydgoszcz.

Author contributions

Mateusz Badura: concept, dissection, collecting data, statistical analysis, literature search, writing the article.
Anna Badura: concept, dissection, collecting data, statistical analysis, literature search, writing the article.
Magdalena Grzonkowska: dissection, literature search.
Mariusz Baumgart: dissection, collecting data, statistical analysis.
Monika Paruszewska-Achtel: dissection, literature search, writing the article.
Michał Szpinda: writing the article, final approval of article.

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Table 1. Characteristics of the examined fetal sample with its distribution to age, number and sex

Gestational age (weeks)	Crown-rump length [mm]				Number of fetuses	Sex	
	Mean	SD	Minimum	Maximum		Male	Female
17	128	–	–	–	1	1	–
18	137	4.15	133	143	5	4	1
19	151.3	3.51	148	155	3	2	1
20	161.6	3.05	158	166	5	2	3
21	175.1	3.47	170	181	17	8	9
22	186.6	3.82	182	191	7	4	3
23	199.6	2.79	195	203	7	1	6
24	210.2	3.76	204	213	6	3	3
25	218.8	3.19	215	223	5	1	4
26	231.7	1.53	230	233	3	2	1
27	238.7	2.07	236	241	6	3	3
28	247	2.65	245	250	3	1	2
29	255	1.41	254	256	2	1	1
Total					70		

Table 2. Statistical analysis of numerical data of the belly length, tendon length, total length and total volume (mean ± SD) of the right extensor digitii minimi muscle

Gestational age (weeks)	Number of fetuses	Right extensor digiti minimi muscle EDMM									
		Belly length [mm]		Tendon length (mm)							
				Proximal to the extensor retinaculum of wrist		Subjacent to the extensor retinaculum of wrist		Distal to the extensor retinaculum of wrist		Total tendo length	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SI
17	1	16.22		0.85		2.19		11.61		14.65	
18	5	20.95	1.55	1.28	0.18	3.53	0.51	10.68	1.28	15.48	1.9
19	3	22.92	2.78	1.61	0.48	4.10	0.90	13.85	1.07	19.56	2.0
20	5	22.46	2.09	1.28	0.12	3.43	0.37	13.27	0.76	17.98	1.0
21	17	25.49	2.56	1.73	0.47	4.33	0.70	15.02	1.88	21.02	2.1
		(p < 0.05)		(p < 0.05)							
22	7	27.28	2.01	1.91	0.33	4.70	0.62	15.66	1.45	22.26	1.9
23	7	27.53	3.00	1.91	0.40	4.63	0.50	17.73	1.48	24.28	2.1
24	6	30.48	2.85	1.83	0.14	4.66	0.69	17.03	1.11	23.53	0.3
25	5	31.00	3.99	2.26	0.47	5.33	0.48	18.67	1.84	26.18	1.7
		(p < 0.05)		(p < 0.05)							
26	3	34.04	2.56	2.17	0.19	5.61	0.51	18.95	0.59	26.73	0.8
27	6	32.51	1.51	2.28	0.35	5.90	0.68	20.51	1.99	28.69	2.2
28	3	33.35	1.89	1.99	0.18	5.34	0.52	20.31	1.15	27.65	1.8
29	2	34.65	1.37	2.48	0.22	6.15	0.12	24.36	0.50	33.00	0.4
		(p < 0.05)		(p < 0.05)							

Table 3. Statistical analysis of numerical data of the belly length, tendon length, total length and total volume (mean ± SD) of the left extensor digitii minimi muscle

Gestational age (weeks)	Number of fetuses	Left extensor digiti minimi muscle EDMM						
		Belly length (mm)	Tendon length (mm)				Total length (mm)	To volu (cr
			Proximal to the extensor retinaculu	Subjacent to the extensor retinaculu	Distal to the extensor retinaculu	Total tendon length		

				m of wrist		m of wrist		m of wrist						
		mean	**SD**	**mean**	**SD**	**mean**	**SD**	**mean**	**SD**	**mean**	**SD**	**mean**	**SD**	**mean**
17	1	16.14		0.83		2.03				14.39		30.53		0.006
18	5	21.01	1.59	1.28	0.19	3.40	0.51	10.68	1.30	15.35	1.96	36.35	3.35	0.009
19	3	22.96	2.67	1.60	0.47	4.27	1.43	13.56	0.83	19.44	1.97	42.40	4.59	0.012
20	5	22.45	2.058	1.28	0.12	3.30	0.35	13.29	0.86	17.87	1.12	40.32	1.97	0.018
21	17	25.51	2.60	1.67	0.28	4.30	0.67	14.93	1.81	20.90	2.13	46.42	3.65	0.036
		(p < 0.05)					(p < 0.05)					(p < 0.05)		(p <
22	7	27.22	1.92	1.84	0.27	4.79	0.70	15.67	1.44	22.29	2.09	49.51	2.87	0.051
23	7	27.67	2.97	1.93	0.40	4.71	0.77	17.64	1.26	24.28	2.20	51.94	3.26	0.062
24	6	30.45	2.87	1.82	0.18	4.71	0.51	17.04	1.13	23.56	0.66	54.01	3.18	0.076
25	5	31.21	4.14	2.19	0.39	5.12	0.52	18.58	1.89	25.89	1.75	57.10	5.19	0.081
		(p < 0.05)					(p < 0.05)					(p < 0.05)		(p <
26	3	34.00	2.68	2.19	0.17	5.56	0.39	18.90	0.58	26.64	0.61	60.64	2.32	0.087
27	6	32.42	1.47	2.30	0.35	5.78	0.72	20.33	1.83	28.42	2.20	60.83	2.88	0.095
28	3	33.42	2.02	2.00	0.18	5.17	0.50	20.33	1.06	27.50	1.71	60.92	3.00	0.105
29	2	35.73	2.75	2.47	0.08	6.36	0.53	24.34	0.49	33.18	0.12	68.92	2.87	0.115
		(p < 0.05)					(p < 0.05)					(p < 0.05)		(p <

Table 4. Statistical analysis of numerical data of the belly width, tendon width and projection surface area (mean ± SD) of the right extensor digitii minimi muscle

Gestational	**Number**	**Right extensor digiti minimi muscle EDMM**

age (weeks)	of fetuses	Belly width [mm]				Tendon width [mm]				Pro	
		Measured at its origin		Measured at its mid-length		Measured proximal to the extensor retinaculum of wrist		Measured subjacent to the extensor retinaculum of wrist		Total	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	S
17	1	0.71		0.74		0.64		0.36		25.81	
18	5	1.09	0.16	1.18	0.17	0.55	0.07	0.40	0.11	27.25	1.5
19	3	0.81	0.14	0.82	0.08	0.62	0.12	0.52	0.02	38.72	4.9
20	5	0.88	0.25	0.93	0.06	0.56	0.07	0.50	0.05	34.64	5.
21	17	1.23	0.18	1.29	0.23	0.75	0.12	0.62	0.12	46.05	4.
		($p < 0.05$)		($p < 0.05$)		($p < 0.05$)					
22	7	1.37	0.27	1.43	0.24	0.94	0.12	0.69	0.11	53.99	4.2
23	7	1.51	0.19	1.55	0.22	0.90	0.23	0.68	0.08	63.55	5.5
24	6	1.51	0.19	1.62	0.26	1.01	0.25	0.74	0.14	70.40	3.0
25	5	1.61	0.23	1.92	0.20	1.02	0.20	0.78	0.14	70.46	2.9
		($p < 0.05$)		($p < 0.05$)		($p < 0.05$)					
26	3	1.65	0.15	1.70	0.07	1.10	0.07	0.75	0.01	74.55	7.0
27	6	1.67	0.25	1.79	0.32	1.16	0.13	0.91	0.12	76.07	1.9
28	3	1.75	0.04	2.12	0.32	1.19	0.21	0.80	0.16	80.15	4.3
29	2	2.03	0.08	2.03	0.02	1.29	0.10	0.88	0.01	83.46	0.4
		($p < 0.05$)		($p < 0.05$)		($p < 0.05$)					

Table 5. Statistical analysis of numerical data of the belly width, tendon width and projection surface area (mean ± SD) of the left extensor digitii minimi muscle

Gestational age (weeks)	Number of fetuses	Left extensor digiti minimi muscle EDMM									
		Belly width [mm]				Tendon width [mm]				Pro	
		Measured at its origin		Measured at its mid-length		Measured proximal to the extensor retinaculum of wrist		Measured subjacent to the extensor retinaculum of wrist		Total	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
17	1	0.73		0.75		0.67		0.36		24.62	
18	5	1.09	0.13	1.15	0.18	0.53	0.06	0.40	0.09	27.45	1.64
19	3	0.80	0.12	0.83	0.04	0.62	0.09	0.53	0.01	38.07	5.22
20	5	0.87	0.25	0.91	0.07	0.58	0.04	0.49	0.05	36.29	3.53
21	17	1.22	0.19	1.31	0.21	0.75	0.13	0.61	0.11	46.48	3.58

		$(p < 0.05)$		$(p < 0.05)$		$(p < 0.05)$					
22	7	1.37	0.30	1.45	0.23	0.95	0.12	0.69	0.13	54.18	2.86
23	7	1.50	0.17	1.57	0.22	0.90	0.23	0.68	0.07	63.96	4.46
24	6	1.57	0.22	1.65	0.24	0.99	0.26	0.73	0.15	69.50	1.79
25	5	1.57	0.28	1.91	0.22	1.02	0.17	0.78	0.13	69.44	1.89
		$(p < 0.05)$		$(p < 0.05)$		$(p < 0.05)$					
26	3	1.65	0.15	1.71	0.06	1.11	0.07	0.74	0.03	72.71	6.67
27	6	1.63	0.23	1.79	0.33	1.16	0.12	0.89	0.13	77.88	0.57
28	3	1.75	0.03	2.12	0.35	1.13	0.25	0.77	0.20	80.74	2.67
29	2	1.98	0.03	2.05	0.03	1.36	0.13	0.86	0.01	82.25	0.21
		$(p < 0.05)$		$(p < 0.05)$		$(p < 0.05)$					

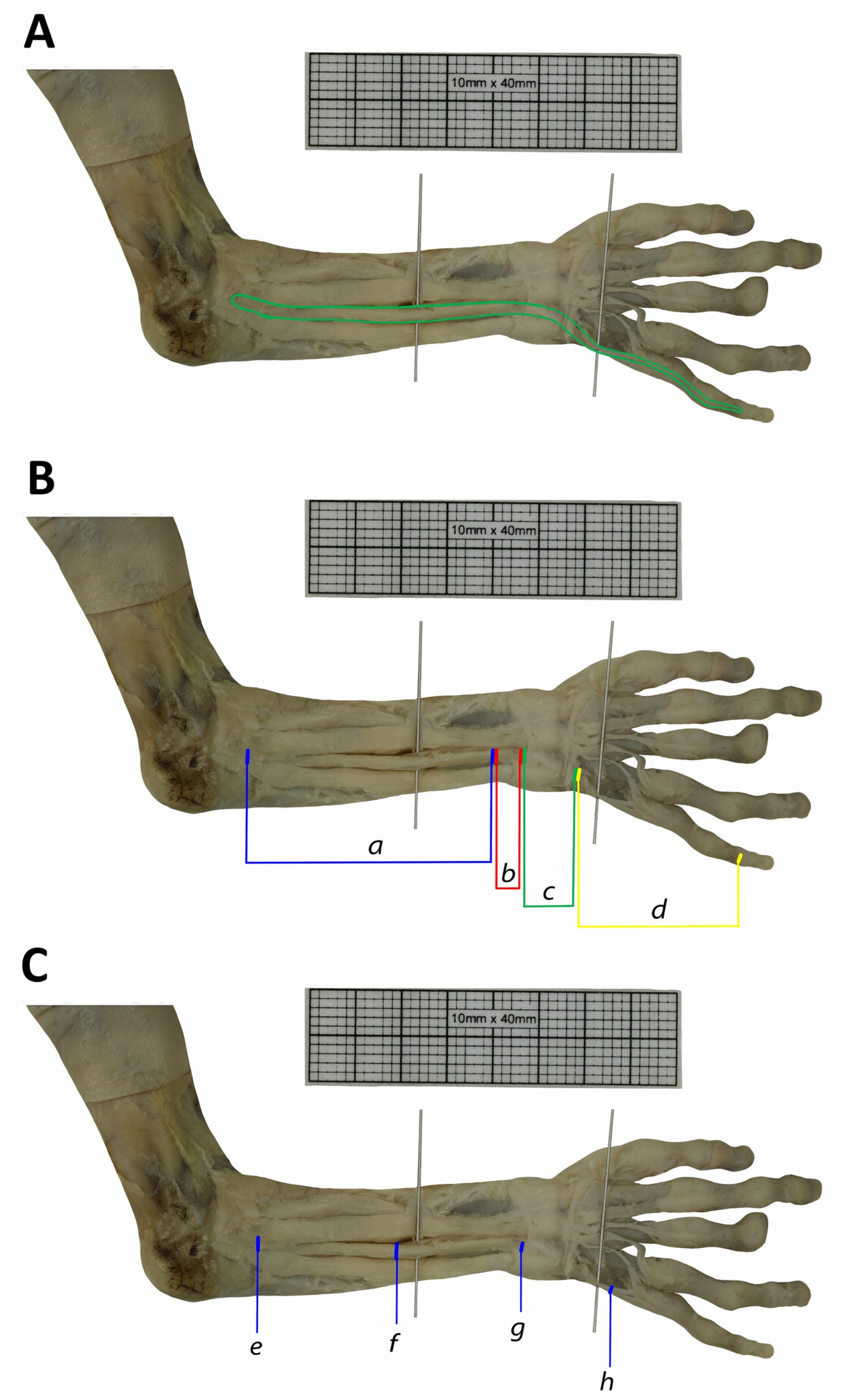

Figure 1. The extensor digiti minimi muscle in a male fetus at 22 weeks. **A.** Total projection surface area of EDMM; **B.** a — belly length of EDMM – measured from its origin to its end, b — tendon length of EDMM proximal to the extensor retinaculum of wrist, c — tendon length of EDMM subjacent to the extensor retinaculum of wrist, d — tendon length of

EDMM distal to the extensor retinaculum of wrist; **C.** e — belly width of EDMM measured at its origin, f — belly width of EDMM measured at its mid-length, g — tendon width of EDMM — measured proximal to the extensor retinaculum of wrist, h — tendon width of EDMM — measured distal to the extensor retinaculum of wrist.

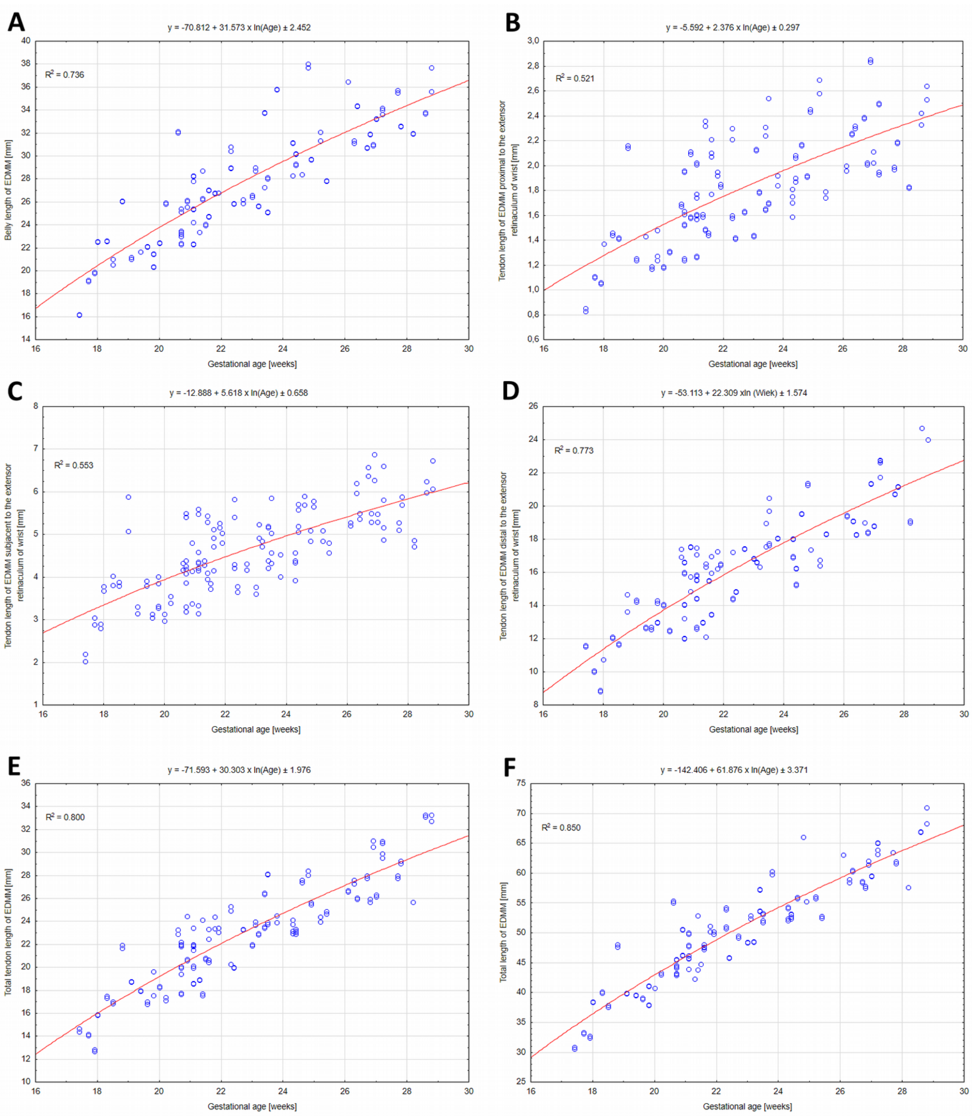

Figure 2. Regression lines for the lengths of the extensor digiti minimi muscle. **A.** Belly length; **B–F.** Tendon length

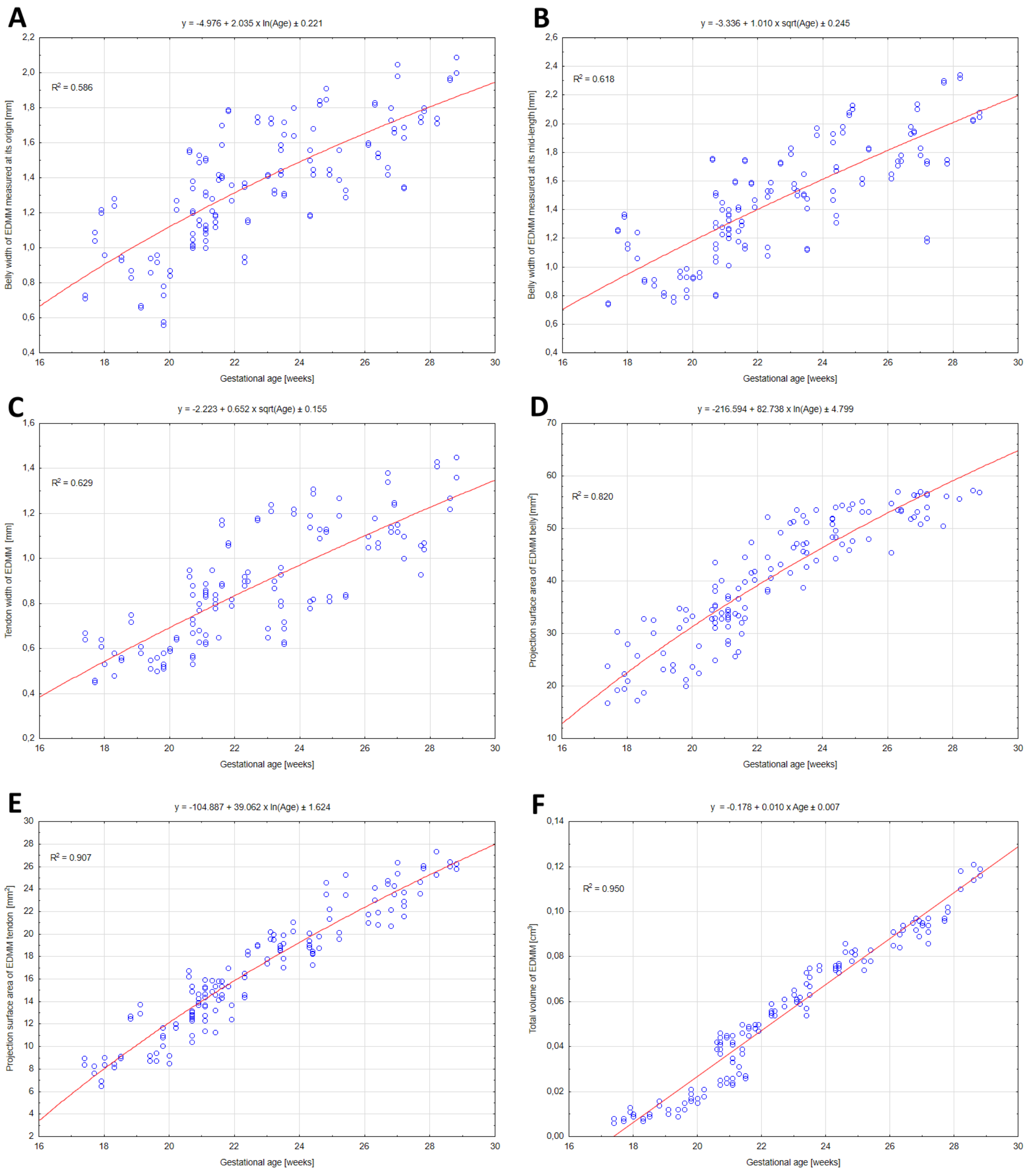

Figure 3. Regression lines for the widths (**A–C**), projection surface area (**D, E**) and total volume (**F**) of the extensor digiti minimi muscle