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RESEARCH ON THICKNESS AND DENSITY OF GAMBLE TWINS MUSCLES MYOCYTES IN COMMERCIAL MEAT HYBRID COBB-500

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ABSTRACT. From 10 individuals of male and female sex, belonging to the commercial meat hybrid COBB-500, histological samples were collected from the two twins leg muscles (lateral gastrocnemius and medial gastrocnemius). Sampling was done during the slaughter of these birds at the age of 42 days, when they had body weights of 2168-2296 grams, depending on sex. Samples were processed in conformity with the paraffin section technique, resulting 20 histological slides, which were studied with a photonic binocular microscope. The device used (OM MC_3) permited direct cytometric determinations on cross sections displayed on the microscopic slides. The following results were obtained: the mean thickness of myocytes was 36.49 ± 0.59 μ, for the male juveniles and 32.14 ± 0.61 μ, for the female juveniles. These values were found in lateral gastrocnemius muscle. Medial gastrocnemius muscle myocytes had an mean thickness of 36.15 ± 0.78 μ, on male and 31,09 ± 0,68 μ in females. Muscle fiber density was 485.89 to 488.55 fm/mm^2, for males and from 698.06 to 699.67 fm/mm^2 in females. Differences between the twin leg muscles are statistically insignificant in all indicators examined, while for the two sexes, these differences are statistically significant.

Key words: COBB-500; Gastrocnemius; Myocytes; Thickness; Density.

REZUMAT. Cercetări privind grosimea şi densitatea miocitelor din muşchii gemeni ai gambei la hibridul comercial de gaină pentru carne COBB-500. De la 10 indivizi de sex mascul şi femel, aparţinând hibridului comercial de găină pentru carne COBB-500, s-au recoltat probe histologice din cei doi muşchi gemeni ai gambei (gastrocnemianul lateral şi gastrocnemianul medial). Recoltarea s-a făcut cu ocazia sacrificării acestor păsări la vârsta de 42 de zile, când au avut greutăţi corporale de 2168-2296 grame, în funcţie de sex. Probele recoltate au fost procesate după tehnica "secţionării la parafină", obţinându-se 20 de lame histologice, care apoi au fost studiate la microscopul fotonic binocular. Aparatul folosit (MO MC_3) a permis determinări citometrice directe pe secţiunile transversal, etalate pe lamele preparat. S-au obţinut următoarele rezultate: grosimea medie a miocitelor a fost de 36,49 ± 0,59 μ, la puii

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de sex mascul şi de 32,14 ± 0,61 μ, la puii de sex femel, aceste valori fiind găsite în mușchiul gastrocnemian lateral. În mușchiul gastrocnemian medial, miocitele au avut o grosime medie de 36,15 ± 0,78 μ la masculi şi una de 31,09 ± 0,68 μ la femele. Densitatea fibrelor musculare a fost de 485,89 – 488,55 f.m./mm^2 la sexul mascul şi de 698,06 – 699,67 f.m./mm^2 la sexul femel. Diferențele dintre cei doi mușchi gemeni ai gambei sunt nesemnificative din punct de vedere statistic, la toți indicatorii analizați, în timp ce între cele două sexe, aceste diferențe sunt foarte semnificative din punct de vedere statistic.

Cuvinte cheie: COBB-500; gastrocnemieni; miocite; grosime; densitate.

INTRODUCTION

In all species of animals, meat quality is determined by many factors, including those related to the histological structure of the various somatic muscles. Thus, the thickness, density of muscle cells or muscle fibers, form and profile of these muscles, are affecting all physical, chemical and technological characteristics of meat. In birds, especially hybrids specialized for meat production, the pectoral muscles of the hind limb (thigh, gamble, etc.) interest most the producers, processors and especially consumers. Regarding commercial chicken hybrids, newly created and used, such as ROSS-308 or COBB-500, meat quality from the two or three anatomical body regions (chest, thighs, gamble), viewed through the prism of histological indices, is little or not known up to present time (Radu-Rusu *et al*., 2007; Teușan, 2000; Teușan *et al.,* 2009). In this context, we want to bring some contribution and a partial elucidation of some of the issues mentioned above.

MATERIALS AND METHODS

In the first stage of this research, we used as biological material, 10 individuals (five males and five females) belonging to avian hybrid COBB-500, which were slaughtered at 42 days. At this age, those birds had an mean body weight of 2296 grams for males and 2168 grams for females. From the carcasses obtained at slaughter, histological samples were collected from twins leg muscles: lateral gastrocnemius muscle (*Gastrocnemius lateralis*), respectively medial gastrocnemius muscle (*Gastrocnemius medialis*) (Coțofan *et al.,* 2002; Gheție *et al.,* 1976; Nickel *et al.,* 1977). From the muscles, with a volume of about 0.5 to 0.7 cm^3, samples were taken from the middle side, using specific anatomical instruments (scalpels, tweezers, scissors, dissecting needles). Later, muscle samples taken from their anatomical sites were introduced into a fixing solution (10% formalin) and then processed by histological paraffin section techniques.

This technique involves successive stages of the histological samples through the mounting operations, shaping, sizing, dewatering, clarification, paraffin work, inclusion in paraffin, sectioning, displaying sections on glass slides, drying, staining and mounting of histological sections in permanent preparations.

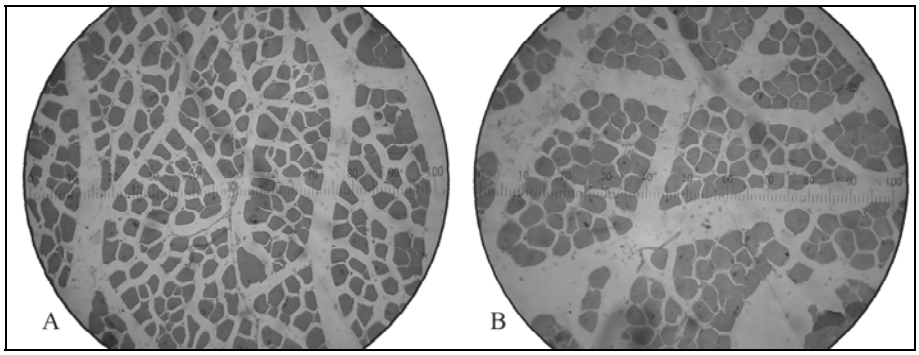


Figure 1 - Microscopical aspects of twins leg muscles:
A *Gastrocnemius lateralis*; B *Gastrocnemius medialis*

The materials used for this purpose were represented by: glass slides, Berzelius glasses, cylinders, jars with glass stopper, battery attachment, battery clarification, dewatering and paraffin battery, dye baths, ovens, Leukart bars, semiautomatic microtome, photonic binocular microscope, objective and ocular micrometer, digital camera, laptop; pocket computer, etc. Among the reagents used: ethyl and amyl alcohol, Mayer albumin, toluene, benzene, xylene, Canada balsam, hematoxylin and eosin dyes. Finally we obtained 20 histological slides (permanent preparations) with cross sections of muscles studied, with a dye dichromate type HE (hematoxylin-eosin). Further these slides have been investigated under a MC3 type photonic microscope which was adjusted and calibrated prior to three associations of oculars and objectives (OC10xOB6; OC10xOB10; OC10xOB20). Calibration of the microscope, led to the calculation and use of three micrometer values, respectively: 15.00, 9.011 and 4.441 μ. On the microscopic field were outlined the best cross sections, large and small diameters of muscle fibers (myocytes) and the number of primary beam structure (Teușan, 2000; Teușan *et al.,* 2009) were measured (using ocular micrometer). Through mathematical calculations we determined the mean diameter of myocytes, their profile and format index, their density and the cross-section surface of muscle fibers.

We used the following mathematical relationship:

(1) $D\bar{x} = \frac{DM + Dm}{2}$: $D\bar{x}$ = mean diameter (μ); DM = large diameter of myocytes (μ); Dm= small diameter of myocytes (μ).

(2) $Ip = \frac{DM}{Dm}$: Ip= profile index of muscle fibers (x/1).

(3) $If = \frac{Dm \times 100}{DM}$: If= format index of muscle fibers (%).

(4) $S.s.t. = \frac{DM \times Dm}{4} \times \pi$: S.s.t. = cross section area of muscle fibers (myocytes) (μ^2); π = circle area ratio with official value of 3.141592654.

(5) $D.f.m. = \frac{n \times 10^6}{SstMFI}$: D.f.m. = density of muscle fibers (f.m./mm^2); n = number of muscle fibers in an MFI; Sst = muscle cross-sectional area of the primary diameter (MFI = muscular fibers I) (μ^2)

All data obtained from measurements and calculations were processed and interpreted using statistical estimators, first calculating the usual statistics (mean and standard error of the mean, variance and standard deviation and coefficient of variation) (Sandu, 1995).

To test the statistical significance of differences between the two muscles studied and the characters of both sexes, Single Factor ANOVA algorithm was applied, using Microsoft Excel software (Sandu, 1995).

RESULTS AND DISCUSSION

The muscles of primarily interest in birds are the pectoral and legs (thighs and legs thighs = lower legs), which together represent 57-63% of carcass weight. The thighs and legs muscles contain both white and red muscle fibers. These muscles are richest in fat than the ches (Radu-Rusu *et al.,* 2007; Radu-Rusu *et al.,* 2008). From the leg muscles, our study aproached the two twins muscles: medial gastrocnemius and lateral gastrocnemius, with a fusiform aspect, lengths of 5-7 cm and weights of 10 to 15 grams each, according to race, individual, sex, hybrid etc. (Coțofan *et al.,* 2002; Nickel *et al.,* 1977).

In terms of histologic aspects, our results revealed an interesting structural picture.

In male, the lateral gastrocnemius muscle myocytes have a larger diameter of 40.92 ± 0.61 μ, with a range between 31.09 and 57.73 μ (v = 13.41%).

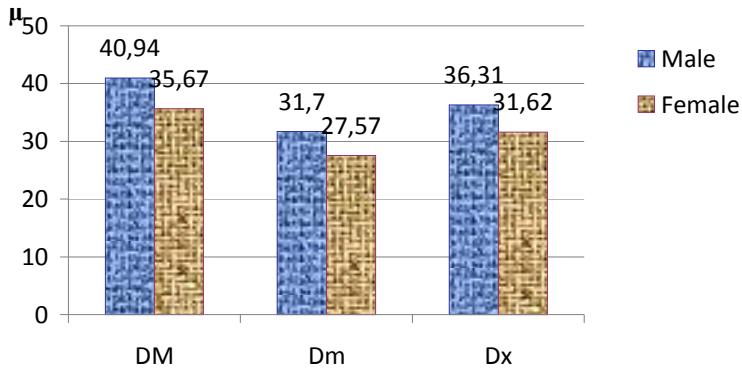
In the muscle pair (*gastrocenmius medialis*) from the same sex, these myocytes had a larger diameter of 40.95 ± 0.84 μ (v = 18.39%) *(Table 1).* The small diameter of these myocytes had means of 32.07 ± 0.70 μ in the lateral gastrocnemius muscle and 31.35 ± 0.87 μ in the medial gastrocnemius muscle. Mean diameter of these myocytes had values of 36.49 ± 0.59 μ, respectively 36.15 ± 0.78 μ in the two twins leg muscles mentioned above (v = 14.36 to 19.31%) *(Table 1).*

In the offsprings of female sex, muscle fibers (myocytes) of the lateral gastrocnemius muscle have a larger diameter of 36.03 ± 0.67 μ (v = 16.70%). The medial gastrocnemius muscle myocytes have a large diameter of was 35.34 ± 0.78 μ (v = 19.82%) *(Table 1).* The small diameter of myocytes of the two twins leg muscles had values of 28.26 ± 0.7 to 26.84 ± 0.72 μ (v = 22.02 to 23.89%) *(Table 1).*

The mean diameter of these muscle cells amounted to 31.09 ± 0.68 to 32.14 ± 0.61 μ (v = 17.08 to 19.59%) *(Table 1).* The profile of muscle fibers of the two muscles studied, are cilindroid, values highlighted by the specific index (profile) and index format. Thus, the index profile has very similar values, for the two twins leg muscles in both sexes, being of 1.302/1 to 1.357/1 *(Table 1).*

Table 1 - Statistical indicators on the thickness and density of the myocytes twins leg muscles in the COBB-500 hybrid hen chicks

Specification	MU	Studied muscles	Chicks sex	n	Statistical indicators			Limits of variation	
					$\bar{x} = s \pm \bar{x}$	s	V %	minimum	maximum
The large diameter of muscle fibers (MD)	μ	Lateral gastrocnemius	Male	80	40.92±0.61	5.488	13.41	31.09	57.73
			Female	80	36.03±0.67	6.016	16.70	17.76	46.63
		Medial gastrocnemius	Male	80	40.95±0.84	7.529	18.39	17.76	57.73
			Female	80	35.34±0.78	7.006	19.82	17.76	44.41
The small diameter of muscle fibers (mD)	μ	Lateral gastrocnemius	Male	80	32.07±0.70	6.281	19.58	17.76	44.41
			Female	80	28.26±0.70	6.222	22.02	13.32	39.97
		Medial gastrocnemius	Male	80	31.35±0.87	7.796	24.87	13.32	48.85
			Female	80	26.84±0.72	6.413	23.89	13.32	39.97
Mean diameter of muscle fibers ($D\bar{x}$)	μ	Lateral gastrocnemius	Male	80	36.49±0.59	5.241	14.36	26.64	48.85
			Female	80	32.14±0.61	5.489	17.08	15.54	43.30
		Medial gastrocnemius	Male	80	36.15±0.78	6.981	19.31	17.76	48.85
			Female	80	31.09±0.68	6.091	19.59	15.54	39.97
Index profile of muscle fibers (Ip)	x/1	Lateral gastrocnemius	Male	80	1.302±0.03/1	0.241	18.50	1.00/1	2.25/1
			Female	80	1.313±0.03/1	0.257	19.55	1.00/1	2.00/1
		Medial gastrocnemius	Male	80	1.354±0.032/1	0.284	20.99	1.00/1	2.334/1
			Female	80	1.357±0.031/1	0.278	20.46	1.00/1	2.00/1
Muscle fibers index format (If)	%	Lateral gastrocnemius	Male	80	78.68±1.39	12.441	15.81	44.43	100.00
			Female	80	78.82±1.59	14.213	18.03	49.98	100.00
		Medial gastrocnemius	Male	80	76.81±1.68	14.653	19.08	42.84	100.00
			Female	80	76.61±1.64	14.689	19.17	49.98	100.00
The surface in cross section of muscle fibers	μ^2	Lateral gastrocnemius	Male	80	1050.24±33.90	303.233	28.87	542.08	1812.28
			Female	80	817.27±29.65	265.241	32.45	185.80	1463.83
		Medial gastrocnemius	Male	80	1038.32±43.05	385.073	37.09	247.73	1874.21
			Female	80	767.43±30.75	275.003	35.83	185.80	1254.75
Muscle fibers density	fm/ mm^2	Lateral gastrocnemius	Male	15	485.89±20.88	80.855	16.64	378.52	646.72
			Female	15	698.06±40.49	156.818	22.46	399.81	922.83
		Medial gastrocnemius	Male	15	488.55±15.87	61.485	12.59	380.77	644.48
			Female	15	699.67±46.40	179.575	25.67	404.20	1084.00



DM=large diameter; Dm=small diameter; Dx=medium diameter
Miocites thickness

Figure 1 -The thickness of myocytes of the gastrocnemius muscle (lateral and medial) of the offspring of hybrid leg COBB-500, according to sex (mean of the two gastrocnemius muscles)

Regarding the format of index values of these muscle fibers, they are between 76.61% and 78.82%, the differences between the two muscles and the two sexes are not too high, which shows that these myocytes are at least of similar shape*).*

The surface of cells muscle developed cross-section similar to their thickness, being 1050.24 ± 33.9 μ^2 at male in lateral gastrocnemius muscle and 1038.32 ± 43.05 μ^2 at the same sex, but in the medial gastrocnemius muscle . In females, the fibers are thinner, have a lower surface (in cross section), being of 817.27 ± 29.65 μ^2 in the lateral gastrocnemius muscle and of 767.43 ± 30.75 μ^2 in the gastracnemian medial muscle (v = 32.45 to 35.83%) *(Table 1).*

In terms of density of muscle fibers, in both muscles studied, the values found are in inverse correlation with those on their thickness, so there are fewer myocytes in juvenile male muscles and more in the female muscles. Thus, for lateral gastrocnemius muscle in males, the mean density was 485.89 ± 20.88 fm/mm^2, while for females, the mean in the same muscles was 698.06 ± 40.49 fm/mm^2 *Table 1).* As the values determined for myocytes characterization of the two twins leg muscles were found to be fairly close, for a better characterization of them, we proceeded to calculate the mean of the two gastrocnemius muscles. *Table 2*, shows these mean values, on the thickness and density of the myocytes, in both sexes.

Table 2 - Statistical indicators on the thickness and mean density of myocytes of the two leg muscles twins in hybrid chicks of hens COBB-500

Chicks sex	Specification		UM	n	Statistical indicators			Limits of variation	
					$\bar{x} = s \pm \bar{x}$	s	V %	min.	max.
MALE	The mean of the two leg muscles twins	The large diameter of muscle fibers (DM)	μ	80	40.94±2.26	4.497	10.98	30.64	55.51
		The small diameter of muscle fibers (Dm)	μ	80	31.70±0.55	4.940	15.58	17.76	42.19
		Mean diameter of muscle fibers ($D\bar{x}$)	μ	80	36.31±0.47	4.192	11.55	25.53	46.63
		Index profile of muscle fibers (Ip)	x/1	80	1.312±0.02/1	0.1794	13.68	1.026/1	1.876/1
		Muscle fibers index format (If)	%	80	77.58±1.12	10.0557	12.96	53.32	97.44
		The surface of the cross section of myocytes	μ^2	80	1029.0±26.72	238.975	23.22	464.63	1645.80
		Density myocytes	fm/ mm^2	15	487.22±16.74	64.843	13.31	379.65	645.60
FEMALE	The mean of the two leg muscles twins	The large diameter of muscle fibers (DM)	μ	80	35.67±0.51	4.598	12.89	22.20	44.41
		The small diameter of muscle fibers (Dm)	μ	80	27,57±0,50	4,463	16,19	15,52	37,75
		Mean diameter of muscle fibers ($D\bar{x}$)	μ	80	31,62±0,45	4,062	12,85	19,98	39,41
		Index profile of muscle fibers (Ip)	x/1	80	1,311±0,02/1	0,1832	13,98	1,00/1	1,819/1
		Muscle fibers index format (If)	%	80	77,61±1,16	10,3975	13,40	54,99	100,00
		The surface of the cross section of myocytes	μ^2	80	780,78±21,74	194,440	24,90	309,66	1208,30
		Density myocytes	fm/ mm^2	15	698,86±43,06	166,789	23,87	402,0	1003,41

For male sex, the mean of the two twins of the leg muscles was 40.94 ± 2.26 μ for large diameter of muscle fibers, 31.70 ± 0.55 μ for the small diameter of these fibers and 36.31 ± 0.47 μ for their mean diameter (v = 10.98 to 15.58%) *(Table 2) (Fig. 1)*. Cross-sectional area of myocytes was 1029 ± 26.72 μ^2, and their density was 487.22 ± 16.74 fm/mm^2 *(Table 2) (Figs. 2 and 3)*.

The two twins leg muscles mean of female offsprings, was 35.67 ± 0.51 μ for the large diameter of myocytes, to 27.57 ± 0.5 μ for the small diameter of myocytes and 31.62 ± 0.45 μ for the mean diameter of the components of these muscle myocytes (v = 1285 to 16.19%) *(Table 2) (Fig. 1)*.

Profile index had values of 1312/1 for males and 1311/1 for females. The index format was situated at 77.58 to 77.61%, according to sex *(Table 2)*. The cross-section surface of muscle fibers was 1029 ± 26.72 μ^2 for male and 780.78 ± 21.74 μ^2 for females and the density of myocytes of the two twin leg muscles (lateral and medial) had an mean of 478.22 fm/mm^2 in males and 698.86 fm/mm^2 in females *(Table 2) (Figs. 2 and 3)*.

If we compare the two sexes in terms of values that characterize the thickness and density of the two twins leg muscle myocytes, we find important differences. Thus, in both the gastrocnemius muscle, the myocytes are thinner in the juvenile females compared with the males. This is demonstrated by the mean of large, small and medium diameter of the muscle fibers, which are 11.88 to 14.39% lower in females compared to males *(Tables 3 and 4)*. Regarding the profile of muscle fibers in the muscles studied, it seems that there are notable differences.

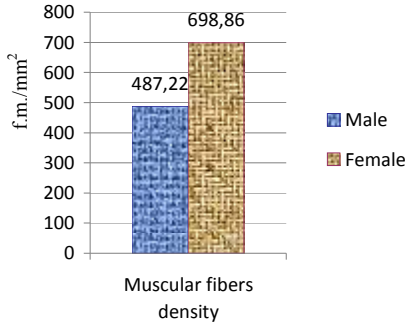


Figure 2 - Myocytes density of twins leg muscles (their mean), of the COBB-500 hybrid offspring, according to sex

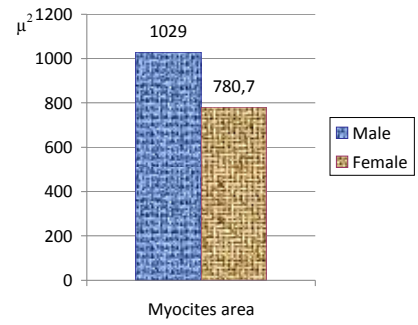


Figure 3 - Cross-sectional area (Shh) of myocytes from the twins leg muscles, of the COBB-500 hybrid offspring, according to sex

Table 3 - Thickness and density of twins leg muscle myocytes from chickens hybrid COBB-500, according to sex

Specification	MU	Studied muscles	The gender of studied chicks				
			Male (M)		Female (F)		±%F/M ±pp*
			Absolute Values	Relative Values	Absolute Values	Relative Values	
The large diameter of muscle fibers (DM)	μ	Lateral gastrocnemius	40.92	100.0	36.03	88.05	-11,95%
		Medial gastrocnemius	40.95	100.0	35.34	86.30	-13.70%
Small diameter of muscle fibers(Dm)	μ	Lateral gastrocnemius	32.07	100.0	28.26	88.12	-11.88%
		Medial gastrocnemius	31.35	100.0	26.84	85.61	-14.39%
Mean diameter of muscle fibers ($D\bar{x}$)	μ	Lateral gastrocnemius	36.49	100.0	32.14	88.08	-11.92%
		Medial gastrocnemius	36.15	100.0	31.09	86.00	-14.00%
Index profile of muscle fibers (Ip)	x/1	Lateral gastrocnemius	1.302	100.0	1.313	100.84	+0.84%
		Medial gastrocnemius	1.354	100.0	1.357	100.22	+0.22%
Index format of muscle fibers (If)	%	Lateral gastrocnemius	-	78.68	-	78.82	+0.14%
		Medial gastrocnemius	-	76.81	-	76.61	-0.20%
The surface of the cross section of myocytes	μ^2	Lateral gastrocnemius	1050.24	100.0	817.27	77.82	-22.18%
		Medial gastrocnemius	1038.32	100.0	767.43	73.91	-26.09%
The density of muscle fibers (Dfm)	fm/ mm^2	Lateral gastrocnemius	485.89	100.0	698.06	143.67	+43.67%
		Medial gastrocnemius	488.55	100.0	699.67	143.21	+43.21%

*pp=procentual points

Regarding the area of transversal section of muscle fibers, there are quite large differences between females and males in both twins leg muscles. Thus, in lateral gastrocnemius muscle, females are inferior to males with 22.18%, and in medial gastrocnemius muscle the difference is greater, from 24.12 to 26.09% *(Tables 3 and 4).* In terms of density of muscle fibers the situation is reversed, with more myocytes in a given area (mm^2) in females compared to males. The difference in this case is 43.67% in the lateral gastrocnemius muscle and 43.67% in medial gastrocnemius muscle *(Table 3)* and the the difference mean of the two muscles studied, is 43.44% for females *(Table 4) (Fig. 2).*

Table 4 - Thickness and density of the myocytes of the two leg muscles twins in hybrid chicks of COBB-500, according to sex

	Specification	MU	The gender of studied chicks				±%F/M ±pp
			Male		Female		
			Absolute Values	Relative Values	Absolute Values	Relative Values	
The mean of the two leg muscles twins for:	The large diameter of muscle fibers (DM)	µ	40.935	100.0	35.685	87.17	-12.83%
	Small diameter of muscle fibers (Dm)	µ	31.710	100.0	27.550	86.88	-13.12%
	Mean diameter of muscle fibers ($D\bar{x}$)	µ	36.320	100.0	31.615	87.05	-12.95%
	Index profile of muscle fibers (Ip)	x/1	1.328	100.0	1.335	100.53	+0.53%
	Index format of muscle fibers (If)	%	-	77.745	-	77.715	-0.03%
	The surface of the cross section of myocytes	μ^2	1044.28	100.0	792.35	75.88	-24.12%
	The density of muscle fibers (Dfm)	fm/ mm^2	487.22	100.0	698.865	143.44	+43.44%

Differences in thickness, profile, cross-sectional area and density of the muscle fibers, were found between the two muscles studied and between the two sexes. These differences were tested statistically. Calculations made in this direction have shown that these differences between lateral gastrocnemius muscle and gastrocnemius muscle are lower than the Tukey values (w = 0.01) and are therefore statistically insignificant (F <Fα (1;158 GL)(p≤0,05). This is demonstrated by data in *Table 6*, for females and data in *Table 5*, for the males. Regarding the differences between the two sexes, male and female, the situation is different from that found between the muscles studied. Thus, the differences concerning large diameter of low and mean muscle fibers were found to be highly statistically significant and Tukey values (w = 0.01) were smaller than them. Calculated F values 1;158 GL are greater than those tabulated (Fα 1, 158 GL) *(Table 7).* The same is true for the cross-section area of muscle fibers, and their density, the differences found between the two sexes are highly statistically significant (F > Fα 1;158 GL) (F > Fα 1;28 GL) *(Table 7).* Regarding the index profile and index format for myocytes from these muscles, the differences between the sexes were found to be statistically semnificative (F <Fα 1;158 GL) *(Table 7).*

Table 5 - The statistical significance of differences between the two twins leg muscle, of the thickness and density of male chickens myocytes, belonging to hybrid COBB-500

Specification	Twins leg muscles that are compared	The differences between the compared results	Tukey values (W=0.01)	Statistical semnificatin of the differences	At 1;158 GL, for:			
					P	p≤0.05	p≤0.01	p≤0.001
					Fα	3.84	6.64	10.83
The large diameter of muscle fibers (DM)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 0.030	2.681	n.s.	$\hat{F}$	0.001014		
Small diameter of muscle fibers (Dm)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 0.720	2.881	n.s.	$\hat{F}$	0.4159		
Mean diameter of muscle fibers ($D\bar{x}$)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 0.340	2.512	n.s.	$\hat{F}$	0.1230		
Index profile of muscle fibers (Ip)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 0.052	0.1072	n.s.	$\hat{F}$	1.51286		
Index format of muscle fibers (If)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 1.87	5.531	n.s.	$\hat{F}$	0.7599		
The surface of the cross section of myocytes	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 11.92	141.045	n.s.	$\hat{F}$	0.04727		
The density of muscle fibers (Dfm)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 2.66	72.568	n.s.	$\hat{F}$	At 1;28 GL, for:		
						4.20	7.64	13.50
						0.01027		

Table 6 - The statistical significance of differences between the two twins leg muscles, of the thickness and density of the myocytes in young females, belonging of COBB-500 hybrid

Specification	Twins leg muscles that are compared	The differences between the compared results	Tukey values (W=0.01)	Statistical semnification of the differences	At 1;158 GL, for:			
					P	p≤0.05	p≤0.01	p≤0.001
					Fα	3.84	6.64	10.83
The large diameter of muscle fibers (DM)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 0.690	2.657	n.s.	$\hat{F}$	0.45198		
Small diameter of muscle fibers (Dm)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 1.420	2.571	n.s.	$\hat{F}$	2.010076		
Mean diameter of muscle fibers ($D\bar{x}$)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 1.050	2.359	n.s.	$\hat{F}$	1.32604		
Index profile of muscle fibers (Ip)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 0.044	0.109	n.s.	$\hat{F}$	1.07722		
Index format of muscle fibers (If)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 2.21	5.882	n.s.	$\hat{F}$	0.93932		
The surface of the cross section of myocytes	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 49.835	109.948	n.s.	$\hat{F}$	1.36104		
The density of muscle fibers (Dfm)	Lateral gastrocnemius (LG) / Medial gastrocnemius (MG)	LG - MG 1.61	170.323	n.s.	$\hat{F}$	At 1;28 GL, for:		
						4.20	7.64	13.50
						0.000681		

Table 7 - The statistical significance of differences between the sexes, of the thickness and density profile of the leg muscle cells in the two muscles, of hybrid COBB-500 offspring

	Specification	The genders that are compared	The differences between the compared results	Tukey values (W=0.01)	Statistical semnificatin of the differences	At 1;158 GL, for:			
						P	p≤0.05	p≤0.01	p≤0.001
						Fα	3.84	6.64	10.83
The mean of the two leg muscles twins for:	The large diameter of myocytes(DM)(μ)	Male(M) / Female(L)	M-F=5.270	1.8507	***	F̂		53.669	
	Small diameter of myocytes (Dm)(μ)	Male(M) / Female(L)	M-F=4.130	1.9158	***	F̂		30.6569	
	Mean diameter of myocytes ($D\bar{x}$) (μ)	Male(M) / Female(L)	M-F=4.69	1.6799	***	F̂		51.748	
	Index profile of myocytes (Ip)(x/1)	Male(M) / Female(L)	M-F=0.001	0.0738	n.s.	F̂		0.0304	
	Index format of myocytes (If)(%)	Male(M) / Female(L)	M-F=0.03	4.1624	n.s.	F̂		0.000497	
	The surface of the cross section of myocytes (μ^2)	Male(M) / Female(L)	M-F=248.22	88.657	***	F̂		51.932	
	The density of myocytes (D)(f.m./mm^2)	Male(M) / Male(M)	M-F=211.64	127.845	***	F̂	At 1;28 GL,for:		
							4.20	7.64	13.50
								20.980	

CONCLUSIONS

The mean thickness of the leg muscle cells in the twins muscle in the avian hybrid COBB-500 is 36.31 μ in males, and 31.62 μ in females, the difference between the sexes was 12.95% and highly statistically significant.

The density of muscle cells from the twins muscles of the leg in avian hybrid COBB-500, is 487.22 fm/mm^2 in males and 698.86 fm/mm^2 in females, the gender difference being of 43.44% and highly statistically significant.

There is an inverse correlation between the thickness and density of muscle fibers of the two twins leg muscles in both sexes.

Differences in the thickness and density of muscle cells, between the two gastrocnemius muscles (twins) of the leg, are very small and statistically insignificant, both in males and females.

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