

# CONTRIBUTIONS TO THE KNOWLEDGE OF THICKNESS AND STRUCTURE OF 1<sup>ST</sup> ORDER MUSCULAR FASCICLES, AT BROILER CHICKENS “Ross - 308”

Lucia Dănăilă<sup>1\*</sup>, I. Vacaru-Opriș<sup>1</sup>, Rodica Dănăilă<sup>2</sup>

<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

<sup>2</sup> S.C. Rom Trading Company S.R.L. Doina Avian Farm, Neamț County, Romania

## Abstract

To effectuate the histological studies on meat gathered from broiler chickens “Ross - 308”, reared at S.C. “Avi-Top” S.A. Iași, were choose 4 (four) somatic muscles, considered to be representative for the provenience anatomical regions. Because we want to make a detailed characterization of the quality of the analysed muscles under histological aspect were determinate also the main dimensional elements of 1<sup>st</sup> order muscular fascicles (great diameter -  $\mu$ ; small diameter-  $\mu$ ; average diameter -  $\mu$ ; rate DM/Dm and square area per transversal section -  $\mu^2$ ), together with the number of muscular fibres and myocytes density-nr.f.m./mm<sup>2</sup>. Generally, from the obtained data resulted, as it was normal, a directly proportional rate between the values of dimensional elements of myocytes from the studied muscles and the ones calculated for 1<sup>st</sup> order muscular fascicles. Exception from the rule, was at medial gastrocnemius muscle at which the square area on transversal section of 1<sup>st</sup> order muscular fascicles was of only 58,440.94±8,025.92  $\mu^2$ , at both sexes, face to 184,831.65±24,457.19  $\mu^2$ , at both sexes, in profound pectoral muscle and of 66,387.97±15,437.73  $\mu^2$ , at both sexes, in superficial pectoral muscles.

**Key words:** birds’ meat, muscles, histology

## INTRODUCTION

Research regarding the knowledge of thickness and structure of 1<sup>st</sup> order fascicles for bird meat gathered from commercial hybrid “Ross-308”, on muscles categories are very few, so each new element in this way is welcomed, to be able to make a complete characterisation of the nutritive value of birds’ meat.

In the current paper were studied 4 important muscles of birds, respectively: profound pectoral muscle, superficial pectoral muscle, biceps gill muscle, medial gastrocnemius muscle; these birds were slaughtered at the age of 35 days, following that in future research to be established the quality values of the meat for other slaughtering ages of hen commercial hybrid (38 days and 42 days).

## MATERIAL AND METHODS

The samples for cito and histometric studies were processed using *paraffin section method*. So, the gathered pieces were shaped, individualized and introduced in fresh solution of formalin (10%), for fixation, for 2 months. After this period of time, were passed through dehydration baths with ethylic alcohol of increasing concentrations, from 85% to 100%. Dehydration duration was of 10 hours. After that, the samples were clarified with amyl acid and afterwards impregnated in melt paraffin.

Paraffining of samples was realised in thermo-adjustable oven, at the temperature of +56°C for 6 hours. After paraffining, impregnated pieces were casted in paraffin blocks with dimensions of 3 × 1.15 × 1.5 cm, using Leuckart bars, tweezers and a thick plate of thermo-resistant glass. After that the paraffin blocks were shaped and the pieces were sectioned at microtome. Previously the microtome knife was well sharpened, and the device was adjusted to realise sections with a

\*Corresponding author: lucyka85@yahoo.com

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thick of 8-10 $\mu$ . In parallel were prepared (washed, skimmed and greased with Mayer albumin) around 50 glass slides, with dimensions of 75  $\times$  20  $\times$  1 mm, as a support for the samples resulted from pieces' cutting. On the slide, which were prepared as we mention above, were placed 3-5 sections from the most better ones, and on them were pipetted some drops of warm water (40°C), so the section to have a better adherence on glass support. Further, the slides with sections were dried and then we started to colour the sections. Colouring was preceded by some operations of clarification and hydration. Was realised a dichromate staining with haematoxylin and eosin.

Finally, were realised mounting, drying and labelling of the prepared slides, using Canada balm.

For studying the histological samples and data processing was used a digital photonic microscope Motic DMWB 1-223, calibrated at 3 pairs of ocular-objective. Calibration was realised for: OB 6  $\times$  OC 10; OB 10  $\times$  OC 10; OB 40  $\times$  OC 10; OB 20  $\times$  OC 10 and OB 90  $\times$  OC 10. After this procedure, we started to study the histological slides and to highlight the most successful sections, then micro-photography and the measurements were realised through a computer, using *line measurement* and *area computation* function form its software.

The obtained date served for concretion of *average thickness of the muscular fibres* using the following formula:

$$D\bar{x} = \frac{DM + Dm}{2}$$

in which:

$D\bar{x}$  = average diameter ( $\mu$ );

DM = great diameter ( $\mu$ );

Dm = small diameter ( $\mu$ ).

To determinate *the density of muscular fibres* (nr. fibres/mm<sup>2</sup> muscles) we counted them very precisely, at the level of each muscular fibre I (Nr. f.m.) and also we calculate

the transversal square area of muscular fibre I (S. FM I). The obtained date was introduced in the following formula:

$$Dens = \frac{Nr. f.m. \times 1.000.000}{S. FM I}$$

## RESULTS AND DISCUSSIONS

In tables 1 and 2 are presented the dimensional elements of 1<sup>st</sup> order muscular fascicles and the density of myocytes from the analysed muscles. From the data presented in tables could be observed that the lowest values were obtained for biceps gill muscles, also on sexes (33,075.66 $\pm$ 7,856.06  $\mu^2$ , at males and 28,695.17 $\pm$ 5,385.68  $\mu^2$ , at females), and also for both sexes (30,885.42 $\pm$ 6,620.87  $\mu^2$ ).

Regarding the *density of myocytes* (nr.f.m./mm<sup>2</sup>) was observed that the lowest values were obtained for superficial pectoral muscle (184.19 $\pm$ 12.53, at males; 166.38 $\pm$ 17.67, at females and 175.28 $\pm$ 15.10, for both sexes), where also the square area on transversal section of 1<sup>st</sup> order muscular fascicles was the greatest one (184,831.65 $\pm$ 24,457.19  $\mu^2$  – both sexes). In an ascendant order followed: medial gastrocnemius muscle (351.95 $\pm$ 21.16 – both sexes; 385.95 $\pm$ 19.66, at males and 317.95 $\pm$ 22.63, at females); profound pectoral muscle (392.58 $\pm$ 24.03 – both sexes; 392.77 $\pm$ 30.45, at males and 392.39 $\pm$ 17.61, at females) and biceps gill muscle (680.02 $\pm$ 50.92 – both sexes; 655.34 $\pm$ 54.42, at males and 704.69 $\pm$ 47.42, at females), with the smaller square area per transversal section of 1<sup>st</sup> order muscular fascicles (30,885.42 $\pm$ 6,620.87  $\mu^2$  – both sexes).

The studied character recorded a low variability to a medium one (CV%=8.05-15.78).

Between the calculated means were founded, differences statistically assured at the comparison between sexes.

Table 1 Dimensional elements of 1<sup>st</sup> order muscular fascicles and density of myocytes in the analysed muscles

Studied muscles	Sex	Statistic estimators	Great diameter (μ)	Small diameter (μ)	Average diameter (μ)	Rate DM/Dm	Square area per transversal section (μ <sup>2</sup> )	Number of muscular fibres	Density (nr. f.m./mm <sup>2</sup> )
Pectoral superficial	♂	$\bar{X} \pm s_{\bar{x}}$	628.28 <sup>d</sup> ±44.55	281.32 <sup>b</sup> ±58.34	455.10 <sup>d</sup> ±51.44	2.23 <sup>c</sup> ±0.34	212459.85 <sup>d</sup> ±31079.23	60.20 <sup>d</sup> ±8.99	184.19±12.53
		CV%	10.05	30.14	7.23	23.34	20.29	21.12	9.73
		Min.	501.33	191.62	346.47	1.02	147206.45	37.12	153.95
		Max.	726.64	511.22	618.93	2.98	319670.32	85.76	224.46
	♀	$\bar{X} \pm s_{\bar{x}}$	509.56 <sup>a</sup> ±94.07	260.45 <sup>a</sup> ±18.76	385.02 <sup>a</sup> ±56.41	1.96 <sup>a</sup> ±0.40	157203.46 <sup>a</sup> ±17835.16	47.36 <sup>a</sup> ±8.12	166.38±17.67
		CV%	25.59	10.47	14.59	36.72	16.24	24.56	13.35
		Min.	318.86	210.47	264.66	1.04	109946.59	26.24	145.13
		Max.	772.52	302.32	537.42	3.07	202798.50	71.68	229.03
	♂+♀	$\bar{X} \pm s_{\bar{x}}$	569.24±69.31	270.88±33.55	420.06±53.92	2.09±0.37	184831.65±24457.19	53.78±8.55	175.28±15.10
		CV%	17.82	20.31	11.02	30.02	18.27	22.87	11.54
		Min.	318.86	191.62	264.66	1.02	109946.59	26.24	145.13
		Max.	772.52	511.22	618.93	3.07	202798.50	85.76	229.03
Pectoral profound	♂	$\bar{X} \pm s_{\bar{x}}$	344.36±47.14	183.34±29.24	266.85±38.19	1.88±0.35	64838.61±11573.96	30.24±4.61	392.77±30.45
		CV%	24.48	27.63	19.82	29.49	31.92	27.39	13.87
		Min.	222.32	89.68	156.00	0.98	19573.75	12.05	313.73
		Max.	474.56	260.96	367.76	2.35	81597.31	36.20	490.46
	♀	$\bar{X} \pm s_{\bar{x}}$	353.97±70.07	183.28±23.75	268.62±46.91	1.93±0.25	67937.34±19301.51	33.44±9.36	392.39±17.61
		CV%	35.40	23.18	29.09	27.74	50.80	50.07	8.05
		Min.	193.28	129.76	161.52	1.09	28566.29	12.84	324.29
		Max.	558.56	270.80	414.68	2.87	124314.86	56.07	429.09
	♂+♀	$\bar{X} \pm s_{\bar{x}}$	349.17±58.60	183.33±26.50	267.73±42.55	1.90±0.30	66387.97±15437.73	31.84±6.98	392.58±24.03
		CV%	29.96	25.41	24.45	28.61	41.36	38.73	10.96
		Min.	193.98	89.68	156.00	0.98	19573.75	12.05	313.87
		Max.	558.56	270.80	414.68	2.87	124314.86	56.07	490.46

Table 2 Dimensional elements of 1<sup>st</sup> order muscular fascicles and density of myocytes in the analysed muscles

Studied muscles	Sex	Statistic estimators	Great diameter (μ)	Small diameter (μ)	Average diameter (μ)	Rate DM/Dm	Square area per transversal section (μ <sup>2</sup> )	Number of muscular fibres	Density (nr. f.m./mm <sup>2</sup> )
Biceps gill	♂	$\bar{X} \pm s_{\bar{x}}$	260.10 <sup>d</sup> ±49.81	135.15±11.82	197.62 <sup>b</sup> ±30.81	1.92±0.31	33075.66 <sup>b</sup> ±7856.06	25.99±4.87	655.34 <sup>c</sup> ±54.42
		CV%	36.40	16.62	27.12	31.67	45.14	37.06	15.78
		Min.	178.50	102.08	140.25	1.12	16823.22	10.20	515.35
		Max.	280.53	165.77	197.62	2.38	29741.04	26.35	792.55
	♀	$\bar{X} \pm s_{\bar{x}}$	236.10 <sup>a</sup> ±39.45	130.73±10.07	183.41 <sup>a</sup> ±24.76	1.80±0.27	28695.17 <sup>a</sup> ±5385.68	24.31±5.13	704.69 <sup>a</sup> ±47.42
		CV%	31.76	14.64	21.69	30.09	35.67	40.12	12.79
		Min.	161.25	106.65	133.45	1.09	15741.54	11.09	594.30
		Max.	253.21	165.75	186.62	2.03	28353.15	28.97	815.43
	♂+♀	$\bar{X} \pm s_{\bar{x}}$	248.10±44.63	132.94±10.94	190.51±27.79	1.86±0.29	30885.42±6620.87	25.15±4.92	680.02±50.92
		CV%	34.08	15.67	24.41	31.02	40.41	38.59	14.30
		Min.	161.25	102.08	133.45	1.09	15741.54	10.20	515.35
		Max.	280.53	165.77	197.62	2.38	29741.04	28.97	815.43
Medial gastrocnemius	♂	$\bar{X} \pm s_{\bar{x}}$	384.38 <sup>c</sup> ±41.75	173.79±24.30	279.08 <sup>b</sup> ±33.02	2.21 <sup>d</sup> ±0.42	60100.44 <sup>d</sup> ±9091.79	28.2 <sup>b</sup> ±4.28	385.95 <sup>d</sup> ±19.66
		CV%	20.64	26.57	12.97	35.17	28.75	29.94	9.68
		Min.	249.30	125.63	247.14	0.98	45158.10	22.00	335.71
		Max.	477.95	244.97	347.26	3.03	95684.09	44.20	431.98
	♀	$\bar{X} \pm s_{\bar{x}}$	342.06 <sup>a</sup> ±39.55	181.32±14.97	261.69 <sup>a</sup> ±27.26	1.89 <sup>a</sup> ±0.24	56781.44 <sup>a</sup> ±6960.05	21.74 <sup>a</sup> ±1.64	317.95 <sup>a</sup> ±22.63
		CV%	21.98	15.74	14.08	26.09	23.30	15.10	13.52
		Min.	269.79	146.03	235.87	1.12	43949.85	16.65	253.28
		Max.	495.40	235.87	338.21	2.63	82723.65	25.70	386.78
	♂+♀	$\bar{X} \pm s_{\bar{x}}$	363.22±40.65	177.55±19.63	270.38±30.14	2.05±0.33	58440.94±8025.92	24.97±2.96	351.95±21.16
		CV%	21.31	21.20	13.53	30.63	26.03	22.52	11.67
		Min.	249.30	125.63	235.87	0.98	43949.85	16.65	253.28
		Max.	495.40	244.97	347.26	3.03	95684.09	44.20	431.98

## CONCLUSIONS

*Mean thickness of myocytes* was of: 33.53±0.68 μ, in superficial pectoral muscle; 31.95±0.80 μ, in superficial pectoral muscle; 26.76±0.39 μ, in biceps gill muscles and of 36.32±0.73 μ, in medial gastrocnemius muscle. Generally, the mean thickness of myocytes was higher at males than females; so, for superficial pectoral muscle, mean thickness of myocytes reached a level of 33.75±0.55 μ, at males and 33.31±0.81 μ at females.

*1<sup>st</sup> order muscular fascicles* presented mean thickness (for both sexes) of; 420.06±53.92 μ, in superficial pectoral muscle; 267.73±42.55 μ, in superficial pectoral muscle; 190.51±27.79 μ, in biceps gill muscles and of 270.38±30.14 μ, in medial gastrocnemius muscle. Values for males were superior to the ones calculated for females.

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