RESEARCH REGARDING THE MYOCYTES THICKNESS AND PROFILE OF THE LATERAL MUSCLE IN *POLYODON SPATHULA* SPECIES

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Abstract: *Histological samples from the lateral muscle (dorsal epaxial) were collected from ten, four year old, male sturgeon (PolyodonSpathula) specimens. These samples were processed in accordance with the paraffin sectioning method. Twenty histological slides were obtained with transversal sections from the above mentioned muscle. HEA coloration method was used and the slides were analyzed with a MC3 type optical microscope. Through microscopy, in the microscopic field, the small and big diameters of the primary muscle bundle (PMB) myocytes were determined. Calculations were made for the average diameter; perimeter and the values for the two indices that characterize the myocyte profile. The analysis was made on five secondary muscle bundles (SMB) and the obtained results were compared. The big myocyte diameter from the five SMB varied between48.397µ and52.605µ, with a mean of 51.363µ.Regarding the small myocyte diameter, it varied between 32.582µ and 37.119µ, with a mean of 35.238µ. The average thickness of the myocytes from the five SMB was between 40.489µ and 44.866µ, with a mean of 43.300µ. The average perimeter of the myocytes taken into this study was 136.048µ and the profile and shape index had average values of 70.303%, 1,512/1 respectively, which characterizes a cylindroid format with a tendency towards cylindrical. Most differences (95%) between the five SMB, for the 6 studied parameters are insignificant from a statistical point of view.*

Keywords:*Polyodon Spathula; epaxial muscle; thickness; myocyte; profile.*

INTRODUCTION

The rapid growth of human population across the globe, as well as the increase in food quality demands, led animal breeders to supply a diversified range of animal species for human consumption. Although continental and sea waters provided man since ancient times with a constant supply of food (proteins), semi-intensive and intensive breeding of fish (pisciculture) is a relatively new practice. Many species of fish are bred for their meat and roe, yet they vary according to the country's development in this field of animal husbandry. In Romania, pisciculture is an old tradition, but it did not have a significant growthas compared with poultry farms. Fish meat can compete successfully with poultry, due to its dietary, nutritional and sanogenous qualities. Regarding the trade and human consumption of fish meat and roe, as well as other fish products, there are major differences across the globe. In the last decades, from the many fish species bred for consumption, a rise in sturgeon farms has been observed, due to their high value market price of meat and roe (caviar). The sturgeon species taken into study in the present article is *Polyodon spathula* (Paddlefish), which has recently been introduced in mono and mixed cultures in Romania (Nucet Research Station - 1992)[7]. This plankton-eating freshwater fish has a rapid growth, but the qualitative characteristics of its somatic muscles are not known. The structural aspects of the lateral dorsal epaxial muscles are the object of this study.

MATERIALS AND METHODS

At least two categories of materials and a few methods were used to organize and conduct the research for the present study. Biological samples were used from the lateral dorsal epaxial muscles (L-ED), from ten four years old male paddlefish (Ps3+)[7]. The samples were processed according to the paraffin sectioning method [12][13], in the pathological anatomy laboratory of the Faculty of Veterinarian Medicine, UASVM Iasi. Twenty sample slides were obtained with transversal muscle sections from the afore mentioned muscles, which were coloured according to the HEA technique. The slides were then observed with a photonic microscope, MO-MC3 type (calibrated in advance)[9]. The calibration was done for three types of eyepieces: OC10xOB6; OC10xOB10 and OC10xOB20. The micrometric values (MV) from the calibration of the MO-MC3 were: VM=15,000μ, for OC10xOB6; VM=9,011μ, for OC10xOB10 and VM=4,441μ, for OC10xOB20 [10]. For the study of the slides the following were also used: an eyepiece micrometer, a calibration blade, a myocyte numbering grate, a digital camera and other instruments. After the best images were identified in the microscopic field, the myocyte and primary muscle bundle (PMB) diameters were measured. The best images are shown in the present article. The following were determined through measurements: the average diameter, the perimeter, the shape index, the profile index and the myocyte transversal section surface from the 18 PMB found in the structure of the five secondary muscle bundles (SMB). The following mathematical equations were used:

(1) Dx=(LD+Sd)/2, where: Dx=average diameter (μ); LD=large diameter (μ); Sd=small diameter (μ).
(2) P=[(LD+Sd)/2]xπ, where: P=Perimeter of myocytes (μ); π=calculation coefficient for the lenght and surface of the circle=3,141592656.
(3) If=LD/Sd, where: If= format index of myocytes (x/1).
(4) Ip=(Sdx100)/LD, where: Ip=Profile index of myocytes (%)
(5) C.s.s.=[(LDxSd)/4]xπ, where: C.s.s.= Cross-section surface of myocytes (μ^2).

The obtained data from the measurements and calculus were interpreted statistically in two steps. In the first step all the general statistical indices were calculated: the statistical mean, the standard deviation of the mean; standard deviation, the variant and the variant coefficient) [4]. The second step consisted of the variation analysis, estimating the Fischer (F) and Tukey (w') values [4], to test the differences between the five SMBs of the studied muscle (L-ED) for the six morphological parameters that were studied. For the statistical calculus the ANOVA Single Factor (ASF) algorithm (integrated in the Microsoft Excel software) was used[4]; [9]; [10].

RESULTS AND DISCUSSIONS

In fish, the somatic muscle structure is not that much different than the one of mammals or birds. Therefore the fundamental morphological structure of the lateral dorsal epaxial muscle is the myocyte (rhabdocyte), which through association, form larger and larger muscle structures called bundles (primary, secondary, tertiary, quaternary). In the present study, five secondary muscle bundles (SMB) were investigated from the dorsal lateral epaxial muscle (ML-ED), which contained in their structure 18 primary muscle bundles

(PMB) and 602 myocytes. Regarding the latter, a series of parameters that characterize their finesse and profile were determined. In the structure of the first secondary muscle bundle (SMB1) three PMBs were found, which had 40, 29 and 51 myocytes. (tab. 1), totaling to 120 muscle fibers (myocytes).

Table 1.

Statistical indicators for thethickness and profile of the myocytes from the firstsecundary muscular bundle (SMB1)**, ofthe *Polyodon spathula* lateral muscle.

Specification						MU	n	Statistical indicators			Variation limits	
Species	Age	Sex	Muscle	PMB studied	Parameterstudied at myocytes level			±s	s	V (%)	Min.	Max.
Polyodon spathula	The fourth summer(ps 3+)	Male	Dorsal epaxialmuscle	PMB1*	Large diameter (LD)	µ	40	48,929±2,222	14,051	28,72	27,033	90,100
					Small diameter (Sd)	µ	40	32,845±1,486	9,395	28,61	18,022	58,572
					Average diameter (D)	µ	40	40,887±1,699	10,746	26,28	23,428	74,336
					PMB* perimeter	µ	40	128,45±5,338	33,758	26,28	73,601	233,533
					Format index (If)	x/1	40	1,533±0,062	0,392	25,55	1,000/1	3,000/1
					Profile index (Ip)	%	40	68,666±2,332	14,747	21,48	33,33	100,0
				PMB2*	Large diameter (LD)	µ	29	51,86±2,865	15,431	29,76	27,033	81,099
					Small diameter (Sd)	µ	29	33,838±1,508	8,123	24,00	22,527	54,066
					Average diameter (D)	µ	29	42,849±1,916	10,320	24,08	27,033	67,582
					PMB* perimeter	µ	29	134,613±6,02	32,421	24,09	84,927	212,315
					Format index (If)	x/1	29	1,563±0,081	0,437	27,95	1,000/1	2,667/1
					Profile index (Ip)	%	29	68,505±3,222	17,352	25,33	37,50	100,00
				PMB3*	Large diameter (LD)	µ	51	46,009±1,395	9,962	21,65	27,033	72,088
					Small diameter (Sd)	µ	51	31,662±0,986	7,045	22,25	18,022	45,055
					Average diameter (D)	µ	51	38,835±1,075	7,675	19,76	22,527	56,318
					PMB* perimeter	µ	51	122,005±3,38	24,112	19,77	70,771	176,928
					Format index (If)	x/1	51	1,483±0,041	0,292	19,70	1,050/1	2,174/1
					Profile index (Ip)	%	51	69,873±1,819	12,988	18,59	46,000	95,240

*PMB= primary muscular bundle;**SMB=secondary muscular bundle.

In table 1 the general statistical indicators (the mean and its deviation; standard deviation; variation coefficient) and the variation limits for the 6 parameters are shown. These parameters characterize the myocyte thickness and profile. It has been observed that the variability of the raw data, for these parameters, is accentuated (v=18.59%-29.76%) (tab.1).

Similarly in tables 2, 3, 4 and 5 the general statistical indicators for the six parameters are shown for the secondary muscle bundles 2, 3, 4 and 5. The same observation can be made for these SMBs as well: the primary data variability is also accentuated (v=21.07%-34.05%) (v=14.24%-25.42%) (v=21.93%-35.68%) (v=20.41%-26.47%).

In the second secondary muscle bundle (SMB2) five primary muscle bundles (PMB) were found, each having: 28, 22, 30, 24 and respectively 20 myocytes, totaling 124 muscle fibers (tab. 2). In SMB 3, there were three PMBs with 40, 35 and respectively 41 myocytes, totaling 116 muscle fibers (tab. 3). In SMB 4, four PMBs were found, with 30, 28, 26 and respectively 40 myocytes, totaling 124 muscle fibers (tab. 4). Lastly, in SMB 5 there were 3 PMBs, with 32, 32 and respectively 54 myocytes, totaling 118 muscle fibers (tab. 5).

After the statistical analysis for each of the PMBs, the values of the 6 studied myocyte parameters were analyzed for each SMB and the results are shown in table 6.

Hence, the big diameter of the SMB 1 myocytes has values ranging from 27.033 to 90.10µ, and the statistical mean of the 120 values is 48.397±1.183µ (v=26.77%). For the small diameter of these myocytes, the variation limits were 18.022µ and 58.572µ, with a mean of 32.582±0.742µ (v=24.95%) (tab.6).

The average diameter of the SMB 1 myocytes ranges between 22.527µ and 74.336µ, with a statistical mean for the 120 values of 40.489±0.867µ (v=23.46%) (tab.6). The myocytes from this SMB have a mean perimeter of 127.2±2.724µ (v=23.46%), and aspect-wise they have a cylindroid shape with a cylindic tendency. This characteristic is backed up by the two mean values of the specific indices: the shape index(If=1.519±0.033/1) and the profile index (Ip=69.14±1.334%)(tab.6).

For the SMB 2, the myocyte's big diameter statistical mean has a value of 52.605±1.243µ(v=26.31%); a statistical mean of the small diameter of 37.119±0.956µ and a statistical mean of the average diameter of 44.866±0.97µ (v=24.08-28.69%) (tab.6). The perimeter of these myocytes measures on average 140.95±3.048µ, and the shape is also a cylindroid. (If=1.489±0.038/1) (Ip=72.3±1.532%) (tab.6).

Regarding SMB 3, the big diameter for the 116 myocytes varied between 31.538µ and 85.605µ, with a statistical mean of 51.767±1.071µ(v=22.28%)(tab.6).

The small diameter values ranged from 18,022µ to 56,066µ, with a mean for the 116 values of 35.158±0.738µ (v=22.61%) (tab.6). The average thickness of these myocytes was of 43.458±0.813µ (v=20.15%), and the perimeter average had a value of 136.602±2.56µ (v=20.18%) (tab.6). Also, the myocytes of this SMB had a cylindroid shape (If=1.511±0.032/1) (Ip=69.114±1.272%) (v=19.82-22.48%) (tab.6).

The big diameter of the fourth SMB (124 myocytes) varied between 27.033 µ and 85.604µ, with a statistical mean of 51.704±1.19µ(v=25.62%) (tab.6). The small diameter of these myocytes had a mean of 35.106±0.884µ (v=28.03%), while the average diameter mean value was 43.405±0.901µ (v=23.1%) (tab.6).

The muscle fiber perimeter from SMB 4 varied between 77,849µ şi 212,315µ, with a mean value of 136.369±2.831µ (v=24.78%) (tab.6). Regarding, the shape of these myocytes it is cylindroid (If=1.544±0.042/1) (Ip=69.775±1.588%) (tab.6).

The big diameter of the 118 myocytes that form SMB 5 ranged from 27.033µ to 81.099µ, with a mean of 52.34±1.149µ (v=23.85%) (tab.6).The small diameter varied between 18.022µ and 54.066µ, with a mean value of 36.227±0.816µ (v=24.46%). The limits of the average diameter were 27.033µ and 67.582µ, with a mean of 44.283±0.849µ (v=20.82%) (tab.6).The perimeter values ranged from 84.927µ to 212.315µ, and the mean value was 139.12±2.667µ(v=20.82%)(tab.6). Regarding the myocyte shape of SMB 5, the mean values of the specific indices show that these muscle fibers are also cylindroid shaped. The shape index has a mean value of 1.493±0.036/1, and the profile index mean value was 72.187±1.541% (tab.6).

Next, the mean values of the six studied parameters were analyzed for all of the SMBs (tab.7). The big diameter varied between 48,397µ and 52,605µ, with a mean of 51.363µ (tab.7).

Table 2.

Statistical indicators for the thickness and profile of the myocytes from the secondary muscular fascicle(SMB2), of the *Polyodon spathula* lateral muscle**

Specification						MU	n	Statistical indicators			Variation limits	
Species	Age	Sex	Muscle	PMB studied	Parameterstudied at myocytes level			±s	s	V(%)	Min.	Max.
Polyodon spathula	The fourth summer (ps 3+)	Male	Dorsal epaxial muscle	PMB1*	Large diameter (LD)	µ	28	54,581±2,965	15,691	28,75	36,044	90,110
					Small diameter (Sd)	µ	28	39,68±2,299	12,168	30,66	22,527	63,077
					Average diameter (D)	µ	28	47,146±2,28	12,065	25,59	31,538	72,533
					PMB* perimeter	µ	28	148,114±7,16	37,903	25,59	99,080	227,869
					Format index (If)	x/1	28	1,468±0,094	0,500	34,05	1,000/1	3,333/1
					Profile index (Ip)	%	28	74,884±3,623	19,172	25,60	30,00	100,00
				PMB2*	Large diameter (LD)	µ	22	53,411±2,979	13,974	26,16	36,044	90,110
					Small diameter (Sd)	µ	22	34,856±1,93	9,0512	25,97	18,022	54,066
					Average diameter (D)	µ	22	44,133±2,007	9,415	21,33	31,538	63,077
					PMB* perimeter	µ	22	138,649±6,31	29,579	21,34	99,080	198,162
					Format index (If)	x/1	22	1,612±0,123	0,578	35,87	1,053/1	3,000/1
					Profile index (Ip)	%	22	67,927±3,81	17,869	26,31	33,33	95,00
				PMB3*	Large diameter (LD)	µ	30	50,552±2,171	11,894	23,53	31,538	72,088
					Small diameter (Sd)	µ	30	35,063±1,77	9,694	27,65	22,527	63,077
					Average diameter (D)	µ	30	42,802±1,764	9,661	22,57	31,538	67,582
					PMB* perimeter	µ	30	134,466±5,54	30,351	22,57	99,080	212,315
					Format index (If)	x/1	30	1,508±0,066	0,361	23,92	1,000/1	2,400/1
					Profile index (Ip)	%	30	70,74±2,925	16,024	22,65	41,67	100,00
				PMB4*	Large diameter (LD)	µ	24	53,052±2,885	14,134	26,64	36,044	90,110
					Small diameter (Sd)	µ	24	37,508±2,22	10,878	29,00	23,429	54,066
					Average diameter (D)	µ	24	45,28±2,322	11,374	25,12	31,538	65,330
					PMB* perimeter	µ	24	142,252±7,29	35,732	25,12	99,080	205,240
					Format index (If)	x/1	24	1,479±0,06	0,316	21,40	1,000/1	2,222/1
					Profile index (Ip)	%	24	71,799±3,237	15,859	22,09	45,00	100,00
				PMB5*	Large diameter (LD)	µ	20	51,498±3,177	14,209	27,59	27,033	90,110
					Small diameter (Sd)	µ	20	38,657±2,466	11,028	28,53	22,527	54,066
					Average diameter (D)	µ	20	45,077±2,61	11,672	25,89	27,033	72,088
					PMB* perimeter	µ	20	141,614±8,199	36,668	25,89	84,927	226,471
					Format index (If)	x/1	20	1,365±0,06	0,289	21,14	1,000/1	2,000/1
					Profile index (Ip)	%	20	76,433±3,60	16,101	21,07	50,00	100,00

The small diameter values ranged from 32.582µ to 37.119µ, and a mean of 35.238µ (tab.7). The average diameter of the myocytes varied between 40.489µ and 44,866µ, with a mean of 43.3µ (tab.7). The myocyte perimeter for the 5 SMBs varied between 127.2µ and 140.95µ, with a mean of 136,048µ (tab.7). Regarding the mean values of the indices that characterise the shape and profile of the myocytes forming the 5 SMBs, it can be observed that the values are very close: Shape index values ranged from 1.489/1 to 1.544/1, with a mean of 1.5112/1 (tab.7), and the profile index values were between 69.114% and 72.30%,and with a mean of 70.3032% (tab.7). Analyzing the data shown in table 7, it can be concluded that the SMB 1 myocytes are the thinnest, whilst the ones in SMB 2 are the thickest. The myocytes that form SMB 3, 4 and 5 have intermediary parameters in regards to their thickness. Regarding the shape and profile, the differences between the five SMBs are minor. The differences found among the five SMBs were statistically tested (tab.8) and the

differences between SMB 1 and SMB 2 are significant from a statistical point of view. All other differences are not statistically significant (tab.8).

Table 3.

Statistical indicators for the thickness and profile of the myocytes from the tkird muscular fascicle(SMB3), of the *Polyodon spathula* lateral muscle**

Specification						MU	n	Statistical indicators			Variation limits	
Species	Age	Sex	Muscle	PMB studied	Parameterstudied at myocytes level			±s	s	V (%)	Min.	Max.
Polyodon spathula	The fourth summer (ps 3+)	Male	Dorsal epaxial muscle	PMB1*	Large diameter (LD)	µ	40	56,071±2,254	14,254	25,42	31,538	85,605
					Small diameter (Sd)	µ	40	35,864±1,38	8,725	24,33	18,022	54,066
					Average diameter (D)	µ	40	45,967±1,675	10,596	23,05	27,934	65,330
					PMB* perimeter	µ	40	144,409±5,26	33,289	23,05	87,757	205,240
					Format index (If)	x/1	40	1,593±0,05	0,340	21,34	1,125/1	2,571/1
					Profile index (Ip)	%	40	65,202±1,91	12,083	18,53	38,89	88,89
				PMB2*	Large diameter (LD)	µ	35	49,432±1,19	7,038	14,24	31,538	63,077
					Small diameter (Sd)	µ	35	34,139±1,181	6,986	20,46	18,022	49,560
					Average diameter (D)	µ	35	41,785±1,032	6,107	14,62	29,285	51,813
					PMB* perimeter	µ	35	131,272±3,24	19,187	14,62	92,002	162,813
					Format index (If)	x/1	35	1,490±0,05	0,297	19,91	1,091/1	2,500/1
					Profile index (Ip)	%	35	69,452±2,131	12,610	18,16	40,00	91,67
				PMB3*	Large diameter (LD)	µ	41	49,56±1,666	10,670	21,53	31,538	72,088
					Small diameter (Sd)	µ	41	35,341±1,254	8,031	22,72	18,923	49,560
					Average diameter (D)	µ	41	42,45±1,032	8,337	19,64	27,032	60,824
					PMB* perimeter	µ	41	133,534±4,12	26,364	19,74	84,924	191,084
					Format index (If)	x/1	41	1,448±0,057	0,365	25,18	1,000/1	2,857/1
					Profile index (Ip)	%	41	72,642±2,389	15,298	21,06	35,00	100,00

*PMB= primary muscular fascicle;**SMB=secondary muscular fascicle.

Table 4.

Statistical indicators for the thickness and profile of the myocytes from the four muscular fascicle(SMB4), of the *Polyodon spathula* lateral muscle**

Specification						MU	n	Statistical indicators			Variation limits	
Species	Age	Sex	Muscle	PMB studied	Parameterstudied at myocytes level			±s	s	V(%)	Min.	Max.
Polyodon spathula	The fourth summer(ps 3+)	Male	Dorsal epaxialmuscle	PMB1*	Large diameter (LD)	µ	30	55,418±2,665	14,595	26,34	31,538	81,099
					Small diameter (Sd)	µ	30	33,671±1,618	8,862	26,32	18,022	54,066
					Average diameter (D)	µ	30	44,544±1,878	10,284	23,087	27,033	67,582
					PMB* perimeter	µ	30	139,939±5,90	32,308	23,09	84,927	212,315
					Format index (If)	x/1	30	1,710±0,09	0,491	28,69	1,000/1	3,044/1
					Profile index (Ip)	%	30	62,791±2,97	16,268	25,91	32,86	100,00
				PMB2*	Large diameter (LD)	µ	28	49,303±2,423	12,823	26,01	31,538	72,088
					Small diameter (Sd)	µ	28	35,529±1,724	9,122	25,67	18,022	63,077
					Average diameter (D)	µ	28	42,416±1,766	9,346	22,03	28,384	67,582
					PMB* perimeter	µ	28	133,252±5,55	29,361	22,03	89,171	212,315
					Format index (If)	x/1	28	1,450±0,10	0,517	35,68	1,000/1	3,500/1
					Profile index (Ip)	%	28	74,623±3,399	17,985	24,10	28,57	100,00
				PMB3*	Large diameter (LD)	µ	26	48,867±2,101	10,715	21,93	31,538	72,088
					Small diameter (Sd)	µ	26	32,509±2,001	10,201	31,38	18,022	58,571
					Average diameter (D)	µ	26	40,688±1,82	9,282	22,81	24,78	65,329
					PMB* perimeter	µ	26	127,863±5,74	29,268	22,89	77,849	206,237

					Format index (If)	x/1	26	1,603±0,096	0,489	30,52	1,000/1	3,000/1
					Profile index (Ip)	%	26	67,051±3,285	16,748	24,98	33,33	100,00
				PMB4*	Large diameter (LD)	µ	40	52,444±2,161	13,669	26,06	27,033	85,604
					Small diameter (Sd)	µ	40	37,576±1,661	10,503	27,95	22,527	63,077
					Average diameter (D)	µ	40	45,01±1,685	10,656	23,68	27,033	67,582
					PMB* perimeter	µ	40	141,402±5,29	33,478	23,68	84,927	212,315
					Format index (If)	x/1	40	1,448±0,06	0,374	25,85	1,000/1	2,333/1
					Profile index (Ip)	%	40	73,391±2,795	17,679	24,09	42,86	100,00

*PMB= primary muscular fascicle;**SMB=secondary muscular fascicle.

Table 5.

Statistical indicators for the thickness and profile of the myocytes from the fifth muscular fascicle(SMB5), of the *Polyodon spathula* lateral muscle**

Specification						MU	n	Statistical indicators			Variation limits	
Species	Age	Sex	Muscle	PMB studied	Parameterstudied at myocytes level			±s	s	V(%)	Min.	Max.
Polyodon spathula	The fourth summer (ps 3+)	Male	Dorsal epaxial muscle	PMB1*	Large diameter (LD)	µ	32	54,573±2,374	13,428	24,61	31,538	81,099
					Small diameter (Sd)	µ	32	34,157±1,299	7,350	21,52	20,725	54,066
					Average diameter (D)	µ	32	44,365±1,601	9,055	20,41	28,384	63,077
					PMB* perimeter	µ	32	139,376±5,029	28,448	20,41	89,171	198,162
					Format index (If)	x/1	32	1,629±0,069	0,392	24,05	1,000/1	2,667/1
					Profile index (Ip)	%	32	64,908±2,741	15,508	23,89	37,50	100,00
				PMB2*	Large diameter (LD)	µ	32	53,869±2,201	12,45	23,11	31,538	81,099
					Small diameter (Sd)	µ	32	36,044±1,687	9,542	26,47	18,022	54,066
					Average diameter (D)	µ	32	44,956±1,713	9,692	21,56	27,033	67,582
					PMB* perimeter	µ	32	141,234±5,382	30,447	21,56	84,927	212,315
					Format index (If)	x/1	32	1,556±0,072	0,405	26,04	1,000/1	2,400/1
					Profile index (Ip)	%	32	68,312±2,902	16,415	24,03	41,67	100,00
				PMB3*	Large diameter (LD)	µ	54	50,111±1,60	11,761	23,47	27,033	81,099
					Small diameter (Sd)	µ	54	37,562±1,248	9,169	24,41	22,527	54,066
					Average diameter (D)	µ	54	43,837±1,249	9,178	20,94	27,033	63,077
					PMB* perimeter	µ	54	137,716±3,924	28,833	20,94	84,927	198,162
					Format index (If)	x/1	54	1,374±0,05	0,343	24,95	1,00/1	2,250/1
					Profile index (Ip)	%	54	76,612±2,202	16,178	21,12	44,44	100,00

*PMB= primary muscular fascicle;**SMB=secondary muscular fascicle.

Table 6.

Statistical indicators for the thickness and profile of the myocytes, from the muscular secondary fascicle(SMB)*, of the *Polyodon spathula* lateral muscle

Specification						MU	n	Statistical indicators			Variation limits	
Species	Age	Sex	Muscle	SMB studied	Parameterstudied at myocytes level			±s	s	V (%)	Min.	Max.
Polyodon spathula	The fourth summer (ps 3+)	Male	muscular fascicles)(SMB)	SMB1*	Large diameter (LD)	µ	120	48,397±1,183	12,957	26,77	27,033	90,100
					Small diameter (Sd)	µ	120	32,582±0,742	8,129	24,95	18,022	58,572
					Average diameter (D)	µ	120	40,489±0,867	9,499	23,46	22,527	74,336
					PMB* perimeter	µ	120	127,2±2,724	29,842	23,46	70,771	233,533
					Format index (If)	x/1	120	1,519±0,033	0,364	23,93	1,000/1	3,0/1
					Profile index (Ip)	%	120	69,14±1,334	14,608	21,13	33,33	100,0
				SMB2*	Large diameter (LD)	µ	124	52,605±1,243	13,840	26,31	27,033	90,110
					Small diameter (Sd)	µ	124	37,119±0,956	10,651	28,69	18,022	63,077
					Average diameter (D)	µ	124	44,866±0,97	10,802	24,08	27,033	72,533

					PMB* perimeter	µ	124	140,95±3,048	33,936	24,08	84,927	227,869
					Format index (If)	x/1	124	1,489±0,038	0,424	28,47	1,000/1	3,333/1
					Profile index (Ip)	%	124	72,30±1,532	17,064	23,60	30	100
				SMB3*	Large diameter (LD)	µ	116	51,767±1,071	11,532	22,28	31,538	85,605
					Small diameter (Sd)	µ	116	35,158±0,738	7,948	22,61	18,022	56,066
					Average diameter (D)	µ	116	43,458±0,813	8,756	20,15	27,032	65,330
					PMB* perimeter	µ	116	136,602±2,559	27,561	20,18	84,924	205,240
					Format index (If)	x/1	116	1,511±0,032	0,340	22,48	1,000/1	2,857/1
					Profile index (Ip)	%	116	69,114±1,272	13,701	19,82	35	100
				SMB4*	Large diameter (LD)	µ	124	51,704±1,19	13,246	25,62	27,033	85,604
					Small diameter (Sd)	µ	124	35,106±0,884	9,842	28,03	18,022	63,077
					Average diameter (D)	µ	124	43,405±0,901	10,028	23,10	24,780	67,582
					PMB* perimeter	µ	124	136,369±2,831	31,522	23,12	77,849	212,315
					Format index (If)	x/1	124	1,544±0,042	0,470	30,44	1,000/1	3,500/1
					Profile index (Ip)	%	124	69,775±1,588	17,68	25,34	28,57	100,00
				SMB5*	Large diameter (LD)	µ	118	52,34±1,149	12,482	23,85	27,033	81,099
					Small diameter (Sd)	µ	118	36,227±0,816	8,862	24,46	18,022	54,066
					Average diameter (D)	µ	118	44,283±0,849	9,219	20,82	27,033	67,582
					PMB* perimeter	µ	118	139,12±2,667	28,962	20,82	84,927	212,315
					Format index (If)	x/1	118	1,493±0,036	0,387	25,95	1,000/1	2,667/1
					Profile index (Ip)	%	118	71,187±1,541	16,742	23,52	37,500	100,00

*SMB=secondary muscular fascicle.

Table 7.

Average statistical values for the thickness and profile of myocytes from secondary muscular fascicles, from lateral muscle, of *Polyodon spathula* fish

Specification		Secundary muscle fascicles studied for lateral muscle (average statistical values)					Average value of the five SMB*studied
Morphological parameters studied at myocytes level	MU	SMB_1	SMB_2	SMB_3	SMB_4	SMB_5	
Large diameter (LD)	µ	48,397	52,605	51,767	51,704	52,340	**51,363**
Small diameter (Sd)	µ	32,582	37,119	35,158	35,106	36,227	**35,238**
Average diameter (D)	µ	40,489	44,866	43,458	43,405	44,283	**43,300**
Perimeter (P)of myocytes	µ	127,200	140,950	136,602	136,369	139,120	**136,048**
Format index of myocytes	x/1	1,519/1	1,489/1	1,511/1	1,544/1	1,493/1	**1,5112/1**
Profile index of myocytes	%	69,14	72,30	69,114	69,775	71,187	**70,3032**

*FMS= secondary muscular fascicle.

Table 8.

Statistical significance of the differences between the five (5) secundary muscular fascicles of the lateral muscle of *Polyodon spathula*, regarding the thickness and profile of myocytes.

Studied parameters of myocytes	Differences between average values of the 5 SMB* compared	Tukey values(w'=0,01)	Statistical significance	At 4; 597 LL (liberty levels), for:			
				P	p≤0.05	p≤0.01	p≤0.001
				Fα	**2,370**	**3,320**	**4,620**
Large diameter of myocytes(µ)	SMB_1-SMB_2= 4,208	4,2523	**n.s.**		**2,108297**		
	SMB_1-SMB_3=3,370	4,8939	**n.s.**				
	SMB_1-SMB_4=3,307	5,1400	**n.s.**				
	SMB_1-SMB_5=3,943	5,4400	**n.s.**				
	SMB_2-SMB_3=0,838	4,2894	**n.s.**				
	SMB_2-SMB_4=0,901	4,7734	**n.s.**				
	SMB_2-SMB_5=0,265	5,1622	**n.s.**				
	SMB_3-SMB_4=0,063	4,2894	**n.s.**				
	SMB_3-SMB_5=0,573	4,9143	**n.s.**				
	SMB_4-SMB_5=0,636	4,2705	**n.s.**				

Small diameter of myocytes (μ)	SMB_1-SMB_2=4,537	3,0536	**		4,174364
	SMB_1-SMB_3=2,576	3,5144	n.s.		
	SMB_1-SMB_4=2,524	3,6898	n.s.		
	SMB_1-SMB_5=3,645	3,9069	n.s.		
	SMB_2-SMB_3=1,961	3,0802	n.s.		
	SMB_2-SMB_4=2,013	3,4278	n.s.		
	SMB_2-SMB_5=0,892	3,7070	n.s.		
	SMB_3-SMB_4=0,052	3,0802	n.s.		
	SMB_3-SMB_5=1,069	3,5290	n.s.		
	SMB_4-SMB_5=1,121	3,0667	n.s.		
Average diameter of myocytes (μ)	SMB_1-SMB_2=4,377	3,2264	**		3,6381587
	SMB_1-SMB_3=2,969	3,7133	n.s.		
	SMB_1-SMB_4=2,916	3,9001	n.s.		
	SMB_1-SMB_5=3,794	4,1280	n.s.		
	SMB_2-SMB_3=1,408	3,2546	n.s.		
	SMB_2-SMB_4=1,461	3,6218	n.s.		
	SMB_2-SMB_5=0,583	3,9168	n.s.		
	SMB_3-SMB_4=0,053	3,2546	n.s.		
	SMB_3-SMB_5=0,825	3,7287	n.s.		
	SMB_4-SMB_5=0,878	3,2403	n.s.		
Perimeter of myocytes (μ)	SMB_1-SMB_2=13,750	10,1404	**		3,637561
	SMB_1-SMB_3=9,402	11,6706	n.s.		
	SMB_1-SMB_4=9,169	12,2576	n.s.		
	SMB_1-SMB_5=11,920	12,9740	n.s.		
	SMB_2-SMB_3=4,348	10,2288	n.s.		
	SMB_2-SMB_4=4,581	11,3831	n.s.		
	SMB_2-SMB_5=1,830	12,3103	n.s.		
	SMB_3-SMB_4=0,233	10,2283	n.s.		
	SMB_3-SMB_5=2,518	11,7191	n.s.		
	SMB_4-SMB_5=2,751	10,1839	n.s.		
Format index of myocytes (Fi)(x/1)	SMB_1-SMB_2=0,030	0,1318	n.s.		0,386628
	SMB_1-SMB_3=0,008	0,1516	n.s.		
	SMB_1-SMB_4=0,025	0,1593	n.s.		
	SMB_1-SMB_5=0,026	0,1686	n.s.		
	SMB_2-SMB_3=0,022	0,1329	n.s.		
	SMB_2-SMB_4=0,055	0,1479	n.s.		
	SMB_2-SMB_5=0,004	0,1600	n.s.		
	SMB_3-SMB_4=0,033	0,1329	n.s.		
	SMB_3-SMB_5=0,018	0,1523	n.s.		
	SMB_4-SMB_5=0,051	0,1323	n.s.		
Profile index of myocytes (Pi)(%)	SMB_1-SMB_2=3,160	5,2929	n.s.		0,918012
	SMB_1-SMB_3=0,026	6,0916	n.s.		
	SMB_1-SMB_4=0,635	6,4775	n.s.		
	SMB_1-SMB_5=2,047	6,7719	n.s.		
	SMB_2-SMB_3=3,186	5,3391	n.s.		
	SMB_2-SMB_4=2,525	5,9416	n.s.		
	SMB_2-SMB_5=1,113	6,4255	n.s.		
	SMB_3-SMB_4=0,661	5,3390	n.s.		
	SMB_3-SMB_5=2,073	6,1169	n.s.		
	SMB_4-SMB_5=1,412	5,3156	n.s.		

*SMB=secondary muscular bundle (fascicle).

CONCLUSIONS

1. Diametrul mare al miocitelor din cele 5 FMS, ale mușchiului lateral-epaxial dorsal, la specia Polyodon spathula, are o valoaremedie de 51,363μ.
2. Diametrulmic al miocitelor din cele 5 FMS, ale mușchiului lateral-epaxial dorsal, la specia Polyodon spathula, are o valoaremedie de 35,238μ.
3. Diametrulmediu al miocitelor din cele 5 FMS, ale mușchiului lateral-epaxial dorsal, la specia Polyodon spathula, are o valoaremedie de 43,30μ.
4. Perimetrulmiocitelor din cele 5 FMS, ale mușchiului lateral-epaxial dorsal, la specia Polyodon spathula, are o valoaremedie de 136,048μ.

5. Valoareamedie a indicelui formatului, pentru miocitele din mușchiul studiat(lateral-epaxial dorsal), este de 1,5112/1, iar valoarea medie pentruindiceleprofiluluimiocitelor din acelaşimuşchieste de 70,303%.
6. Profilulmiocitelor din mușchiul lateral-epaxial dorsal, la specia Polyodon spathula, estecilindroid.
7. Mareamajoritate a diferențelor(95%) dintre cele 5(cinci) fascicule musculare secundare, pentru cei 6(șase) parametri studiați, la nivelul miocitelor, s-au dovedit a fi nesemnificative statistic.

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