



Original Contribution

FOOD VALUES AND REFLECTANCE SPECTRA OF THE COMMON CARP (*CYPRINUS CARPIO*, L.) FLESH AFTER WINTERING

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ABSTRACT

Studies of the food values of the 2-year old male and female carp were carried out. Flesh samples of the female fish contained higher quantities of fat and lower levels of water. In addition these samples had a higher content of phosphorus. Data obtained from reflectance spectra of the flesh exhibited spectral gender differences at both ends of the visual spectrum. This study is related to the problems associated with the sales and consumption of the fresh fish after wintering. Therefore the influence of winter on the consumption of this fish and its reflectance spectra are discussed.

Key words: carp, meat composition, reflectance spectra, wintering

INTRODUCTION

Wintering of fishes is an important factor of influence on composition of flesh, especially with respect to the common carp. According to Grozev et al., (4) long winter period with low daily water temperatures (below 4°C) decreased body weight of 2-year-old carps up to 6%. Part of carp ready for human consumption is sold after wintering in spring time (from March to May). Composition of meat is changed and influenced on quality of product. Wintering period is related to energy reserves of the fish body. Spangenberg and Schreckenbach, (8) considered crude body fat contents for carp (*Cyprinus carpio*, L.) from 10 to 14%, as optimal values before the wintering period.

The goal of this study was to evaluate parameters of meat composition and meat reflectance of 2-year-old common carp, ready for human consumption after wintering.

MATERIALS AND METHODS

Fourteen individual two-year-old (8 female and 6 male) carps were selected among fish reared in an earthen pond and fed wheat grain in the region of town of Nikolaevo, Stara Zagora district. The live weight of the fish

ranged from 1230 to 2550 grams. Spinal meat samples (70 grams each) without skin from all carp specimens were taken and examined after wintering (April 2004). Some parameters of meat composition were evaluated: content of moisture in % (dehydrate at 105°C for 2 hours); crude protein (N x 6,25) was determined according to the Kjeldahl distillation method (Kjeltec System, Tecator); crude fat was analyzed by petroleum ether extraction in a Soxhlet apparatus (Soxtec System HT, Tecator), and ash was evaluated by combustion at 500°C. Macroelements (calcium (Ca), phosphorus (P)) were determined after ashing according the method of Bulgarian State Standard 11374-86 /1/.

Reflectance spectra in the visual diapason of electromagnetic waves, were measured by spectrophotometer. The reflectance spectra are useful for further processing of data – both for the composition – reflectance connections from one side, and for colorimetric calculations. Spinal meat samples were taken from 17 two-year-old carps (7 female and 10 male fishes). For this purpose, the reflectance spectrum of a 10 mm layer of the sample was measured in 40 points of the visual area of the electromagnetic spectrum – within the wavelengths range 380–770 nm by 10 nm steps. The spectra were measured using an automated system of spectrophotometric and color measurement, consisting of a spectrophotometer and a computer, developed in the Department of

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significance was determined by the Student's t-test. Statistical significance was defined as $P < 0.05$.

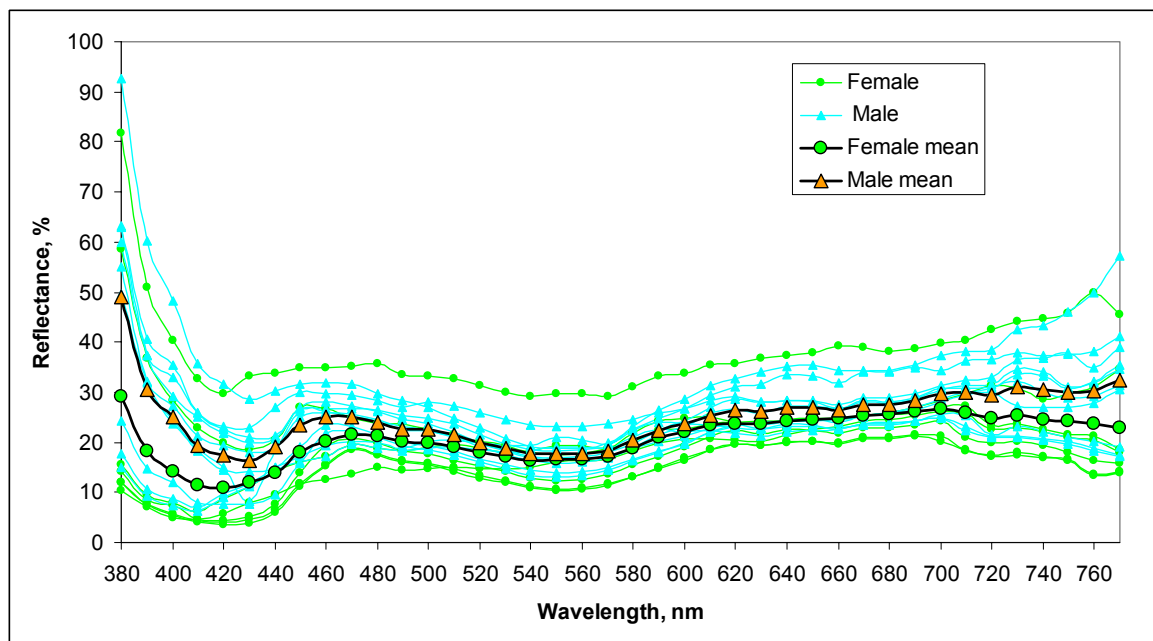


Figure 1. Reflectance spectra of fish (carp) meat of both genders, on different wavelength ($\lambda=380-770$ nm). Female – 7 samples, male – 10 samples.

RESULTS

Data in **Table 1** showed differences in meat composition of two-year-old female and male carps after wintering. Female carps, ready for human consumption had statistically higher content of intramuscular fat in meat (14.18%) compared to male samples (8.26%). Sex differences in content of moisture and crude

protein were also significant ($P < 0.05$) after wintering. Values for female carps were lower (70.82% moisture and 15.745% crude protein) compared to male fish results (75.03% and 16.8%). Ash, calcium and phosphorus content were close for both sexes and had no significant differences ($P > 0.05$).

Table 1. Meat composition of 2-year old female and male common carps after wintering

	Content of moisture, %	Content of crude protein, %	Content of crude fat, %	Total ash content in %	Calcium content in %	Phosphorus content in %
FEMALE CARPS						
X	70.82	15.745	14.18	0.99	0.106	0.19
± Sx	0.97	0.27	1.51	0.06	0.016	0.014
n	8	8	8	8	8	8
MALE CARPS						
X	75.03	16.80	8.26	0.97	0.091	0.15
± Sx	1.15	0.054	0.79	0.018	0.012	0.017
n	6	6	6	6	6	6
P	< 0.05	< 0.01	< 0.01	> 0.05	> 0.05	≥ 0.05 (marginally significant)

Data in **Table 2** presented mean and standard deviation for spectral data of the samples, different for male and female fishes. The same data is graphically shown in **Figure 1**. The spectral data did not show sexual differences in the spectral interval 480 – 700 nm, but in the interval 380–480 nm and in interval 700–

770 nm the male mean reflectance coefficient prevails. The data showed possibilities to obtain relationship between the point reflectance at 400 nm and 770 nm from one side and the crude protein and moisture from the other. These relationships can be used for developing of a rapid method for protein/moisture determination in the carp

flesh.

Table 2. Reflectance spectra of fish meat of both genders, on different wavelength (λ , nm 380-770)

Carps		Reflectance, %									
Femal e	wavelength, nm	380	390	400	410	420	430	440	450	460	470
n = 7	mean	29.20	18.29	14.27	11.38	10.85	12.06	14.02	18.08	20.15	21.60
	Stadard deviation	28.81	17.99	14.15	11.59	10.10	10.60	10.14	9.25	7.91	6.90
	wavelength, nm	480	490	500	510	520	530	540	550	560	570
	mean	21.18	20.07	19.81	19.18	18.07	17.16	16.42	16.55	16.72	17.16
	Stadard deviation	6.89	6.67	6.52	6.56	6.45	6.33	6.35	6.68	6.60	6.13
	wavelength, nm	580	590	600	610	620	630	640	650	660	670
	mean	18.94	20.93	22.00	23.30	23.69	23.59	24.38	24.60	24.72	25.45
	Stadard deviation	6.28	6.51	6.06	5.92	5.62	6.14	6.04	6.17	6.76	6.28
	wavelength, nm	680	690	700	710	720	730	740	750	760	770
	mean	25.58	26.16	26.71	25.79	24.89	25.32	24.56	24.15	23.70	22.96
	Stadard deviation	5.89	5.98	6.54	7.79	9.17	9.46	9.79	10.58	13.08	12.23
Male	wavelength, nm	380	390	400	410	420	430	440	450	460	470
n = 10	mean	48.92	30.48	24.94	19.22	17.42	16.35	19.05	23.50	25.01	25.07
	Stadard deviation	24.02	15.58	12.81	9.71	7.61	6.84	6.13	5.85	4.59	3.90
	wavelength, nm	480	490	500	510	520	530	540	550	560	570
	mean	24.08	22.74	22.50	21.53	19.99	18.70	17.69	17.62	17.73	18.23
	Stadard deviation	3.69	3.53	3.37	3.08	2.90	2.75	2.83	3.08	2.98	2.67
	wavelength, nm	580	590	600	610	620	630	640	650	660	670
	mean	20.34	22.41	23.60	25.46	26.32	26.17	27.01	26.98	26.37	27.47
	Stadard deviation	2.82	2.93	3.00	3.40	3.88	4.20	4.44	4.42	4.03	4.06
	wavelength, nm	680	690	700	710	720	730	740	750	760	770
	mean	27.58	28.35	29.62	29.87	29.56	30.93	30.48	30.01	30.11	32.33

DISCUSSION

Considering results of this study and other authors observations (2) on carps with body weight from 1172 to 3196 g in autumn, we can remark that female fish had lower content of crude protein 15.72 % to 15.75 % in male fishes and lower moisture (73.5% to 73.63%). In our experiment the same tendency was found, but showing more clear difference between both sexes. Fishes (females) with a higher growth rate had a higher content of dry matter and fat and lower protein content. Corraze et al., (3) reported similar data regarding rainbow trout. Our study showed that female fish (14.18%) had higher content

of fat, compared to males (8.26%). Sahu at al. (7) reported that fat percentage of 16-18% in fillet was too high. Fish fat is important for consumers due to n-3-fatty acids content. Kimura, (6) proved that carp oil significantly reduced tumor growth and metastasis to the liver. According to Hardman (5) oils containing (n-3) (omega-3) fatty acids slowed the growth of various types of cancers, including lung, colon, mammary, and prostate.

CONCLUSIONS

Meat composition of ready for human consumption 2-year-old carps after wintering

depended of sex of fish.

Parameters of meat as moisture, crude protein and fat had statistically significant differences. At the same time reflectance spectra of meat of both sexes in the interval of 480-700 nm were similar.

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