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Beata Grzegrzółka

CT PHENOTYPING OF CARCASS TRAITS IN MIRROR CARPS (*Cyprinus carpio*)

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INTRODUCTION

The carp is the most important culinary fish within the EU after the salmonides. In Germany, some regions produce carps protected by the EU as Protected Geographical Indication (PGI). Since 2012, also the Aischgrund carp is listed as a PGI. The specification for this carp includes – among others – a maximum body weight of 1700g and a maximum fat content of 10% within the fillet including the skin. As carps are sold alive, the production of carp fulfilling the specifications requires a method to predict the meat quality in live fish.

Mirror carps (*Cyprinus carpio*)


linear measurements

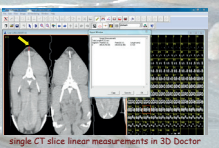

body weight measurement

Figure 1. Experimental scheme.

MATERIALS AND METHODS

During this study, 60 mirror carps (*Cyprinus carpio*), originating from 6 different ponds of the Bavarian region 'Aischgrund', were measured *in vivo* for their body weight using an electronic scale, and different linear body measurements using a measuring tape (Fig. 1). Finally, all carps were slaughtered in order to measure different carcass traits including the backfat thickness of the split carcass. After slaughtering, before dissection, the whole carps were scanned, using a computed tomography scanner (Siemens Somatom Plus 4 with 140 kV, 146 mA, 30 cm FOV, and 3 mm slice thickness). After dissection and collecting all carcass traits, one fillet of each carcass including the skin was analyzed chemically for reference fat content (Fig. 1). Linear measurements were taken of 33 carps on single CT slices 2 cm cranial to the beginning of the first ray of the dorsal fin (at the nearest position ± 1 mm; cf. Figure 2). The software IBM SPSS Statistics v. 21.0 and the R package were used for statistical analyzes.


post mortem CT scanning


single CT slice linear measurements in 3D Doctor


dissection and carcass traits measurements


fillet chemical analysis

RESULTS AND DISCUSSION

Single *in vivo* measurements showed poor prediction of fat content. Correlations between weight, several tape measurements and fillet fat content were very low and negative in all cases but backfat (Table 1).
Linear measurements taken on single CT slices of special regions of the fish in some cases revealed higher relationship with fat content ($R^2 \leq 0.81$) or fillet weight ($R^2 \leq 0.87$) (respective correlations marked white in Table 1). Previous studies on carps from the Aischgrund region revealed a high relationship ($R^2=0.85$) between the fat content of the fish and its back fat layer measured at the split carcass using a caliper (Oberle et al., 2013).
Multiple linear models including different *in vivo* measurements are in progress to propose a best solution for improving the determination of carcass properties.

Table 1. Pearson's correlations for chosen traits measured in mirror carps (N=33).

Traits[1]	f.f.c.	CT4A	CT4B	CT4C	CT4_AC	CT4_BC	CT4D_L	CT4D_R	CT4E_L	CT4E_R	CT4F_L	CT4F_R
live weight	-0.263*	0.456**	0.431*	0.885**	-0.041	-0.173	-0.100	-0.103	0.941**	0.934**	0.872**	0.881**
length1	-0.472**	0.171	0.098	0.584**	-0.206	-0.355*	-0.224	-0.222	0.644**	0.626**	0.677**	0.631**
length2	-0.395**	0.332	0.273	0.804**	-0.148	-0.308	-0.248	-0.243	0.891**	0.887**	0.841**	0.800**
length3	-0.383**	0.335	0.263	0.798**	-0.130	-0.312	-0.226	-0.218	0.850**	0.853**	0.785**	0.777**
length4	-0.407**	0.308	0.225	0.788**	-0.162	-0.353*	-0.270	-0.253	0.854**	0.865**	0.780**	0.780**
height	-0.221	0.428*	0.437*	0.910**	-0.087	-0.182	-0.043	-0.047	0.907**	0.905**	0.834**	0.903**
circumference1	-0.081	0.518**	0.544**	0.819**	0.098	0.028	0.034	0.052	0.858**	0.793**	0.862**	0.805**
circumference2	-0.167	0.438*	0.439*	0.898**	-0.071	-0.173	-0.041	-0.055	0.935**	0.915**	0.894**	0.898**
circumference3	-0.061	0.337	0.376*	0.812**	-0.142	-0.182	-0.048	-0.098	0.899**	0.839**	0.865**	0.800**
circumference4	-0.279*	0.429*	0.443**	0.822**	-0.030	-0.110	-0.044	-0.068	0.925**	0.899**	0.909**	0.877**
carcass weight	-0.211	0.459**	0.434*	0.886**	-0.039	-0.171	-0.097	-0.099	0.940**	0.934**	0.871**	0.881**
b.f. thickness1	0.547**	0.791**	0.806**	0.561**	0.612**	0.555**	0.332	0.327	0.471**	0.480**	0.494**	0.471**
b.f. thickness2	0.615**	0.871**	0.868**	0.527**	0.750**	0.671**	0.422*	0.463**	0.398*	0.400*	0.319	0.331
b.f. thickness3	0.540**	0.825**	0.768**	0.380*	0.795**	0.669**	0.545**	0.597**	0.188	0.196	0.100	0.204
fillet weight L	-0.219	0.501**	0.473**	0.899**	0.008	-0.130	-0.063	-0.059	0.933**	0.922**	0.852**	0.868**
fillet weight R	-0.242	0.483**	0.462**	0.901**	0.014	-0.144	-0.062	-0.069	0.933**	0.924**	0.854**	0.877**
fillet fat content	1	0.536**	0.706**	-0.025	0.712**	0.900**	0.620**	0.638**	-0.150	-0.104	-0.122	-0.064

* p≤0.05
** p≤0.01

[1]length1-4 and circumference1-4 indicate different tape measurements, b.f. thickness1-3 represent caliper measurement at different positions on the back fat layer: 2.5 cm, 3.3 cm from the beginning and 2 cm cranially to the back fin, respectively; CT4_AC trait means CT4A to CT4C ratio (for BC analogically); L- left, R – right side of fish.; b.f. - back fat, f.f.c. – fillet fat content.

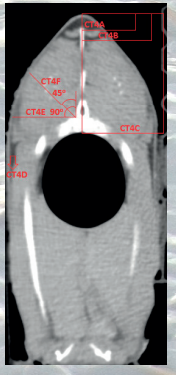


Figure 2.
Linear measurements on single CT slice.

CONCLUSION

As CT technology is possible without slaughtering, multiple linear regression models based on several *in vivo* traits and chosen CT measurements would be useful in prediction of fat content and fillet weight in live fish, as these two traits seem to be among the most important for carp consumers.

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REFERENCES

Oberle M., Hlavac D., Hopkins J. (2013). Ableitung des Fettgehaltes von Karpfenfilets aus der Fettauflage am Rücken [in German]. Bayerische Landesanstalt für Landwirtschaft - Institut für Fischerei, Jahresbericht 2012, April 2013, pp. 23-25

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