COMPARTIVE STUDY FOR CARCASS TRAITS AND CHEMICAL COMPOSITION ON SOME FRESHWATER FISH GROWN UNDER EGYPTIAN CONDITIONS

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Abstract

Dressing traits and chemical body composition comparisons for four fish specie (12 fishes for each) were determined, namely Tilapia (*Oreochromis aureus*), Bayad (*Bagrus bayad*), common carp (*Cyprinus carpio*) and African catfish (*Clarias gariepinus*) during the summer months of year 2004. Samples of studied fish species were sorted and divided into 4 size grades (3 fish for each) using stratified random sampling technique. After collecting, fish were frozen until analysis. After thawing, the parts of fish were separated according to their anatomy. These parts were divided into edible and in-edible parts, where the in edible parts are 1-head, 2-backbone, 3-viscera, 4-fins, and 5-scales, while, the edible parts are 1-meat yield (muscles and gonads) and 2-fillet. Tow samples of fillet were taken from each species for measuring the body chemical composition. The results obtained can be summarized as follows: (1) The size grade had no significant effect (P<0.05) on the condition factor for all tested species (except African catfish). Contrary, the species had a significant effect (P<0.05) on condition factor, where the Tilapia had the highest significant values (1.93-2.41), but, common carp had the least values (0.54-0.59) when compared to other tested species. (2) The fish size grade (except for Bayad) species was affected significantly (P<0.05) on dress-out %. The results demonstrated that the lower significant values (P<0.05) of dress-out % were reported for Tilapia (79.85-83.92%). Also, the higher values (P<0.05) were for African catfish (84.65-89.55%) when compared to the other species. (3) In general, the edible parts weight % (muscles and gonads weight %), fillet yield % and the in-edible parts % showed similar trend, where, they were affected significantly (P<0.05), by the species, but not by the size grade. (4) There was a general tendency towards increasing the fins weight % as the fish size increased within each species (Tilapia, Bayad and common carp), while, the African catfish fins % decreased as the fish size increased. (5) All chemical body composition parameters were affected significantly (P<0.05) by species. Small variations were observed for both moisture % (71.75-76.00%) and protein % (16.95-19.45%) as affected by species. Tilapia showed highly significant value (P<0.05) of protein % (19..45%), but a lower significant (P<0.05) value of lipids % (1.65%) was calculated on fresh weight.

INTRODUCTION

The total fish production in Egypt was estimated by 875,990 ton in 2003, where the Tilapia, Bayad, common carp and African catfish formed about 39.92%, 2.29%, 1.94% and 4.95%, respectively, (GAFRD, 2003).

The determination of weight composition of fish is useful to estimate the relative proportion of the edible parts of fish, meat yield, and to ensure that the in-edible parts of fish, not usually consumed by human, are converted into meal for animal feed (Pauey and Stinglein, 1997, Roensholdt *et al.*, 2000).

The effect of fish size at harvest on processing yield and the proportions is useful for fishermen and fish farms to determine the meat yield-round weight for harvest that provides the maximum edible portion of fish at different round weight intervals (size groups) (Eyo, 1993).

Large percentage of fish is made up of in-edible parts of fish which can be used for the manufacture of fish meal. The relation between meat percentage and fish size needs to be determined for best use of all parts of fish in a rational way. Effects of body weight categories on dressing percentages and the proportions of the main body parts need to be assessed in these important fish species (Borka, 1987).

Data on carcass traits for different size grades of Tilapia, Bayad, common carp and African catfish species are lacking in the literature. So, the objectives of this study were to investigate the differences among Tilapia , Bayad, common carp and African catfish species in a-dressing traits and b-meat yield. Also, the differences in dressing traits among different size grades within each species and among different fish species will be considered using both analysis techniques and factorial analysis.

MATERIALS AND METHODS

Dressing traits for the studied four species of fishes were determined, namely Tilapia (*Oreochromis aureus*), Bayad (*Bagrus bayad*), common carp (*Cyprinus carpio*) and African catfish (*Clarias gariepinus*). Twelve fish from each species were collected and bought from local market (Giza fish market) during the summer months (Jun, July and August) of year 2004. These fishes were divided into 4 size grades (3 fish for each size for each species) using stratified random sampling. The first size grade of fish had ranged from 401 to 500 g, the second size grade 301-400 g, the third size grade 201-300 g and the fourth size grade was between 101 and 200 g in weight. Three specimens from each size grade (within the weight range for each species) were used for determining the weight composition for dressing yield comparisons (Table 1). The parts of fish were separated according their anatomy. After collecting fish from the market, the fish were frozen until analysis. After thawing, the body weight and total body length of each fish were recorded, after which, they were divided into two main groups of parts A-edible parts, are 1-meat yield (muscles and gonads) and 2-fillet, and B-in-edible parts,1-head, 2-backbone, 3-viscera, 4-fins, and 5-scales, as previously described by Vlieg (1982). The fish were divided into nine body parts: head, backbone, viscera, fins, scales, edible parts, in-edible parts, dress-out and meat yield. The fish were scaled, fins and head removed, the belly was slit and visceral organs removed. The head less fish was then filleted by prying the flesh from the bone. The fish was then filleted by hand. Finally, the weight of each separated portion was then determined and its percentage to the whole weight of fish was calculated. All the body components were weighed to the nearest 0.1 gram. Fish were filleted at the laboratory, and the skin-on fillets (edible portion of fish) and offal (in-edible portion of fish induding: head, backbone, fins, scales and viscera), were analyzed separately, according to Weatherup and MCCracken (1999). The fish were filleted by removing the muscle from the backbone and rib bones, and meat yield was calculated relative to weight of the whole fish according to Clement and Lovell (1994).

Body traits and calculations

The following dressing traits were recorded individually on each specimen within each species:

1. Whole body weight of fish was measured to the nearest 0.1 g.
2. Total body length was measured from the snout to the tip of the caudal fin to the nearest 0.1 cm.
3. The co-efficient of condition factor was computed as

   $K = 100^* (W/L^3)$

   Where W is the total body weight (g) and L is body length (cm).
4. a - Dressing weight (dress-out weight) was estimated as the relative weight of fish after the fins, scales, head and viscera were removed,

   Dress-out weight =

   body W – (Head W+ Scales W+ Viscera W + Fins W)

   b- Dressing-out percentage (Dress %) =

   [{ Body W– (Head W+ Scales W+ Viscera W+ Fins W)}/Body W]*100.
5. The fillet yield (skin-on fillet weight), edible parts, in-edible parts, viscera, scales, head, fins, backbone and skin were separated, weighed (to the nearest 0.1 g) and their percentages to the whole body weight were calculated.

Body chemical composition

Tow samples of fillet were taken from each species for measuring the body chemical composition (moisture, total protein, total lipids and ash) according to standard methods described by AOAC (1995). The values were calculated based on wet weight of the fillet samples.

Statistical analysis

All dressing traits data were computed and submitted to analysis of variance (ANOVA) and Duncan multiple–range test (1955) in one way analysis of variance among grades within each species and among different fish species within the same size grade. SAS (1999) program software (Version 8) was used to analyze these data using a significant level 5%.

RESULTS AND DISCUSSION

The results were recorded in the following: Table 1 showed that the size grade had no significant effect at the probability of ($P<0.05$) on the condition factor (K factor) for all species (except African catfish). Contrary, the species had a significant effect at the probability of ($P<0.05$) with condition factor, where the Tilapia had the highest significant values (1.93-2.41), but common carp had the least values (0.54-0.59) when compared to other species.

The fish size grade (except for Bayad) and species affected significantly ($P<0.05$) the dress-out %. Table 2 demonstrated that the lower significant values at ($P<0.05$) of dress-out % were for Tilapia (79.85-83.92%), also, the higher values were recorded by African catfish (84.65-89.55%) when compared to the other species. Lovell and Li (1992) conducted a feeding experiment on two age groups of channel catfish (*Ictalurus puncatatus*). The dressing yield was significantly higher for third year fish (66.3%) than for second-year fish (96.80%).As presented in Table 2, the variations among size grades within each species and among different species in the same size grade were not large. Clement and Lovell (1994) raised Nile Tilapia (*Oreochromis niloticus)* and channel catfish (*I. puncatatus*) from fingerlings to harvest size and fed it on the same commercial diet and recorded that processing yield (total fish weight- head, skin and viscera) was lower for Tilapia (51.0% VS 60.6 % for channel catfish indicating that Tilapia showed lower values than channel catfish. These results are lower in value for catfish and Tilapia when compared with recorded results in the present study.

There was no significant differences ($P>0.05$) for the size grade on the fillet yield % within species, but, significant differences ($P<0.05$) were observed for the species on the fillet yield % among different size grades. Also, small variations were noted for the fillet yield values % among each size grade and each species where they fluctuated from 37.40% to 52.27%. The fourth grade of all species and all Tilapia's size grades were characterized with higher values of fillet yield when compared with the other (Table 2).

In general, the fillet yield of African catfish is less on the average when compared with other important aquaculture species. Most fish have a fillet yield in the range of 37-52%. Fillet yields for paddlefish (33.5%) were lower than for aquacultured striped bass, catfish (Ammeramn, 1985) and rainbow trout (Smith *et al.*, 1988), who obtained dressed fillets yield of 40%, 45.7% and 57.50%, respectively. In this respect, Clement and Lovell (1994) found that both the mean dressing (51%) and fillet (25.4%) yields as percentages were significantly lower for Tilapia than those of channel catfish 60.6% (dressing yield) and 30.9% (fillet yield), respectively.

Also, the edible parts weight percent (fillet and gonads weight %) showed a similar trend as for fillet yield percent. The in-edible parts had a contrary trend than that of fillet yield and edible parts percent, where African catfish had significant higher values at ($P<0.05$), and Tilapia showed lower significant values at ($P>0.05$) (Table 3). Both size grades (except African catfish) and species affected significantly ($P<0.05$) viscera weight percent. Table 3 showed that as size grade weight increased, the viscera weight percent decreased for Tilapia with higher general mean when compared with other species. The African catfish had a lower general mean of viscera weight percent as compared with others. Nelson and Amador (1981) reported that the yield of gutted hake depends on the size of the fish. The gut content of the larger sized fish is relatively bigger than for the smaller sized fish. Larger hake (mean length 65 cm) had a relatively higher gut content than the smaller hake (mean length 38-44 cm).

The African catfish and Bayad fish species have no scales compared to common carp and Tilapia. Results of Table 3 demonstrated that the scales weight percent was affected significantly ($P<0.05$) by both size grade and species, where, Tilapia has higher values of scales weight percent than common carp. By conventional processing procedures, where head, skin and viscera are removed, Tilapia gave a lower dressing yield than channel catfish (*I. puncatatus*). Processing yield depends on processing technique and fish size (Clement and Lovell, 1994).

Both size grade (except common carp) and species released a significant effect ($P<0.05$) on the head weight percent. The fourth size grade (small size) has lower values of head weight percent (23.24%) for Tilapia, but, it has higher values for Bayad (28.52%) and catfish (36.52), but, the first size grade (big size) has lower values of head weight percent (24.88%) for Bayad, but, it showed higher values for Tilapia (27.44%), catfish (29.73%) and common carp (30.36%) (Table, 4). So, Bayad fish species produce higher dressing % than other. Chappell (1979) showed that catfish (*I. furacatus*) have a higher dressing percent, while, catfish (*I. puncatatus*) grow slowly to harvestable size and produce smaller yield partially because of a large head (Benchakan, 1979). There was a general tendency towards increasing the fins weight as the fish size increased within each species (Tilapia, Bayad and common carp), while, the African catfish fins percent was decreasing as the fish size increased, which ranged from 2.47% for the first size to 3.16% for the fourth size (Table 4). The size grade affected significantly ($P<0.05$) the backbone and skin percent for Bayad, where as the size grade increased the backbone and skin percent increased, so, a positive relationship may be noted. But the size grade had no effect as ($P>0.05$) the other species (Table 4). The species affected significantly (P<0.05) the backbone and skin percent. The lowest values were observed with common carp (2.66-4.75%), but, the higher values were observed for both African catfish (8.25-17.71%) and Bayad (10.50-15.74%) (Table 4). The yield of the fish is a reflection of its structural anatomy.

Fish with the large heads and frames, compared to their musculature, produce a lower filleting yield than those with smaller heads and frames, which produce higher filleting. Since a large percentage of fish is made up of the head, gut and frame which are usually discarded as offal, it is therefore suggested that these in-edible parts may be used for the manufacture of fish meal (Eyo, 1993).

In general, the edible parts weight percent (fillet and gonads weight percent), fillet yield percent and the in-edible parts percent showed similar trend, where, they were affected significantly by the species, but not by the size grade at (P<0.05).

As presented in Table 4, Tilapia showed highly significant values of both protein percent (19.٤٥.%) and ash percent (5.10%) at (P<0.05), but, lower significant value of lipids percent (1.5%) at (P<0.05). African catfish had lower significant value of both moisture percent (71.75%) and protein percent (16.95%) at (P<0.05). Percentage of edible protein seems to vary with the species (Miller and Ballantine, 1974), with the fish size (Hickling, 1968, Gomah, 2001).

Generally, all chemical body composition parameters were affected significantly (P<0.05) by the species. Small variations were observed for both moisture % (71.75-67.00%) and protein % (16.95-19.45%) among all species (Table 4). Tilapia muscles contained approximately 25% less than channel catfish muscles which allowed for a higher protein percentage and lower caloric content of Tilapia flesh. Fat content for fish muscles varied markedly with fish size as reported by Clement and Lovell (1994).

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Table 1. Means of total body weight (g), total body length (cm) and K factor of tilapia, bayad, common carp and African catfish species according to size grades.

Item	Size grade (g)	Tilapia	Bayad	Common carp	African catfish
Body weight (g)	First (401-500)	455.20 Aa ± 25:76	463.50 Aa ± 20.76	471.20 Aa ± 15.52	457.77 Aa ± 23.70
	Second (301-400)	361.10 Ba ±15.40	356.70 Ba ± 7.88	360.20 Ba ± 18.14	357.83 Ba ± 23.68
	Third (201-300)	254.00 Ca ± 17.20	251.80 Ca ± 13.80	258.60 Ca ± 19.69	259.33 Ca ± 21.25
	Fourth (101-200)	147.30 Da ± 8.46	149.7 Da ± 10.70	157.90 Da ± 14.53	159.63 Da ± 23.96
T.body length (cm)	First (401-500)	28.80 Ab ± 1.87	40.10 Aa ± 1.37	43.90 Aa ± 1.23	40.90 Aa ± 0.87
	Second (301-400)	24.80 ABc ± 1.22	36.20 Ab ± 0.57	40.70 Aa ± 1.80	36.70 Ba ± 0.69
	Third (201-300)	22.43 BCb ± 0.87	32.60 ABa ± 2.80	35.30 Ba ± 1.32	32.80 Ca± 0.52
	Fourth (101-200)	19.70 Cb ± 0.61	26.40 Ba ± 3.72	30.20 Ca ± 1.19	30.33 Da ± 0.43
K factor	First (401-500)	1.96 Aa ± 0.27	0.72 Ab ± 0.05	0.56 Ab ± 0.03	0.67 ABb ± 0.01
	Second (301-400)	2.41 Aa ± 0.24	0.75 Ab ± 0.02	0.54 Ab ± 0.05	0.72 Ab ± 0.01
	Third (201-300)	2.26 Aa ± 0.13	0.77 Ab ± 0.16	0.59 Ab ± 0.03	0.73 Ab ± 0.03
	Fourth (101-200)	1.93 Aa ± 0.13	1.01 Ab ± 0.42	0.57 Ab ± 0.02	0.57 Bb ±0.08

* Means followed by different capital letters indicate to that there are significant difference among grades, but the small indicate to that there are significant difference among species.

Table 2. Means of dress out, fillet yield and edible parts percentages (% of body weight) of tilapia, bayad, common carp and African catfish species according to size grades.

Item%	Size grade (g)	Tilapia	Bayad	Common carp	African catfish
Dress out	First (401-500)	83.92 Ac ± 0.49	87.72 Aa ± 0.19	86.44 ABb ± 0.39	88.35 ABa ± 0.38
	Second (301-400)	83.14 Ad ± 0.10	85.99 Ac ± 0.24	87.20 Ab ± 0.27	89.55 Aa ± 0.50
	Third (201-300)	80.81 Bc ± 0.75	86.00 Aab ± 0.91	85.38 Bb ± 0.31	88.05 ABa ± 0.63
	Fourth (101-200)	79.85 Bb ± 0.21	87.43 Aa ± 1.97	87.71 Aa ± 0.90	84.65 Bab ± 2.37
Fielet yield	First (401-500)	51.23 Aa ± 1.45	45.60 Ab ± 1.18	52.27 Aa ± 0.91	44.63 Ab ± 0.69
	Second (301-400)	50.50 Aa ± 0.82	46.77 Aab ± 0.54	49.50 Aa ± 0.65	43.17 Ab ± 2.55
	Third (201-300)	51.70 Aa ± 1.00	45.23 Ab ± 0.58	49.83 Aab ± 2.08	43.77 Ab ± 1.92
	Fourth (101-200)	49.63 Aa ± 2.00	43.23 Aab ± 2.55	48.77 Aa ± 1.12	37.40 Ab ± 4.34
Edible part	First (401-500)	52.93 Aa ± 1.52	47.11 Ab ± 1.12	53.78 Aa ± 0.93	46.40 Ab ± 0.69
	Second (301-400)	52.48 Aa ± 1.11	48.10 Aab ± 0.62	51.76 Aa ± 0.50	44.93 Ab ± 2.35
	Third (201-300)	53.79 Aa ± 0.86	47.43 Ab ± 0.49	51.91 Aa ± 0.93	45.88 Ab ± 2.31
	Fourth (101-200)	52.98 Aa ± 1.96	46.63 Aab ± 1.95	51.90 Aa ± 0.94	40.32 Ab ± 3.83

* Means followed by different capital letters indicate to that there are significant difference among grades, but the small indicate to that there are significant difference among species.

Table 3. Means nonedible parts, viscera and scales weight percentages (% of body weight) of tilapia, bayad, common carp and African catfish species according to size grades.

Item%	Size grade (g)	**Tilapia**	**Bayad**	**Common carp**	**Catfish**
Non-edible parts	First (401-500)	47.07 Ab ± 1.52	52.89 Aa ± 1.12	46.22 Ab ± 0.93	53.60 Aa ± 0.69
	Second (301-400)	47.52 Ab ± 1.11	51.90 Aab ± 0.62	48.24 Ab ± 0.50	55.07 Aa ± 2.35
	Third (201-300)	46.21 Ab ± 0.86	52.57 Aa ± 0.49	48.09 Ab ± 0.93	54.12 Aa ± 2.31
	Fourth (101-200)	47.17 Ab ± 1.96	53.37 Aab ± 1.95	48.10 Ab ± 0.94	59.68 Aa ± 3.83
Viscera	First (401-500)	9.48 Ca ± 0.35	9.27 Ba ± 0.19	9.87 ABa ± 0.27	9.18 Aa ± 0.32
	Second (301-400)	10.82 Ba ± 0.23	11.21 Aa ± 0.23	8.85 Bb ± 0.12	7.89 Ac ± 0.33
	Third (201-300)	12.88 Aa ± 0.62	10.20 ABb ± 0.92	11.01 Aab ± 0.25	9.09 Ab ± 0.66
	Fourth (101-200)	13.91 Aa ± 0.17	10.46 ABab ± 0.17	8.64 Bb ± 0.80	11.75 Aab ± 2.49
Scales	First (401-500)	3.31 Ba ± 0.10	0	0.90 Cb ± 0.05	0
	Second (301-400)	3.15 Ba ± 0.05	0	1.17 Bb ± 0.2	0
	Third (201-300)	3.40 ABa ± 0.12	0	1.20 Bb ± 0.02	0
	Fourth (101-200)	3.67 Aa ± 0.04	0	1.36 Ab ± 0.07	0

* Means followed by different capital letters indicate to that there are significant difference among grades, but the small indicate to that there are significant difference among species.

Table 4. Mean of head; fines; backbone & skin weight percentages (% of body weight) and chemical composition means of tilapia , bayad , common carp and African catfish species according to size grades.

Item%	Size grade (g)	**Tilapia**	**Bayad**	**Common carp**	**African catfish**
Head	First (401-500)	27.44 Abc ± 1.30	24.88 Bc ± 0.39	30.36 Aa ± 0.58	29.73ABab ± 0.79
	Second (301-400)	0	25.23 Bb ± 1.04	32.24 Aa ± 0.44	26.72 Bb ± 1.93
	Third (201-300)	24.76 ABb ± 1.18	26.74 ABb ± 0.71	30.82 Aa ± 0.86	26.87 Bb ± 1.76
	Fourth (101-200)	23.24 Bc ± 0.77	28.52 Abc ± 0.91	31.06 Aab ± 0.82	36.52 Aa ± 3.35
Fines	First (401-500)	3.29 Aa ± 0.10	3.00 Aa ± 0.003	2.79Aab ± 0.09	2.47 Bc ± 0.09
	Second (301-400)	2.89 ABb ± 0.24	2.80 Ba ± 0.003	2.79 Aa ± 0.15	2.74 ABa ± 0.02
	Third (201-300)	2.92 ABa ± 0.02	2.70 Cb ± 0.01	2.40 Bc ± 0.07	2.86 ABa ± 0.05
	Fourth (101-200)	2.57 Bbc ± 0.10	2.80 Bab± 0.02	2.28 Bc ± 0.07	3.16 Aa ± 0.23
Back & skin	First (401-500)	6.55 Ab ± 2.34	15.74 Aa ± 1.20	2.31 Ab ± 1.23	12.21 Aa ± 0.88
	Second (301-400)	4.22 Ab ± 1.66	12.66 ABa ± 1.63	3.19 Ab ± 1.14	17.71 Aa ± 4.42
	Third (201-300)	4.61 Ab ± 1.23	11.82 ABab ± 1.16	2.66 Ab ± 1.26	15.30 Aa ± 4.68
	Fourth (101-200)	6.11 Aa ± 1.08	10.50 Ba ± 1.82	4.75 Aa ± 1.32	8.25 Aa ± 2.14
Chem. comp	Miosture %	74.65 AB ±0.55	72.85 BC ± 0.60	76.00 A ± 0.60	71.75 C ± 0.05
	Protein %	19.45 A ±0.25	19.10 AB ± 0.65	17.65 BC ± 0.35	16.95 C ± 0.35
	Lipid %	1.65 C ± 0.15	10.50 A ± 0.20	7.15 B ± 1.15	9.80 A ± 0.10
	Ash %	5.10 A ± 0.20	1.25 B ± 0.05	0.85 B ± 0.25	1.35 B ± 0.15

* Back & skin means back bone and skin, chem. comp means chemical composition
* Means followed by different capital letters indicate to that there are significant difference among grades, but the small indicate to that there are significant difference among species.

دراسة مقارنة لصفات الجسم والتركيب الكيماوي لبعض أنواع أسماك المياه العذبة النامية تحت الظروف المصرية

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المعمل المركزي لبحوث الثروة السمكية- مركز البحوث الزراعية – وزارة الزراعة – الدقي - جيزة

تم دراسة صفات التصافي والتشافي والتركيب الكيماوي للجسم لأربعة أنواع من أسماك المياه العذبة المستزرعة في مصر (١٢ سمكة من كل نوع) من أسماك البلطي الأوريا والبياض و المبروك العادي والقراميط الإفريقية أثناء شهور صيف ٢٠٠٤ . تم جمع ١٢ سمكة من كل نوع من الصيد التجاري (الموجود في السوق المحلي لمدينة الجيزة). تم تقسيم هذه الأسماك إلي أربع درجات وزنية (٣ سمكة لكل درجة تحت كل نوع) باستخدام طريقة جمع العينات العشوائية الطبقية، ثم تم حفظها تحت درجة التجميد لحين التشريح. تم تشريح وتقسيم الأسماك إلي تسعة أجزاء جسمية هي الرأس، السلسلة الظهرية والجلد، الأحشاء، الزعانف، القشور، الأجزاء المأكولة، الأجزاء الغير مأكولة، التصافي وأخيرا محصول اللحم (الفيليه) وحساب معامل الحالة، بعدها تم أخذ عينتين من الفيليه من الأنواع الأربعة لتقدير التركيب الكيماوي لها. وكانت أهم النتائج المتحصل عليها كما يلي: لم يتضح وجود أي تأثير معنوي لحجم الأسماك علي معامل الحالة لكل الأنواع ماعدا القراميط، وكانت أعلي قيمة لمعامل الحالة في أسماك البلطي الأوريا (١,٩٣-٢,٤١) في حين كانت أقل قيمة لأسماك المبروك (٠,٥٤-٠,٥٩). كان لحجم الأسماك (ماعدا البياض) تأثير معنوي علي نسبة التصافي حيث كانت أقل قيمة لها في أسماك البلطي (٧٩,٨٥-٨٣,٩٢%) وأعلى قيمة كانت للقراميط ٨٤,٦٥-٨٩,٥٥%) بالمقارنة بباقي الأنواع. تأثرت النسبة المئوية لكل من الأجزاء المأكولة (الفيليه+الغدد التناسلية) ومحصول اللحم والنسبة المئوية للأجزاء الغير مأكولة معنوياً بالنوع ولم يتضح أي تأثير لحجم الأسماك علي هذه الصفات.