



Application of the Healthy Fatty Index to discriminate the meat nutritional quality of different slow-growing chickens

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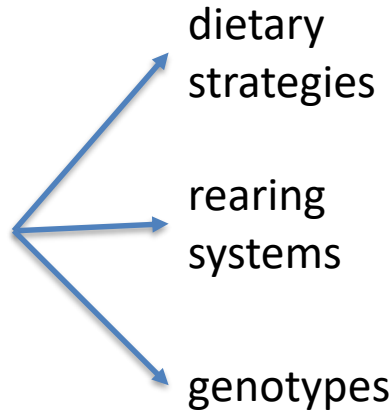
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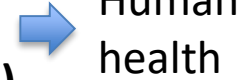
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INTRODUCTION



Lipids (fatty acids)



Human health

- ↓ lipids
- ↓ SFA
- ↑ PUFA
- ⚠️ PUFA oxidized



Potential role of important nutraceuticals in poultry performance and health - A comprehensive review

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Poultry Meat and Eggs as an Alternative Source of n-3 Long-Chain Polyunsaturated Fatty Acids for Human Nutrition

Alice Cartoni Mancinelli^{1,*}, Simona Maitoli¹, Cornelia Twining², Alessandro Dal Bosco¹, Ann M. Donoghue³, Komala Arvi³, Elba Angelucci¹, Diletta Chiattoni¹ and Cesare Castellini¹



Omega-3 and Omega-6 Fatty Acids in Poultry Nutrition: Effect on Production Performance and Health

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Indexing of Fatty Acids in Poultry Meat for Its Characterization in Healthy Human Nutrition: A Comprehensive Application of the Scientific Literature and New Proposals

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the determination of the fatty acid profile, especially if expressed as a percentage, is not sufficient to explain the nutritional properties of a food

INTRODUCTION

Many indexes, able to estimate and compare nutritional characteristics, have been designed, mainly referred to lipid composition.

Sub-categories	Indexes	Unit	Sign.	References
Qualitative	<ul style="list-style-type: none"> • PUFA/SFA • n-6/n-3 ratio • LA/ALA • EPA + DHA % • Unsaturation Index (UI) 	% % % % %	D I I D I	Many Authors Simopoulos, 2008 [1]; Undurti, 2006 [2]; Holub, 2009 [3], Crupi and Cuzzocrea, 2022 [4]; Shahidi and Zhong, 2010 [5].
Nutritional	<ul style="list-style-type: none"> • Nutrition Value Index • Index of Atherogenicity (IA) • Index of Thrombogenicity (IT) • Hypocholesterolemic/Hypercholesterolemic (HH) • Health-Promoting Index (HPI) • Fish Lipid Quality/Flesh Lipid Quality (FLQ) 	% % % % % %	D I I D D D	Chen et al., 2016 [6]; Ulbricht and Southgate, 1991 [7]; Ulbricht and Southgate, 1991 [7]; Santos-Silva et al., 2002 [8]; Chen et al., 2004 [9]; Xie et al., 2022 [10].
Metabolic	<ul style="list-style-type: none"> • Elongase • Thioesterase • Δ 9-desaturase (18.0) • Δ 9-desaturase (16.0 + 18.0) • Δ5-desaturase + Δ6-desaturase • Activity index 	% % % % % %	- - - - - -	Zhang et al., 2007 [12]; Zhang et al., 2007 [12]; Vessby et al., 2002 [13]; Vessby et al., 2002 [13]; Sirri et al., 2011 [14]; Failla et al., 2021 [19].
Lipid- or energy-related content indexes	<ul style="list-style-type: none"> • EPA + DHA quantity • Index of nutritional quality • QuantiN-3 index • Healthy fatty index 1 	mg/100 g mg/100 g mg/100 g mg/100 g	D D D D	Godbe, 1994 [20]; Sorenson et al., 1976 [21]; Present paper; Present paper.

Dal Bosco et al., 2021

The aim of the present research was to apply a novel quali/quantitative Healthy Fatty Index (HFI) to possibly discriminate the meat nutritional quality of different slow-growing chickens reared outdoor to provide a useful evaluation of the best “nutritional traits”.



$$\text{Healthy Fatty Index} = \frac{\left(\frac{mg}{100g} \text{ of MUFA} \times 2 \right) + \left(\frac{mg}{100g} \text{ of } n-6 \times 4 \right) + \left(\frac{mg}{100g} \text{ of } n-3 \times 8 \right) + \left(\frac{\frac{mg}{100g} n-3}{\frac{mg}{100g} n-6} \right)}{\left(\frac{mg}{100g} \text{ of SFA} \right) + \left(\left(\frac{mg}{100g} \text{ of MUFA} \right) \times 0.5 \right) + \left(\left(\frac{mg}{100g} \text{ of } n-6 \right) \times 0.25 \right) + \left(\left(\frac{mg}{100g} \text{ of } n-3 \right) \times 0.125 \right) + \left(\frac{\frac{mg}{100g} n-6}{\frac{mg}{100g} n-3} \right)}$$



MATERIAL & METHODS

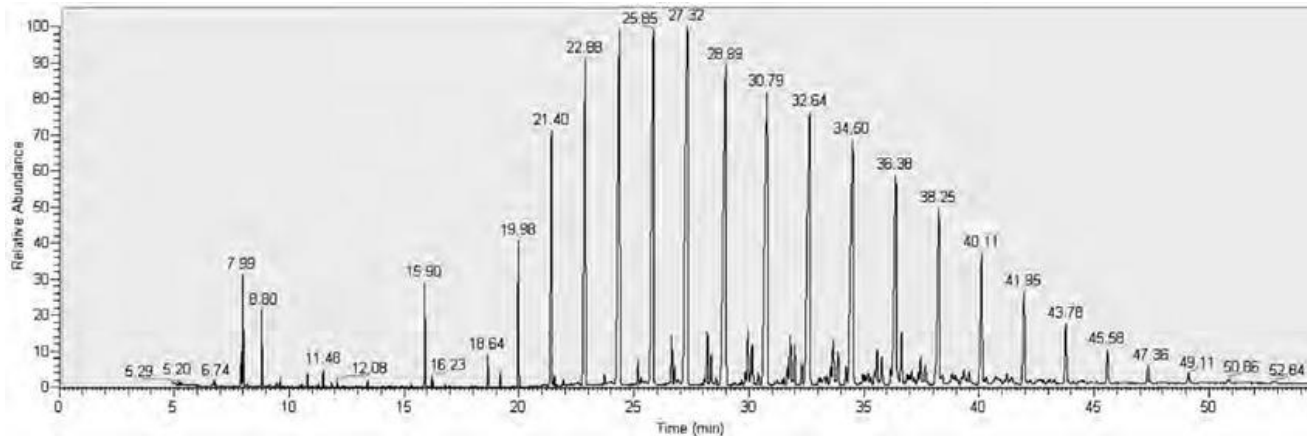


- 100 hundred chicks/strain of both sexes were used.
- Chickens were reared in pens (2 pens/strain) with an indoor (0.10 m²/bird) and outdoor (4 m²/bird) area.
- The animals fed *ad libitum* the same starter and grower diets.
- At 81 days of age, 15 chickens/pen were selected and slaughtered.

MATERIAL & METHODS



- ✓ The breast and thigh muscles were excised from the carcasses, sampled, and stored at -20°C till fatty acids evaluations by GC-FID (mg/100g).
- ✓ The total lipid content was also quantified by AOAC method.

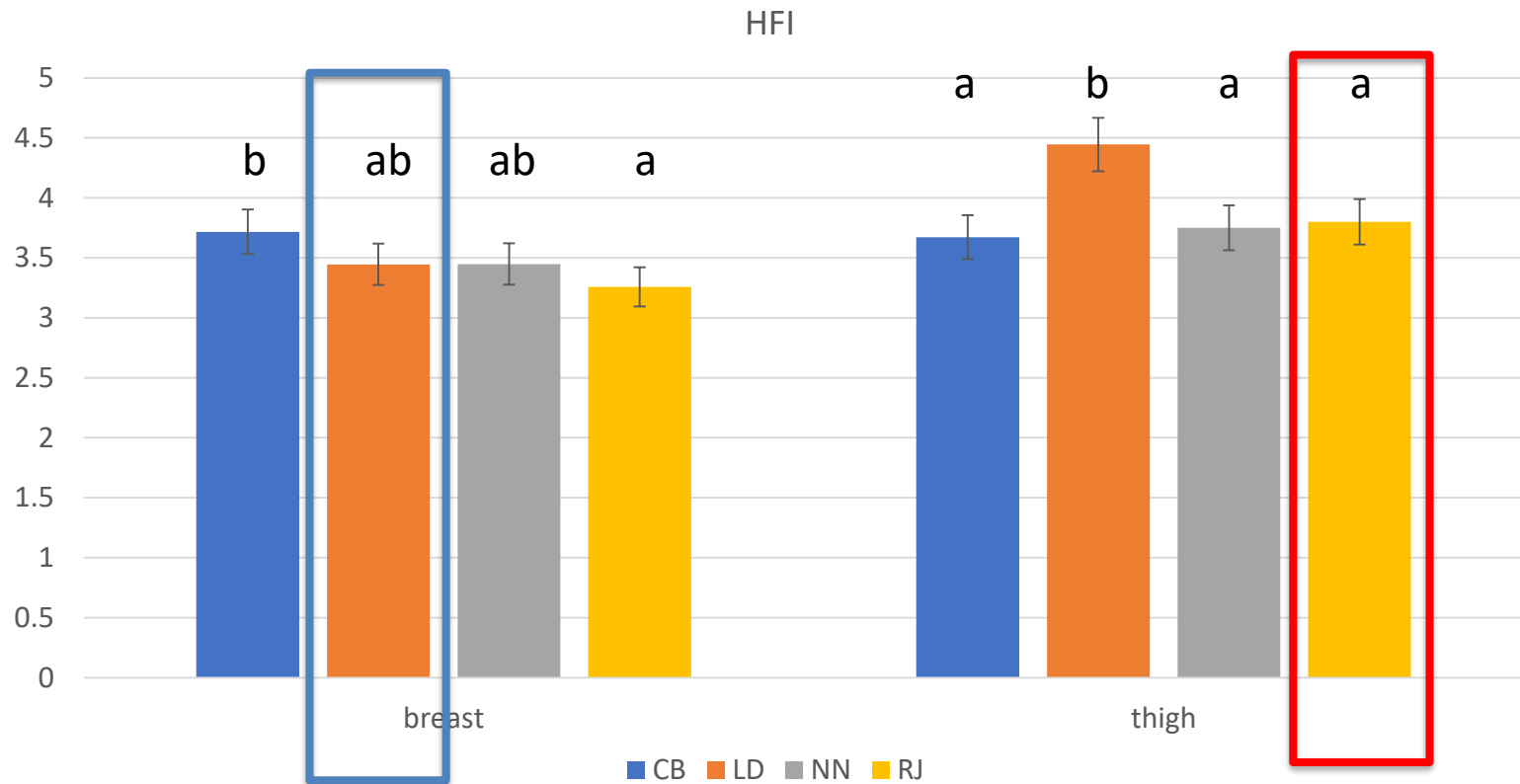


The HFI was determined.

RESULTS: Fatty acids profile (mg/100g) of breast and thigh meat

	breast, mg/100g of meat						thigh, mg/100g of meat					
	CB	LD	NN	RJ	RMSE	P value	CB	LD	NN	RJ	RMSE	P value
lipids	4.62	5.80	4.46	3.27	0.277	0.012	5.22	5.78	4.08	7.88	0.625	0.001
C14	12.57	18.35	10.79	10.20	0.681	0.000	23.92	28.82	14.13	68.90	1.344	0.000
C16	864.66	1214.97	916.01	703.81	4.215	0.000	935.26	867.74	683.67	2676.65	8.276	0.000
C16:1	51.91	57.93	31.65	40.17	1.466	0.000	149.03	130.81	76.39	460.77	3.839	0.000
C17	14.38	18.97	10.67	6.47	0.970	0.001	18.77	23.90	14.29	50.29	1.134	0.000
C17:1	3.29	6.60	2.62	2.38	0.476	0.000	8.63	14.90	7.45	25.03	0.812	0.000
C18	474.38	601.48	478.74	359.82	3.168	0.000	403.61	354.84	406.50	1138.75	5.640	0.000
C18:1 n-9	1004.68	1248.16	766.55	694.64	5.078	0.000	1400.83	1550.29	997.85	4137.36	10.324	0.000
C18:2 n-6, LA	702.79	1031.67	652.71	517.03	4.470	0.000	1045.82	1424.95	853.38	3414.00	9.156	0.001
C18:3 n-6, γ -ALA	2.81	12.75	3.20	2.06	0.923	0.000	4.14	16.78	5.26	31.81	1.552	0.000
C18:3 n-3, α -ALA	21.14	49.24	24.19	20.09	1.221	0.000	51.95	93.35	44.86	221.69	2.473	0.000
CLAcis9trans11	4.76	1.34	3.68	0.58	0.508	0.000	0.60	1.78	1.50	5.08	0.383	0.000
C20:2	12.99	18.86	13.02	9.56	0.664	0.000	12.18	18.24	12.50	35.52	0.932	0.000
C20:4 n-6, AA	351.50	381.73	401.53	244.82	3.304	0.000	137.05	194.13	184.40	402.85	3.726	0.000
C22:2	5.20	3.39	4.74	3.21	0.373	0.000	2.02	3.88	1.60	7.51	0.605	0.000
C20:5n-3, EPA	68.23	69.28	72.66	42.24	1.363	0.000	31.11	44.34	37.60	77.35	1.506	0.000
C22:4	17.07	16.07	14.38	9.06	0.691	0.000	6.31	9.42	6.40	14.36	0.695	0.000
C22:5n-3, DPA	40.49	47.74	40.98	24.97	1.114	0.000	16.09	26.25	19.02	42.10	1.209	0.000
C22:6n-3, DHA	90.58	39.94	38.68	21.94	1.505	0.000	57.74	23.20	18.17	38.29	1.373	0.000
tot	3743.41	4838.49	3486.81	2713.05	8.402	0.000	4305.07	4827.62	3384.98	12848.29	17.636	0.000
SFA	1365.98	1853.77	1416.21	1080.31	5.086	0.017	1381.57	1275.30	1118.59	3934.58	9.918	0.000
MUFA	1059.87	1312.69	800.83	737.19	5.224	0.000	1558.50	1696.00	1081.69	4623.16	10.959	0.000
PUFA	1317.56	1672.02	1269.77	895.56	5.304	0.000	1365.01	1856.32	1184.70	4290.55	10.159	0.000
n-6	1057.10	1426.15	1057.44	763.91	4.924	0.000	1187.01	1619.07	1037.78	3816.85	9.574	0.000
n-3	225.21	207.54	180.20	109.82	2.147	0.000	157.49	188.93	121.16	384.51	2.980	0.000
n6/n3	4.69	6.87	5.87	6.96	0.358	0.017	7.54	8.57	8.57	9.93	0.213	0.000
HFI	3.72	3.45	3.45	3.26	0.175	0.050	3.67	4.44	3.75	3.80	0.283	0.023

RESULTS: HFI index estimation of breast and thigh meat



a,b p<0.05

CONCLUSIONS

- The HFI is partially able to discriminate fatty acids differences between poultry genotypes but the contemporary inclusion of fat content and the lipid profile of meat had a relevant impact in discriminating the nutritional quality of poultry meat from different genetic strains.
- An overall and final evaluation must consider the many factors that regulate the nutritional properties of food. In particular, the level of fats, the FA profiles and the relationships between them is of fundamental importance for the design and adoption of the index.
- Further investigations are necessary to better define the weights of the different classes of fatty acids (or of the single fatty acid), the discriminatory capacity of this index (within different foods) and its parameterization with a standard dose of meat for consumption.
- Moreover, when Healthy Fatty Index will be validated, it is our intention to broaden our horizon to other meats and foods (both of animal and vegetable origin) in order to create a new-generation nutritional quality database.

Work in progress...



Communication

Assessment of the Healthy Quality of Foods by Comparing a Fatty Acid Comprehensive Index with Atherogenicity and Thrombogenicity Ones

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Thank you for your attention

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