STUDY ON THE NUTRITIONAL QUALITY OF SOME FRESH MINCED MEAT ROLLS PRODUCTS FROM ROMANIA

M.I. Pop[1], Gabriela Frunză[1*]

[1]University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

Abstract

The purpose of this study was a comparative analysis of the nutritional-economic characteristics of fresh minced meat rolls, marketed under its own brand in the main supermarkets in Romania (Auchan, Billa, Carrefour, Kaufland, Lidl), and respectively produced and marketed of a local butchery. There were analyzed 36 samples (purchased in June 2017), based on the ingredients and additives used, but also of the chemical composition, of the energy value and the price of products, using both, the information on the labels and also the results of the own determinations. The content of proteins, lipids, collagen and water was determined using the automatic analyzer Food Check (infrared spectrophotometer); the mineral substances were determined by calcination and the carbohydrates and energy value were determined by calculation, using conventional formulas. The data obtained were statistically processed, including by analysis of variance, with significant and very significant differences for the most parameters analyzed (differences that can be attributed to different manufacturing recipes respectively of the raw material and the chemical composition). The most important differences between the products analyzed have targeted the lipid content (up to 111.6 g/kg of product), water (up to 97.7 g/kg product) and the energetic value (up to 893 kcal/kg of product) but also for protein content (up to 24.4 g/kg of product).

Key words: minced meat rolls, chemical composition, energy value

INTRODUCTION

The assortment of meat product taken in the study - fresh minced meat rolls - it is especially important in Romania due to the high volume traditionally consumption and frequency and thus, as a share and value in sales. The study aimed a comparative analysis of the main nutritional-economic characteristics (based on the chemical composition, of the energy value and of the price) of fresh minced meat rolls, marketed under its own brand in the main supermarkets in Romania (*Auchan, Billa, Carrefour, Kaufland, Lidl)*, and respectively produced and marketed of a local butchery.

Excessive consumption of fat and salt has negative repercussions on the health of consumers, according to specialized studies. Meat is a high quality food but can become unhealthy due to the incorporation of a large amount of saturated fat during processing. The consumption of meat products is associated with an increased risk of cardiovascular disease, hypertension, obesity, colorectal cancers, etc [1, 2, 3, 4, 5]

MATERIALS AND METHODS

The material studied was represented by 36 samples of minced meat rolls, marketed under its own brand in the main supermarkets from Iasi, *(Auchan, Billa, Carrefour, Kaufland, Lidl*- sources randomly coded in the paper with letters from A to E) and respectively from a local butchery (code F) from Moldova (six samples of the product from each source, purchased in June 2017).

The content of water, proteins, lipids, and collagen was determined with the automatic analyzer Food Check (infrared spectrophotometer); the mineral substances were determined by calcination and nitrogen free extract -as carbohydrates- and energy value were determined by calculation, using conventional formulas. The conversion factors were: for proteins 4.27, for lipids 9.02 and for nitrogen free extract 3.87 (after FAO, 2003). The results obtained were statistically processed, including through analysis of

*Corresponding author: frunza.gabriela27@gmail.com
The manuscript was received: 09.10.2017
Accepted for publication: 12.02.2018

variance (Anova One Way, Multiple Comparison, GraphPad Prism 7).

RESULTS AND DISCUSSION

In the minced meat rolls composition, according to the labels on the packaging of the products under study, enters in all cases as basic ingredients (in variables proportions) beef and pork meat and/or back-fat to which water is added, salt, spices, and various food additives. Water is added to the most products (only the local manufacturer does not indicate the addition of water).

The comparative analysis of ingredients of these six products (tab. 1) highlights however a great variability both in terms of the proportions of the basic ingredients, as well as the type and proportions of additions.

Table 1 The ingredients of the assortments of minced meat rolls taken in the study (according to the product label)

Declared ingredients (%):	Minced meat rolls - sources					
	A	B	C	D	E	F
Pork meat	58.58	35.00	x	46.00	47.80	60.00
Beef meat	25.10	35.00	48.00	22.00	21.70	40.00
Total meat	83.68	70.00	48.00	73.00	68.50	100
Pork back-fat	--	30.00	29.00	?	?	x
Total meat+pork back-fat	83.68	100	77.00	73 +?	68.5 +?	100
Other ingredients	dextrose sunflower oil	x	dextrose	vegetable oil, sugars	x	x
Water	?	?	?	?	?	-
Salt	1.39	?	?	0,9	1.0	1.6
Spices	pepper, cumin black pepper nutmeg	garlic sweet paprika	spices and natural extracts	garlic and other spices	2.40% mixed spices	garlic black pepper other
Additives	sodium ascorbate E301 carmine- E120 sodium bicarbonate, paprika extract flavors	x	sodium bicarbonate	Sodium acetate sodium carbonate	sodium acetate sodium carbonate ascorbic acid-E300	Sodium bicarbonate, sodium monoglutamate-E621 ascorbic acid - E300

? = ingredient declared on the label but without specified value
x = without mention on the label

In the case of some producers on the label, the ingredients are mentioned but are not mentioned the proportion: the water and the bacon (products D and E) and the salt (products B and C).

Appear and inconsistencies in the case of some products, to which, though on the label the basic ingredients sums up already 100% are mentioned and additions (water, salt spices, additives -for product B, salt, spices and additives -for product F).

The chemical composition and the energy value of each product studied are presented in Table 2 - Table 7; comparing the values indicated by the manufacturers on the label, with those obtained in ours determinations has highlighted important differences in particular regarding the fat content and the energy value of the analyzed products.

It should be noted that two of the products (B and C) did not have nutritional information on the label, despite legal recommendations. Thus, for product A (Table 2), was highlighted a lower lipid content (18.32% vs. 24.22%) and higher of protein (17.22% vs 14.03%) and the energy value established it was much lower than that mentioned on the product label (242.3 kcal vs 278 kcal /100g).

Table 2 Chemical composition and energy value of minced meat rolls from source A

Chemical content and energy value	Label values	Personal results			
		$\overline{X} \pm S_{\overline{x}}$	V%	Min	Max
Fats %	24.22	18.32 ± 0.24	3.15	17.90	19.40
Proteins %	14.03	17.22 ± 0.14	1.92	16.80	17.70
Collagen %		2.80 ± 0.03	2.36	2.69	2.89
Carbohydrates %	1.00	0.92 ± 0.12	3.93	0.50	1.20
- which Fibers %	<0.1	n	n	n	N
Salt %	1.39	1.40 ± 0.29	5.11	0.62	1.90
Water %		61.60 ± 0.17	0.68	60.80	61.90
Ash %		2.18 ± 0.01	1.66	2.15	2.22
Dry matter %		38.40 ± 0.17	1.09	38.10	39.20
GE kcal/100g	278	242.3 ± 1.92	1.94	238.69	250.98
kJ100 g		1014 ± 8.05	1.94	998.69	1050.10

GE = gross energy
n = no analyzes

Table 3 Chemical composition and energy value of minced meat rolls from source **B**

Chemical content and energy value	Label values	Personal results			
		$\overline{X} \pm S_{\overline{x}}$	V%	Min	Max
Fats %	-	27.19±0.51	4.97	25.50	29.30
Proteins %	-	15.39±0.12	2.07	15.00	16.00
Collagen %	-	2.18±0.04	4.27	2.04	2.34
Carbohydrates %	-	0.71±0.07	27.33	0.50	1.00
- which: Fibers %	-	n	n	n	n
Salt %	-	1.19±0.21	6.05	0.87	1.60
Water %	-	54.63±0.40	1.93	53.00	56.00
Ash %	-	1.79±0.03	3.98	1.67	1.91
Dry matter%	-	45.37±0.40	2.33	44.00	47.00
GE kcal/100g	-	313.7 ±4.11	3.46	300.27	330.66
kJ/100 g	-	1312 ±17.18	3.46	1256.31	1383.47

GE = gross energy,
n = no analyzes

Table 4 Chemical composition and energy value of minced meat rolls from source **C**

Chemical content and energy value	Label values	Personal results			
		$\overline{X} \pm S_{\overline{x}}$	V%	Min	Max
Fats %	-	16.03±0.37	5.62	15.20	17.30
Proteins %	-	17.78±0.19	2.60	17.30	18.60
Collagen %	-	2.98±0.04	3.31	2.89	3.14
Carbohydrates %	-	0.98±0.10	24.42	0.60	1.20
- which Fibers %s	-	n	n	n	n
Salt %	-	0.28±0.15	99.04	0.00	0.90
Water %	-	64.40±0.30	1.14	63.40	65.10
Ash %	-	1.46±0.01	0.92	1.44	1.47
Dry matter %	-	35.60±0.30	2.06	34.90	36.60
GE kcal/100g	-	224.4 ±2.87	3.13	216.94	234.37
kJ/100 g	-	939 ±12.01	3.13	907.68	980.62

GE = gross energy
n = no analyzes

Table 5 Chemical composition and energy value of minced meat rolls from source **D**

Chemical content and energy value	Label values	Personal results			
		$\overline{X} \pm S_{\overline{x}}$	V%	Min	Max
Fats %	19.00	20.32±0.17	2.10	19.90	21.10
Proteins %	13.00	16.85±0.15	2.18	16.30	17.30
Collagen %		2.66±0.03	2.76	2.54	2.75
Carbohydrates %	1.90	0.85±0.12	35.49	0.50	1.20
- which: Fibers %	1.30	n	n	n	n
Sugars %	0.60	n	n	n	n
Salt %	0.90	1.40±0.29	51.11	0.00	1.90
Water %		59.98±0.15	0.62	59.30	60.30
Ash %		2.53±0.01	0.99	2.50	2.55
Dry matter %		40.02±0.15	0.93	39.70	40.70
GE kcal/100g	233	258.5 ± 1.35	1.28	255.30	264.57
kJ/100 g		1081 ± 5.65	1.28	1068.19	1106.95

GE = gross energy
n = no analyzes

For product D (Table 5) was determined a higher fat content (20.32% vs. 19%) and especially protein (16.85% vs. 13%) and respectively an energy value much higher than the one on the label (285.5 kcal vs 233 kcal-/100g of product) but also a much higher salt content (1.40% vs. 0.90%) and with very high variability.

And in the case of product E were determined other values, than those listed on the label were determined: with over 4.5g more lipids and respectively a higher energy value of 39.3 kcal for 100g of product but also a lower salt content (0.18% vs. 1.10%) (Table 6).

The established coefficient of variation, (V%) for salt content had very high values in the case of products B, C, D and E, indicating a obvious inhomogeneity of the mixture salting, in some samples the salt can not be detected by the used analyzer.

Table 6 Chemical composition and energy value of minced meat rolls from source E

Chemical content and energy	Label values	Personal results			
		$\overline{X} \pm S_{\overline{x}}$	V%	Min	Max
Fats %	18.00	22.53±0.41	4.49	21.20	23.80
Proteins %	16.00	16.45±0.11	1.71	16.10	16.70
Collagen %		2.52±0.03	3.07	2.42	2.59
Carbohydrates %	3.00	0.73±0.08	28.17	0.50	1.00
- which : Fibers %	0.1	n	n	n	n
Sugars %	< 0.5	n	n	n	n
Salt %	1.00	0.18±0.18	44.95	0.00	1.10
Water %		58.28±0.32	1.34	57.30	59.30
Ash %		2.14±0.01	1.50	2.11	2.17
Dry matter %		41.72±0.32	1.87	40.70	42.70
GE kcal/100g	237	276.3 ±3.33	2.95	265.55	286.52
kJ/100 g		1156 ±13.92	2.95	1111.06	1198.80

GE = gross energy
n = no analyzes

In the case of the product F, the results of the own determinations were the closest of the values found on the label, both for the chemical composition and for the energy value of the product. However, this is the only product containing sodium monoglutamate (E621), a controversial additive, considered potentially dangerous for the health of consumers.

Products B and C had very different characteristics: a fat content of 27.19% and 16.03% respectively, protein content 15.39% vs. 17.78%, water 54.63% vs. 64.4%, salt 1.19% vs. 0.28% and a calculated energy value of 313.7 kcal vs. 224.4 kcal/100g of product.

Table 7 Chemical composition and energy value of minced meat rolls from source F

Chemical content and energy	Label values	Personal results			
		$\overline{X} \pm S_{\overline{x}}$	V%	Min	Max
Fats %	16.60	16.57±0.18	4.14	15.20	17.60
Proteins %	18.55	17.83±0.08	1.63	17.50	18.40
Collagen %	-	2.97±0.02	2.29	2.87	3.11
Carbohydrates %	0.60	0.73±0.05	27.75	0.50	1.00
- which: Fibers %		n	n	n	n
Salt %	1.6	1.10±0.05	12.86	0.90	1.30
Water %		62.95±0.13	0.80	62.20	64.00
Ash %		2.50±0.02	2.28	2.44	2.59
Dry matter %		37.05±0.13	1.36	36.00	37.80
GE kcal/100g	222.57	228.4 ±1.40	2.37	217.61	236.57
kJ/100 g		955 ±5.86	2.37	910.47	989.82

GE = gross energy
n = no analyzes

As has already been shown, between the six studied products important differences were highlighted for most of the chemical and nutritional characteristics analyzed, the statistical significance of the differences established on the basis of variance analysis by the Anova multiple comparison method being presented in the table. 8. The results obtained in this study with regard to the chemical composition of minced meat rolls can be compared with those presented by Pintado et al., 2018 in a study of fresh sausages with added back-fat, showing the high variability of these products.

Table 8 The statistical significance of the differences on chemical composition and energy value of minced meat rolls studied

ANOVA Multiple comp. test	Lipids		Proteins		Collagen		Salt		Water		Ash		NFEs%		GE kcal/100g	
	S	P Value	S	P Value	S	P Value	S	P Value	S	P Value	S	P Value	S	P Value	S	P Value
A-B	***	<0.0001	***	<0.0001	***	<0.0001	ns	0.9843	***	<0.0001	***	<0.0001	ns	0.6304	***	<0.0001
A-C	***	0.0005	ns	0.0578	**	0.0023	*	0.0198	***	<0.0001	***	<0.0001	ns	0.9961	***	0.0007
A-D	**	0.0029	ns	0.4190	*	0.0421	ns	>0.9999	**	0.0017	***	<0.0001	ns	0.9961	**	0.0024
A-E	***	<0.0001	**	0.0037	***	<0.0001	**	0.0088	***	<0.0001	ns	0.6045	ns	0.7503	***	<0.0001
A-F	**	0.0017	**	0.0065	***	0.0007	ns	0.0584	**	0.0018	***	<0.0001	ns	0.5501	**	0.0018
B-C	**	<0.0001	***	<0.0001	***	<0.0001	ns	0.0749	***	<0.0001	***	<0.0001	ns	0.3231	***	<0.0001
B-D	***	<0.0001	***	<0.0001	***	<0.0001	ns	0.9843	***	<0.0001	***	<0.0001	ns	0.8999	***	<0.0001
B-E	***	<0.0001	***	<0.0001	***	<0.0001	*	0.0356	***	<0.0001	***	<0.0001	ns	>0.9999	***	<0.0001
B-F	***	<0.0001	***	<0.0001	***	<0.0001	ns	0.2283	***	<0.0001	***	<0.0001	ns	>0.9999	***	<0.0001
C-D	***	<0.0001	***	0.0003	***	<0.0001	*	0.0198	***	<0.0001	***	<0.0001	ns	0.9189	***	<0.0001
C-E	***	<0.0001	***	<0.0001	***	<0.0001	ns	0.9996	***	<0.0001	***	<0.0001	ns	0.4446	***	<0.0001
C-F	ns	0.7884	ns	0.9998	ns	0.9981	ns	0.8819	***	0.0007	***	<0.0001	ns	0.2283	ns	0.8278
D-E	***	0.0008	ns	0.3236	*	0.0351	**	0.0088	***	0.0009	***	<0.0001	ns	0.9526	***	0.0007
D-F	***	<0.0001	***	<0.0001	***	<0.0001	ns	0.0584	***	<0.0001	ns	0.9579	ns	0.8813	***	<0.0001
E-F	***	<0.0001	***	<0.0001	***	<0.0001	ns	0.6962	***	<0.0001	***	<0.0001	ns	>0.9999	***	<0.0001

The nutritional-economic characterization of the studied products was followed by the comparison of their price and the quantity of water, protein, fat and energy received by the consumer for a value unit (1 RON) (Table 9).

Table 9 Nutritional - economic characteristics of the products type minced meat rolls

Nutritional - economic characteristics		Minced meat rolls from source					
		A	B	C	D	E	F
Price	RON/ kg	13.90	11.99	13.99	12.99	13.99	16.00
Protein	g / kg	172.2	153.9	177.8	168.5	164.5	178.3
	g / RON	12.39	12.83	12.71	12.97	11.76	11.14
Fat	g / kg	183.2	271.9	160.3	203.2	225.3	165.7
	g / RON	13.17	22.67	11.46	15.64	16.10	10.3
Energy	GE kcal / kg	2423	3137	2244	2585	2763	2284
	kcal / RON	174.3	261.6	160.4	198.9	197.5	142.7
Water	g / kg	616.0	546.3	644.0	599.8	582.8	629.5
	g / RON	44.31	45.56	46.03	46.17	41.66	39.34

Even if the prices for one kg of minced meat rolls do not differ greatly much (12-16 RON/kg), the amount of fat offered to consumers for 1 RON is more than double for product B (22.67 g), compared to product F (10.3 g) and implicitly the number of calories is higher (261.6 kcal for B product vs. 142.7 kcal). Thus, product B can be considered to be energetically unbalanced (hypercaloric) and this fact can also be related to the lack of nutritional information on the product label. The consumer should be fair and fully informed so that they can reasonably choose the product they prefer.

CONCLUSIONS

Based on the conducted study the following can be concluded:

- Minced meat rolls is an assortment of meat product prepared after recipes and with different ingredients depending on the manufacturer, which leads to a high variability in chemical and energy content.
- The lipid content for all analyzed products exceeds 16g/100g of the product and varies significantly, reaching values up to 27.2g/ 100g of the product, resulting in a high energy value.
- For some of the products studied, there were major discrepancies between the nutritional values on product labels and those obtained by specific determinations while the label of two products did not contain nutritional information
- Differences between products in terms of nutrient content (fat, protein) but also in water and salt are not directly related to the price of products and the consumer can receive very different amounts of water, fat and energy for the same unit price.

REFERENCES

[1] FAO, 2003: Food energy – methods of analysis and conversion factors. Food and Agriculture Organization of the United Nations, Rome, Report of a technical workshop. http://www.fao.org/uploads/media/FAO_2003_Food_Energy_02.pdf.

[2] Fernandez-Gines J.M., Fernandez-Lopez J., Sayas-Barbara, E., Perez-Alvarez, J.A., 2005: Meat products as functional food: A review. *J. Food Sci*. 70: R37-R43.

[3] Massimo De Marchi, Carmen L. Manuelian, Sofia Ton, Davide Manfrin, Michele Meneghesso, Martino Cassandro, Mauro Penasa 2017: Prediction of sodium content in commercial processed meat products using near infrared spectroscopy, Meat Science, vol. 125, p. 61–65.

[4] Pintado T., Herrero A.M., Jiménez-Colmenero F., Pasqualin Cavalheiro C., Ruiz-Capillas C., 2018: Chia and oat emulsion gels as new animal fat replacers and healthy bioactive sources in fresh sausage formulation. Meat Science, vol 135, p. 6–13. https://doi.org/10.1016/j.meatsci.2017.08.004

[5] Yadav P., Ahlawat S.S., Jairath G., Rani M., Bishnoi S., 2015: Studies on physico-chemical properties and shelf life of developed chicken meat analogue rolls. Haryana Vet., 54 (1), 25-28.