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Short Communication

Nutrient retention factors of deep-fried milanesas

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Abstract

Milanesa is a typical food in Argentina, which consists of beef that is first soaked in crude whisked eggs and then covered with breadcrumbs. The aim of this work was to determine the retention factors for protein, fat, ash and total dietary fiber (TDF), as well as those for Fe, Cu, Ca, Mg and Zn of deep-fried milanesas. The analyses were carried out according to AOAC official methods, except for fat, that was extracted according to the Bligh and Dyer method. Minerals were determined by atomic absorption spectrophotometry after hydrolysis in sulfuric/nitric acids. Three batches of ten milanesas were deep-fried at 180°C for 1 min per 100 g of product in partially hydrogenated soybean oil. The nutrient retention factors were 1.01, 3.70, 0.78 and 1.39 for protein, fat, ash and TDF, respectively. Retention factors for the minerals were 0.87, 0.97, 0.75, 0.87 and 0.97 for Fe, Cu, Zn, Mg and Ca, respectively.

Keywords: Milanesa; Nutrient retention factors; Deep-frying

1. Introduction

Nutritional research and food industry depend on accurate information of food contents for public health nutrition. Mixed dishes or multi-ingredient foods represent the majority of items in diets world-wide. These include not only food prepared at home but also food prepared in restaurants, by food vendors, in institutions such as schools, and by food industry. To enable dietitians, nutritionists, and epidemiologists to evaluate the role of these foods in the health of individuals, there is a need for composition data of these foods. Currently, these data are not

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always adequate for existing needs. Often they are incomplete, inaccurate, inconsistent, or not available at all (Rand et al., 1991).

Only a few data are available for the calculation of nutrient retention factors of foods that take up fat while losing moisture like deep-fried meat products (Murphy et al., 1975; Bognár and Piekarski, 2000). A true retention should give the proportion of a certain nutrient in the food after cooking in relation to the amount of that nutrient originally present in the food before cooking. Thus, the direct measurement of true retention factors requires data about the weight of the food before and after cooking, as well as the contents of the nutrient per gram (or other unit of weight) in raw and cooked food.

Deep-fat frying is one of the oldest processes of food preparation. For decades, consumers have desired deep-fat fried products because of their unique flavor-texture combination (Moreira et al., 1999). "Milanesas" (schnitzel or breaded-veal) is a typical Argentine food, especially in the North, and it is frequently fried.

The aim of this work was to determine the retention factors for protein, fat, ash, total dietary fiber (TDF) and Fe, Cu, Ca, Mg and Zn, of deep-fried milanesas in partially hydrogenated soybean oil.

2. Materials and methods

2.1. Material

Partially hydrogenated soybean oil was purchased in a local store. Milanesas were prepared as follows before frying: flattened and compacted beef was covered in whisked egg and then coated with breadcrumb. Each portion was approximately 150 g.

2.2. Performance of frying

Domestic fryers with a 3-l aluminum vessel were used. The oil was heated to 180°C for 30 min prior to frying. Milanesas were fried for 1 min/100 g of food, at the initial temperature of 180°C. After each frying operation the oil was heated at 180°C for 15 min for another frying operation. This cycle was repeated until 10 milanesas were deep-fried. After frying, the samples were left on a paper towel at room temperature to cool down. Then the milanesas were weighed again and stored at −70°C for further analysis. Three batches, each consisting of 10 deep-fried milanesas, were prepared.

2.3. Analytical procedures

- *Proximate composition:* moisture, protein, TDF and ash were determined according to 950.46.B, 928.08, 985.29 and 930.22, respectively (AOAC International, 1995).
- *Lipid extraction*: milanesa fat was extracted according to Bligh and Dyer (1959).
- *Minerals determination*: minerals contents were determined by atomic absorption spectrophotometry, according to 965.09 (AOAC International, 1995), after wet-ash treatment with a nitric/sulfuric acid technique (Osborne and Voogt, 1986).

Results are expressed as follows: after frying each batch was homogenized in a blender and the mean value of the three mixed batches was determined, except for TDF, which came from a pool of the three batches.

Calculations: Energy values were calculated using factors 4 kcal/g (16.74 kJ/g) for proteins and carbohydrates and 9 kcal/g (37.67 kJ/g) for fat. Protein was calculated by multiplying nitrogen with 6.25.

2.4. Nutrient retention factor

The nutrient retention factor defined by Bognár (1998) was used and weight yield and retention factors were measured as follows:

$$\text{Weight yield } \% = \frac{\text{Weight of food after cooking in g}}{\text{Weight of food before cooking in g}} \times 100 = d, \quad (1)$$

$$\text{Nutrient retention in } \% = \frac{\text{Content of nurtrient } i \text{ per 100 g of food after cooking}}{\text{Content of nutrient } i \text{ per 100 g of food before cooking}} \times d. \quad (2)$$

3. Results

The proximal composition of raw and deep-fried milanesas is summarized in Table 1. Since no data are available on prepared foodstuffs, but only on each of the components of the product, a comparison study was carried out between the composition of milanesa after analysis and that calculated with food composition tables. Data were obtained from "Tablas de Composición de Alimentos de LATINFOODS", which is available on the Internet (FAO/LATINFOODS, 2000), and from Food Composition and Nutrition Tables (FCNT, Souci et al., 1994), and calculations were based on the amount of each of the ingredients in the recipe (Rand et al., 1991). It can be observed that the composition of raw milanesa analytically determined does not significantly differ from the calculated composition (Tables 1 and 2), with respect to moisture, protein, fat and ash. TDF contents are similar to the FCNT table, but slightly higher than the LATINFOODS table. With respect to the mineral composition, analytical data were only compared with those from the FCNT, as LATINFOODS does not provide such data. Cu values were similar. Values for Ca and Zn were very low compared to the table, whereas those for Fe and Mg were higher. These differences are probably due to the fact that the analytical values are compared with a European table and it is well known that micronutrient contents highly depend on the production conditions of the food (Pennington, 1996). This reaffirms the need of a national food composition table.

In order to determine the retention factors, the weight yield was previously measured (Table 3). It can be observed that there is no statistically significant difference between the treatments, and therefore an average of 81.28% for the weight yield was used to calculate the retention factors. This value is slightly higher than those found for deep-fat fried chicken (breaded): 77–80% (Matthews and Garrison, 1975).

Retention factors were calculated for protein, fat, ash and TDF contents as well as for Fe, Cu, Zn, Ca and Mg using the composition analytically determined for both raw and deep-fried

Table 1
Proximal composition and total energy value of raw and deep-fried milanesas

Milanesa	Moisture (g/100 g)	Protein (g/100 g)	Fat (g/100 g)	TDF[a] (g/100 g)	Ash (g/100 g)	Fe (mg/100 g)	Cu (mg/100 g)	Zn (mg/100 g)	Ca (mg/100 g)	Mg (mg/100 g)	Energy	
											kcal/100 g	kJ/100 g
Raw	64.19 ± 0.55	18.07 ± 0.58	3.03 ± 0.44	1.88 ± 0.06	3.33 ± 0.08	3.72 ± 0.38	0.12 ± 0.02	2.04 ± 0.35	2.22 ± 0.84	34.04 ± 1.47	138	576
Deep-fried	44.37 ± 5.22	23.31 ± 2.21	13.76 ± 1.83	3.21 ± 0.10	2.74 ± 0.64	3.94 ± 0.31	0.14 ± 0.02	1.85 ± 0.13	3.61 ± 1.49	36.34 ± 1.90	268	1120

Values are mean values ± S.D. $n = 3$.
[a] TDF: total dietary fiber.

Table 2
Calculated data for nutrient contents in raw milanesas

(a) *Source: LATINFOODS table*

(Recipe for 100 g)	Ingredients (g)	Moisture (g/100 g)	Protein (g/100 g)	Fat (g/100 g)	Ash[a] (g/100 g)	TDF[b] (g/100 g)
Meat (*nalga*[c])	80.6	75.3	21.2	1.4	2.1	—
Bread crumb	13.4	9.9	24.8	8.2	5.7	0.9
Egg	4.24	74.9	12	11.8	1.0	0.0
Salt (NaCl)	1. 8					
		65.2	20.9	2.7	4.3	0.1

(b) *Source: Food composition and nutrition tables*

(Recipe for 100 g)	Ingredients (g)	Moisture (g/100 g)	Protein (g/100 g)	Fat (g/100 g)	Ash[d] (g/100 g)	TDF[b] (mg/100 g)	Fe (mg/100 g)	Cu (mg/100 g)	Zn (mg/100 g)	Ca (mg/100 g)	Mg (mg/100 g)
Fillet	80.6	73.40	21.20	4.00	1.15	—	2.30	0.08	4.41	22.00	3.33
Crisp bread	13.4	6.19	9.37	1.40	2.30	14.60	4.70	0.40	3.10	68.00	55.00
Egg	4.2	74.10	12.90	11.20	1.10	—	2.10	0.14	1.35	12.00	56.00
Salt (NaCl)	1.8										
		63.10	18.88	3.88	3.08	1.96	2.57	0.12	4.03	27.35	12.41

[a] Ash contents = $(2.1 \times 80.6 + 5.7 \times 13.4 + 1.0 \times 4.2)/100 + 1.8$.
[b] TDF: total dietary fiber.
[c] *Nalga*: semi-membranous muscle.
[d] Ash content = $(1.15 \times 80.6 + 2.30 \times 13.4 + 1.10 \times 4.2)/100 + 1.8$.

Table 3
Weight yield factor for deep-fried milanesas

Treatment 1	Treatment 2	Treatment 3	Mean value
83.56 ± 0.08	80.67 ± 0.05	79.62 ± 0.04	81.28

Values represent average ± S.D. ($n = 10$).
No significant differences were found at $P < 0.01$.

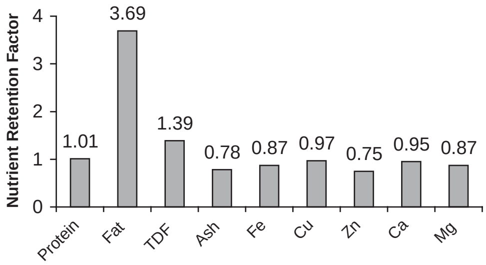

Fig. 1. Nutrient and mineral retention factors for deep-fried milanesas.

Table 4
Influence of the deep-fat frying method on the weight and contents of water, fat, proteins, total dietary fiber, and ash in milanesas

Milanesa	Weight		Water		Fat		Protein		TDF[a]		Ash	
	Yield	Change (a)	Content (b)	Change (c)	Content (b)	Change (c)	Content (b)	Change (c)	Content (b)	Change (c)	Content (b)	Change (c)
Raw	100		64.19		3.03		18.07		1.88		3.33	
Deep-fried	81.28	−18.72	36.09	−28.10	11.18	8.15	18.13	0.06	2.61	0.73	2.23	−1.10

(a) Weight of raw food—yield
(b) contents per 100 g of fried food × yield/100 = C (g)
(c) contents per 100 g raw food—C (g)
(−) loss
(+) absorption.
[a] TDF: total dietary factor.

milanesa from Table 1. Results are given in Fig. 1. The retention factor for protein was 1.01; those for fat and TDF were a little higher, 3.69 and 1.39, respectively. Due to the deep-frying cooking process, fat from the cooking oil is absorbed by the milanesa, which explains the higher retention factor for fat. The increase in retention factor for TDF could be caused by the conversion of digestible starch from the breadcrumbs into resistant (indigestible) starch during the frying process (Pokorny, 1998). The retention factor for ash was 0.78, which means a mineral loss of 22%. This is much higher than the 2–8% found in the literature for breaded-meat in general (Bognár, 1998).

Frying is a process that produces dehydration of the food and therefore the density of the nutrients in fried foodstuffs is higher than in raw products (Vaquero, 1998). Consequently, there seems to be a net increase in nutrients, but the contents of these nutrients in deep-fried food is, except for fat, less or equal if the calculation is based on 100 g of raw product. Table 4 shows that the protein contents remained constant, whereas TDF showed a slight increase. Total minerals, determined as ash, showed a loss of 1.1 g per 100 g of raw initial product, while fat showed absorption of 8 g per 100 g of raw milanesa, which coincides with values found in the literature: 2–13.3 g per 100 g of raw product. The increase in fat in breaded-meat is related to the fat contents of raw products and the amount of breadcrumbs used to cover the surface (Bognár, 1998).

4. Conclusions

In the present work, the nutrient retention factors for deep-fried milanesa were determined. The nutrient retention factors were 1.01, 3.70, 0.78 and 1.39 for protein, fat, ash and TDF, respectively. Retention factors for the minerals were 0.87, 0.97, 0.75, 0.87 and 0.97 for Fe, Cu, Zn, Mg and Ca, respectively.

It is important to emphasize that these new data will contribute both to the Tabla Nacional de Composición de Alimentos de Argentina and the Tablas de Composición de Alimentos del LATINFOODS.

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