Nutritional quality of preparations based on Döner Kebab sold in two towns of Veneto Region, Italy: preliminary results

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Abstract

The sampling activity for this study was performed between September and October 2012. It involved seven shops in Verona, eleven in Vicenza and two in its province (Bassano del Grappa), northern Italy. The scope was to measure the values of energy and nutritional components and to identify the profile of fatty acids in a serving of ready to eat Döner Kebab. The samples were collected according to the usual proportions of this preparation, keeping all the components (bread, meat, vegetables and sauces) separated in different bags. In the laboratory, each component was weighed and, after pooling, processed for the analytical determination of humidity, crude protein, lipid content and fatty acid profile, ashes, sodium (salt), carbohydrate, collagen (measured only in meat) and fibre. The results showed a highly standardized recipe, while the comparison between the two towns showed a significant difference in carbohydrate concentration (mainly due to the quantity of bread used). By observing data on the serving sizes sampled (274 to 618 g) and the nutritional values obtained, Döner Kebab can be seen as a ready to eat dish providing much energy: on average a serving size covers 45 and 36% of the recommended daily intake of energy, 95.7 and 82.1% of protein, 42.5 and 33.4% of saturated fatty acids for females and males, respectively, and 85.5% of salt regardless of gender. Döner Kebab can be considered as an occasional substitute to one of the two main meals of the day.

Introduction

Döner Kebab is one of the most popular and consumed ethnic ready-to-eat (RTE) dishes in Europe. People are used to eating this take-away food as a meal substitute or as a snack in several different occasions depending also on the local customs and traditions. According to a survey conducted for Unaitalia, the kebab is the favorite dish for almost 30% of young people under 34 years old (Colussi, 2014). The rapid spread of this dish is mainly due to its widespread distribution and selling network, consisting of shops, kiosks and stands open several hours a day to sell without competition from other kinds of restaurant (Paolini, 2005). This has certainly had an impact on sales with nearly 1.3 million portions of Döner Kebab, as an example, being sold by static and mobile vendors every day in the United Kingdom (British Kebab Awards, 2013). Moreover, the statistics highlight that in Italy since 2001 there has been a continuous rising in the percentage of people consuming at least one meal outside homes (Censosimo, 2011).

There is not a single definition of Döner Kebab, there has been an evolution of the recipe as well as of the terminology in every geographical area. With regard to the etymology, it can be stated that the word kebab means *roasted meat* (from the Arabian *Kabab*) and that is usually preceded by an adjective which allows identifying the dish or the method of cooking meat (in this case *Döner* refers to the vertical rotating skewer). Using a generic description, we can say that Döner Kebab is a traditional Turkish dish (the inventor seems to be a Turk emigrated to Germany) consisting of meat cooked on a vertical rotating spit and portioned at the time of consumption or ordering. The meat of the original recipe can be lamb, mutton, beef, goat or chicken. The method of preparation consists of stacking seasoned or marinated slices of lean meat on a vertical spit, giving a cylindrical shape to the finished product. Nowadays the meat used for the recipes comes from big companies that export frozen skewers made mostly of chicken, turkey and beef. At the shops, the meat cooking process by radiant infrared heat emanated from hot plates or gas-powered burners (reaching a temperature between 200 and 300°C) starts when the shop opens and goes on until the meat is cut for consumption. At this point thin slices of cooked meat are cut and put in a pocket of pita bread or in a *piadina*. This dish is often accompanied by a choice of sauces (mayonnaise, ketchup, tzatziki, harissa) and vegetables (Heinz and Hautzinger, 2007). Nevertheless, in most of the shops an industrial product often made with poor quality meat is served (Castellani, 2007). The studies relating to the nutritional aspects of this preparation are very few, and most of them are limited to the analysis of only two ingredients (bread and meat) or only meat (Marletta *et al*., 2010; Vazgecer *et al*., 2004). The most comprehensive survey was published in 2009 by LACORS. Commissioned by the British government, its scope was to verify the correspondence of the information contained in the label of the kebab and its real content (animal species identification) and to analyze the nutritional composition of the Kebab, mainly bread and meat, creating a comparison with the nutritional guidelines and indications (LACORS, 2009).

The purpose of the present study was to evaluate the variability of the recipe and the nutritional quality (through a detailed analysis of the nutrients) of an ethnic dish distributed in two towns of Veneto region and prepared according to a commercial formula by mixing meat of Döner, bread, vegetables and sauces. It must be said that the choice of the two towns is not completely random. Although they are neighbouring, they differ for the type of consumers. Verona is the fifth Italian town for inflow of foreign tourists (1,800,000 foreign guests in 2012; Osservatorio Nazionale del Turismo, 2013) and it also has a large population of university students. The same considerations cannot be transferable to the town of Vicenza that substantially relies only on local consumers. Hence the interest to compare the two different towns. Moreover, for each nutrient fact the contribution of a full portion of Döner Kebab was calculated and then compared to the suggested daily reference intakes for the Italian population. Given that in the literature information on proximate composition and nutritional value of kebab intended as gastronomic preparation is incomplete, in this preliminary study it was therefore decided to give priority toward a most detailed analysis, investigating almost all the macro-nutrients in

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addition to measure the energy value, limiting the sampling rate to a number of well-defined retailers.

Materials and Methods

Sampling and sample preparation

The determination of the number and location of the retailers to be sampled was done in collaboration with the Veterinary Services of the Local Health Authority responsible for those areas. The sampling activity, conducted between September and October 2012, involved a total of 20 public retailers, 7 of which were in the town of Verona, 11 in the town of Vicenza and 2 in the town of Bassano del Grappa (VI). For each point of sell, one sampling time has been performed, reaching a total of 10 samples of sandwiches and 10 samples of piadinas. Each Döner Kebab was sampled keeping the bread (pita or flat bread) and the meat separated from the vegetables (tomato, green salad, onion, pepper, cabbage, squash) and from the sauces. All these main ingredients were collected according to the usual proportions used in each shop but kept in three separate containers (gas impermeable) with the aim to prevent loss of ingredients or macronutrients between the different matrixes (in particular to avoid migration of humidity especially from vegetables and/or sauce to bread). At the same time a copy of the label of the skewer was taken, so that the origin, composition and animal species of the meat could be known. After the individual weighing of each of the four ingredients and calculation of the respective percentage, a portion of each one after grinding (4000 rpm min^{-1} for 5 sec, Grindomix GM200; Retsch, Dusseldorf, Germany) was used to obtain a representative mixed sample that was homogenized again (4000 rpm min^{-1} for 5 sec). The homogenate was then freeze-dried and subsequently homogenized (4000 rpm min^{-1} for 5 sec) to further improve the precision of the analytical data. The residual quotes of each ingredient were used to measure collagen (in the case of meat) and to measure the pH value (for all others meat included, in order to verify if their values were in line with the usual ones or were modified by technological processes). After homogenization in distilled water (1:10 w/v, at 13,000 rpm min^{-1} for 30 sec with a disperser UltraTurrax T25 basic; Ika Werke, Staufen, Germany), pH was measured using a Portamess pH-meter (Knick 910; Knick, Berlin, Germany) equipped with INLAB 427 electrode (Mettler Toledo, Urdof, Switzerland).

Analytical determinations

The measurement of moisture was carried out gravimetrically by drying approximately 10 g of sample (two decimal figures) in a convection oven at 103±2°C until constant weight (AOAC 983.18; AOAC, 1990). To calculate protein, 0.5 g of sample (four decimal figures) were submitted to the Kjeldahl procedure, total nitrogen was converted into crude protein using the 6.25 factor (AOAC 928.08; AOAC, 1990). Ashes were measured by gravimetric method after combustion of 3 g of sample (four decimal figures) in a muffle furnace at 550±2°C until obtaining a white residue (AOAC 923.03; AOAC, 1990). The percentage of fat was determined gravimetrically (Folch *et al*., 1957) on 5 g of sample (two decimal figures). The salt content was determined on 2.5 g of sample (four decimal figures) using the Volhard method (AOAC, 1990). Gross energy was measured by combustion of 1 g of sample (four decimal figures) in an excess of oxygen in a bomb calorimeter under standardized conditions (FAO, 2011). Total dietary fibre was determined submitting 1 g of sample (four decimal figures) to enzymatic-gravimetric method (AOAC 985.29; AOAC, 1990). To measure carbohydrate (starch), 0.5 g of sample (four decimal figures) were analysed by enzymatic method (AOAC 979.10; AOAC, 1990). Collagen was measured through the determination of hydroxyproline. The method consisted of an initial step of acid hydrolysis (conducted with HCl 6 M on 1 g weighed with four decimal figures warmed at 100±2°C for 18 h), followed by hydroxyproline oxidation to pyrrole by means of chloramine T (Sigma-Aldrich, Milan, Italy) and the registration of its light absorption at 558 nm after complexation with the Ehrlich reagent (Edwards and O'Brien, 1980). To convert the absorbance values in concentrations, a calibration curve was fitted using diluted concentrations of a pure standard of hydroxyproline (Sigma-Aldrich). To calculate the percentage of collagen, the concentration of hydroxyproline was multiplied by 8. For fatty acid (FA) analysis, the anhydrous fat (Folch *et al*., 1957) was first esterified in an acid medium then analyzed by gas chromatography. Briefly, 40 mg of fat weighed in a test tube with screw cap with Teflon sealing were derivatized using 1 mL of methanolic HCl 3 N (Supelco Italy, Milan, Italy) at 90±2°C for 1 h mixing the solution every 10 min. After cooling to room temperature, 1 mL of distilled water was added and mixed, which was followed by the addition of 2 mL of n-hexane (Sigma-Aldrich). The mixture was centrifuged at 400xg for 10 min (Eppendorf centrifuge 5804; Eppendorf, Hamburg, Germany) and the upper phase, containing the fatty acids methyl esters (FAME), was transferred into a clean vial. Fatty acids methyl esters were analyzed using a gas chromatograph (Shimadzu GC-17A; Shimadzu Co., Kyoto, Japan) equipped with a split-splitless injector (set at 280°C) and a flame ionization detector set at 250°C. One µL of FAME mix was injected in split mode (ratio 1:40) with hydrogen at 40 cm sec^{-1} as carrier gas and an Omegawax 250 capillary column (30 m, 0.25 mm, 0.25 µm; Supelco Inc., Bellefonte, PA, USA) used to separate the components according to initial temperature of 40°C for 5 min, first ramp at 10°C min^{-1} up to 120°C (holding time 0.5 min) and second ramp at 4°C min^{-1} up to 240°C (holding time 5 min). The response factor for each peak was determined from an equal weight commercial standard mix of fatty acids methyl esters (Sigma-Aldrich). The original solution was diluted to give a final concentration of 1.0 mg/mL total FAME. Fatty acids methyl esters were identified by matching their retention time with that of an external standard mixture (Sigma-Aldrich) and expressed as a percentage of total fatty acids and in concentration of mg/100g of Döner Kebab using the following equation (Greenfield and Southgate, 2007):

$$\text{Fatty acid (mg/100g)} = \text{FAME\%} \times \text{Fat\%} \times 0.945 \times 10$$

Statistical analysis

Mean and standard deviation of the data are reported in Tables 1-3. A one-way ANOVA test was used to determine significant differences within two fixed factors: town of sampling (to verify if a standardization of the recipe exists) and median value of the meat percentage (since the cooked meat is the more abundant component of the dish as well as with greater nutrient density it was decided to check how much the percentage of added meat can modify the quantity and quality of macronutrients. The percentage of meat was used as fixed factor since in all the sampled points of sell the Döner had the same composition in terms of animal species). The statistical difference level was set at $P<0.05$. Pearson correlation coefficients were used to explore possible relationships between the percentage of the ingredients and chemical indexes. Statistical analyses of the data were performed by SPSS version 15.0 (SPSS Inc., Chicago, IL, USA).

Results

From the measures obtained some considerations about the composition of a medium portion of Döner Kebab can be drawn. Looking at the origin of the ingredients, it is evident that the noticeable differences among different preparations are mainly consequence of the quantity of ingredients used. In fact, from the information collected at the point of sell it was evident that bread and sauces are usually bought at supermarkets, and so they are made with the same ingredients; vegetables are bought from the same supplier; meat comes from the same producers, meaning that animal species, additives and preparation are the same for each skewer. In all the sampling point the meat was chicken or a chicken/turkey mix-

ture. The predominant ingredient was certainly meat (percentage ranged between 34.7 and 39.5%) in both towns. With regard to bread, vegetables and sauces the amount present did not vary significantly between the recipes of the two towns. Detailed percentages of the ingredients and the significance of the data obtained are reported in Table 1. The pH value of the individual ingredients ranged between a minimum of 6.57 and a maximum 7.05, 4.88 and 6.44, 4.39 and 5.48, 3.81 and 4.49 respectively in meat, bread, vegetables and sauce (Table 1).

Considering now the variables of narrower nutritional interest, we must keep in mind that the values refer to the sample assembled, after a weighted mixing of the four components (meat, bread, vegetables and sauce). The data collected were analyzed in order to focus attention on the differences between the towns of sampling and the influence of the meat percentage on the chemical composition. Concerning the second factor, the samples were grouped according to the value of the median (36.7%) of meat percentage. Comparing the two towns, the data showed a significant difference in terms of carbohydrate content, ranging from 10.1 g/100g measured in the samples from Vicenza to 13.8 g/100g in the samples collected in Verona (Table 2). This difference is probably due to the different percentage of bread used in the preparation of the dish (r=0.747, P<0.001 between bread percentage and carbohydrate concentration). The statistically most interesting observations can be made observing the various nutritional intakes of the kebab considering a meat content above or below the median value. As can be seen from Table 2, samples with a higher content of meat were also those with a higher energy intake (237.4 Kcal/100g compared to 215.8 Kcal; r=0.595, P<0.01 between meat percentage and energy), higher protein (14 g/100 g *vs* 12 g/100 g) and fat (9.6 g/100 g compared to 7.8 g/100 g) content. Another consequence of high quantity of meat is the lower content of total dietary fibre which is equal to 1 g/100g against 1.3 g/100g of the samples with an average content of meat lower than 36.7% (r=0.642, P<0.01; r=0.621, P<0.01 and r=-0.55, P<0.05 between meat percentage and protein, fat and dietary fibre content respectively). Salt concentration ranged between 1 and 1.1% for samples respectively below and above the value of the median of the meat percentage. It is interesting to note that salt percentage was relatively constant and independent from the other chemical variables and ingredients. The data of collagen percentage has been expressed on the meat, with the aim to highlight the quality of this component. The values measured ranged between 1.3 and 5.8%. With regard to this, it is useful to point out that all the Döner Kebab sampled, according to the list of ingredients on the label of the meat, were almost all consisting of chicken or mixed chicken/turkey and came from the same producers. From the analysis of fatty acids, it can be seen that the most represented category was that of monounsaturated fatty acids (2445.9 and 2678.4 mg/100g of sample in Verona and Vicenza respectively), compared to saturated and polyunsaturated, as it can be seen in Table 3. As expected, the concentration of fatty acids was affected by the percentage of meat in the Döner Kebab. In particular, significant differences were observed for saturated fatty acids (2638.3 and 1959.9 mg/100g in the samples with a content of meat respectively above and below 36.7%) and monounsaturated (3006.1 mg/100 g above the median value and 2188 mg/100 g below). Instead, the amount of polyunsaturated was not clearly influenced neither by the percentage of meat nor from that of the other ingredients used for the preparation of the dish. The most represented fatty acid was oleic acid (18:1n9), with values of 2245.6 and 1947.9 mg/100g in Vicenza and Verona respectively, followed by linoleic acid (18:2n6), palmitic acid (16:0), stearic acid (18:0), palmitoleic acid (16:1n7), α-linolenic acid (18:3n3), vaccenic acid (18:1n7), arachidonic acid (20:4n6) and myristic acid (14:0). It is clear in Table 3 that the amount of certain fatty acids was significantly affected by the amount of meat used to prepare the Döner Kebab. The main quantitative differences that have been noted concerning single compounds are relative to palmitic, stearic, palmitoleic,

Table 1. Percentage and pH of the components of twenty Döner Kebab preparations collected in two towns of Veneto Region.

	Ingredient (%)		pH		P	
	Verona	Vicenza	Verona	Vicenza	%	pH
Meat	34.8±10.2	39.5±6.8	6.74±0.07	6.77±0.15	ns	ns
Bread	26.9±3.4	22.5±6.1	5.67±0.16	5.84±0.41	ns	ns
Vegetables	24.7±9.1	25.8±7.4	5.04±0.16	5.03±0.36	ns	ns
Sauces	13.6±2.7	12.2±4.5	4.15±0.05	4.19±0.23	ns	ns

ns, not significant. Values are presented as mean±standard deviation.

Table 2. Energy values and chemical composition of twenty preparations based on Döner Kebab collected in two towns of Veneto Region.

Variable	Town		Median		P	
	Verona	Vicenza	≤36.7% meat	>36.7% meat	Town	Median
Energy (Kcal/100g)	229.8±23.6	224.2±27.3	215.8±20.7	237.4±26.8	ns	*
Moisture (g/100g)	58±3	60.4±4.2	60.4±3.8	58.7±4.1	ns	ns
Protein (g/100g)	13.2±2.4	12.8±2	12±1.2	14±2.5	ns	*
Fat (g/100g)	8.5±1.8	8.7±1.8	7.8±1.6	9.6±1.4	ns	*
Ash (g/100g)	2.7±0.2	2.5±0.3	2.6±0.3	2.6±0.3	ns	ns
Salt (g/100g)	1.2±0.2	1±0.2	1±0.3	1.1±0.2	ns	ns
Carbohydrate (g/100g)	13.8±2.4	10.1±3.6	12.4±4.2	10.1±2.7	*	ns
Collagen° (g/100g)	3.2±1.4	3±1.3	3±1.4	3.2±1.3	ns	ns
Dietary fibre (g/100g)	1.2±0.4	1.1±0.2	1.3±0.3	1±0.2	ns	*

Values are presented as mean±standard deviation. °Values are referred to meat only. *P<0.05; ns, not significant.

oleic, vaccenic and α-linolenic acid. Finally, the ratio omega-6/omega-3, whose values ranged from 4.1 to 17 with an average value of 11.5, was not affected neither by the place of sampling nor by the percentage of meat.

Discussion

It is noteworthy that the preparation based on Döner Kebab appeared extremely standardized among different commercial retailers and also between different towns, and this fact is mostly due to the origin of the ingredients. The majority of the skewers were imported from the same German company and in most cases the sauces used, like mayonnaise and ketchup, were bought at the supermarket. The assumption shown in the introduction for the existence of any differences in the formulation of the dish between the two towns to satisfy a different type of consumer (occasional *vs* habitual consumer) can be refuted, even if these are preliminary data.

The pH of the meat was high if compared with what may be the common values for fresh breast poultry meat (Ylä-Ajos *et al*., 2007). The use of polyphosphates and the industrial storage in regime of freezing of the skewer before commercialization to retailers, in addition to cooking at the point of sell, may cause a significant rise in the pH value (Ergönül and Kundakci, 2007; Demirok *et al*., 2011). In contrast, the low pH values of the sauces could be explained by the frequent use of yoghurt for their preparation. For a more complete discussion about the nutritional intake arising from the Döner Kebab, the data obtained from the present study were compared with the RDAs (set of reference values for the diet in the population and for healthy people) published by the Italian Society of Human Nutrition in 2012. The reference values used were the recommended intake for the population or nutritional objective for the prevention or reference interval for the intake of macronutrients or level of adequate intake with regard to protein, saturated fat, carbohydrates, fibre and lipids or tolerable levels of intake for the Italian population in the case of salt (SINU, 2012).

Considering an individual with a low to medium level of physical activity, as it may be that of an office worker, the energy needs for a male are of 2500 kcal/day, while for a female is 2000 kcal/day. Comparing these needs with the mean value of 226.1±25.7 kcal/100g of a mean serving portion of Döner Kebab (402 g for a total of 900.9 kcal; Table 4), it can be noted that the contribution of this RTE is equal to 36.0 and 45.0% of the daily energy requirements for males and females respectively (Table 4). The energy was correlated with the percentage of meat, as previously said, whereas the contribution of vegetables and sauces used in the preparation was quite marginal (r=-0.57, P<0.01; r=-0.44 P<0.05). The protein content of a portion of Döner Kebab (12.95±2.12 g/100g equal to 51.7g for a mean serving size) can be considered equal to 82.1% of the reference interval (RI) for male and 95.7% for female. For total carbohydrates (mainly repre-

Table 3. Fatty acid profile of twenty preparations based on Döner Kebab collected in two towns of Veneto.

Fatty acid (mg/100g of wet sample)	Town		Median		P	
	Verona	Vicenza	≤36.7% meat	>36.7% meat	Town	Median
Lauric acid (C12:0)	102.1±84	64±45.8	74.8±74.5	80±51.7	ns	ns
Myristic acid (C14:0)	116.9±58.2	79±44.6	73.3±48.4	111.2±50	ns	ns
Palmitic acid (C16:0)	1261.5±376.9	1499.3±494.6	1175±419.6	1657.2±379.8	ns	*
Stearic acid (C18:0)	541.2±172.4	596.8±141.2	508.8±155.6	645.8±115.4	ns	*
Arachidic acid (C20:0)	14.9±4	17.3±5.6	14.1±5.1	18.8±4.2	ns	*
Behenic acid (C22:0)	56.6±9.9	72.9±31.4	66.3±31.1	68.1±23.5	ns	ns
Σ Saturated	2152.4±682.6	2378.1±644	1959.9±618.3	2638.3±501.4	ns	*
Myristoleic acid (C14:1n5)	16.8±7.8	12.5±5.5	12.7±6.4	15.4±6.7	ns	ns
Palmitoleic acid (C16:1n7)	168.6±71.6	180.7±65.7	147±56.8	205.9±64.1	ns	*
Oleic acid (C18:1n9)	1947.9±582.9	2245.6±650	1799.5±558.5	2483.3±512.8	ns	*
Vaccenic acid (C18:1n7)	143±44.8	148.6±33.5	128.4±33.7	164.8±31.2	ns	*
Eicosenoic acid (C20:1n9)	24.7±12.9	27.1±10.8	23.2±11.7	29.3±10.5	ns	ns
Erucic acid (C22:1n9)	136.3±57.6	55.4±79	69.5±73.5	97.9±89.3	ns	ns
Σ monounsaturated	2445.9±715	2678.4±768.4	2188±631.9	3006.1±619.9	ns	**
Linoleic acid (C18:2n6)	1866.6±344.7	1566.8±439.2	1548.5±418.2	1794.9±416.2	ns	ns
γ-linolenic acid (C18:3n6)	5.1±1.4	6.5±2.8	5.4±2.1	6.6±2.7	ns	ns
α-linolenic acid (C18:3n3)	148.7±66.1	160.6±79.9	120.4±46.8	192.4±80.1	ns	*
Rumenic acid (C18:2c9t11)	22.5±30.5	5.6±5.5	15.2±27.1	7.8±6.1	ns	ns
Eicosadienoic acid (C20:2n6)	18.1±7.4	12.1±9.9	10.6±6.1	17.8±10.9	ns	ns
Dihomo-γ-linolenic acid (C20:3n6)	20.4±13.8	17.3±5	17.6±11.2	19.1±6.2	ns	ns
Arachidonic acid (C20:4n6)	130.9±59.7	120.1±37.4	116.6±41.7	131.2±49.5	ns	ns
Eicosatrienoic acid (C20:3n3)	4.8±1.7	5±2.5	4±0.8	5.9±2.8	ns	ns
Eicosapentaenoic acid (C20:5n3)	10.9±4.2	11±4.3	9.35±3.2	12.6±4.5	ns	ns
Docosahexaenoic acid (C22:6n3)	2.7±2.7	7.6±19	10.3±21.2	1.5±2.6	ns	ns
Σ polyunsaturated	2230.7±450.2	1912.6±496.4	1857.1±489.4	2189.9±462.7	ns	ns
Σ omega-3	167.1±69.3	184.3±81.2	144.0±49.6	212.5±84.2	ns	*
Σ omega-6	2023±413	1710.6±467.4	1688.2±457.2	1951.8±454.6	ns	ns
Omega-6/omega-3°	13.17±3.50	10.52±3.88	12.42±3.45	10.48±4.22	ns	ns

°Data obtained from the fatty acids in percentage. *P<0.05; **P<0.01; ns, not significant.

sented by starch), it can be seen that the values obtained (11.3±3.7 g/100 g equal to 43.8 g for a serving size) fall below the RI (45-60% of energy). Looking at the lipid intake, a meal based on Döner Kebab (34.7 g per serving size) can cover, on average, 41.8 and 51.8% of the daily RI of fat for male and female respectively. In comparison with others studies, the mean energy content (226.1 kcal/100 g) was lower than 268 kcal/100g (Marletta *et al*., 2010) or that of 336 kcal/100g registered by the LACORS study. However, it must be pointed out that in both studies the values were indicative solely of bread plus meat or only meat. The low values found in this study, where the total ingredients were analyzed after pooling, may be due to the low energy density of the vegetables but also to the use of meat with relatively low lipid content. The lipids content, expressed per 100 g of sample, was 8.6, 16.7 and 20.6 g respectively for the present study, (Marletta *et al*., 2010) and LACORS. Saturated fat was 2.3, 6 and 9.8 g. Such differences are certainly determined by the different sampling approach, but also by the quality and kind of meat species (in particular with reference to saturated fat). In the kebabs collected for the LACORS study, more than 70% of the meat was ovine and/or beef, while in the present study the meat was poultry or poultry/turkey mixture. The protein content, that was obviously affected by the sampling approach in relation to the amount of meat, was 29.7% (Marletta *et al*., 2010), 18.7% (LACORS, 2009) and 12.95% in the present study. The collagen concentration (a component of the total protein) normally is less than 1% in chicken and turkey breast, and slightly greater than 1% in the case of leg muscles (Food Standard Agency, 2004). However, the value increases as a function of the amount of skin that is inserted in the Döner preparation which means that the values measured in the present study may appear high but are still lower than those shown by Vazgecer *et al*. (2004). Salt content was 1.96% in LACORS and 1.1% in this study. In other words, it means that a serving size of Döner Kebab in both studies covers, if not completely, most of the recommended daily quota for sodium chloride with severe concerns in the case of people that suffer for hypertensive phenomena or more in general for the prevention of cardiovascular disease (Starmans-Kool *et al*., 2011). With regard to carbohydrates and dietetic fibre, the contribution arising from Döner Kebab to these nutrients appeared to be less than 20% of the recommended values. Carbohydrates for serving was equal to 15.5% (males) and 19.5% (females) whereas fibre touches 15% (slightly less for males) of the suggested reference daily intake. On the other hand, the protein content of a serving of Döner Kebab (51.7 g) is enough to cover almost the full daily requirements for females whereas it reaches 82.1% in the case of males. Kebab with yoghurt – a Turkish traditional food – made of mutton, veal, flat bread, whole fat yoghurt, butter, tomato paste, green pepper, red tomato and tap water-has a chemical composition of 226 kcal/100 g, moisture 60.4%, protein 9.2%, fat 15.6%, ash 1.6%, salt 0.95%, fibre 1.1%, carbohydrate 12.07% (Biringen Löker *et al*., 2013). Therefore, it is a kebab preparation with a chemical composition very similar to that of the Döner Kebab sampled in the towns of Verona and Vicenza. Looking at the fats, from the point of view of nutritional quality, consuming a serving of Döner Kebab provides an intake of saturated fatty acids (the most harmful to health) equal to 33.4% and 42.5% of RI respectively for males and females, whereas the coverage of n3 requirements is less than 17%. Polyunsaturated fats were 29.2 and 37.2% of daily RI for males and female respectively. Among n3 fats, α-linolenic acid that shows positive effects on cardiovascular health reached the average concentration of 156 mg/100g of Döner Kebab which is half of the minimum value necessary to define a food a source of omega-3 fat (Reg. 116/2010/EC; European Commission, 2010). On the other hand, the average ratio omega-6/omega-3 found in the samples of the present study was rather high if compared to the levels normally suggested that should be at least 4:1 or minor (Simopoulos, 2008).

Conclusions

The preparations based on Döner Kebab analyzed in this study have highlighted the nutritional value and energy content of this RTE food. There is a high content of protein as well as a considerable amount of salt in an average serving size. If the meat used is of chicken and/or turkey, the content of polyun-

Table 4. Daily reference intake for energy, macronutrients and salt of a serving size of preparation based on Döner Kebab and consumers' satisfaction of the serving size.

	Recommended or suggested macronutrients		Serving size of 402 g*	Satisfaction with the serving size (%)	
Male	Female	Male	Female		
Energy (kcal)	2500	2000	900.9	36.0	45.0
Protein (g)°	63	54	51.7	82.1	95.7
Carbohydrate (g)#	282	225	43.8	15.5	19.5
Fat (g)§	83	67	34.7	41.8	51.8
Saturated fat (g)^	28	22	9.36	33.4	42.5
Monounsaturated fat (g)§	28	22	10.56	37.7	48.0
Polyunsaturated fat (g)**	28	22	8.19	29.2	37.2
Omega-6 fatty acids°°	22	18	7.34	33.4	40.8
Omega-3 fatty acids##	5.6	4.4	0.75	13.3	16.9
EPA+DHA fatty acids§§	0.25	0.25	0.05	18.0	18.0
Fibre (g)^^	36.5	29.2	4.43	12.1	15.2
Salt (g)§§	5	5	4.28	85.5	85.5

*Amount of energy (kcal) and macronutrients (g) obtained with the consumption of a serving of 402 g (average weight); °recommended intake for the population (PRI); #reference interval for the intake of macronutrients (RI)=45% of the energy (kcal); §RI=30% of the energy (kcal); ^nutritional objective for the prevention (STD)=10% of the energy (kcal); §calculated as difference, considering the SDT for saturated fatty acids and the RI for PUFA; **RI=10% of the energy (kcal); °°RI=8% of the energy (kcal); ##RI=2% of the energy (kcal); §§level of adequate intake (AI)=fixed value of 250 mg; ^^14.6 g/1000 kcal; §§fixed value for tolerable levels of intake for the Italian population (UL) [calculated as Na (g) x 2.5].

saturated fatty acids is about a third of the nutritional requirement. However, the quality of the meat used seemed to be low, when considering the collagen content. The nutritional value of the dish seemed to be mainly influenced by the abundance of meat used in the preparation and less related to that of other components. The consumption of an average portion of this RTE food contributes with one-third and slightly less than half of the energy requirements for males and females respectively and it can be an alternative to one of the two daily meals, although with a moderate frequency of consumption.

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