



Original/*Valoración nutricional*

Assessment of the food patterns of immigrant Ecuadorian population in Southern Spain based on a 24-h food recall survey

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Abstract

Introduction: Ecuador is a country with limited nutritional information, with exception of some general studies supported by Food Agriculture Organization (FAO)

Aims: to carry out a nutritional assessment of the diet of Ecuadorian immigrant population in Southern Spain to determine differences in food patterns and possible nutritional deficiencies.

Methods: the nutritional assessment was based on a 24-h food recall survey applied to the Ecuadorian population residing in Seville and Córdoba (Spain) in combination with the application of national and international food composition data bases. Nutrient intake levels and fulfillment of Dietary Reference Intakes (DRIs) were estimated and statistically tested for social, sex, age and geographical factors.

Results: macronutrient distributions and nutrient intake levels in relation with DRIs were adequate in most cases. Importantly, Ecuadorian food habits were still present in immigrant population, with rice being the main energy source. Intakes levels were significantly different for several nutrients depending on age group, sex, place of residence and professional occupation. Comparison with previous nutritional data from Ecuador revealed a better nutritional status of immigrant population in Spain, though deficiencies in fiber, vitamin E, I and Se were detected in the diet of both populations. Nevertheless, data for these deficiencies were insufficient to be conclusive given both limitations in the food composition data bases (e.g. Se) and the lack of more adequate information tools for its assessment (e.g. long-term studies for vitamin E).

Conclusions: the results in the present study evidenced that Ecuadorian immigrants in Spain showed more adequate food patterns that those reported for Ecuador. These

EVALUACIÓN DEL PATRÓN ALIMENTARIO DE LA POBLACIÓN ECUATORIANA INMIGRANTE EN EL SUR DE ESPAÑA BASADO EN UN ESTUDIO DE RECORDATORIO DE ALIMENTOS DE 24 HORAS

Introducción: Ecuador es un país con limitada información nutricional con la excepción de algunos estudios de carácter general realizados por FAO (Food Agriculture Organization).

Objetivos: realizar una evaluación nutricional de la dieta de la población inmigrante ecuatoriana en el sur de España para determinar diferencias en los patrones alimentarios y posibles deficiencias nutricionales.

Métodos: la evaluación nutricional se basa en un estudio de recordatorio de alimentos de 24 horas llevado a cabo sobre la población ecuatoriana residente en Sevilla y Córdoba (España) en combinación con la aplicación de bases de datos nacionales e internacionales de composición de alimentos. Se estimaron los niveles de ingesta de nutrientes y el cumplimiento de las ingestas dietéticas de referencia (IDR) que se analizaron estadísticamente para los factores, género, edad, profesión y ciudad.

Resultados: según las IDR utilizadas, la distribución de macronutrientes y los niveles de ingesta de nutrientes fueron, en la mayoría de los casos, adecuadas. De manera destacada, se constató que los hábitos alimentarios ecuatorianos permanecieron en la población inmigrante, con el arroz como fuente principal de energía. Los niveles de ingesta fueron significativamente diferentes para diferentes nutrientes dependiendo del grupo de edad, sexo, lugar de residencia y ocupación profesional. Comparando estos datos con un estudio previo en Ecuador reveló que la población inmigrante en España presenta un mejor estado nutricional, si bien en ambas poblaciones se detectaron deficiencias en fibra, vitamina E, I y Se. En cuanto a estas deficiencias, los resultados no pueden considerarse concluyentes debido a limitaciones propias de las bases de datos (por ej. Se) y a la carencia de estudios adecuados que permitan una evaluación más precisa (por ej. estudios de larga duración para vitamina E).

Conclusiones: estos resultados evidencian que la población inmigrante ecuatoriana presenta un patrón alimentario más adecuado que el documentado para la población Ecuador. Estos resultados pueden ser útiles para

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data can be helpful to get further insight into the nutritional value of Ecuadorian diet and develop suitable nutrition intervention.

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Key words: *Ecuadorian diet. Food patterns. Dietary Reference Intakes. Immigration. Se. Folates. Vitamin E.*

Introduction

The Ecuadorian emigrant population constitutes the largest immigrant population group in Spain with an increasing trend over the last years. According to the Spanish Institute of Statistics (INE)¹, 406,333 Ecuadorians reside in Spain, which means 0.85 % of the Spanish population. The change of culture can also affect food habits of immigrant populations. It has been suggested that acquisition of new food habits of populations migrating from a country of food scarcity to a nation of food abundance such as Spain, could lead to the development of nutritional disequilibria. These are related to high fat and energy intakes, reduction in the complex carbohydrates and fiber, high simple sugar consumption and specific deficits of certain vitamins and minerals together with an excessive consumption of alcohol^{2,3}. Given the impact of immigration on food habits and in consequence of their health status, it is of relevant interest to assess the nutritional quality of the diet of Ecuadorians in Spain and the possible influence on the health and welfare of this specific subpopulation in Spain. So far, little nutrition and food habit information is available about these specific populations in Spain. Therefore, this information, if available, might be used to develop effective nutrition interventions, including educational programs or specific recommendations to mitigate certain nutritional deficiencies or unhealthy food habits in this specific population.

An appropriate tool to estimate food habits is the method of 24-h food recall which can help to obtain a good approximation to the real intake, provided questionnaires are applied on at least two different days (preferably 3) and none of them concerns weekend intake in which diet usually differs from the rest of the week. Following this, food pattern data of the studied diet can be turned into nutritional intake values through the use of food composition data bases, providing a preliminary assessment of the nutritional status of these population groups.

Aims

Therefore, the objective of this study was to determine food consumption patterns by means of a 24-h food recall survey of the Ecuadorian population in Andalusia (Spain) and, based on their outcomes, to carry out a nutritional assessment of their diet.

determinar el valor nutricional de la dieta ecuatoriana y desarrollar estrategias adecuadas de intervención nutricional.

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Palabras clave: *Dieta ecuatoriana. Patrón alimentario. Ingesta dietética de referencia. Inmigración. Se. Folatos. Vitamina E.*

Material and methods

Sample estimation and sampling location

Theoretical simple size was estimated based on statistics of the Ecuadorian population in Spain according to the Spanish Institute of Statistics (INE)¹, assuming an estimation error below 5% for a confidence interval of 90% according to the parameters used by the project PESA- FAO2007⁴ for central American population; the nominal section was carried out by means of simple random sampling of the population registered in the census⁵. The obtained result corresponded to 120 individuals residing in the region of Andalusia, from which data were collected in the cities of Seville and Cordoba which were considered a representative sample for this population in Southern Spain. The selected individual ages ranged between 14 and 69 years old and diverse professional occupations in Spain. The survey was carried out by means of 24-h food recall questionnaires, considering two different weekdays, and one during the weekend in different months over a year (three-month interval between interviews).

24-h food recall questionnaire design and food consumption data collection

The 24-h food recall questionnaire was designed to include contact information, food intake (i.e. breakfast, brunch, lunch, afternoon snack, evening snack and dinner), serving size (g), and type of serving. This information was collected to estimate consumption frequency, comparison with DRIs (Dietary Reference Intakes), deficit or excess of nutrients, and differences between distinct studied factors⁶. Regarding serving size, when possible, photographs and/or weight were taken from the dishes in order to contrast information given by respondents. Prior to the survey, interviewers were trained by researchers in order to standardize criteria and the data collection methodology.

Data treatment and nutritional assessment of the surveyed population

For the nutritional assessment, information from the 24-h food recall survey was tabulated in Excel (Microsoft, Redman). For conversion of food consumption

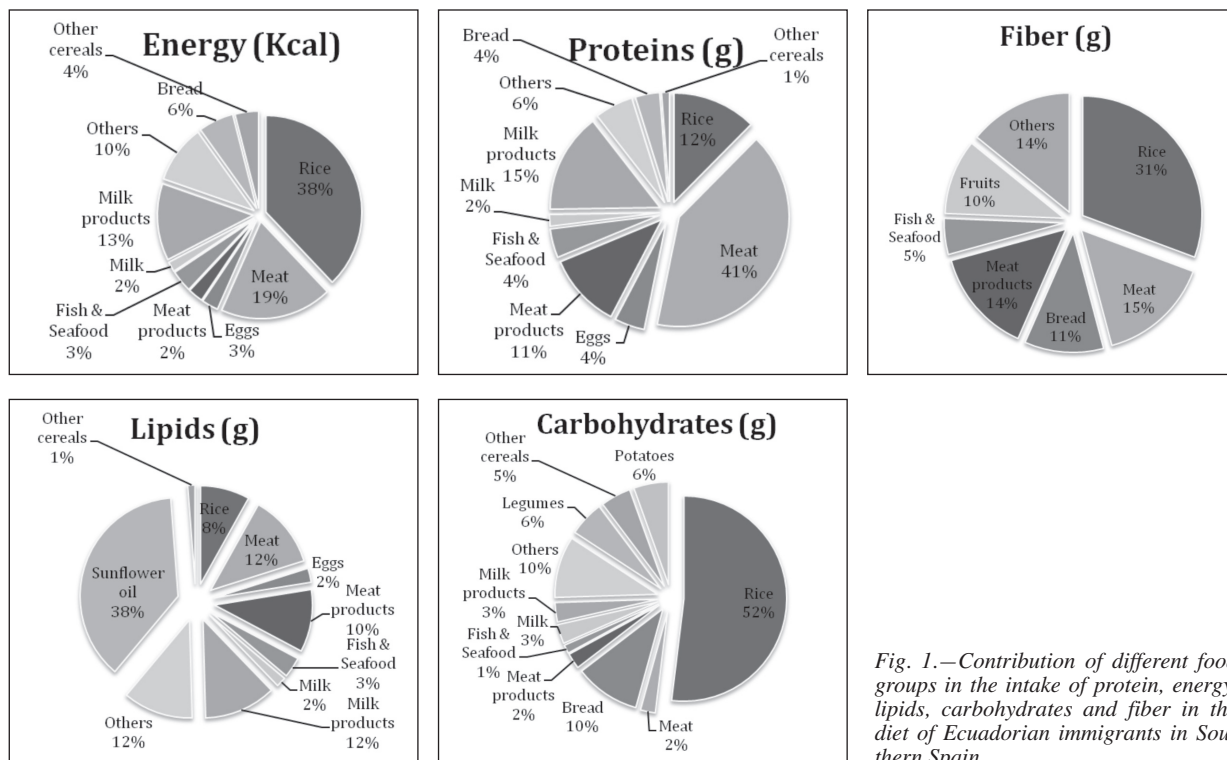


Fig. 1.—Contribution of different food groups in the intake of protein, energy, lipids, carbohydrates and fiber in the diet of Ecuadorian immigrants in Southern Spain.

data and dish formulations, included in the questionnaire, to nutrient intakes, *Nutriplato* software⁷ (www.nutriplato.es) was used based on the food composition data base for Spanish (BEDCA)⁸ foods together with values retrieved from other existing data bases (Latin-Food, USDA, and from scientific literature). Nutritional information was expressed in total energy and nutrient intakes per food and then added so as to obtain intake values for the time of day of food intake and whole day (i.e. daily). The latter was used for comparison with DRIs through the estimation of the percentage (%) of compliance with established DRIs (i.e. % DRIs). As exclusion criterion of biased responses to the questionnaire, inaccurate reports of energy intake were assessed by the method suggested by Willet & Lenart⁷. The dietary data were excluded for women, when <500 kcal / day or >3500 kcal / day were reported and for men, when these values were <850 kcal / day or >4000 kcal / day⁹. In addition, specific classification factors were considered for statistical study such as: sex (man and woman), age groups (14-19, 20-29, 39-39, 40-49, 50-59, 60-69), professional occupation (restaurants and services, administrative, farmers, construction workers) and city (Cordoba and Seville).

Application of Dietary Reference Intakes (DRIs)

For an estimation of the contribution of the studied diet to daily nutrient needs, DRIs proposed by Federación Española de Sociedades de Nutrición, Alimentación y Dietética (FESNAD)⁶ for the Spanish population

were applied to calculate the percentage of nutrient intakes with respect to these reference values. The used DRIs were “Recommended Intakes” which are defined as the intake of a nutrient that is recommended to meet the requirement of 97.5 % healthy Spanish population, expressed for person/day⁶. The exception was Na, whose DRI corresponded to the upper tolerable limit (i.e. safe intake) for this electrolyte. Therefore, conclusions for this electrolyte would be different if DRI were exceeded.

Statistical analysis

The statistical treatment was performed by means of the software SPSS 15.0 (Statistical Package for the Social Sciences) for Windows (Statpoint Technologies, Inc., Chicago). In order to identify differences in relation to %DRI, a multivariate factorial design was used (MANOVA), considering as factors: sex (male and female), age group, occupation, and city and as quantitative variables: energy, protein, lipids, carbohydrates, fiber and cholesterol; calcium (Ca), magnesium (Mg), phosphorus (P), sodium (Na), potassium (K), iron (Fe), selenium (Se), zinc (Zn), manganese (Mn), copper (Cu), iodine (I), vitamin A, vitamin E, ascorbic acid, thiamine, riboflavin, pantothenic, biotin, niacin, vitamin B₆, vitamin B₁₂, folates, saturated (SFA), monounsaturated (MUFA) and polyunsaturated fatty acids (PUFA); sugar (mono and disaccharides) and polysaccharides. This design allowed determining differences between levels of each factor. Multivaria-

Table I
Mean food intakes organized into different food categories in Ecuadorian immigrant population of Andalusia (Spain) based on a 24-h food recall

<i>Meat and meat products (g)</i>	<i>Seafood</i>	<i>Milk and Dairy products</i>	<i>Bread and Cereals</i>	<i>Legumes and nuts</i>	<i>Vegetables and fruits</i>	<i>Root vegetables</i>	<i>Sugar and sweets</i>	<i>Oils and fats</i>	<i>Non-alcoholic beverages</i>	<i>Alcoholic beverage</i>
[236.18] ¹	[73.55]	[186.81]	[467.8]	[51.1]	[266.1]	[132]	[25.7]	[17.2]	[756.4]	[110.25]
Beef 79.05	White fish 20.55	Skimmed milk 7.4	White wheat bread 112.8	Legumes (lentils, frijols) 45.3	Ají (ecuadorian pepper) ² 1.8	Potato 87.3	Refine sugar 11.1	Sunflower oil 10.5	Coffee 150.8	Beer 100.3
Pork 42.2	Oily fish 1.0	Whole milk 89.9	Whole wheat bread 5.2	Peanut 5.8	Cabbage 7.0	Yuca 12.6	Brown sugar 0.6	Olive oil 6.7	Chocolate 45.3	Wine 7.25
Poultry 86.43	Freshwater fish 20.04	Semikim-med milk 9.61	Rice 311.0		Lettuce 28.3	Plantain 33.1	Candies and sweets 6.4	Palm oil 6.7	Sodas 242.1	Spirit drink 2.7
Goat 1.6	Tuna 20.3	Fresh cheese 39.6	Pasta 35.7		Pepper 21.3		Honey 1.0		Tea 68.1	
Cow liver 6.1	Sardine 4.4	Hard/semi hard cheese 1.2	Choclo 3.1		Tomate 52.6		Mermelade 6.6		Fruit juices 250.1	
Cow intestine 4.7	Prawns 6.9	Skimmed youghurt 0.9			Carrot 33.0					
Pork intestine 2.1		Whole youghurt 36.4		Spanish fruits 67.6						
Other parts 2.7		Butter 1.8		Guineo 46.9						
Ham 14.3				Avocado 6.5						
Sausages 22.4				Tamarillo 1.1						

¹ Total intake (g) for the food category; ² Ecuadorian pepper variety

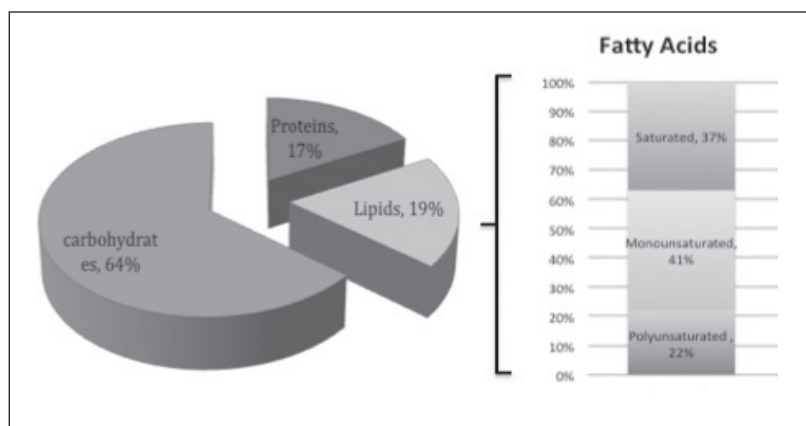


Fig. 2.—Distribution of energy over macronutrients in the diet of Ecuadorian immigrants in Southern Spain.

Table II
Mean and Standard deviation for % Dietary Reference Intakes (DRIs) for men between age groups

	Age group					
	14-19	20-29	30-39	40-49	50-59	60-69
Energy	96%	92%	101%	104%	128%	128%
Protein	161%	158%	164%	158%	190%	190%
Lipid	120%	116%	108%	119%	137%	137%
Carbohydrates	94%	87%	111%	110%	130%	130%
Fiber	47%	46%	56%	49%	72%	72%
Ca	105%	88%	99%	104%	107%	107%
Mg	104%	95%	105%	109%	102%	102%
P	224%	197%	221%	228%	232%	232%
Na	352%	305%	388%	356%	415%	415%
K	94%	88%	101%	96%	103%	103%
Fe	143%	157%	189%	173%	203%	203%
Cu	131%	102%	115%	107%	89%	89%
Zn	94%	99%	120%	108%	137%	137%
Mn	209%	331%	236%	211%	309%	309%
I	72%	68%	52%	58%	76%	76%
Se	49%	66%	48%	42%	93%	93%
Tiamin	151%	132%	171%	152%	190%	190%
Riboflavin	120%	67%	74%	75%	127%	127%
Niacin	252%	200%	230%	219%	267%	267%
Vit B6	151%	133%	146%	145%	150%	150%
Folic ac.	90%	72%	82%	85%	107%	107%
Ascorbic ac.	226%	228%	234%	255%	303%	303%
Vit A	173%	101%	108%	102%	229%	229%
Vit E	42%	53%	43%	42%	51%	51%
Cholesterol	109%	111%	95%	111%	152%	152%

te models were built on the basis of the social-economic, cultural and personal indicators described above¹⁰. When significant differences were found for more than two classification factors, a post-hoc analysis was performed based on a multiple range Tukey test with a significance level of 95% ($p < 0.05$).

Results

An assessment of the foods most consumed by Ecuadorian immigrant population was carried out based on the 24-h food recall survey. In Table I, consumption data evidence that the Ecuadorian population, immigrant in Spain, still maintains original^{11, 12} Ecuadorian food habits since, for example, average rice consumption was high, with 311 g/day. In addition, a noticeable consumption of yucca or manioc and banana was ob-

served, but it was in smaller amounts than those found in Ecuador due to probably lower availability and higher prices on the Spanish market^{13, 14}. Regarding new food habits acquired in Spain due to the culture shock, pork meat, bread and pasta among others showed considerably high consumption level in comparison with those found in Ecuador¹³.

Translating these consumption levels into nutrient intakes (Figure 1), it can be observed that the food category with the highest contribution to protein intake was meat and meat products. Energy was mainly obtained from rice, meat and meat products and bread and carbohydrates were obtained from rice and bread¹³. Lipid contribution was mostly derived from sunflower oil and other oils, meat and meat products and milk products. Looking at the fatty acid profile, saturated and monounsaturated fatty acids were obtained from pork, poultry and beef meat and polyunsaturated

Table III
Mean and Standard deviation for % Dietary Reference Intakes (DRIs) for women between age groups

	Age group				
	14-19	20-29	30-39	40-49	50-59
Energy	139%	110%	139%	136%	140%
Protein	236%	190%	201%	197%	198%
Lipid	153%	122%	143%	147%	153%
Carbohydrates	147%	115%	158%	141%	143%
Fiber	73%	66%	87%	81%	79%
Ca	99%	98%	100%	103%	84%
Mg	112%	118%	124%	99%	103%
P	200%	193%	221%	215%	194%
Na	369%	310%	390%	307%	370%
K	95%	89%	103%	100%	86%
Fe	91%	81%	86%	100%	95%
Cu	105%	103%	98%	83%	101%
Zn	146%	149%	163%	150%	145%
Mn	443%	328%	366%	238%	204%
I	58%	61%	65%	57%	52%
Se	40%	54%	62%	43%	41%
Tiamin	190%	149%	203%	199%	153%
Riboflavin	99%	109%	109%	127%	114%
Niacin	286%	258%	302%	269%	249%
Vit B6	167%	163%	191%	178%	151%
Folic ac.	81%	86%	87%	88%	60%
Ascorbic ac.	208%	290%	189%	283%	176%
Vit A	159%	211%	143%	189%	115%
Vit E	25%	35%	54%	48%	36%
Cholesterol	82%	83%	115%	124%	97%

fatty acids from sunflower oil. Finally, cholesterol was obtained from eggs, poultry and pork meat and Ca intakes from yoghurt and whole milk.

Macronutrient distributions in diet

According to national and international recommendations, macronutrient distributions are adequate in the diet studied. In figure 2, average distributions for carbohydrates, proteins and lipids with respect to their energy contribution are represented. Regarding the fatty acid profile, the major contribution to the energy intake was observed in monounsaturated fatty acids (41%), followed by saturated fatty acids (37%), and finally by polyunsaturated fatty acids (22%). The lipid contributions exceeded the recommended maximum intake of 10% diet calories.

Fulfillment of DRIs in the diet of Ecuadorian immigrants in Spain

Overall, results indicated that Ecuadorian immigrants in Spain show relatively high intakes for most nutrients, fulfilling DRIs, although some exceptions were found that will be commented below (Table II and III).

The statistical comparison of %DRIs between men and women indicated that women showed higher % DRI ($p < 0.05$) for energy, proteins, lipids, carbohydrates, fiber, Zn, riboflavin, niacin, and vitamin B6 except for Fe, which was higher for men.

Looking at % DRI within men (Table II), proteins, P, Na, Fe, Cu, Mn, thiamin, niacin, vitamin B6, ascorbic ac. and vitamin A are provided in diet at levels above DRIs for all age groups. Moreover, intake levels for energy, lipids, carbohydrates, Ca, Mg, K, Zn, fola-

Table IV
Mean and Standard deviation for % Dietary Reference Intakes (DRIs) of those nutrients showing significant differences between age groups

	Age group					
	14-19	20-29	30-39	40-49	50-59	60-69
Energy (Kcal)	117.5±35ab	100.1±20.9a	112.7±28.3ab	113.8±27.1ab	134.2±36.9b	140.4±25.3b
Carbohydrates (g)	120.7±40.7ab	100.4±29.3a	125.2±35.7ab	119.4±35.4ab	136.4±42ab	158.2±24.6b
Se (mg)	44.4±19ab	60.3±30.8ab	52.3±36.4ab	42.1±27.2ab	67±49.8b	29.7±21a
Riboflavin (mg)	109.3±20.1ab	86.6±34.7ab	84.8±31.5ab	90.2±42.5ab	120.2±48.6b	76.2±32.5a

¹Letters in rows show homogenous group derived from the multiple range Tukey test (p<0.05).

Table V
Mean and Standard deviation for % Dietary Reference Intakes (DRIs) of those nutrients showing significant differences between professional occupations

	Professional occupation			
	Administration	Construction workers	Restaurants and services	Farmers
Energy (Kcal)	115.3±24.2ab1	110.8±28.3a	129.5±32.3b	105.2±31.9a
Proteins (g)	183.4±41.7ab	163.8±38.7a	193.4±31.5b	167.4±42.2ab
Lipids (g)	133.3±39.5b	125.2±41.5ab	135.8±37.2b	109.9±34.3a
Fibers (g)	63±23.4ab	58.8±18.7a	74±23.3b	57.9±24.9a
Iron(mg)	139.6±60.1ab	168.6±53.2b	138.2±71.4a	133.4±42.6a
Zn (mg)	125.4±34.9ab	124.3±31.2ab	143.1±32.8b	116.4±35.3a
Riboflavin (mg)	94.2±35.9ab	87.7±40.8ab	106.2±42.4b	81.3±30.1a
Niacin (mg EN)	241.3±58.9ab	238.3±49.9ab	275.6±65.3b	217.2±59.3a
Vitamin B6 (mg)	150.4±30.9ab	159.9±44.8ab	169±39.3b	134±40.5a
Folic Acid (ug)	82.5±23.5ab	86.2±23.5ab	89.6±31b	72.3±16.4a

¹Letters in rows show homogenous group derived from the multiple range Tukey test (p<0.05).

tes and cholesterol were considered adequate (>≈90% DRIs). However, a clear deficiency was detected for fiber, I, Se and vitamin E. For women, in table III, it can be noted that %DRI exceeded 100% in all age groups for energy, protein, lipids, carbohydrates, Mg, P, Na, Zn, Mn, thiamine, niacin, vitamin B6, ascorbic acid and vitamin A. There were values close to 100% that varied depending on age group in Ca, K, Fe, riboflavin, and cholesterol. Diet was deficient in fiber, I, Se, vitamin E and slightly on folates, especially for the age group of 50-59 years.

Concerning the statistical test applied to the factor "age group", this reported that the 60-69 years group obtained the highest %DRI for energy, carbohydrates (Table IV). The age group showing the lowest %DRI corresponded to the 20-29 years group. In Se and

riboflavin intakes, the 50-59 years group showed the highest %DRI, while 60-69 years in men showed the lowest value (Figure 3). There were no significant differences for the rest of nutrients.

In regards to professional occupation, statistical analysis showed that restaurant and services workers showed the highest %DRI for energy, protein, lipids, fiber, Zn, riboflavin, niacin, vitamin B6 and folates. In Fe, construction workers showed a higher intake. On the contrary, farmers obtained lower %IDR for most of these nutrients (Table V). For the rest of nutrients, there were no significant differences.

The place of residence significantly affected %DRI levels for certain nutrients (Figure 3). Cordoba showed the highest %DRI levels of energy, lipids and Na while Seville obtained higher %DRIs for Se, pantothenic and

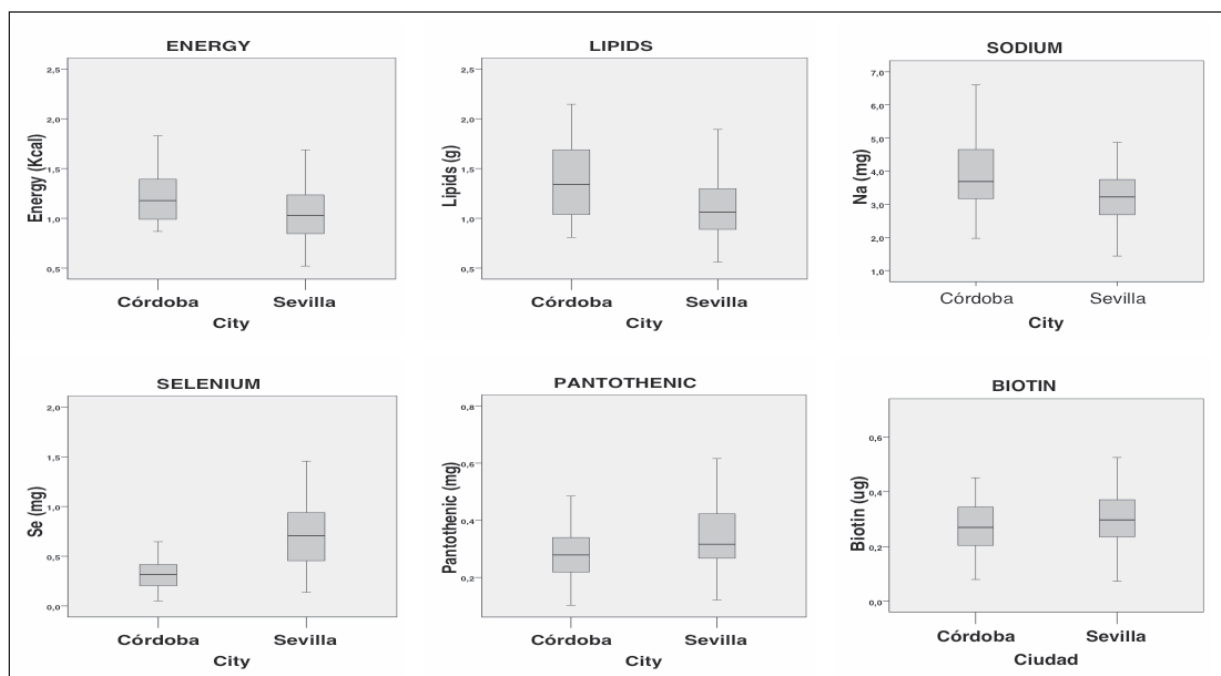


Fig. 3.—Mean Difference of nutrient intake considering the city of residence Córdoba and Sevilla.

biotin. The rest of nutrients were statistically similar for the different populations surveyed.

Discussion

No previous studies have been found regarding the consumption patterns of the Ecuadorian population in Spain. Therefore, results derived from this work are of special relevancy to assess intake levels of this population and provide recommendations, if needing.

Regarding the quality of the ingested fat, it can be assessed by the ratio between the sum of monounsaturated and polyunsaturated fatty acids and saturated fatty acids, which was over 2. This value is in agreement with recommendations given by national and international organisms^{11, 12}. This fact supports the fact that the lipid percentage in diet may be in the range 30-35% as recommended for diets with a high content of monounsaturated fatty acids.

The intake level for Fe was high for men as compared to women. This difference is expected since although intakes were similar for men and women, recommendations are usually lower for women, except for Fe whose DRI is much higher for women than for men (15-18 and 9-10 mg/day, respectively).

One of the main concerns arisen from the present study was the high intakes detected for Na which were higher than the upper tolerable limits for Na, whose value was used as criterion in this work. High Na intake are usually associated with cardiovascular diseases and hypertension³.

Concerning I and Se, intakes were above 50% DRI and for Se, in some specific cases, reaching nearly 100%. The combination of selenium and iodine deficiency is considered a potential determining factor in the development of the myxedematous or nervous form of endemic cretinism¹⁵. However, these results should be taken with caution regarding their possible impact on public health since food composition data bases usually lack reliable information for these elements resulting in more uncertain intake estimates. In the case of Se, the type of soil where foods are obtained is determinant for the Se content in foods. For I content in foods, the type of salt used in processed foods (i.e. iodized salt, mineral or marine salt) is also an important factor affecting variability in I content, which is barely included in food composition data bases or determined through 24h food recall surveys. Finally Vitamin E intakes were below their DRI. However, once again, limitations in food composition data bases is a probable cause of this result, since not all chemical forms of vitamin E with biological activity are included or reported for all ingredients. In addition, given that it is a liposoluble vitamin, a sporadic high consumption can still ensure an adequate intake due to its bioaccumulation in tissues acting as reservoirs (e.g. adipose, liver, muscle, etc.)¹⁶; however this fact is barely detected in surveys based on the 24-h food recall method and it would be better assessed in mid-term studies where daily diet is surveyed for longer periods.

Regarding fiber, the study showed a diet with intake levels below 70% DRI. This can be related to a lower consumption of vegetable and fruits. This fact is usually observed in poor and developing countries¹⁷,

which also occurred in the Ecuadorian immigrant population in Spain (Table I). In addition, the types of cereal consumed could significantly affect fiber intake. For example, the most consumed cereals in this study corresponded to white rice and bread (Table I) in which fiber content is expected to be lower. In contrast to this, legumes, being considered a significant source of fiber, showed a high consumption in our study, even over the levels observed in the Spanish population¹⁸.

Finally, results indicated that farmers and construction workers had lower % DRI than administration and restaurant and services workers, even though in most cases they were above 100 %. These differences could be rather associated with culture aspects, specific food consumption habits or lower income associated with these professions. Specially, the latter becomes relevant due to the economy crisis undergone by Spain in the period in which survey was carried. This situation strongly affected construction increasing the unemployment rate related to this profession hence reducing purchasing power. This fact could have reduced the consumption levels in families dependent on construction sector which could have led to a lower % DRI although as above-mentioned, still fulfilling DRIs for most of the nutrients.

Conclusions

Results indicated that nutrient intake levels for the Ecuadorian immigrant population in Spain were moderately high for most studied nutritional components showing, in general, more appropriate food patterns as compared to Ecuador. Nevertheless, deficiency in fiber, vitamin E, I and Se were observed in the diet of both populations, although limitations in food composition data bases for these elements and other pitfalls inherent to the 24-h food recall method did not allow a more definitive conclusion regarding this outcome. Finally, the results in the present study could be helpful to derive recommendations or nutrition intervention strategies for the Ecuadorian population in Spain.

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