Nutrición Hospitalaria

Original/*Valoración nutricional*

Nutritional content of foods offered and consumed in a Spanish university canteen

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Abstract

Objective: The prime objective of our work was to study the eating habits at lunchtime of staff and students at a University of "hidden due to confidentiality"of Spain. The second one was to attempt to reduce the energy consumption of cholesterol and fat in the diet of those groups.

Setting: The study was made between 2010 and 2012 in the main canteen serving food at this university, focusing on food intake at lunch, the main meal of the day, containing between 35 and 40% of the total calories ingested throughout the day.

Subjects: A total of 9530 observations were made, each one corresponding to the nutritional valuation of food eaten (a complete lunch) per person, by students, teachers and service personnel.

Design: The study was carried out in 5 intervention stages and a previous non-intervention one to establish the habitual food intake of these groups. In each stage the nutritional information supplied to canteen users was increased to that in the final stage a modification of the price of the menus served was made.

Analysis: The food choices freely made by the groups were converted into the amount of nutrients by means of a prior nutritional evaluation of the dishes offered via their calculation using the database Nutriplato®. This permitted the evaluation of 29 nutrients which, taking the user data observed, were converted into % of contribution to the RDA (per each population group), which produced a standardization of the data, permitting a subsequent statistical study by the GLM (SPSS v15) procedure to assess the effect of the different factors contemplated.

Main Outcome Measure(s): The following were taken into account as classification factors (independent variables): sex, age group and level of body fat, as well as the intervention stage. The dependent variables were: energy, protein, lipid, carbohydrate, fiber, Ca, Mg, P, Na, K, Fe, Cu, Zn, Mn, I, Se, vitamins: B1, B2, B3, B5, B6, B8, B9, B12, C, A, D, E and cholesterol.

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CONTENIDO NUTRICIONAL DE ALIMENTOS OFRECIDOS Y CONSUMIDOS EN UNA CANTINA UNIVERSITARIA ESPAÑOLA

Resumen

Objetivo: El primer objetivo de nuestro trabajo fue estudiar los hábitos alimentarios durante el almuerzo en la Universidad de Córdoba. En segundo término se trató de reducir el consumo energetico de colesterol y grasa en la dieta de dicho colectivo.

Marco: El estudio se realiza entre los años 2010 al 2012 sobre la principal cantina en la que se sirve comida en esta Universidad, centrándonos en la toma de alimento del almuerzo, que es la principal toma alimentaria a lo largo del día, suponiendo entre el 35 y 40% del total de calorías ingeridas a lo largo del día.

Muestras: Se han abordado un total de 9530 observaciones que corresponden cada una de ellas a la valoración nutricional de una toma de alimento (almuerzo completo) por estudiantes, profesorado y personal de servicios.

Diseño: El estudio se desarrolló en 5 fases de intervención y una previa en la que no se intervino, esta última se utilizó para establecer las ingestas habituales alimentarias del colectivo. En cada fase se incremento la información nutricional suministrada a los usuarios de la cantina, para en la fase final, desarrollar también una modificación del precio de los menús servidos.

Análisis: Las elecciones alimentarias que realizaban los universitarios de forma libre fueron transformadas en cantidad de nutrientes mediante la valoración nutricional previa de los platos, desarrollada por cálculo mediante la base de datos Nutriplato®. Esto permitió evaluar 29 nutrientes que a partir de los datos observados de los usuarios se transformaron en % de aporte a la RDA (de cada grupo de población) lo que produce una estandarización de los datos que permitió un estudio estadístico posterior, mediante el procedimiento GLM (SPSS v15) para evaluar el efecto de los diferentes factores contemplados.

Principales medidas tomadas: Se tuvieron en cuenta como factores de clasificación (variables independientes): sexo, grupo de edad y nivel de grasa corporal, así como la fase de intervención. En cuanto a las variables dependientes fueron: energia, proteina, lípidos, carbohydratos, fibra dietética, Ca, Mg, P, Na, K, Fe, Cu, Zn, Mn, I, Se, vit: B1, B2, B3, B5, B6, B8, B9, B12, C, A, D, E y colesterol.

Result: The mean energy and cholesterol intake was significantly reduced in the individuals investigated in the last two intervention stages. Moreover, those last two stages were statistically differentiated, the last one being that which presented the lowest intake of those nutrients. As positive collateral effects, although this was not a priority objective in the study, a greater statistically significant intake of vitamin D, B9, dietetic fiber, and calcium and a lower intake of sodium with respect to the initial stages were noted.

Conclusions and implications: Our conclusions go in two directions: the positive effect of the nutritional information and the need to complement that information with economic measures that encourage still further food changes in population groups whose purchasing power is not very great.

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Key words: *Canteen lunch. Young adults. Food choice. Catering. Healthy eating.*

Resultados: La ingesta media de energía y colesterol se redujo significativamente en los individuos investigados en las dos últimas fases de intervención, pero además estas dos últimas fases se diferenciaron estadísticamente, siendo la última la que presentaba la ingesta de estos nutrientes más bajas. Como efectos positivos colaterales, aunque no era un objetivo prioritario del estudio se observó una estadísticamente significativa mayor ingesta de vitamina D, B9, fibra dietética, calcio y una menor ingesta de sodio, respecto a las fases iniciales

Conclusiones e implicaciones: Nuestras conclusiones son en dos sentidos: el efecto positivo que tiene la información nutricional y la necesidad de complementar dicha información con medidas económicas que incentiven aún más los cambios alimentarios en poblaciones cuyo poder adquisitivo no es muy elevado.

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Palabras clave: *Almuerzo. Cantina. Adultos jóvenes. Elección alimentaria. Catering. Alimentación saludable.*

Abbreviations

RDA: Recommended Dietary Allowance.

Introduction

The university is a place for intellectual and professional training but it also has to concern itself with other spheres of human qualities in favor of the users of its facilities. The Andalusian Network of Andalusian Universities (RAUS), which encompasses all the universities in the Autonomous Government of Andalusia, promotes several actions oriented towards improving the health habits of both university teachers and students.

One of these initiatives is the Healthy Food program at our University of "hidden due to confidentiality". The latter has over 18000 students, over 1500 teachers and about 750 administration and services staff. Nearly a third of these three groups carries out its activities in the main Campus. In this campus there are four catering centers, out of which the classroom canteen, for its size and location, serves approximately half the meals available in the campus. The Campus is located at 6 km from the city of "hidden due to confidentiality"and there is only an industrial estate in its surroundings so that eating options are very limited. Moreover, the degree subjects offered are taught both mornings and afternoons, so that many students, teachers and other personnel need to eat lunch at the Campus. For this they usually either bring food from home or eat in the Campus canteens. According to a survey conducted prior to the study, 85% of the respondents ate in the canteens at least 3 times a week and the remaining 15% ate home-cooked food.

During the study period the mean daily affluence of users of the classroom canteen in which the study was made was of 150 people daily.

Papadaki et al.[1], reported that when students left home to study at university the quality of their diet deteriorated. According to Durá Travé and Castroviejo Gandarias[2], 76% of the college students investigated by them in another Spanish region needed to improve their eating patterns, and these authors suggested that nutritional education programs for college students should be instigated. More alarming data were supplied by Nilufer Acar Tek et al.[3] who, in a study on somewhat lower age groups, indicated that 43% of the young people presented bad eating habits and the rest needed to improve theirs. Among the bad habits, one which stood out was skipping lunch according to Neslisah and Akal Emine[4] by up to 25% of students between 19 and 24 years of age; these authors also declared the need for an intervention in this group. Lachat et al.[5] checked the selection of foods in Belgian universities and verified that the nutrient profile of food eaten was highly correlated with what was offered and proposed changes in that offer, increasing supplies of vegetables and fruit and reducing fat and salt intake. Nedaa & Al-Khamees[6] in an intervention study proved the efficacy of nutritional information on eating habits in college students. The effects of good dietary guidelines at university were demonstrated in the work of Guagliardo et al.[7], who reported that 33% of students of between 18 and 24 who ate regularly at the university obtained adequate amounts of fruit, vegetables, fish and meat. This study also showed that the strata with a lower economic level had a less suitable diet.

In view of the above, the current study had two aims: to study the eating habits of the population at "hidden due to confidentiality" University when making use of the canteens, and, besides that, to interve-

ne in that consumption in order to improve the food's nutritional quality based on three criteria: total calory intake, contribution and quality of fat, and the contribution of cholesterol. For this purpose, the food consumed was evaluated with data selected in the queue of the self-service buffet in the classroom canteen.

Material and methods

The study was conducted at "hidden due to confidentiality". It began in 2010 and ended in 2012, in the area of the college catering establishments, with a total of 9530 observations each one corresponding to the complete consumption of luncheon food per person and per day. Lunch is the main meal in Spain and it represents approximately 30-35% of the daily calory intake of young people[8].

It is important to note that the canteen customers can choose between eating mixed platters or sandwiches, or, conversely, going through the canteen buffet. Given that it is less possible to act on either mixed platters or sandwiches, this study focused on the canteen buffet, in which there are two options: the "menu of the day" in which two choices of the first course and two choices of the second one are offered; and the "student's menu" with a special low price but in which only one first and one second course are offered. In both menu types a drink, bread and a dessert are included. In the annotations of each observation, information was collected on which choice each individual made of each component of his/her menu: first course, second course (with main item and its garnish), bread, dessert, drinks and sauces or supplements (for example, (extra French fries) which made up that lunch. In each observation the individual studied is classified in terms of gender, age group (18-25 years >25 years) and according to their visible fat reserve (-1: slim/0: normal weight/+1 overweight).

Prior to carrying out the study, the users had no nutritional information on the dishes or had any design of the menus based on their nutrient supply.

Actions prior to conducting the study

Gathering information about the dishes served: We collected details of all the ingredients and of the preparation of the dishes usually served in the canteen, both the meals and snacks, and the food in the buffet. The information collected was transformed into nutrients through the program Nutriplato[9]. Battistini et al.[10] came to the conclusion, in their study on college students from Modena, that the use of computing tools for nutritional assessment of this population is an effective and cost saving alternative compared to laboratory analysis.

A classification of the nutritionally evaluated dishes was made depending on their nutritional contributions.

This classification was based on nutritional adequacy criteria taking the total intake of calories, fat, and type of fat, cholesterol and sodium. Thus, all the dishes were encompassed within one of the four following categories: "highly recommended", "recommended", "not recommended" and "occasional consumption". This classificationwas used only to provide nutrition information, in some of the phases, to users but not as a tool for nutritional study.

Data Collection

Data collection consisted of taking notes of the choice each user made in the self-service queue, as if a mere accounting or administrative control was being carried out. Each observation consisted of a starter, main course (main ingredient and its garnish), bread, dessert, drink, coffee and extra elements (sauces: ketchup, mayonnaise, etc., serving of French fries, etc). Along with consumer data classification , data including gender, body fat assessment (assigning -1 to the people who were underweight , 0 people of normal weight and +1 to people who were overweight), age group (making a group of 18-25 year olds and people over 25 years) were also collected.

Consumption data were crossed with the composition of the dishes using MS-Access, to obtain the nutrient intake of each individual . They were given a subroutine for processing each ingredient of the menu depending on its nutritional contribution. Later, calculations of the ingredient aggregation were performed per individual / day for nutrient intake data in each observation.

Development and intervention study

Between 2010 and 2011, a food consumption sampling of all users of the canteen in the self-service section was carried out on the days established previously by design phases described below. The total number of individuals / shots made was 9530.

– Phase 0: annotations were only made about which food people selected in the self-service section, without their knowing that the investigation was being made and why they were being asked for such information.

– Phase 1: the annotations of food consumption continued, but during this period a survey on adherence to the Mediterranean diet and anthropometric assessments were made simultaneously .In addition, the leftovers that remained in the trays after lunch was eaten were assessed. Although at no time was a direct link between these actions and consumer data collection expressed, we believe that it exerted a psychological pressure on

the importance of healthy eating. Furthermore, these data were used as the basis for comparing the consumption information collected.

– Phase 2: continued with the annotation of food consumption but provided relevant information on the self-service section in the form of a logo that identified nutritionally recommended dishes (only the category "highly recommendable" of the four that were classified from all the foods tested). The possibility of composing a menu of highly recommended healthy food was ensured, but it did not propose the whole menu and only pinpointed items among the eligible ones.

– Phase 3: the annotation of food consumption was accompanied on this occasion by more nutrition information in the self-service queue, identifying dishes that belonged to the three most favorable categories (obviously the non-labeled dishes were not recommended, but this rejection of them was not expressed). Simultaneously, on some television screens placed in the dining room during the meal, the nutritional profile of all the dishes offered that day in the self-service section was shown, indicating the most important nutritional characteristics in accessible language and clarifying the benefits of foods recommended as opposed to nutritional disadvantages in the less desirable dishes

– Phase 4: the food consumption score was complemented by a healthy menu proposal designed to be nutritionally adequate. Therefore, menus consisted of a starter and a main course, bread, a drink and dessert / coffee. In this phase, the nutritional information was still provided daily through the TV screen and logos identifying the nutritional recommendation grade of each dish using the 4 categories designed.

– Phase 5: The annotation was made on the basis of two menus: the daily menu that was again the traditional normal price, and the healthy and reduced price menu which was the only one that the students could enjoy at such a low price. The nutritional information continued to be provided daily through the TV screen and recommendation logos based on the nutritional intake with 4 categories. At this stage, the swapping of food between menus was allowed, but in this case there was no price reduction.

The idea behind the design of the healthy menus was to reduce caloric, lipid, cholesterol and also salt intake. Basically, both the first and main courses were selected with these criteria, the usual offer of French fries was changed for various other options such as plain rice, sauteed vegetables, cooked or baked potatoes, or lettuce and tomato salad. The drink choices were water, juice, isotonic drinks, tea, beer, wine or gazpacho (tomato and water-based drink, typical of southern Spain); for dessert, the choices were fruit, yogurt and coffee.

The data collected were not comparable between the different gender and age groups, as their nutritional recommendations were different. Moreover, in using different quantification units for different nutrients, we were not able to make direct comparisons between them. Therefore, we proceeded to standardize the data by calculating the input of each nutrient with respect to the IDR recommended in the Spanish population[11]. For a better fit, we used nutrient ratio data corresponding to a regular lunch intake obtained from the Spanish Nutritional Dietary Intake Study[12]. Applying both standardization criteria, if values close to 100% were obtained this indicated the fitness of the nutrient contribution to the IDR of the lunch for the population group ; values clearly below 100% were indicative of a deficiency in the supply; and, on the contrary values exceeding 100% showed an excessive input of the nutrient. Obviously, these inputs must be understood as being in the context of the effects of the lack and excess of every nutrient investigated.

Results and discussion

The results obtained have permitted an evaluation of the content of nutrients provided by food selections made by canteen users in the different phases of the study.

Food choices for college lunch have been converted into nutrients by calculation using Nutriplato® and therefore, each observation actually comprises 29 nutrients, which were then transformed into % RDA.

We used the GLM procedure (SPPS v15) to evaluate the impact of different effects on the variables. First , a multivariate study was conducted by 4 classical tests: Pillai, Wiks Lambda, Hotelling's Trace and Roy's largest root applied to all variables (% of RDI for all nutrients) as a whole as opposed to factor classification. The results show that all the rating factors (stage, gender, age group and classification) and their interactions gave significant differences (p <0.01), except for some 3rd level interactions, which were only p <0.1.

After evidencing the effect of the factors on the variables globally, we proceeded to study the effect of these factors on each of the% RDI of nutrients individually. Again, we used the GLM procedure that gave the results reported in table I. As can be seen, the phase factor provided statistically significant differences in most of the contributions to the recommended daily intake of nutrients. Next was the gender factor, and the one least statistically represented was the ranking factor.

With regard to the interaction of these factors, only some significant differences were found in the case of phase vs. gender group interaction for Ca, Fe, Zn and Cu, B8, Vitamin D and Vitamin E. In the case of the in-

Nutrient	Phase	Sex	Age group	Assessment
Kcal	***	***	n.s.	n.s.
Protein	***	***	***	n.s.
Lipid	***	***	n.s.	n.s.
Carbohydrate	***	***	n.s.	n.s.
Fiber	***	***	***	n.s.
Ca	***	***	***	n.s.
Mg	***	***	n.s.	n.s.
P	***	**	n.s.	n.s.
Na	***	**	n.s.	n.s.
K	**	n.s.	n.s.	n.s.
Fe	***	***	***	n.s.
Cu	***	*	n.s.	*
Zn	***	***	n.s.	n.s.
Mn	n.s.	n.s.	**	n.s.
I	***	n.s.	***	n.s.
Se	n.s.	**	*	n.s.
B1	n.s.	n.s.	n.s.	n.s.
B2	n.s.	n.s.	n.s.	n.s.
B3	***	***	n.s.	n.s.
B5	***	**	***	n.s.
B6	***	***	n.s.	n.s.
B8	***	**	***	n.s.
B9	***	n.s.	**	n.s.
B12	*	n.s.	n.s.	n.s.
VitC	***	n.s.	***	n.s.
VitA	***	***	***	n.s.
VitD	***	n.s.	n.s.	n.s.
VitE	***	*	**	n.s.
Cholesterol	**	n.s.	n.s.	n.s.

*** p<0.001
** p<0.01
* p<0.05
n.s p>0.05

teraction phase x age group, the differences were found mainly in the group of fat soluble vitamins and water soluble ones except for B1, B2 and B3. The remaining interactions were, with one exception, not significant.

From the results of the GLM studies it was easy to extract the groups that had a higher or lower% RDI, by making a simple observation of the means in the case of the Gender and Age Group, due to presenting only two classification groups. In contrast, for the intervention factor, Tukey Post host studies (p <0.05) were necessary for each nutrient. In general, it was found that the last two phases of the intervention (4 and 5) formed an independent homogeneous group presenting lower levels of energy intake, lipids and cholesterol, which was the fundamental objective of the study and intervention. Namely, the energy, lipid and cholesterol intake was significantly lower in individuals investigated in these last two intervention phases. Simultaneously, there were other beneficial side effects that, although they were not the fundamental objective of the intervention, also had an influence on its improvement. For instance, the last three intervention phases differed significantly (p> 0.05) with a greater intake of vitamin D, the last two phases displayed a higher intake of vitamin B9, the fifth phase a lower sodium intake and increased fiber intake, and phases 2-5 a greater input of Ca with respect to 0 and 1 that were different homogeneous groups.

% RDA results of energy, lipids, cholesterol and sodium are shown in table II, for classification factors exhibiting a greater differential effect (stage, gender and age group).

Our results agree with those indicated by Lachat et al.[5], who postulate that a significant impact on food supply selection is made in university canteens. Moreover, they also match those given by Burton et al.[13], who observe that consumers of the quick service restaurant menu, have a scant capacity to estimate the quality of their meals in terms of calories, fat and sodium, which is more marked in the less healthy menus, with nutrition labeling of food having an unequal effect on the choice made by those consumers. According to Riddell et al.[14] the perception of students is that they usually eat a healthy diet, which, however, is usually not fulfilled in terms of saturated fat and sodium; in our survey of adherence to the Mediterranean diet by Kidmed test[15] we also obtained high adhesion results (between 6.40-7.28 on average per year) even higher than those reported by Dura Trave & Castroviejo Gandarias[2]. However, simply improving their nutritional training in our study showed itself to be insufficient; Blades & Al-Khamees[16] report that simple nutritional knowledge does not necessarily mean the choice of a healthy menu. This argument is also supported by Hoefkens et al[16], who say that, indeed, the posting of nutritional information in university canteens did not change meal choices and nutrient intakes; despite the intervention, meal choices were largely determined by the meals offered. Therefore, nutrition-information interventions in canteens may be more effective with a healthier meal supply. Our idea of providing nutritional information and offering healthier menus at a reasonable cost may be the best way of improving the nutrition at our university. In any case, this economic aspect should not be overlooked, because, as indicated by Guagliardo et al.[7], this issue is an influential factor in college student food quality.

Table II

Percentage of the RDA for the lunch food selection covers the university students for energy, fat, cholesterol and sodium

	Man			Woman			Total
	adult	young	total	adult	young	total	
Phase 0							
Kcal	89,2%	88,0%	**88,3%**	109,0%	111,2%	**110,9%**	**96,9%**
Lipid	84,4%	83,1%	**83,4%**	99,0%	109,2%	**107,8%**	**92,8%**
Cholesterol	247,3%	210,9%	**219,3%**	220,6%	204,0%	**206,4%**	**214,3%**
Na	417,9%	366,8%	**378,6%**	381,7%	365,9%	**368,2%**	**374,6%**
Phase 1							
Kcal	88,6%	85,8%	**86,5%**	103,8%	105,1%	**104,8%**	**93,9%**
Lipid	89,0%	81,4%	**83,4%**	123,4%	104,2%	**108,5%**	**93,5%**
Cholesterol	203,3%	200,7%	**201,4%**	207,1%	202,0%	**203,1%**	**202,1%**
Na	286,8%	270,8%	**275,0%**	216,8%	231,7%	**228,4%**	**256,2%**
Phase 2							
Kcal	87,5%	85,7%	**86,1%**	105,7%	114,1%	**113,0%**	**96,0%**
Lipid	94,4%	87,1%	**88,7%**	110,7%	126,6%	**124,5%**	**102,0%**
Cholesterol	205,4%	196,9%	**198,8%**	194,2%	209,2%	**207,2%**	**201,9%**
Na	333,1%	342,6%	**340,5%**	326,9%	305,6%	**308,5%**	**328,6%**
Phase 3							
Kcal	91,7%	87,9%	**88,6%**	117,3%	113,2%	**113,5%**	**97,7%**
Lipid	98,9%	82,9%	**85,8%**	122,6%	115,5%	**116,0%**	**96,8%**
Cholesterol	242,2%	198,0%	**206,0%**	192,9%	190,8%	**191,0%**	**200,5%**
Na	322,6%	299,3%	**303,5%**	313,3%	269,0%	**272,0%**	**292,1%**
Phasee 4							
Kcal	82,3%	80,9%	**81,2%**	103,8%	101,0%	**101,5%**	**88,8%**
Lipid	72,3%	70,4%	**70,9%**	93,1%	95,4%	**95,0%**	**80,1%**
Cholesterol	186,7%	196,9%	**194,5%**	193,7%	188,0%	**188,9%**	**192,4%**
Na	346,8%	335,2%	**338,0%**	338,5%	319,6%	**322,5%**	**332,2%**
Phase 5							
Kcal	81,4%	75,9%	**77,3%**	102,5%	101,5%	**101,7%**	**86,6%**
Lipid	72,8%	72,0%	**72,2%**	96,9%	91,1%	**92,0%**	**79,5%**
Cholesterol	193,2%	179,3%	**182,8%**	165,8%	194,6%	**189,2%**	**185,3%**
Na	310,2%	296,5%	**299,9%**	284,0%	268,5%	**271,3%**	**288,9%**

Conclusions

The conclusion reached was that, to achieve any substantial change in the eating habitsof college students, it is not enough to merely provide nutritional information on the meals, but there should be some intervention in the food supply accompanying that information. We have also deduced that the financial aspect is crucial in the selection of food made by the student, so, for it to be effective, no nutritional action should entail any economic overhead.

Implicactions for reference and practise

It can be concluded that to achieve any substantial change in the eating habits of college students it is not enough to provide nutritional information, but there should be some intervention in the food supply accompanying that nutritional information. We have also concluded that the economic aspect is crucial in the selection of foods made by the student, so, for it to be effective, any nutritional action should not incur any economic overhead.
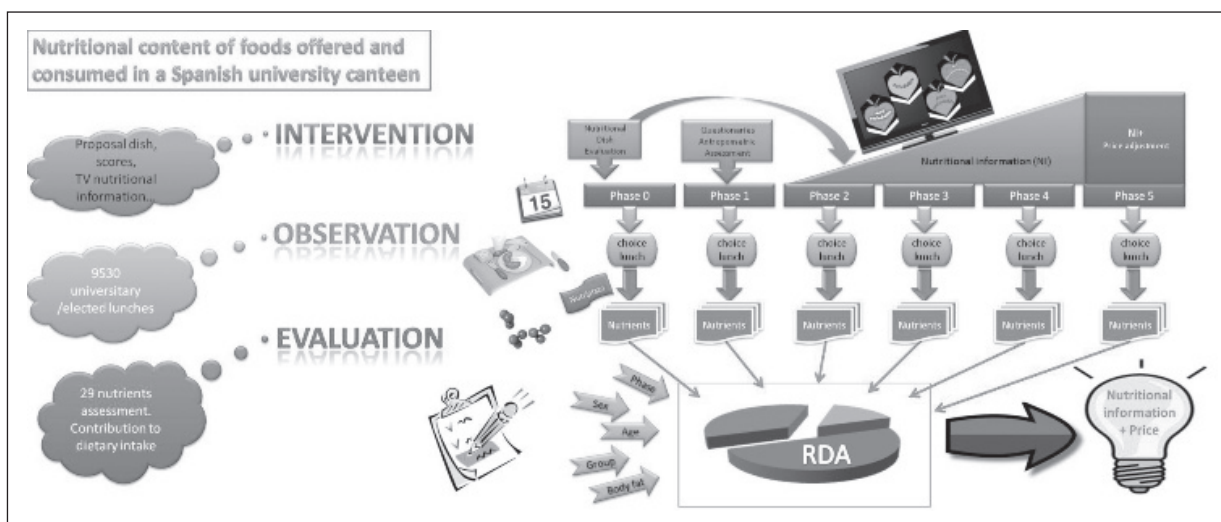
Fig. 1.

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