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Original

Attitudinal determinants of fish consumption in Spain and Poland

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Abstract

Objective: **To identify attitudinal determinants of fish consumption in Spain and Poland, and to discuss the potential impact of local healthy eating policies in the observed reported frequency of fish consumption.**

Design: **Repeated survey analysis , multivariate linear regression analysis. Data collected through a questionnaire that included socio-demographics, self-reported anthropometrics, as well as validated items of attitudinal and involvement scales, validated items of knowledge about fish, and behaviours (reported fish consumption).**

Setting: **Consumer survey in Poland and Spain, 1800 respondents in 2004 and 1815 respondents in 2008.**

Results: **In Poland, intentions to consume more fish and reported fish consumption increased in the four years period between both surveys, together with objective knowledge regarding fish. In Spain with the exception of subjective knowledge, fish consumption at home and total fish consumption, all attitudinal and involvement scale changes were statistically significant. Multivariate regression revealed that age had a small but significant positive effect in all scales, except for satisfaction with life, fish consumption out of home and subjective health. Satisfaction with life and subjective knowledge were significantly determined by household size. The differences between countries were statistically significant for involvement with health and fish, for intention to eat fish, the general attitudes and objective knowledge regarding fish.**

Conclusions: **In Poland, a more positive attitude towards fish, and increased levels of knowledge about this product were observed and could partially be attributed to national policy efforts. In Spain, an interesting feature was observed: more people reported choosing fish when eating out in 2008 compared with respondents in 2004. Such a trend suggests that people slowly move towards healthier choices even in the out of home eating.**

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Key words: *Spain. Poland. SeaFoodPlus. EATWELL. Attitudes. Consumption. Fish. Nutritional Policy. Healthy eating policy.*

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ACTITUDES DETERMINANTES DEL CONSUMO DE PESCADO EN ESPAÑA Y POLONIA

Resumen

Objetivo: **Identificar los factores determinantes de las actitudes hacia el consumo de pescado en España y Polonia, y discutir el impacto potencial de las políticas locales de alimentación saludable en la frecuencia registrada del consumo de pescado entre los participantes.**

Diseño: **Análisis de encuestas repetidas y análisis de regresión lineal multivariante. Los datos fueron recogidos a través de un cuestionario que incluía información socio-demográfica, medidas antropométricas auto-valoradas, así como elementos de validación de escalas validadas de actitudes, de involucramiento, y de los conocimientos acerca del pescado, y los comportamientos (autovalorados) de consumo de pescado.**

Marco: **Encuesta de consumidores en Polonia y España, 1.800 encuestados en 2004 y 1.815 los encuestados en 2008.**

Resultados: **En Polonia, las intenciones de consumir más pescado y el consumo de pescado reportado aumentaron en el período de cuatro años entre las dos encuestas, junto con el conocimiento objetivo sobre el pescado. En España, a excepción del conocimiento subjetivo, el consumo de pescado en el hogar y el consumo total de pescado, todos los cambios en las escala de actitudes hacia el pescado y de involucramiento fueron estadísticamente significativas. El análisis de regresión mulitvariantes reveló que la edad tiene un pequeño efecto positivo, pero significativo en todas las escalas, excepto las de satisfacción con la vida, la de consumo de pescado fuera del hogar y la escala de salud subjetiva. El escore de satisfacción con la vida y el conocimiento subjetivo sobre pescado fueron determinados de manera significativa por el tamaño del hogar. Las diferencias entre países son estadísticamente significativas para involucramiento con la salud y el pescado, con la intención de comer pescado, la actitud general y el conocimiento objetivo sobre el pescado.**

Conclusiones: **En Polonia, una actitud más positiva hacia el pescado, y los mayores niveles de conocimiento acerca de este producto observados pueden atribuirse en parte a los esfuerzos de las políticas nacionales de alimentación saludable. En España, una característica interesante se observó: más personas reportaron haber consumido pescado fuera del hogar en 2008 que en 2004. Esta tendencia sugiere que en España los consumidores se dirigen lentamente hacia opciones más saludables, incluso al comer fuera de casa.**

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Palabras clave: *España. Polonia. SeaFoodPlus. EATWELL. Actitudes. Consumo. Pescado. Política nutricional. Política de alimentación saludable.*

Introduction

Most healthy eating recommendations[1] support privileging the regular consumption of foods of plant origin, such as fruits and vegetables, fibre-rich products (e.g. whole grain bread, integral rice, etc.), moderate consumption of fish and other products of animal origin (fresh meat, eggs and low fat milk and dairy products). At the same time, these guidelines recommend the reduction in consumption or even the avoidance of refined and processed foods, like meat products, hydrogenated oils (sources of trans-fatty acids), sodium from salt and sugary drinks.

Moderate fish consumption is one of the recommendations for a healthy diet; it is also one of the characteristics of the Mediterranean Diet. Fish is the source of n-3 fatty acids, which are well known by their anti-inflammatory effect,[2] and their protective role against chronic disease (cardiovascular diseases (CVD), inflammatory bowel disease (IBD), cancer, and rheumatoid arthritis) and brain damage.[3,4] Fish is also a source of *n*-6 polyunsaturated fatty acids (PUFA) which in the right proportions with *n*-3 PUFA significantly lower blood LDL-cholesterol levels, while it does not increase obesity and several CVD risk factors such as blood pressure, inflammatory markers, haemostatic parameters.[5]

Also the importance of fish in the hospital diet, and its potential role as enhancing treatment outcomes[6,7] is widely recognised due to its immunomodulating effect. Immunomodulating diets (IMDs) provide higher quantities of nutrients that enhance immune cell function and modulate inflammation. Among others, the nutrients that are used in IMDs include arginine, *n*-3 long chain PUFA, RNA, and antioxidants (e.g. ascorbic acid or selenium).

Moreover, compliance with dietary advice has been a challenge for practitioners worldwide.[8] As recently reported, one of the main determinants of satisfaction with foods is taste. If people do not like a specific product, they are less likely to consume it.[9] This of course creates a challenge for the use and success of IMDs and other hospital diets. Therefore, the insights that consumer research can provide to public health practitioners becomes relevant in the understanding of the adherence or not to a given regime.[10,11]

The EU funded integrated research project SEAFOODplus carried out two cross-sectional consumer surveys in 2004 and 2008. The first wave was carried out in Nov-Dec 2004 in Belgium, Denmark, the Netherlands, Poland and Spain; whereas the second wave in May 2008 in France, Poland and Spain, allowing comparing two points in time in the two latter countries. These countries are relevant to contrast culinary traditions and potential attitudinal changes that may be narrowing as a result of EU enlargement.[12,13] Spain represents a Mediterranean country, with its characteristic diet, while Poland is a Central-European country, with its own gastronomic inheritance. According to data provided by the FAO's Balance Sheets for 2007 (http://faostat.fao.org/), the availability of fish in Spain (40 kg/person/y) was four times the availability in Poland (9.6 kg/person/year); therefore, these are two countries with completely different fish consumption levels. Two points in time are neither sufficient to identify age, time or cohort effects, nor to predict future outcomes, but they provide an insight of changes at society level that may reflect the result of changes in awareness regarding healthy eating and the role of fish in a healthy diet.

Therefore, the objective of this paper is to identify attitudinal determinants of fish consumption in Spain and Poland, and to discuss the potential impact of local healthy eating policies in the observed reported frequency of fish consumption. Moreover, it aims at comparing changes within Spain and Poland in the period 2004-2008, to further compare two countries with different culinary traditions in their attitudes, intentions and knowledge in 2008, and provide a number of suggestions on how to address the composition of diets according to the observed attitudinal changes in both countries.

Methods

This study is based on secondary analysis of data obtained from two waves of a consumer study carried out in Spain and Poland in 2004 and 2008, as part of a larger EU funded research project.[14]

A detailed description of the sample and data collection procedure has been provided elsewhere[15,16] and will only be summarised here. Participants in the consumer studies were adult volunteers from whom written informed consent has been obtained. The data collection fieldwork has been performed by professional market research agencies who have agreed to abide the ICC/ESOMAR International Code on Market and Social Research. A quota sampling procedure with age and region as quota control variables was applied. The age range of the population was defined as 20-70 years. All respondents were the main responsible person for food purchase in the household. Briefly, the questionnaire included socio-demographic information, self-reported anthropometrics, as well as validated items of the attitudinal, involvement, knowledge, and behavioural scales described below.[14,15]

Scales of Health involvement and Fish involvement

Two involvement scales (involvement with health and involvement with fish) were measured,[17] each using three items: "Health/fish is very important to me", "I care a lot about health/fish", and "Health/ Fish means a lot to me". Items were scored on a 7-point Likert-scale anchored by totally disagree = 1, neither agree nor disagree = 4, and totally agree = 7. This measure-

ment of involvement also corroborates a validated food involvement scale.[18]

General attitude toward fish scale

A direct measure of general attitude toward eating fish was obtained using six items in semantic differential formats. Respondents were presented with the sentence, "In the following we would like you to think about how you feel when you eat fish. Please indicate which word best describes how you feel?" The bipolar adjectives were bad/good, unsatisfied/satisfied, unpleasant/pleasant, dull/exiting, terrible/delightful, and negative/positive. These items have been used successfully to assess general attitude in food consumption behaviour studies.[19]

Intention to eat fish (a frequency estimate and a probability estimate)

Two different formats of intention, namely a frequency estimate and a probability estimate were assessed. Respondents were asked to indicate how many times during the coming 14 days they plan, expect, desire, intend or want to eat fish for their main course (including today). A frequency scale ranging from "0" to "14 or more" was used. Additionally, people were asked to indicate how likely or unlikely it is for them to fulfill their plan, expectation, desire or intention to eat fish as a main course in the coming 7 days (including today). A 7-point interval scale ranging from "very unlikely" to "very likely" was used. Probability estimates like "unlikely/likely" have frequently been used in food consumption behaviour studies.[20]

Subjective knowledge

Four statements were included to assess consumer's subjective knowledge. Respondents were requested to rate how much they felt they knew about fish in general, compared to an average person and compared to their friends. Additionally, two more items were "I have a lot of knowledge about how to prepare fish for dinner" and "I have a lot of knowledge about how to evaluate the quality of fish". For all items, a 7-point Likert scale ranging from "totally disagree" to "fully agree" was used. This measure is consistent with measures used in previous studies.[21,22]

Objective knowledge

Respondents' level of objective knowledge about fish was measured with four statements that were assumed to be common (fish-related) nutrition knowledge among the population. Two of the statements were false: "Fish is a source of dietary fibre" (fish does not contain any dietary fibre, although many consumers believe so because of some fish's fibrous texture), and "Cod is a fatty fish" (cod is classified as a lean fish). The two other statements were true: "Fish is a source of omega-3 fatty acids"; and "Salmon is a fatty fish". For the four statements, a "true"/"false" scale was used.[22]

Subjective health

Four items with regard to subjective health were included, each to be answered on a 7-point Likert scale: "Compared with people at my age, my health is excellent"; "Compared with people at my age, my current physical health is excellent"; "I am as healthy as anyone I know at my age"; and "Compared with people at my age, my current mental health is excellent". The items were mainly based on the general health perception scale from the short-form health survey.[23]

Satisfaction with life

Satisfaction with life (SWL) was measured using a 7-point Likert scale consisting of four items: "I am satisfied with my life"; "The general conditions of my life are excellent"; "In most ways my life is close to my ideal"; and "If I could live my life over, I would change almost nothing", as developed by Diener et al.[24] This SWL scale is available in several languages and was suggested as a potential cross-cultural index of life satisfaction.[25]

Interest in healthy eating

Interest in healthy eating was measured on a 7-point Likert scale using three items: "It is important to me that the food I eat on a typical day… 1: is good for my physical and mental health; 2: keeps me healthy; and 3: is nutritious". Those items were adapted from the Food Choice Questionnaire.[26] Only the most appropriate and relevant items for the case of fish were included based on findings from exploratory focus group discussions.[27,28]

Fish consumption

Fish consumption behaviour was a self-reported item, which was measured as total fish consumption frequency per week, i.e. the sum of fish consumed at home and fish consumed out of home. A 9-point frequency scale ranging from "never" to "daily or almost every day" was used. This response scale was recoded into frequencies per week (e.g. "never" became 0; "once a week" became 1; and "daily or almost daily" became 6.5 and so on) and aggregated in order to com-

Table I
Changes in mean attitudinal scores in Poland

	2004			2008			
	Mean	*SD*	*95% CI*	*Mean*	*SD*	*95% CI*	*P value**
Health involvement	6.28	1.15	6.21-6.35	5.69	1.75	5.57-5.81	< 0.001
Fish involvement	5.15	1.53	5.06-5.25	4.95	1.78	4.83-5.08	0.010
General attitude to fish	5.72	1.20	5.64-5.79	5.42	1.47	5.32-5.52	< 0.001
Intention to eat fish	2.76	1.86	2.64-2.87	3.24	2.56	3.06-3.42	< 0.001
Intention to consume fish	4.31	2.06	4.18-4.44	4.94	1.85	4.81-5.07	< 0.001
Subjective knowledge	3.77	1.41	3.68-3.85	3.60	1.49	3.49-3.70	0.012
Objective knowledge	1.61	0.83	1.56-1.66	1.92	0.72	1.87-1.97	< 0.001
Subjective health	4.76	1.30	4.68-4.84	4.42	1.28	4.33-4.51	< 0.001
Satisfaction with life	4.39	1.25	4.31-4.47	4.35	1.33	4.26-4.44	0.514
Interest in healthy eating	6.20	0.97	6.14-6.26	5.74	1.25	5.65-5.82	< 0.001
Fish consumption at home	1.05	0.92	0.99-1.10	1.21	1.40	1.11-1.31	0.003
Fish consumption out of home	0.15	0.40	0.13-0.18	0.34	0.69	0.29-0.39	< 0.001
Total fish consumption	1.20	1.10	1.13-1.27	1.55	1.65	1.44-1.67	< 0.001

*Independent samples t-test.

pute one behavioural measure, namely total fish consumption frequency (per week).

Knowledge (both subjective and objective) constructs, and health-related scales, such as interest in healthy eating, subjective health and satisfaction with life have been cross-culturally validated across the consumer samples taken from Belgium, The Netherlands, Spain, Denmark and Poland.[22,23]

Data analysis

Data allowed evaluating changes within countries (or lack thereof) in general attitudes, subjective health and nutritional status in two points in time. Descriptive statistics were performed using SPSS v.16 software. Mean scores of the resulting constructs were calculated and independent samples t-test was used to compare mean scores within and between countries. In all cases a P-value < 0.05 was considered statistically significant. A Multivariate Linear Model was further built for the merged dataset, in order to mutually adjust between constructs and control for confounding. Dependent variables introduced in the model were: "Health involvement", "Fish involvement", "General attitude to fish", "Intention to eat fish", "Intention to consume fish", "Subjective knowledge about fish", "Objective knowledge about fish", "Subjective health", "Satisfaction with life", "Interest in healthy eating", "Fish consumption at home", "Fish consumption out of home", and "Total fish consumption". Age and household size were included as independent continuous variable, while year (2004, 2008), education (unskilled, skilled, superior), gender (male, female), country (Poland, Spain) were included as categorical factors.

Results

Table I shows the changes in mean attitudinal scores in Poland between 2004 and 2008. At an aggregated level all changes were statistically significant except for satisfaction with life. Intentions to consume more fish and reported fish consumption increased in the four years period together with objective knowledge regarding fish.

Table II shows the changes in mean attitudinal scores in Spain between 2004 and 2008. With the exception of subjective knowledge, fish consumption at home and total fish consumption, all changes were statistically significant. This constant fish consumption frequency at home and in total is somewhat expected. It confirms that eating fish is strongly habitual and a part of the traditional Mediterranean diet in Spain. The significant increases in intentions could not be attributed to involvement with fish or interest in healthy eating. An interesting observation was the increase in reported out of home fish consumption, which suggests a shift towards a healthier choice even when eating out (normally convenience and fast foods). Moreover, the intention to eat more fish increased in the period of study, which may be partially due to the increase in objective knowledge about fish and its healthful characteristics.

Tables III, IV and V show the main effects obtained as a result of the multivariate analysis performed. Age had a significant (but rather small) effect in all scales, except for satisfaction with life, fish consumption out of home and subjective health. Satisfaction with life and subjective knowledge were significantly determined by household size. Consistent with the observed changes within countries, year was negatively associ-

Table II
Changes in mean attitudinal scores in Spain

	2004			2008			
	Mean	*SD*	*95% CI*	*Mean*	*SD*	*95% CI*	*P value**
Health involvement	6.24	0.96	6.18-6.30	5.94	1.29	5.85-6.03	< 0.001
Fish involvement	5.06	1.32	4.97-5.14	4.40	0.97	4.33-4.47	< 0.001
General attitude to fish	5.65	1.18	5.58-5.73	5.46	1.52	5.35-5.57	0.003
Intention to eat fish	4.48	2.52	4.32-4.63	5.23	3.21	5.01-5.45	< 0.001
Intention to consume fish	4.22	2.10	4.09-4.35	4.56	1.99	4.42-4.70	< 0.001
Subjective knowledge	3.79	1.32	3.71-3.88	3.70	1.49	3.59-3.80	0.141
Objective knowledge	2.05	0.73	2.00-2.10	2.29	0.69	2.24-2.34	< 0.001
Subjective health	5.10	1.07	5.03-5.17	4.76	1.27	4.67-4.85	< 0.001
Satisfaction with life	4.86	1.16	4.79-4.94	4.61	1.35	4.52-4.71	< 0.001
Interest in healthy eating	6.30	0.88	6.24-6.35	5.95	1.21	5.87-6.03	< 0.001
Fish consumption at home	2.12	1.38	2.03-2.21	2.11	1.62	2.00-2.22	0.892
Fish consumption out of home	0.49	0.84	0.43-0.54	0.65	1.07	0.58-0.72	< 0.001
Total fish consumption	2.60	1.75	2.49-2.71	2.76	2.11	2.61-2.91	0.087

*Independent samples t-test.

ated to all constructs with the exception of reported fish consumption (at home, out of home and total fish consumption), implying that people reported higher consumption in 2008 than in 2004 after controlling of the effect of the other variables. Education was negatively associated to objective knowledge and intention to consume fish, while it was positively associated to subjective health. This study did not find further gender or education differences once mutually adjusted for the effects of the other dependent and independent variables. The differences between countries were statistically significant for all constructs except for interest in healthy eating, general attitude towards fish, subjective knowledge and the intention to consume fish. Furthermore, this analysis confirms the differences in fish consumption between both countries.

Discussion

The culinary traditions are different between Spain and Poland. In Spain some of the characteristics of the Mediterranean Diet are still practiced by a large proportion of the population, with higher intake of fish. In Poland on the contrary, fish consumption is not so widespread and its growing adoption within the culi-

Table III
Main effects model of factors determining health and fish involvement and the intentions to eat and consume fish in 2008

	Health involvement			*Fish involvement*			*Intention to eat fish*			*Intention to consume fish*		
	B	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*
Intercept	6.17	0.21	< 0.001	4.64	0.18	< 0.001	2.52	0.39	< 0.001	4.76	0.30	< 0.001
Year 2004	-1.69	0.25	< 0.001	-1.17	0.20	< 0.001	-0.28	0.45	0.530	-0.22	0.35	0.528
Year 2008	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–
Age (y)	0.01	0.003	0.018	0.01	0.002	< 0.001	0.02	0.01	< 0.001	0.01	0.004	0.039
Household size (n)	0.04	0.02	0.078	0.04	0.02	0.034	0.09	0.04	0.037	0.04	0.03	0.176
Male respondent	-0.42	0.31	0.170	0.08	0.26	0.752	-0.56	0.57	0.327	-0.39	0.44	0.365
Female respondent	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–
Primary Education	-0.35	0.20	0.078	0.08	0.16	0.632	0.04	0.36	0.909	-0.68	0.28	0.015
Lower Secondary	-0.25	0.18	0.172	0.07	0.15	0.656	0.42	0.34	0.217	-0.68	0.26	0.009
Higher Secondary	-0.05	0.12	0.662	-0.04	0.10	0.704	0.18	0.22	0.414	-0.40	0.17	0.019
Superior	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–
Spain	-0.49	0.20	0.012	-0.78	0.16	< 0.001	2.16	0.36	< 0.001	-0.46	0.28	0.097
Poland	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–

Table IV
Main effects model of the factors determining general attitudes, objective and subjective knowledge about fish and subjective health in 2008

	General attitudes towards fish			*Objective knowledge*			*Subjective knowledge*			*Subjective health*		
	B	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*
Intercept	5.34	0.21	<0.001	1.68	0.12	<0.001	2.69	0.23	<0.001	4.18	0.20	<0.001
Year 2004	-0.84	0.24	0.001	-0.11	0.13	0.412	-0.28	0.26	0.283	-0.52	0.23	0.022
Year 2008	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–
Age (y)	0.01	0.003	0.022	0.01	0.002	<0.001	0.01	0.003	<0.001	0.00	0.003	0.499
Household size (n)	0.07	0.02	0.003	-0.02	0.01	0.041	0.09	0.02	<0.001	0.03	0.02	0.217
Male respondent	-0.12	0.31	0.687	-0.03	0.17	0.852	0.30	0.32	0.363	0.65	0.29	0.024
Female respondent	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–
Primary Education	0.01	0.20	0.943	-0.47	0.11	<0.001	0.26	0.21	0.214	0.30	0.18	0.101
Lower Secondary	0.05	0.18	0.764	-0.27	0.10	0.006	0.30	0.19	0.118	0.61	0.17	<0.001
Higher Secondary	0.02	0.12	0.868	-0.14	0.07	0.028	0.05	0.13	0.675	0.31	0.11	0.007
Superior	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–
Spain	-0.16	0.20	0.425	0.41	0.11	<0.001	0.14	0.21	0.485	0.48	0.18	0.008
Poland	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–

nary tradition may reflect mostly the efforts of healthy eating campaigns.

The present consumer study showed that in Poland, changes happened at attitudinal level between 2004 and 2008. Such changes could be attributed to the overall effort made by some of the public information campaigns and healthy eating campaigns in Poland. The campaign "*fish affects all and everything*" aimed at promoting fish and it started in mid 2008, at the time of data collection. The campaign *"Keep Fit"* started in 2006/2007 aiming to promote healthy habits of the school adolescents (secondary schools), namely the principles of active lifestyle and a balanced diet school. The *"I know what I eat"* campaign in Warsaw consisted of educating children and their parents, school directors and kitchen staff, focusing on the elements of a healthy diet.

Therefore, changes in attitudes could be associated to any of the aforementioned campaigns, to their synergic effect, but difficult to be attributed to one in particular. Since all these campaigns were mainly about promoting more informed healthy choices, it was expected that objective knowledge (e.g. about fish healthfulness), as well as the intention to consume more fish

Table V
Main effects model of satisfaction with life, interest in healthy eating and frequency of fish consumption in 2008

	Satisfaction with life			*Interest in healthy eating*			*Fish consumption at home*			*Fish consumption out of home*			*Total fish consumption*		
	B	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*	*B*	*Std. Error*	*Sig.*
Intercept	4.24	0.20	<0.001	5.64	0.18	<0.001	0.45	0.21	0.030	0.27	0.12	0.025	0.72	0.26	0.005
Year 2004	-0.10	0.23	0.682	-0.23	0.20	0.253	0.46	0.24	0.055	0.31	0.14	0.024	0.77	0.30	0.010
Year 2008	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–
Age (y)	-0.003	0.003	0.233	0.01	0.00	0.001	0.01	0.00	<0.001	-0.001	0.002	0.537	0.01	0.003	0.010
Household size (n)	0.06	0.02	0.007	0.03	0.02	0.073	0.03	0.02	0.118	-0.01	0.01	0.275	0.02	0.03	0.443
Male respondent	0.65	0.29	0.028	-0.11	0.26	0.662	0.04	0.30	0.898	-0.11	0.17	0.538	-0.07	0.37	0.858
Female respondent	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–
Primary Education	0.06	0.19	0.760	0.23	0.16	0.167	0.12	0.19	0.523	-0.04	0.11	0.714	0.08	0.24	0.727
Lower Secondary	0.26	0.17	0.134	0.20	0.15	0.185	0.16	0.18	0.380	-0.07	0.10	0.503	0.09	0.22	0.686
Higher Secondary	0.15	0.12	0.195	0.06	0.10	0.522	0.14	0.12	0.246	-0.05	0.07	0.494	0.09	0.15	0.531
Superior	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–
Spain	0.48	0.19	0.010	0.14	0.16	0.372	1.28	0.19	<0.001	0.66	0.11	<0.001	1.93	0.24	<0.001
Poland	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–	Ref.	–	–

would have increased in the period as a result of these interventions. The present study showed that this was the case in Poland.

In Spain, the public information campaign "*Five-a-day*" aimed at promoting fruit and vegetables consumption in Spain. Furthermore, it targeted to communicate the advantages of fruits and vegetables for human health, and to raise awareness at population level. It included mass media spots, and accompanying actions in schools and supermarkets. The time frame of this campaign allowed investigating whether attitudinal changes in the Spanish cohorts could be attributed to the campaign after controlling for potential confounding. The "Strategy for nutrition, physical activity and the prevention of obesity" has as primary goal to significantly reduce the incidence and effects of chronic diseases through the national promotion of a healthy diet and physical activity, particularly focused on obesity and unhealthy behaviours in children and adolescents.

One of the hypothesis of this study was that if changes were significant, they might be partially due to the presence of both, a regulatory frame (the Strategy) and a specific program, both targeting objective knowledge about the components of a healthy diet. Since fish is part of the traditional culinary habits in Spain, matching with the Mediterranean Diet, it would be expected that reported consumption would remain the same throughout time, but that attitudes and knowledge would have changed after exposure to healthy eating messages. This study found that there was a slight decrease in subjective knowledge about fish, while objective knowledge about fish increased in the period, which could be partially attributed to the efforts made by policies promoting healthy eating in Spain.

Diets can enhance or hinder any medical treatment either due to their interaction with medications or by their inflammatory/anti-inflammatory effect.[6] The role of the dietician is therefore crucial in the preparation of menus that would contribute to the patient's healing. Both at hospital and at individual counselling, nutritionists have to deal with the contradiction between dietary recommendations and actual consumption. The challenge is to produce a menu that would be accepted by most patients, using food items with which patients (who are also consumers) would be acquainted. Insights from consumer research may be of help for health practitioners. Understanding how attitudes towards specific healthful products change over time could provide insights to provide more acceptable diets and improve adherence.[29]

From a public health perspective, these reported changes suggest that policy interventions that support more informed choice (public information campaigns, interventions at schools, education, etc.), accomplish their goals, and their role in health cannot be neglected. Furthermore, a societal move to a more positive attitude towards fish (like in Poland), may have positive effects in health in the long run. Moreover, increased objective knowledge about the healthfulness of fish may encourage and preserve the Mediterranean Diet in Spain with its positive expected health outcome. At individual and hospital levels, achieving anti-inflammatory diets would be possible and adherence[8,29] to such diets could improve when attitudes towards specific products like fish, linseed, ginger or fruits would increase. Narrowing the gap between evidence based knowledge and popular (subjective or objective) knowledge, through provision of accurate information could become a tool useful to encourage healthier choices and the achievement of a more anti-inflammatory diet.[11]

We acknowledge the limitations of the study in that two points in time are not sufficient to identify societal trends, nor to predict future outcomes, however, they provide an insight of the direction of changes in awareness regarding healthy eating and the role of fish in a healthy diet at societal level. In Poland, efforts made in the past few years yielded a more positive attitude towards fish, and increased levels of knowledge about this product. Moreover, increases in reported fish consumption levels were significant in this sample. In Spain, an interesting feature was observed: more people chose fish when eating out in 2008 compared with consumers in 2004. Such a trend suggests that people slowly move towards healthier choices even in the out-of home eating.

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