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CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

— Instituto de Agroquímica y Tecnología de Alimentos —

ESTUDIO DE LAS ACTITUDES, CONOCIMIENTOS Y
COMPORTAMIENTO DE LOS CONSUMIDORES.
PARÁMETROS SENSORIALES Y NO SENSORIALES QUE
INTERVIENEN EN LA ELECCIÓN DE ALIMENTOS BAJOS
EN CALORÍAS Y ENRIQUECIDOS CON INGREDIENTES
FUNCIONALES

TESIS DOCTORAL

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HACEN CONSTAR QUE:

El trabajo de investigación titulado **“Estudio de las actitudes, conocimientos y comportamiento de los consumidores. Parámetros sensoriales y no sensoriales que intervienen en la elección de alimentos bajos en calorías y enriquecidos con ingredientes funcionales”** que presenta Dña. María Elizabeth Carrillo Alava por la Universidad Politécnica de Valencia, ha sido realizado en el Instituto de Agroquímica y Tecnología de alimentos (IATA-CSIC) bajo nuestra dirección y que reúne las condiciones para optar al grado de Doctor.

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Fdo: Dra. Susana Fiszman Dal Santo

Fdo: Dra. Paula Varela Tomasco

A mis padres por ser mi apoyo
incondicional e incentivarme a
realizar mis sueños.
A mi hermano por enseñarme a
ser optimista y sonreír a la vida.

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RESUMEN

El estudio de las actitudes, expectativas y conocimientos del consumidor es una herramienta fundamental para el desarrollo de un producto así como para garantizar su éxito en el mercado. En la actualidad una de las principales tendencias de la industria alimentaria es proporcionar alimentos que ayuden al bienestar del consumidor por medio de alimentos bajos en calorías o enriquecidos con ingredientes funcionales. En este contexto, es indispensable identificar las necesidades del consumidor, sus actitudes y motivaciones de compra para establecer si la preocupación por la salud es un factor importante en la compra de alimentos, y si lo es, promover la selección de alimentos que proporcionen efectos beneficiosos para la salud.

El objetivo principal de este trabajo fue estudiar las actitudes, conocimientos y comportamiento de los consumidores frente a parámetros sensoriales y no sensoriales que intervienen en la elección de alimentos bajos en calorías o enriquecidos con ingredientes funcionales.

En primera instancia, se estudiaron los principales factores subyacentes a la selección de un alimento por parte del consumidor, resultando el sabor, el precio y la conveniencia como los principales motivos involucrados en la elección. Se observó que determinados componentes que proporcionan un efecto saludable no fueron considerados importantes en el ranking, lo cual sugirió un bajo conocimiento nutricional. Con este antecedente, se empleó un cuestionario para conocer los conocimientos nutricionales de la población en estudio y su influencia en el uso del etiquetado nutricional. Se observó una directa relación entre el nivel de educación y el conocimiento nutricional y con el uso del etiquetado. A mayores conocimientos, mayor es la influencia del etiquetado en la elección de alimentos y la comprensión de la información mostrada en la etiqueta es mejor.

Debido a que el envase de un alimento es el primer contacto con el consumidor y la información que muestra es la forma más directa de comunicación, se estudió su percepción y las expectativas que producían utilizando como caso

de estudio galletas enriquecidas y/o bajas en azúcar. En este sentido, se observó que la parte frontal del envase era la más observada, y que los mensajes nutricionales o de salud que fueran muy largos y con excesiva información se percibieron negativamente. También se investigó cómo estas expectativas influían en la aceptación de un alimento y la percepción de saludable. Los resultados indicaron que las características sensoriales eran determinantes para valorar un producto de manera favorable o no y asegurar la recompra. La información del envase provocaba que un alimento se percibiera como más saludable pero el consumidor no estaba dispuesto a renunciar al sabor por un efecto saludable. Se demostró cómo los parámetros sensoriales y no sensoriales interactúan para determinar la percepción del consumidor, y en qué medida lo hacen. Esta percepción depende de cada producto (categoría, marca, familiaridad, envase, formulación, mensajes e información).

Otro aspecto importante fue conocer cómo características intrínsecas del consumidor, de personalidad y motivos de selección de alimentos influyen en su comportamiento y en su consumo de alimentos bajos en calorías. Para este fin, se obtuvo un modelo a través del uso de ecuaciones estructurales, en el que se reflejó que el control de peso, la autoestima, la responsabilidad y la inestabilidad emocional fueron los principales motivos (directos o indirectos) para consumir este tipo de productos.

Finalmente, se estudiaron los principales factores que intervienen en el consumo de alimentos funcionales, resultando que las actitudes positivas y la novedad influyen directamente en el comportamiento del consumidor y se observó nuevamente que la salud no era el factor determinante para la compra, lo cual sugirió que el consumidor medio necesita mayor información sobre qué componentes producen un efecto beneficioso para la salud.

ABSTRACT

Consumer science involves the study of consumers' attitudes, expectations and knowledge, as well as consumer preference. This is an excellent tool use in the product development and to help ensuring the product success in the marketplace. Nowadays, one of the main trends in the food industry is to contribute to consumers' wellbeing through offering low calorie foods or enriched with functional ingredients. In this context, it is necessary to know the consumers' necessities and to promote choosing a beneficial diet.

The main objective of this research was to study how different non-sensory and sensory parameters influenced the selection of low calorie or enriched food, including the consumers' attitudes, knowledge and behaviour.

First, we studied the main factors underlying consumers' food choice, resulting that "sensory appeal", "price" and "convenience" were the most important factors underpinning Spaniards' food choice. It was observed that specific health-promoting ingredients were not considered important in the food choice rank, suggesting a low nutritional knowledge. With this background, a nutritional food knowledge questionnaire was applied and related with the use of nutritional food labels. The results revealed that the nutritional knowledge level was linked with the educational level and with the used of nutritional label information. Meaning, the higher the nutritional knowledge, the more frequent it would be the use of nutritional labelling in food choice related decisions.

The first contact between consumers and the food product is normally the packaging and its labelling. Based on this fact, we investigated consumers' perception of the package and the expectations raised by nutritional and health claims in enriched and calorie reduced biscuits. Results revealed that the front part of the package is the most influential and claims too long were perceived as a negative characteristic. In addition, it was studied the effect of food package information and sensory characteristics on the perception of healthiness and the acceptability in the mentioned biscuits. It was observed that

the sensory characteristics played an important role in the acceptability and this fact was decisive to ensure the repurchase. The package information could make a product to be perceived as healthier but the consumers were not willing to sacrifice taste for health effects. This fact, showed how sensory and non-sensory characteristics interact determining consumer perceptions. Nevertheless, these interactions depend on each product (category, brand familiarity, packaging, formulation, and information messages).

In addition, it was studied how consumers' intrinsic characteristics, personality and food choices motives, influence the consumption of low calorie and enriched food. It was obtained a model that explained that weight control, self-esteem, responsibility and emotional instability were the main reasons (direct or indirect) for consuming these products.

Finally, we studied the main factors that involved the functional food consumption. Results revealed that positive attitudes and novelty directly influenced consumers' consumption. Also, it was observed that health was not a decisive factor for the purchase of these products, suggesting that consumer would need more information about which food components produce a health benefit effect.

RESUM

L'estudi de les actituds, expectatives i coneixements del consumidor és una eina fonamental per al desenvolupament d'un producte així com per garantir el seu èxit al mercat. En l'actualitat una de les principals tendències de la indústria alimentària és proporcionar aliments que ajudin al benestar del consumidor per mitjà d'aliments baixos en calories o enriquits amb ingredients funcionals. En aquest context, conèixer el comportament del consumidor és necessari per satisfer les seves necessitats i promoure l'elecció d'un aliment que proveeixin efectes beneficiosos per a la salut.

L'objectiu principal d'aquest treball va ser estudiar les actituds, coneixements i comportament dels consumidors enfront de paràmetres sensorials i no sensorials que intervenen en l'elecció d'aliments baixos en calories o enriquits amb ingredients funcionals.

En primera instància, es van estudiar els principals factors subjacents a la selecció d'un aliment per part del consumidor, resultant el sabor, el preu i la conveniència com els principals motius involucrats en l'elecció. Es va observar que determinats components que proporcionen un efecte saludable no van ser considerats importants en el rànquing, la qual cosa va suggerir un baix coneixement nutricional. Amb aquest antecedent, es va emprar un qüestionari per conèixer els coneixements nutricionals de la població en estudi i la seva influència en l'ús de l'etiquetatge nutricional. Es va observar una directa relació entre el nivell d'educació i el coneixement nutricional i amb l'ús de l'etiquetatge. A majors coneixements l'ús de l'etiquetatge en l'elecció d'aliments és més assidu i amb millor comprensió.

A causa de que l'envàs d'un aliment és el primer contacte amb el consumidor i la informació que mostra és la forma més directa de comunicació, es va estudiar la seva percepció i les expectatives que produïen utilitzant galetes enriquides i/o baixes en sucre com a cas d'estudi. En aquest sentit, es va observar que la part frontal de l'envàs era la més observada, i que els missatges nutricionals o de salut que fossin molt llargs i amb excessiva

informació es van percebre negativament. També es va investigar com aquestes expectatives influïen en l'acceptació d'un aliment i la percepció de saludable. Els resultats van indicar que les característiques sensorials eren determinants per valorar un producte de manera favorable o no i assegurar la recompra. La informació de l'envàs provocava que un aliment es percebés com més saludable però el consumidor no estava disposat a renunciar al sabor per un efecte saludable. Es va demostrar com els paràmetres sensorials i no sensorials interactuen per determinar la percepció del consumidor, i en quina mesura ho faran, depèn de cada producte (categoria, marca, familiaritat, envàs, formulació, missatges i informació).

Un altre aspecte important va ser conèixer com característiques intrínseques del consumidor, de personalitat i motius de selecció d'aliments influeixen en el seu comportament i en el seu consum d'aliments baixos en calories. Per a aquesta fi, es va obtenir un model a través de l'ús d'equacions estructurals, en el qual es va reflectir que el control de pes, l'autoestima, la responsabilitat i la inestabilitat emocional van ser els principals motius (directes o indirectes) per consumir aquest tipus de productes.

Finalment, es van estudiar els principals factors que intervenen en el consum d'aliments funcionals, resultant que les actituds positives i la novetat influeixen directament en el comportament del consumidor i es va observar novament que la salut no era el factor determinant per a la compra, la qual cosa va suggerir que el consumidor mitjà necessita major informació sobre quins components produeixen un efecte beneficiós per a la salut.

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INTRODUCCIÓN

1. Ciencia del consumidor

El estudio de la percepción del consumidor es fundamental para que un producto tenga éxito en el mercado. En particular, en el campo de los alimentos, la comprensión de la percepción del consumidor sobre el propio alimento, sobre su origen y composición, sobre su método de producción, su función en la dieta y sobre el vínculo entre la dieta y la salud, es fundamental y forma parte de una importante área de investigación multidisciplinar. Esta nueva área está en continuo crecimiento e incluye tanto estudios de tecnología de alimentos como sociológicos, psicológicos, nutricionales y estadísticos dando lugar a lo que se denomina Ciencia del Consumo (European Commission, 2007; Simeone y Marotta, 2010).

La ciencia del consumidor es un elemento integrador en la investigación de alimentos que utiliza una variedad de técnicas para medir y determinar el comportamiento del consumidor y sus preferencias. La ciencia del consumidor va más allá de las características intrínsecas del alimento (sabor, olor, apariencia, textura, etc.); trata de conocer la percepción que los consumidores tendrán sobre el producto (su envase, la información nutricional, los ingredientes, los aditivos, su precio, su marca, etc.) y predecir el comportamiento de éstos (momento de consumo, tipo de consumo, elección, etc.) con el fin de obtener las respuestas que conducirán a la compra del producto y la fidelidad hacia este.

La ciencia del consumidor en el ámbito de la alimentación posee cuatro objetivos principales que agregan valor a otros aspectos de la investigación alimentaria:

- Medir con exactitud el comportamiento del consumidor en relación con los alimentos. Este objetivo contempla interpretar sus necesidades, creencias, conocimientos, actitudes, motivaciones y expectativas para conocer y satisfacer sus requerimientos; además de proporcionar métodos que puedan garantizar la realidad de lo que el consumidor afirma.

- Desarrollar modelos que ayuden a comprender el proceso de elección de los alimentos por parte de los consumidores.
- Promover una interacción eficaz con los consumidores para proporcionar canales de comunicación abiertos y de confianza.
- Ayudar a desarrollar estrategias efectivas para comunicar mensajes relacionados con beneficios de la dieta para la salud que puedan producir un cambio favorable en los hábitos de consumo.

La constante evolución de los condicionantes de vida ha producido, entre otras cosas, que el tiempo dedicado a la preparación de alimentos sea cada día menor. Por otro lado, la globalización produce continuos cambios en el tipo de alimentos al alcance de los consumidores, creando nuevas demandas y expectativas. Además, las compañías internacionales aplican la ciencia del consumidor para conocer y satisfacer preferencias de sabor, en las que influyen parámetros culturales de cada país.

Un gran número de alimentos, resultado de largas investigaciones, han fallado en el mercado porque el consumidor no ha reaccionado favorablemente ante ellos. Para tratar de evitar esta situación, se hace fundamental integrar estudios sensoriales y estudios con consumidores en el desarrollo de nuevos productos para garantizar su éxito.

Crear nuevos métodos que permitan conocer en profundidad la reacción frente a los alimentos reformulados o totalmente nuevos es un reto para los investigadores; la ciencia del consumo desempeña un papel esencial en el desarrollo de alimentos que sean sensorialmente satisfactorios y con cualidades nutricionales adecuadas, cumpliendo con las expectativas de los consumidores y contribuyendo a la optimización de los recursos en la industria alimentaria (Piggott, 1995; Jaeger, 2006; Tuorila y Monteleone, 2009).

1.1 Métodos de la ciencia del consumidor

Para estudiar o entender las actitudes de los consumidores, sus creencias, conocimientos, opiniones, etc., se utilizan diferentes métodos. En el análisis sensorial clásico, los métodos de la ciencia de los consumidores se llamaban “métodos afectivos”, ya que estaban dirigidos principalmente a conocer la respuesta hedónica del consumidor hacia diferentes productos o conceptos. Éstos básicamente pueden clasificarse en métodos afectivos cualitativos y cuantitativos (Stone y Siedel, 2004). Más recientemente, aparte de evaluar la preferencia del consumidor, la investigación se ha centrado también en conocer lo antes mencionando teniendo como centro de atención al consumidor.

Métodos cualitativos.- Estos métodos implican una comunicación oral libre, directa y espontánea entre personas, mediante la cual se obtiene información respecto a algún asunto a través de descripciones orales sin información numérica, enfatizando sus aspectos subjetivos, simbólicos y emocionales. Generalmente, estos métodos se utilizan para explorar situaciones preliminares o iniciales de la investigación, para formular hipótesis, buscar o desarrollar nuevas ideas.

Son técnicas muy útiles para conocer actitudes, comportamientos, emociones y motivaciones de los consumidores con grupos pequeños de personas. Ejemplos de estudios cualitativos son los *focus group*, observación directa o filmada de la reacción espontánea del consumidor frente a un producto o situación, entrevistas o libre asociación de palabras.

Independientemente de la técnica, el investigador debe tener presentes todas las opiniones, siendo lo más objetivo posible; debe alentar a la participación y a la libre expresión de ideas. También se deben tener en cuenta las emociones y deseos de los participantes; sin embargo, éstos son los más difíciles de interpretar por medio de métodos cualitativos ya que el consumidor establece barreras cuando se alude a lo íntimo y personal o cuando se involucran costumbres muy arraigadas. En este contexto, las técnicas cuantitativas resultan menos personales para el consumidor.

Métodos cuantitativos.- Estos métodos recopilan información descriptiva sobre los conocimientos, actitudes o hábitos de consumo de una población o un determinado segmento de la misma y preferencias sobre la intención de compra. Estos métodos utilizan las respuestas individuales a encuestas o cuestionarios diseñados en función de un objetivo particular. En ellos, las preguntas se valoran mediante escalas y posteriormente los datos se tratan con algún tipo de análisis estadístico. Estos métodos poseen varias ventajas. Una es la flexibilidad, debido a que se puede obtener información en situaciones diferentes; otra es la versatilidad ya que se pueden emplear encuestas en cualquier contexto y adaptadas a muchas situaciones y a temas diferentes. Sin embargo, requieren un mayor número de personas (Aaker y Day, 1989; Chambers y Smith, 1991; Lawless y Heymann, 1998; Quintanilla, 2008).

Por ejemplo, en el desarrollo de un alimento, conocer la aceptabilidad del producto también es muy importante; esta prueba consiste en que el consumidor dé su impresión probando el producto y valorando cuánto le agrada o desagradan sus características sensoriales a través de escalas. Las comparaciones de preferencia tipo pareadas u ordenaciones de preferencia son otros ejemplos de pruebas cuantitativas realizadas con consumidores. Más allá de la aceptabilidad o preferencia global, las pruebas afectivas cuantitativas pueden medir el agrado por atributos específicos o la adecuación de éstos al gusto del consumidor. Los consumidores pueden también valorar la intensidad de determinados atributos de alimento con escalas cuantitativas.

Pruebas cuantitativas que van más allá del agrado pueden evaluar aspectos no sensoriales involucrados en la elección del consumidor, como características socioeconómicas, usos, actitudes, valores, rasgos de personalidad, frecuencias de consumo, entre muchos otros parámetros.

En la actualidad se emplean ambos tipos de métodos (cualitativos y cuantitativos) y resultan complementarios.

Más recientemente, la línea divisoria entre las ciencias sensoriales, que usan métodos analíticos de análisis con paneles entrenados y la ciencia de los consumidores, que solía basarse en métodos afectivos, se está haciendo cada vez más difusa. Desde los años 80 y a partir del desarrollo de métodos descriptivos que no necesitaban entrenamiento (“Free Choice Profiling” o perfil libre) se planteó la posibilidad de utilizar consumidores para la descripción de productos, y ya no solamente para pruebas afectivas. En los últimos 10 años se han desarrollado técnicas como el “Free Sorting” o clasificación libre de productos, el “Napping” o mapeo proyectivo y el “Flash Profiling” o perfil rápido, entre otros, que permiten obtener una descripción sensorial de primera mano del consumidor (Varela y Ares, 2012). En particular, el mapeo proyectivo, es un método holístico que podría permitir el estudio de parámetros no sensoriales asociados a la elección del consumidor.

2. Interacción de factores sensoriales y no sensoriales que participan en la elección y aceptación de un alimento

La aceptación de un alimento está condicionada tanto por factores sensoriales como no sensoriales. La elección de alimentos es un proceso complejo e incluye diferentes factores que desempeñan, en conjunto, un papel decisivo.

La figura 1 muestra un modelo de elección de alimentos propuesto por Köster y Mojet (2007), uno de los más completos planteados hasta la fecha. Este modelo recoge el punto de vista de diversas disciplinas y su interacción, con el fin de desglosar los factores que intervienen en la elección de alimentos. Se basa en seis factores principales: 1- Características extrínsecas del producto, 2- Características intrínsecas del producto, 3- Factores biológicos y fisiológicos, 4- Factores psicológicos, 5- Factores situacionales y 6- Factores socioculturales.

Este modelo resume la complejidad que tiene que afrontar la industria alimentaria para diseñar y producir alimentos que tengan éxito en el mercado y además sean saludables.

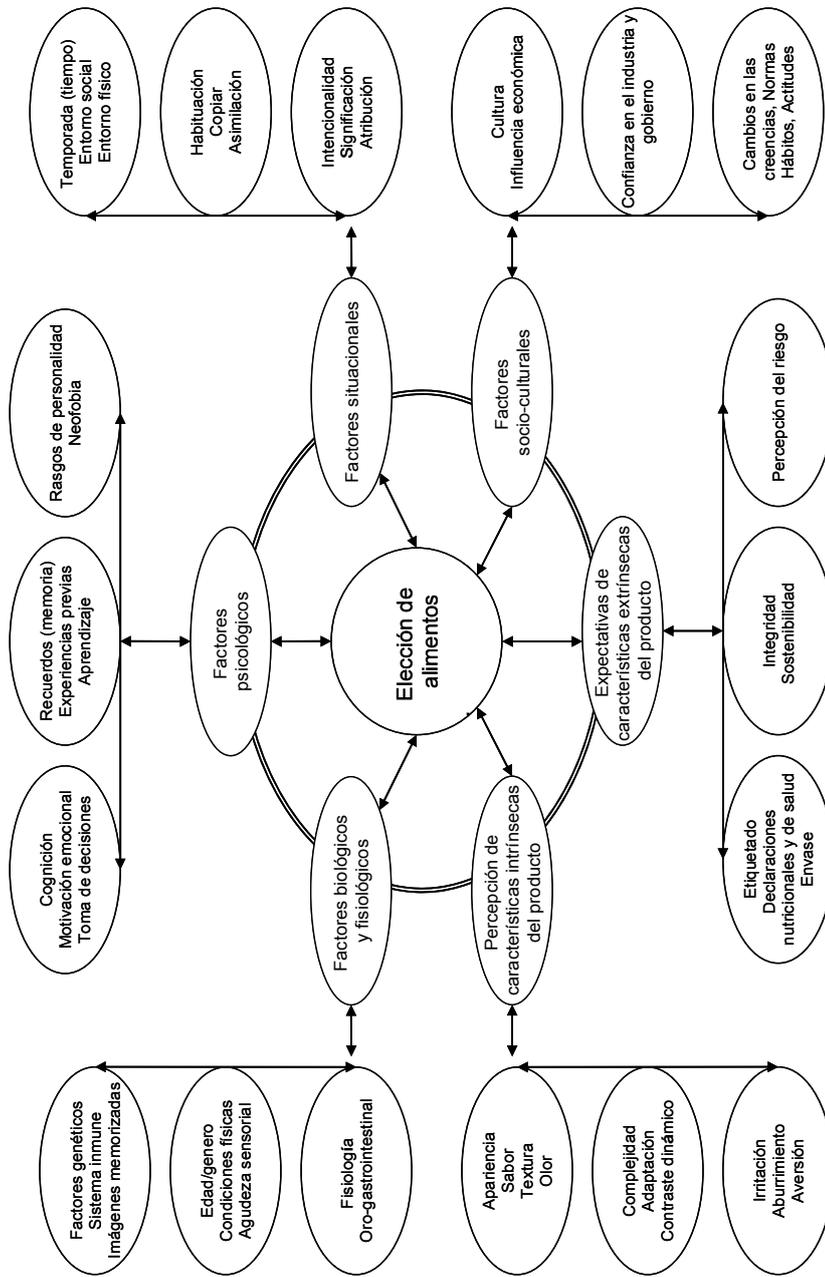


Figura 1. Modelo de elección de alimentos desarrollado por Köster y Mojet.

Para ello deben brindar respuestas positivas a las expectativas del consumidor y, a su vez, aportar una composición que intervenga en la disminución de algunos factores de riesgo en relación con problemas de salud, en concordancia con las actuales tendencias del mercado.

Los factores descritos en el modelo de Köster y Mojet pueden agruparse y resumirse como se muestra en la figura 2. El Producto que engloba sus características tanto intrínsecas como extrínsecas; los Consumidores que están influenciados por factores biológicos, fisiológicos y psicológicos; y el Medio ambiente/ Contexto que incluye factores de situación y socioculturales.

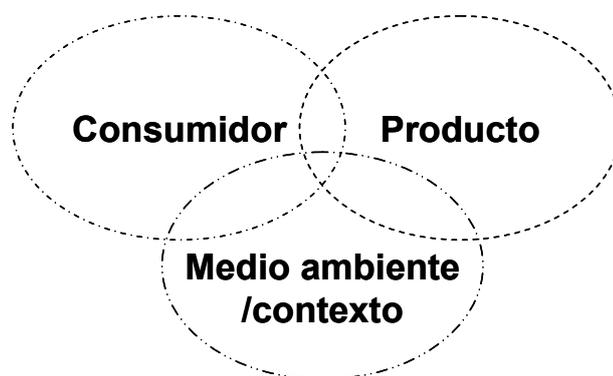


Figura 2. Resumen del modelo de Köster y Mojet sobre los factores que intervienen en la selección de alimentos.

A continuación se describen algunos aspectos relacionados con cada uno de los tres “pilares” de la figura 2.

2.1 Producto

En la figura 3 se puede observar el modelo de Cardello (1996) de aceptabilidad de un alimento, en el que se enfatizan las variables que afectan a los alimentos; en él se tienen en cuenta, por ejemplo, las características sensoriales, pero también se incluyen otros factores no intrínsecos del

alimento. Se puede observar que en el comportamiento del consumidor hacia el producto también intervienen factores tanto sensoriales como no-sensoriales.

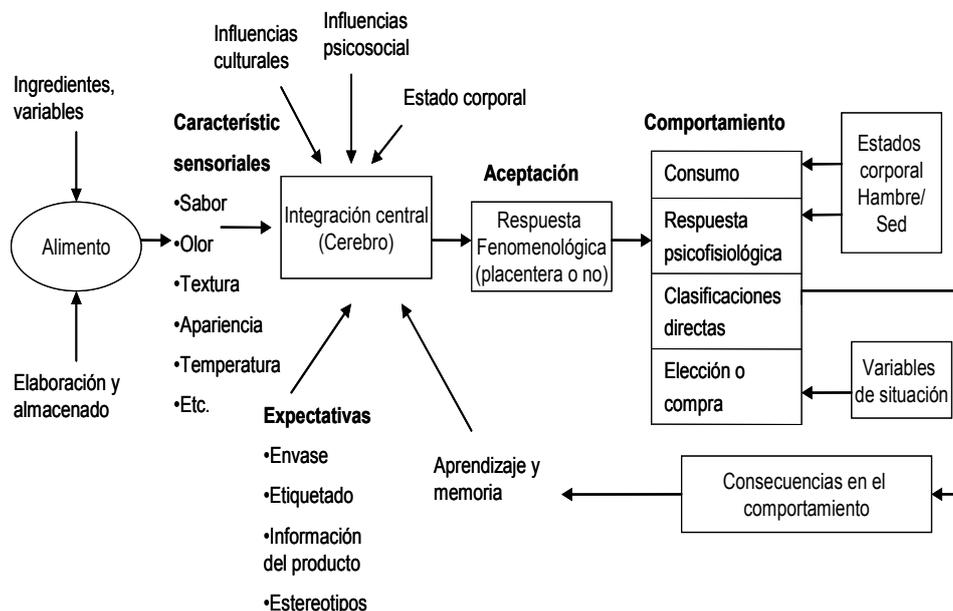


Figura 3. Modelo del comportamiento hacia el producto desarrollado por Cardello (1996).

Algunos parámetros extrínsecos del producto como el precio, envase (forma, colores, tamaño de letra, etc.), la marca, etiquetado con información nutricional, listado de ingredientes, declaraciones nutricionales y de salud son factores clave en la elección y constituyen un primer contacto entre el producto y el consumidor. Estos factores crearán expectativas iniciales y formarán percepciones sobre el producto que influirán de forma definitiva sobre su elección. Las expectativas están relacionadas con la satisfacción o insatisfacción del consumidor con el producto (Shepherd *et al.*, 1991; Cardello, 1994; Deliza y MacFie, 1996; Rowan, 2000; Deliza *et al.*, 2003). En la figura 4, se muestra de forma esquemática el efecto de las expectativas sobre la aceptación de un alimento.

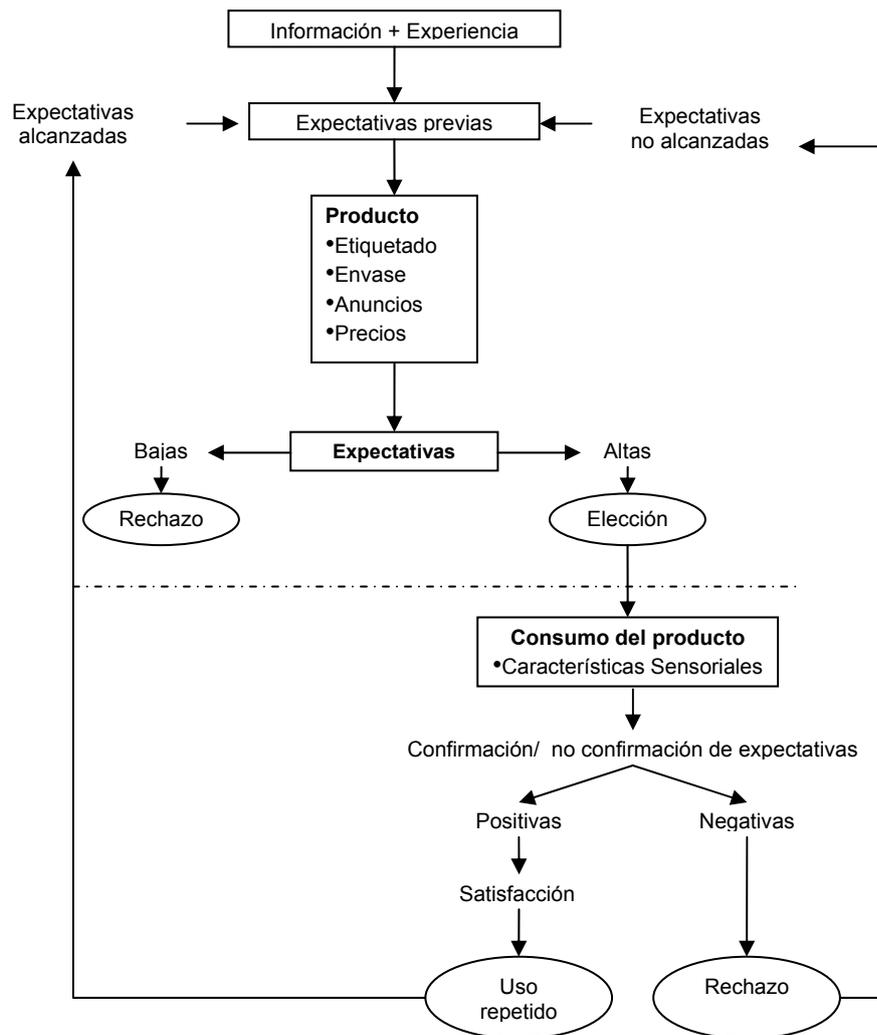


Figura 4. Modelo esquemático del efecto de las expectativas en la elección y aceptación de un alimento (Deliza y MacFie, 1996).

El primer paso en la percepción comienza con información previa (ideas preconcebidas) que crea expectativas acerca del propio alimento. A continuación, ciertos factores no sensoriales del producto (envase, etiquetado) pueden alterar estas expectativas. Si las expectativas no son alcanzadas se

producirá un rechazo; mientras que si las expectativas son alcanzadas o superadas se producirá la elección. En el siguiente paso de este modelo cuando el consumidor prueba el producto, las características sensoriales desempeñan un papel fundamental para que las expectativas se confirmen o no, y el producto vuelva a ser elegido y consumido (vuelva a comprarse) o producirse un rechazo (Deliza y MacFie, 1996).

2.2 Consumidor

Cuando se diseña un producto y para que éste tenga éxito en el mercado, es necesario realizar estudios enfocados hacia el consumidor. Este campo es el más amplio y complejo de estudiar debido a la dificultad de obtener patrones colectivos de comportamiento; éstos, varían de acuerdo a la cultura, localización geográfica, y variabilidad natural entre individuos, entre otros (Hauser *et al.*, 2011). Por lo tanto, desde el punto de vista del consumidor se requiere estudiar diversos aspectos, como refleja la figura 1, que abarquen factores psicológicos biológicos y fisiológicos.

Debido a que las actitudes afectan al comportamiento, éstas se utilizan para explicar la elección de los alimentos. Las actitudes pueden ser definidas como una “tendencia psicológica que se expresa mediante la evaluación de una entidad particular con algún grado de favor o en contra”. (Eagly y Chaiken, 1993; Urala y Lähteenmäki, 2004). Dentro de ciertas poblaciones se han podido trazar patrones similares de comportamiento en los consumidores, mediante el estudio de sus actitudes hacia la salud, sabor, precio, o conveniencia. Éstos se han estudiado, por ejemplo, a través del Food Choice Questionnaire, desarrollado por Steptoe (Steptoe *et al.*, 1995), que se ha aplicado en varios países y ha permitido conocer el peso de ciertos factores en el momento de la elección de un alimento (Fotopoulos *et al.*, 2009; Pieniak *et al.*, 2009).

Otros factores, como los psicológicos, representan un área de gran interés; por ejemplo ciertos rasgos de personalidad, o la preocupación hacia el estado de

salud pueden ser determinantes de la elección de alimentos (Booth-Kewley y Vickers, 1994).

2.3 Medio ambiente/ contexto

En la elección de un alimento, la importancia del contexto nace del hecho de que comer forma parte de un acto social. Por otra parte, la cultura, la religión, los hábitos, entre otros, influyen en lo que se elige para comer y los gustos hacia determinadas comidas; además éstos se transfieren por el entorno. Con respecto a la cultura, estudios realizados por Rozin (2005) indican que los hábitos en la alimentación, marcados por la cultura, son los últimos en cambiar por el efecto de la migración; esto quiere decir que los hábitos hacia los alimentos pueden cambiar dentro de una misma cultura pero adquirir hábitos de otras culturas es más difícil.

Dentro de los factores de contexto, la situación socioeconómica ejerce una gran influencia debido a que aunque se desee un producto si no está al alcance de la economía, la compra no se realiza.

3. El papel de la salud en el desarrollo de nuevos alimentos

Una tendencia que comenzó hace aproximadamente una década y continúa siendo actual en la industria alimentaria es la elaboración de alimentos que ayuden a mejorar algún aspecto de la salud, debido a la obvia relación entre salud y alimentación. Este enfoque ha surgido como respuesta a la preocupación de los consumidores por su salud, que buscan alternativas más saludables. En parte, el acto de comer ha ido cambiando y ha pasado de saciar el hambre a satisfacer, si es posible, un estilo de vida saludable (Korver, 1997; Rozin, 2005; Saba *et al.*, 2010).

La obesidad constituye un problema nutricional grave y se ha definido como la epidemia del siglo XXI tanto por el Grupo Internacional de Trabajo sobre Obesidad (International Obesity Taskforce, IOTF) como por la Organización Mundial de la Salud (OMS). La incidencia de numerosas enfermedades como

hipertensión, cálculos biliares, enfermedades cardiovasculares, hígado graso no alcohólico, diabetes no dependiente de insulina, cáncer de endometrio, etc. se asocia a la obesidad y, por tanto, al desequilibrio energético (calorías consumidas frente a calorías gastadas) (Frazao, 1999; Stein y Colditz, 2004). Se ha determinado que los alimentos y/o modo de alimentación son dos de los principales factores de riesgo, asociados a su vez al nivel socioeconómico, nivel cultural, hábitos de vida como sedentarismo o dieta, entre otros (Aranceta *et al.*, 2005). Así mismo, en las sociedades occidentales, en las últimas décadas se ha tendido a un incremento progresivo del consumo de alimentos de “bienestar” normalmente hipercalóricos (ricos en grasas y azúcares principalmente) y de alta palatabilidad, a la vez que muy disponibles y baratos, creando un ambiente obesogénico poco conveniente.

Como reacción, parte de la industria de alimentos ha comenzado a ofrecer productos que contribuyen a disminuir ciertos riesgos para la salud en forma directa. En este contexto, se han introducido los alimentos funcionales, en los que se ha desarrollado e introducido un componente particular para que produzca un efecto fisiológico específico en el organismo (Diplock *et al.*, 1999; Urala y Lähteenmäki, 2004).

A pesar de todos los trabajos realizados por la industria para ofrecer alternativas al consumidor que ayuden en su dieta, muchos productos no han llegado a su objetivo principal que es la elección y fidelidad por parte del consumidor. En este sentido, la comunicación acerca de las propiedades nutricionales y saludables de los productos es muy importante. A diferencia de las propiedades sensoriales, en las que se emplean los sentidos y mediante las cuales el consumidor decide si un alimento le gusta o no, las propiedades saludables son muchas veces intangibles y en general el consumidor no puede saber cuán saludable es un alimento con solo mirarlo (Korver, 1997). Sobre todo, debe tenerse en cuenta que el consumidor medio no está bien informado sobre las propiedades y funciones de los componentes alimentarios. Con este antecedente, el papel de la comunicación es esencial para que el consumidor

pueda hacer una elección responsable. El uso del etiquetado como medio de comunicación es una herramienta dirigida a informar y ayudar en la elección. Sin embargo, esta comunicación no es una tarea fácil por la gran variabilidad de consumidores en cuanto a nivel de educación, interés por la salud, conocimientos nutricionales, contacto con los alimentos, etc. Algunos estudios, sugieren que el nivel de educación, el género, y el nivel socioeconómico influyen en el interés del consumidor hacia la salud y por tanto en el uso del etiquetado (Drichoutis *et al.*, 2006; Grunert *et al.*, 2010). Además, los conocimientos nutricionales también intervienen en crear expectativas iniciales y por tanto intervienen en la aceptación. En este contexto, es fundamental que un producto se etiquete correctamente y que la información que se encuentra al alcance del consumidor sea comprensible.

En particular, algunos estudios realizados en España señalan que si bien la información nutricional, así como las declaraciones nutricionales y las propiedades saludables influyen en la elección de alimentos saludables, se observaron diferencias de acuerdo al tipo de consumidor, por ejemplo, los que buscan nutrientes específicos y los consumidores más sensibles al precio (Barreiro-Hurlé *et al.*, 2010)

3.1 Alimentos reducidos en calorías

Un amplio sector de la industria alimentaria desarrolla nuevos alimentos bajos en calorías o crea versiones “ligeras” de alimentos ya existentes.

De acuerdo al reglamento (CE) No. 1924/2006 del Parlamento Europeo y del Consejo, un alimento puede ser llamado ligero (*light*), si la reducción del valor energético es como mínimo del 30% en comparación con el producto similar. La declaración deberá estar acompañada por una indicación de la característica o características que hacen que el alimento sea «light» o «lite» (ligero). Declaraciones como “Bajo valor energético” se puede hacer mención si el alimento no contiene más de 40 kcal (170 kJ)/100 g en el caso de los sólidos o más de 20 kcal (80 kJ)/100 ml en el caso de los líquidos.

“Sin aporte energético” podrá declararse si un alimento carece de aporte energético, o si el producto no contiene más de 4 kcal (17 kJ)/100 ml. Para los edulcorantes de mesa se aplicará un límite de 0,4 kcal (1,7 kJ) por porción, con propiedades edulcorantes equivalentes a 6 g de sacarosa (una cucharadita de sacarosa aproximadamente).

En particular, la normativa establece distinciones entre “bajo contenido de grasa” y “sin grasa”. La primera se aplica si el producto no contiene más de 3 g de grasa por 100 g en el caso de sólidos o 1,5 g por 100 ml en el caso de los líquidos. La segunda puede mencionarse si el producto no contiene más de 0,5 g de grasa por 100 g o 100 ml. Con respecto al azúcar, puede hacerse mención a “Bajo contenido de azúcares”, “Sin azúcares” o “Sin azúcares añadidos” si se cumplen los siguientes criterios: la primera, si el producto no contiene más de 5 g de azúcares por 100 g en el caso de sólidos o 2,5 g de azúcares por 100 ml en el caso de líquidos; la segunda si el producto no contiene más de 0,5 g de azúcares por 100 g o 100 ml; y “sin azúcares añadidos” puede mencionarse si no se ha añadido al producto ningún monosacárido ni disacárido, ni ningún alimento utilizado por sus propiedades edulcorantes. Si los azúcares están naturalmente presentes en los alimentos, en el etiquetado deberá figurar asimismo la indicación: “Contiene azúcares naturalmente presentes”.

3.2 Alimentos enriquecidos o con ingredientes funcionales

Otra importante tendencia del mercado que ha surgido en las últimas décadas son los llamados alimentos funcionales a los que se les atribuye cualidades de disminución del riesgo de contraer ciertas enfermedades ocasionadas por la malnutrición, o a mejorar el estado físico y mental (Menrad, 2003).

El término “funcional” fue usado por primera vez en Japón en los años 80 para productos alimenticios enriquecidos con constituyentes que posean efectos fisiológicos ventajosos (Hardy, 2000; Kwak y Jukes, 2001). Actualmente, no hay una definición oficial para estos alimentos, sin embargo, a efectos

prácticos, la más reconocida es la definición proporcionada por la International Life Science Institute (ILSI, 2002) declarando que *“Un alimento puede considerarse funcional si se demuestra satisfactoriamente que ejerce un efecto beneficioso sobre una o más funciones selectivas del organismo, además de sus efectos nutritivos intrínsecos, de modo tal que resulte apropiado para mejorar el estado de salud y bienestar, reducir el riesgo de enfermedad, o ambas cosas. Los alimentos funcionales deben seguir siendo alimentos, y deben demostrar sus efectos en las cantidades en que normalmente se consumen en la dieta. No se trata de comprimidos ni cápsulas, sino de alimentos que forman parte de una dieta normal”*.

La Legislación Europea no considera a los alimentos funcionales como una categoría específica de alimentos y tampoco existe una legislación para ellos (Stanton *et al.*, 2005; Coppens *et al.*, 2006; Niva, 2007). Sin embargo, el antes mencionado “efecto beneficioso” de estos alimentos suele comunicarse a través de declaraciones nutricionales y declaraciones de propiedades saludables que sí están reguladas por el Reglamento (CE) No. 1924/2006 del Parlamento Europeo y del Consejo de 2006.

Las declaraciones nutricionales y de propiedades saludables se utilizan de forma voluntaria en el etiquetado de los alimentos como una herramienta de comunicación. Dan a conocer las características beneficiosas de los alimentos, además, de ser utilizadas en comunicaciones comerciales (anuncios).

Con el objetivo de proteger al consumidor de información falsa y garantizar que las declaraciones de propiedades saludables sean veraces, claras, fiables y útiles, la normativa antes mencionada estableció lo que se entiende por declaración: *“cualquier mensaje o representación que no sea obligatorio con arreglo a la legislación comunitaria o nacional, incluida cualquier forma de representación pictórica, gráfica o simbólica, que afirme, sugiera o dé a entender que un alimento posee unas características específicas”*. Este objetivo debe tenerse presente en la redacción y la presentación de las declaraciones. Cuando el texto de las declaraciones tenga el mismo significado para los

consumidores que el de una determinada declaración autorizada de propiedades saludables (porque demuestra que existe la misma relación entre la salud y una categoría de alimentos, un alimento o uno de sus constituyentes), estas declaraciones deben estar sujetas a las mismas condiciones de uso que la declaración autorizada de propiedades saludables.

En esta normativa se hace una distinción entre declaraciones nutricionales y declaraciones de propiedades saludables. Las primeras se definen como cualquier declaración que afirme, sugiera o dé a entender que un alimento posee propiedades nutricionales benéficas específicas con motivo de: a) el aporte energético (valor calórico), b) los nutrientes u otras sustancias. Se entenderá por “declaración de propiedades saludables” cualquier declaración que afirme, sugiera o dé a entender que existe una relación entre una categoría de alimentos, un alimento o uno de sus constituyentes, y la salud (Reglamento CE No 1924/2006 del Parlamento Europeo y del Consejo).

Actualmente, esta normativa ha sido ampliada y consta en el Reglamento (UE) No. 432/2012 de la Comisión del 16 de mayo de 2012 y que será aplicable a partir del 14 de diciembre de 2012. En este reglamento se establece una lista de declaraciones autorizadas de propiedades saludables de los alimentos distintas de las relativas a la reducción del riesgo de enfermedad y al desarrollo y la salud de los niños.

Las numerosas evidencias científicas hacen evidente que la dieta tiene un impacto directo sobre la salud; ciertos alimentos resultan especialmente beneficiosos y contribuyen al bienestar de los consumidores. Sin embargo, la adopción de una dieta saludable depende de las creencias del consumidor. Ante este hecho, es fundamental estudiar sus actitudes, conocimientos y comportamiento frente a parámetros sensoriales y no sensoriales que intervienen en la elección de los alimentos: específicamente en los bajos en calorías y enriquecidos con ingredientes funcionales. Las aportaciones que ofrecen estos estudios son fundamentales para el diseño de un alimento, para

establecer las directrices en su desarrollo y para promover un consumo responsable.

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OBJETIVOS

El objetivo general de la presente Tesis Doctoral es estudiar las actitudes, conocimientos y comportamiento de los consumidores frente a parámetros sensoriales y no sensoriales que intervienen en la elección de alimentos bajos en calorías o enriquecidos con ingredientes funcionales.

Para alcanzar este objetivo se establecieron los siguientes objetivos específicos:

- Estudiar los principales factores que el consumidor español tiene en cuenta para seleccionar un alimento. Específicamente, conocer sus actitudes hacia el control de peso como parte de un estilo de vida saludable y con relación a la frecuencia de consumo de alimentos bajos en calorías y enriquecidos con ingredientes funcionales.
- Evaluar los conocimientos de los consumidores sobre las principales características nutricionales de los alimentos; en particular las relacionadas con el control de peso. Estudiar la influencia de dichos conocimientos en el uso del etiquetado nutricional.
- Estudiar las percepciones y expectativas generadas por la información nutricional, declaraciones nutricionales y propiedades saludables del envase de galletas bajas en azúcar, grasa y enriquecidas. Analizar la influencia de las características sensoriales y no-sensoriales (etiquetado y envase) sobre la aceptación y la percepción de saludable en dichas galletas.
- Obtener un modelo de la influencia de determinadas características intrínsecas y de personalidad del consumidor sobre la preocupación por su salud y el control de peso en relación con la frecuencia de consumo de alimentos bajos en azúcar y bajos en grasa.

- Conocer el comportamiento, conocimiento y actitudes del consumidor hacia los alimentos funcionales. Obtener un modelo de la influencia de determinados factores como la salud, satisfacción con la vida, contenido natural, novedad y actitudes en la compra de dichos alimentos.

ESTRUCTURA DE LA
TESIS

El trabajo de investigación realizado ha dado origen a diversas publicaciones científicas, cuyo contenido se presenta en los distintos capítulos de la presente Tesis Doctoral. Las referencias de las publicaciones y el capítulo en que aparecen son:

CAPÍTULO I:

ESTUDIO DE LOS PRINCIPALES FACTORES QUE SUBYACEN LA ELECCIÓN DE ALIMENTOS Y COMO INFLUYE EL CONTROL DE PESO EN LA ELECCIÓN

Carrillo, E., Varela, P., Salvador, A., & Fiszman, S. (2011). Main factors underlying consumers' food choice: a first step for the understanding of attitudes toward "healthy eating. *Journal of Sensory Studies*, 26, 85-95.

CAPÍTULO II:

INFLUENCIA DE LOS CONOCIMIENTOS NUTRICIONALES EN EL USO DEL ETIQUETADO NUTRICIONAL

Carrillo, E., Varela, P., & Fiszman, S. (2011). Influence of Nutritional Knowledge on the Use and interpretation of Spanish Nutritional Food Labels. *Journal of Food Science*, 71, H1-H8.

CAPÍTULO III:

INFLUENCIA DE FACTORES INTRÍNSECOS Y EXTRÍNSECOS DEL PRODUCTO EN LA PERCEPCIÓN DEL CONSUMIDOR

Carrillo, E., Varela, P., & Fiszman, S. (2012). Packaging information as a modulator of consumers' perception of enriched and reduced-calorie biscuits in tasting and non-tasting tests. *Food Quality and Preference*, 25, 105-115.

Carrillo, E., Varela, P., & Fiszman, S. (2012). Effects of food package information and sensory characteristics on the perception of healthiness and the acceptability of enriched biscuits. *Food Research International*, 48, 209-216.

CAPÍTULO IV:

INFLUENCIA DE LAS CARACTERÍSTICAS PERSONALES DEL CONSUMIDOR EN LA ELECCIÓN DE ALIMENTOS REDUCIDOS EN CALORÍAS

Carrillo, E., Prado-Gascó, V., Fiszman, S., & Varela, P. (2012). How personality traits and intrinsic personal characteristics influence the consumer's choice of reduced-calorie food. *Food Research International*.
(DOI: 10.1016/j.foodres.2012.09.006).

CAPÍTULO V:

FACTORES NO SENSORIALES QUE INFLUYEN EN LA ELECCIÓN DE ALIMENTOS FUNCIONALES

Carrillo, E., Prado-Gascó, V., Fiszman, S., & Varela, P. (2012). Why buying functional foods? Understanding spending behaviour through structural equation modelling. *Food Research International* (Aceptado).

CAPÍTULO I

**ESTUDIO DE LOS PRINCIPALES
FACTORES QUE SUBYACEN LA
ELECCIÓN DE ALIMENTOS Y
COMO INFLUYE EL CONTROL DE
PESO EN LA ELECCIÓN**

Main factors underlying consumers' food choice: a first step for the understanding of attitudes toward "healthy eating"

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Journal of Sensory Studies (2011), 26, 85-95.

ABSTRACT

This research investigates consumers' factors underlying food choice and their attitudes towards healthy eating. The participants completed a questionnaire composed by two parts. The first one was based on the Food Choice Questionnaire where the mean scores and factor analyses pointed to "sensory appeal", "price" and "convenience" as the most important factors in Spaniards' food choice. The agglomerative hierarchical clustering grouped women and adult people as the most concerned population about health and weight control. Considering the latter factor, the items "Is low in calories", "Help me to control my weight" were more associated with "Is low in fat" than "Is low in sugar". The second part of the questionnaire asked about the consumption frequencies of different kind of foods and revealed dairy products as the most consumed ones. Furthermore, foods with specific health-promoting ingredients exhibited low consumption frequency, most likely motivated by the low interest or knowledge about their health benefits.

Keywords: Consumer's attitudes, low-calorie foods, food choice, low-sugar, low-fat.

1. INTRODUCTION

Different factors beyond sensorial characteristics have become fairly influencing in consumer's food choice and their elucidation contributes to a better understanding of the dietary behavior and the search for a healthy status in food consumption (Furst et al., 1996; Zandstra et al., 2001; Ristovski et al., 2008, Köster, 2008; Saba et al., 2010). Non-sensory aspects such as culture have a big market impact in food choice (Rozin, 1996). James (2004) found that for a certain population of African-Americans in the US, "Eating healthily" meant giving up part of their cultural heritage and trying to conform to the dominant culture. This fact points out the importance of understanding and designing appropriate dietary policies targeted for each population, in particular, when strong rooted food-related customs are linked to the cultural background (Prescott et al., 2002). In this sense, the identification of the principal factors considered by consumers at the time of choosing their food would allow to establish relationships between diet and healthy eating attitudes promoting the consumption of specific groups of food.

The reduction of energy intake of diets is a health recommendation and food with low calorie contents is considered to improve healthiness (Kähkönen & Tuorila, 1999; Carels et al., 2007). Fat and sugar are food components providing a major contribution to sensory and palatable characteristics, but at the same time contributing with high amounts of energy to foods. The increased consumption of foods with high proportion of these components is mainly because of taste preference, aroma, and mouthfeel characteristics (Drewnowski, 1989; Elfhag and Erlanson-Albertsson, 2006). Preference for sweet foods is innate in humans and is believed to be genetically determined; babies present positives responses to sweet taste since birth (Desor and Beauchamp, 1987; Keskitalo et al., 2007). Preference for high-fat foods is universal, and no physiologic mechanisms regulating fat intake have been identified; in addition, fat consumption appears to be highly correlated to the amount of fat available for a certain population (Drewnowski 1997).

Food availability and child-feeding practices are highly influential in the learning of not innate food preferences, the great availability of energy-dense foods in the developed countries - particularly in the U.S.A., but an increasing problem in the European Union - promotes preferences inconsistent with dietary guidelines, with a direct relation to generalized obesity problems (Birch, 1999). Drewnowski (1997), after a systematic study of food preferences in obese population in the U.S.A., proposed that preferences for foods as main sources of fat as opposed to carbohydrates may be a primary characteristic of human obesity syndromes, although carbohydrate cravings were common between obese individuals. In addition, the constant TV advertisement encouraging the intake of high-fat and/or high-sugar containing food should not be disregarded (Klepp et al., 2007; Vereecken et al., 2006).

Nutritional disorders during infant growth development could conduce to serious health consequences in the elderly population (Sala 2009). It is widely known the link between fat and sugar consumption with many diseases such as obesity, which is one of the most widespread and important health concerns for policy-makers in developed countries that are promoting and preventing measures against illnesses (Aranceta et al., 2009). Furthermore, imbalances between intake and overconsumption of calories can also lead to other diseases, such as non-insulin-dependent-diabetes, hypertension, atherosclerotic cardiovascular disease, endometrial cancer and gall-stones (Frazão 1999; Stein and Colditz 2004). The reduction of sugar and fat consumption is, among others, a measure to reduce the risk and control the incidence of these illnesses.

The objective of the present study was to investigate the main factors underlying food choice and the attitudes toward weight control as a factor to maintain healthiness, in relation to consumers' cultural background and food consumption frequency of healthy food. The study focused in the perception and frequency of consumption of low-calorie food; however, other food considered healthy was included in the survey.

2. MATERIALS AND METHODS

2.1 Consumers

A total of two hundred consumers between 18 to 70 years old completed the survey. The sample included approximately half men and half women, that were distributed in three groups according to their age range from 18 to 29 (35%), 30 to 44 (34%) and over 45 (31%) years old. Consumers interviewed were students (21%), people with university degree (44%) and with middle studies (35%). The participants were recruited from official associations of consumers, university areas and coffee places, who voluntarily filled out the questionnaire. Some of the interviews were self administered, and others were carried out face-to-face depending of the ability for self-completion of the participants. The subjects were recruited according to gender, age and education.

2.2 Food questionnaire

The survey consisted of a consent form, questions about motivational factors and frequency of food consumption. The Food Choice Questionnaire (FCQ; Table 1) used was adapted from the one previously developed for English consumers by Steptoe et al., (1995), which involved nine motivational dimensions (or factors) regarding health and non-health considerations to food, where each factor comprised three to six items. The English translation into Spanish statements was carefully conducted by fluent English speakers to avoid misunderstandings and provide familiarity for the thirty-seven evaluated items.

The nine motivational factors (health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity and ethical concern) and their respective items were evaluated by answering to the following question “It is important to me that the food I eat on a typical day...”. In order to know the opinion of low-sugar food and its influence in food choice, the item “Is low in sugar” was included in the questionnaire. All the questionnaire statements were answered on a seven-box scale, labeled from “not at all important” to “very

important”; the change from the original four-box scale was done with the purpose of increasing the discrimination ability among food choice motives (Fotopoulos et al., 2009; Pohjanheimo and Sandell 2009).

A list of thirty different kinds of food products with a special emphasis on low/less-fat, -sugar and healthy food were employed in the questionnaire in order to determine the consumption frequency. In addition, some particular regular products were also included in the list to compare with low calories and functional ingredients-added food. These products are commonly found in the local markets and the participants answered the question “How often do you consume the following food item?” The consumption frequency was quantified with a 5-point category scale (1=daily, 2=most days, 3=more than once a week, 4=at times or seasonally, 5= rarely or never).

2.3 Data analysis

The data survey was analyzed using the statistical software package XIStat (Addinsoft-Barcelona-Spain, version 2009, 4.03). Analysis of variance was performed for each item and factor of the FCQ. A factor analysis with varimax rotation was conducted in order to study the factors influencing food choice. The internal reliability for each factor was analyzed according to Cronbach’s alpha coefficient.

Correlations between factors and their relation to consumer choice were identified by means of Principal Component Analysis (PCA), which was applied to the complete questionnaire as well as to the “Weight Control Factor” items only; in order to further understand the relation between consumer behavior and these four items. Both PCAs were calculated from the mean values according to Pearson’s correlation matrix.

Hierarchical Cluster analyses (HCA), with Euclidean distances, Ward’s aggregation method and automatic truncation, were applied to the complete FCQ and to the “Weight Control Factor’s” items in order to highlight consumer

clusters showing different behaviors based on their food choices. The obtained clusters were characterized in terms of gender and age, and their food consumption patterns were analyzed according to their frequency of mention. Differences in frequency of mention for each product were analyzed by using the chi-squared test to establish statistical differences in the distribution between the clusters.

3. RESULTS AND DISCUSSION

3.1 Food choice

The mean scores for each item of the FCQ are shown in Table 1. The item “Tastes good” was the most important followed by “Good value for money” and “Keeps me healthy” in the third place. On the other hand, items such as “Keeps me awake/alert”, “Is high in fiber and roughage” and “Is like the food I ate when I was a child” were the least valued.

Table 1. FCQ-items: means, standard deviations (SD) and factor loading (n=200) for answer to: “It is important to me that the food I eat on a typical day”.

Factors and Items	Mean	SD	Factor loading
Factor 1. Health			
22. Contains a lot of vitamins and minerals	5.25	1.66	0.79
29. Keeps me healthy	5.83	1.31	0.68
10. Is nutritious	5.50	1.32	0.59
27. Is high in protein	4.47	1.70	0.67
30. Is good for my skin/teeth/hair/nails etc.	4.64	1.96	0.66
9. Is high in fiber and roughage	3.71	1.81	0.66
Factor 2. Mood			
16. Helps me cope with stress	4.08	2.00	0.84
34. Helps me to cope with life	4.18	1.95	0.74
26. Helps me relax	3.83	1.90	0.87
24. Keeps me awake/alert	3.61	1.93	0.63
13. Cheers me up	4.80	1.84	0.80
31. Makes me feel good	5.08	1.70	0.63
Factor 3. Convenience			

1.	Is easy to prepare	4.88	1.78	0.70
15.	Can be cooked very simply	5.26	1.65	0.86
28.	Takes me time to prepare	4.79	1.77	0.85
35.	Can be bought in shops close to where I live or work	5.76	1.37	0.53
11.	Is easy available in shops and supermarkets	5.68	1.37	0.56
Factor 4. Sensory appeal				
14.	Smells nice	5.77	1.20	0.75
25.	Looks nice	5.25	1.50	0.68
18.	Has a pleasant texture	5.76	1.28	0.66
4.	Tastes good	6.51	0.76	0.38
Factor 5. Natural content				
2.	Contains no additives	4.65	1.95	0.73
5.	Contains natural ingredients	5.73	1.35	0.71
23.	Contains no artificial ingredients	5.11	1.80	0.82
Factor 6. Price				
6.	Is not expensive	5.16	1.53	0.77
36.	Is cheap	5.19	1.53	0.66
12.	Is good value for money	6.15	1.02	0.64
Factor 7. Weight control				
3.	Is low in calories	4.39	1.80	0.82
17.	Helps me control my weight	5.00	1.72	0.77
7.	Is low in fat	5.19	1.54	0.78
37.	Is low in sugar	4.51	1.79	0.66
Factor 8. Familiarity				
33.	Is what I usually eat	4.38	1.76	0.71
8.	Is familiar	4.21	1.92	0.69
21.	Is like the food I ate when I was a child	3.84	1.99	0.64
Factor 9. Ethical concern				
20.	Comes from countries I approve of politically	4.31	2.22	0.62
32.	Has the country of origin clearly marked	5.20	1.90	0.81
19.	Is packaged in an environmentally friendly way	5.29	1.71	0.54

Number before each Item refers to the order in which statements were presented in the FCQ. Mean values in bold type correspond to the highest mean for each factor.

Factor analysis was performed in order to detect the load of each item and the relationship with the factor (Table 1). The consistency for all of the evaluated factors was high as concluded by the Cronbach's alpha coefficient values >0.69

(Table 2), these values are in concordance with previously obtained by Steptoe et al., (1995). In addition, Fotopoulos et al., (2009) evidenced a good reliability of the FCQ (Cronbach's alpha from 0.61 to 0.82) with the exception of the "ethical concern" for Greek consumers. This type of questionnaire was also a reliable research instrument in different studies in some South American (Ares and Gámbaro 2007) and European (Eertmans et al., 2006; Honkanen and Frewer, 2009) countries.

Table 2. Cronbach's alpha (α) for the factors of the Food Choice Questionnaire. Mean scores for the whole sample in order of importance and for each of the identified clusters.

Factor	α	Whole sample N = 200	Cluster 1 N = 37	Cluster 2 N = 97	Cluster 3 N = 66
Sensory appeal	0.71	5.82 B ^a	5.25 C ^a	5.66 BC ^a	6.36 A ^a
Price	0.73	5.50 B ^{a,b}	5.05 B ^{a,b}	5.25 B ^a	6.10 A ^{a,b}
Convenience	0.81	5.27 B ^{a,b}	4.52 C ^{a,b}	5.07 BC ^{b,c}	5.99 A ^{a,b}
Natural content	0.80	5.16 B ^{b,c,d}	4.17 C ^{b,c}	4.91 B ^{b,c,d}	6.13 A ^{a,b}
Ethical concern	0.69	4.93 B ^{c,d}	3.44 C ^{c,d}	4.81 B ^{b,c,d}	5.94 A ^{a,b}
Health	0.83	4.90 B ^{c,d}	3.50 C ^{c,d}	4.67 B ^{c,d}	6.00 A ^{a,b}
Weight control	0.84	4.77 B ^d	3.24 C ^{d,e}	4.54 B ^{d,e}	5.95 A ^{a,b}
Mood	0.89	4.26 B ^e	2.34 C ^e	4.04 B ^e	5.69 A ^b
Familiarity	0.72	4.14 B ^e	2.73 C ^{d,e}	4.07 B ^e	5.02 A ^c

For each column means with the same superscript letter are not significantly different ($P < 0.05$) according to the Tukey's multiple range test.

For each row means with the same capital letter are not significantly different ($P < 0.05$) according to the Tukey's multiple range test.

The results identified "Sensory appeal" as the most important factor for the analyzed consumers. It was followed in importance by non-sensory factors such as price, convenience, natural content, ethical concern, health, weight control, mood and familiarity (Table 2). "Sensory appeal" followed by "Price" were also the most important factors considered by the British population (Steptoe et al., 1995); however, some differences in the factors with lower punctuation were

found between these two studies, being “Ethical concern” more important for Spanish consumers than for English consumers, although it has to be pointed out that a low internal consistency for this factor was obtained in the present study. Honkanen and Frewer (2009) reported that different Russian consumer segments ranked the motivational factors to food choice similarly. In addition, research efforts to assess the invariance measurement between western urban population (Italy, Belgium and Canada) have been made, which demonstrated that differences in ranks and motives to food choice are relative to different cultures (Eertmans et al., 2006).

Ares & Gámbaro (2007) investigated the association of food choice with the perception of healthiness and the willingness to try functional foods. These authors showed that several factors such as “Feeling good and safety”, “Sensory appeal” and “Health” were the most important for Uruguayan consumers; when comparing these results with those of the present study, the factor “Health” was not the most important for Spanish consumers, being ranked in 6th place (Table 2). Analyzing specifically the evaluated items for this factor, the participants gave more weight to “Keeps me healthy” than to other items as “High in protein”, “High in fiber” or “Good for my skin/teeth/hair/nails” (Table 1). These results could suggest that consumers might not directly associate a single component (as “Fiber” and/or “Protein”), or a combination of those with “Health”. These answers could also be interpreted as a lack of knowledge of specific benefits attributable to some food components, pointing out the importance of appropriate marketing and educational strategies providing information about this topic. In fact, it is noteworthy that a 44% of the sample population included people educated up to university degree, likely suggesting that a high education level did not positively influence the food choice. Honkanen & Frewer (2009) linked a low education level to a low health factor position (sixth) for food choice in the Russian population. In the same way, Wadolowska et al., (2008) evidenced the direct association in the Polish male population with primary school education level and their negative attitude to health. The differences observed between these studies and the results of

the present study could be attributed to cultural reasons. It could be hypothesized that an important factor such as “health” may have become fairly assumed for Spanish consumers derived from their traditional dietary practices like “Mediterranean diet”.

A low concern of consumers regarding weight control was highlighted by the survey; this factor was located in seventh place of the nine motivational factors to food choice. This is a surprising finding, as nowadays, control weight is considered not only as “physical image model of healthiness” by avoiding overweight, but particularly because of the widespread knowledge of the impact of weight control in reducing the incidence of certain illnesses.

The above-mentioned analyses identified the reasons underlying food choices for the whole population sample analyzed; the next question arising was, are there groups of consumers with different motivations when selecting their products? PCA followed by a HCA was carried out taking into account the full list of items. Results of the PCA showed that most of the items related to “Health” (factor 1 of the questionnaire), “Mood” (factor 2), and “Sensory appeal” (factor 4) were positively correlated to the first principal component (Figure 1A). The items positively related to the second component were those included in the motivational factor 3 “Convenience” and the items of factor number 6 “Price”. This means that both price and convenience were highly correlated, playing together a role in consumers’ choice, not directly related to “Health” or “Mood”, as explained by their association with two not correlated components of the PCA. This grouping of the motives into price/convenience and health/mood/sensory might suggest that “practical versus beneficial” reasons underlying food choice could be placed in two different levels of decision making when considering to buy a food product; some consumers would favor one or the other when choosing. Correlation between price and convenience suggested that Spanish consumers, as in other modern societies, are driven towards a life style where saving time in the preparation of food is important, but it has also to be affordable.

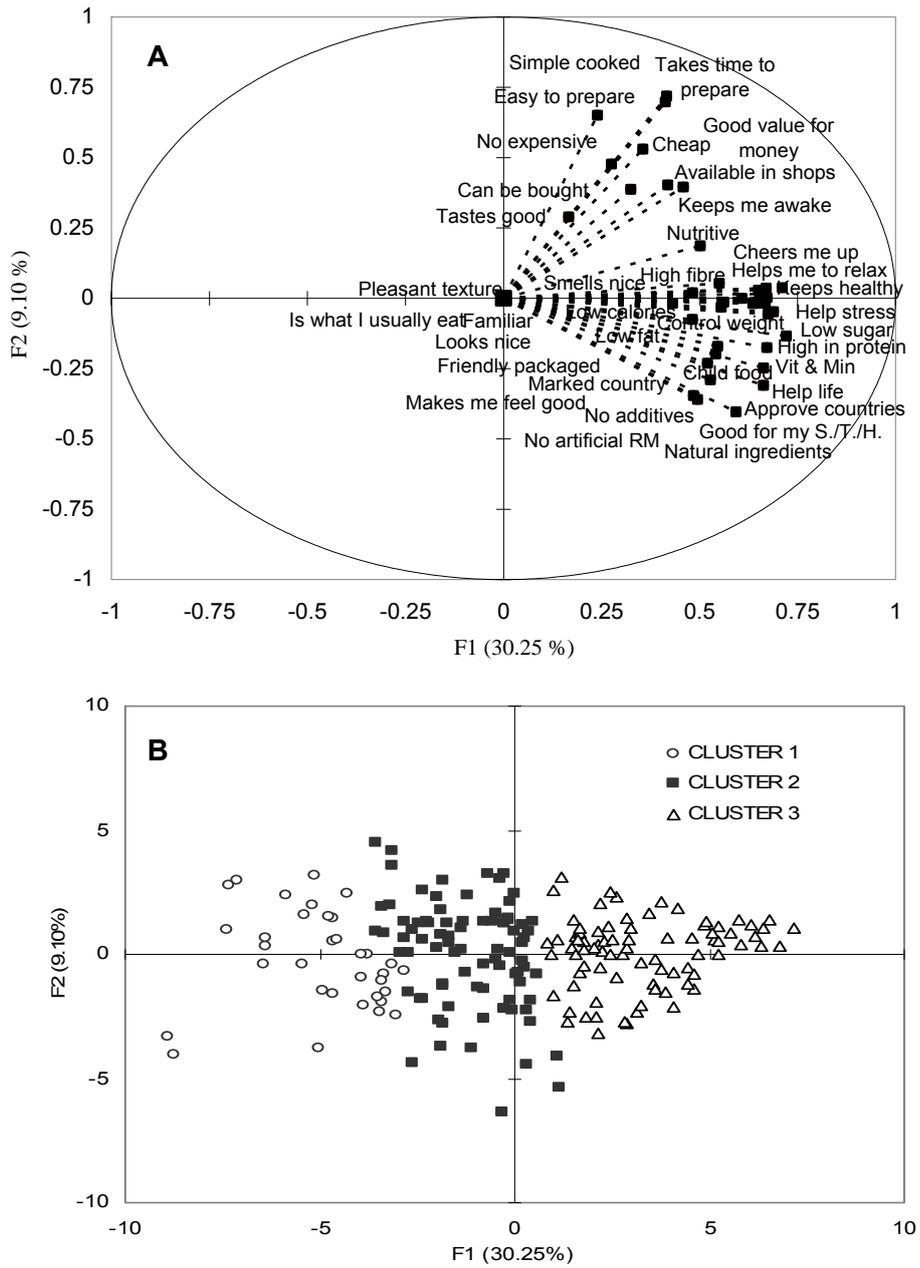


Figure 1. Principal Component Analysis. A) Food choice items; B) Consumers Identified into clusters.

This suggestion is accordance with the results of a study made on six other European countries on traditional food consumption that indicated the relevance of the price for the Spanish population in contrast with the other European population (Pieniak et al., 2009).

An agglomerative hierarchical clustering (HCA) was applied to the complete data set, in order to identify groups of consumers with different food choice patterns (Table 3). Three different clusters were identified, with 37, 97 and 66 consumers in each. Each cluster was analyzed in terms of composition of the interviewed sample. Cluster 1 had a majority of men, and youngsters and young adults (<45 years), while cluster 3 was composed mainly by women and people aged over 45 years old; cluster 2 presented an intermediate distribution and it showed no significant differences with the whole sample.

Table 3. Food choice questionnaire: respondents' age and gender in each of the identified clusters.

Consumers	Cluster 1 N = 37	Cluster 2 N = 97	Cluster 3 N = 66
Gender (%)			
Women	43	45	58
Men	57	55	42
Age (%)			
17-29 years	40	40	27
30-44 years	46	31	30
>45 years	14	29	43

Figure 1B shows all the consumers in the space determined by the first two PC (39.35% of the variance), together with their cluster identification; this allowed a better visualization of the food choice pattern in the three groups. It could be noticed that the clusters were differentiated mainly by the first component of the PCA, meaning that consumers in cluster 3 would be more concerned by the factors correlated positively by PC1: mood, health and sensory appeal, but also

in a lower degree by the factors in PC2 (a bisect in the first quadrant). On the other hand, consumers in cluster 1 would be less driven by those factors. More detailed behaviors of each population cluster can be understood analyzing the mean scores of their responses to the questionnaire (Table 2). The data revealed differences between the three analyzed clusters. Consumers in cluster 3 gave high ratings to most of the measured items, showing a high interest for all of the measured factors, meaning that they were probably in close relation to food purchase and preparation, not surprisingly being a majority of women and middle aged people. On the contrary, cluster 1 (majority of men and youngsters) showed a low interest for all items; in other words, these consumers were less concerned by food choice in general, and within this scenario, their main concerns were “Sensory appeal”, “Price” and “Convenience”. Cluster 2 presented an intermediate behavior, and they were more concerned by sensory appeal, price and convenience. These results were in good agreement with Ares & Gámbaro (2007) who also found three main clusters similar in behavior to the ones in the present study for the Uruguayan population; however, the relative size of the clusters were different in both countries; in Uruguay equal amounts of people integrated the “interested” and “not interested” clusters, and the intermediate was lower in size; for the Spanish population, the “not interested” segment was the smallest, with around 18.5% of the population, followed by the “interested” segment, comprising 33% of the population, and the intermediate/moderate segment was the largest. The detected differences could be related to cultural or social differences between the two countries, although a bigger study in number of consumers might be needed to do a transcultural comparison.

3.2 Weight Control (WC) factor: Principal Component and Cluster Analyses

The WC factor was one of the main interests in this study, trying to identify the relation and importance of food components such as fat and sugar, and their level, in the consumers’ food choice. A PCA was performed with the WC factor responses from all consumers. The items “Is low in sugar”, “Is low in fat”, “Is low

in calories” and “Help me to control my weight” described the WCF (Table 1). The PCA extracted two components, which together explained 81.35% of the results variability (Figure 2).

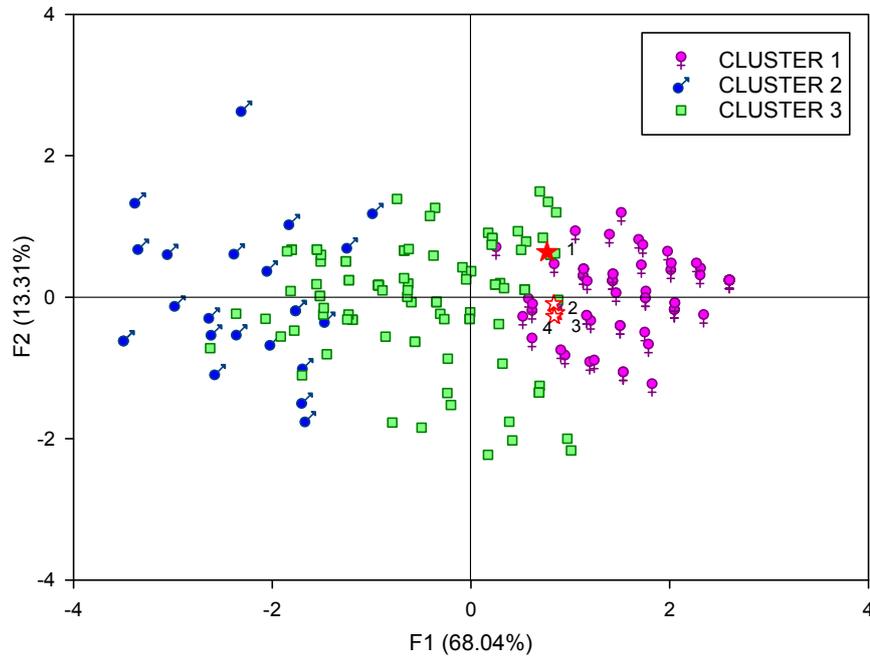


Figure 2. Principal Component Analysis for the responses toward “Control weight” factor classified into clusters. Red plus number in the plot means: 1: “Is low in sugar”; 2 “Is low in fat”; 3 “Is low in calories”; 4 “Help me control my weight”.

The principal contribution was of the 1st component, which explained 68.04% of the results variability. In this component the items “Is low in calories”, “Helps me control my weight” and “Low in fat” were grouped together, and positively correlated to it, suggesting that consumers recognized a clear relationship between them. In contrast, the item “Is low in sugar” was less associated with the mentioned items; it was more correlated to the second PC. The latter could

mean that not all the consumers associated low calories with low sugar content, while they did principally associate low calories to low fat. The results suggested that information about reducing sugar in diet is required. A previous research that studied the effects of health-related claims on the differential threshold of consumers' sweetness sensation suggested that a positive health message included in label claims might activate consumers' health concerns (Chiou et al., 2009).

Consumers' similar attitudes towards the items for WC factor were further investigated according to the food choice behavior patterns and its relation to consumers' age and gender. To better understand the contribution of these consumer characteristics in food choice, an agglomerative hierarchical clustering was conducted. Three clusters were identified and represented onto the PCA, where their differences were mostly driven by PC1 (Table 4).

Cluster 1, principally composed by women (61% of the sample) and persons mostly above 45 years old, was linked with the items "Is low in fat", "Is low in calories" and "Helps me control my weight" as described onto the PC1, but also to the item "Is low in sugar", which was located in the first quadrant of the PCA. The higher proportion of women and adults aged >45 years in cluster 1 suggested the marked concern of this population about the association of weight to a healthier lifestyle, evidencing the association of low-calorie foods, particularly low fat-containing foods, through the benefit of a slim figure. In contrast, Cluster 2 that was mainly composed by men aged 30-44 years old presented a negative correlation with the above mentioned items. These observations were in accordance with a previous study on the Polish population, where women and girls more often showed pro-health attitudes in food choice than men, who exhibited a negative attitude to health (Wadolowska et al., 2008). Finally, cluster 3 was composed by both men and women between 17-29 years old presented an intermediate behavior, with medium concern towards control weight (Table 4, figure 2).

Table 4. Control weight factor. Age and gender of respondents of the identified clusters.

Consumers	Cluster 1 N = 72	Cluster 2 N = 27	Cluster 3 N = 101
Gender (%)			
Women	61	30	45
Men	39	70	55
Age (%)			
17-29 years	23	30	45
30-44 years	28	52	34
>45 years	49	18	21

3.3 Food consumption frequency

A further understanding of the food choice profiles of the consumers grouped in the identified clusters could be gained when analyzing what kinds of foods those consumers eat. Differences in frequency of consumption were mostly found in low-calorie foods (as indicated by the chi-squared values) suggesting different attitudes of the population towards these kind of food product. The frequencies of consumption of different healthy foods were related to the clusters identified by the HCA for the weight control factor (Table 5).

The results showed the high frequency of consumption of low-calorie foods by consumers grouped in cluster 1 and 3, which resulted from the questionnaire in the most important aspect conditioning their attitude to the food choice. This observation supports the medium to high concern found in these groups towards low-calorie foods and healthy eating, as stated above. Although shown by the Spanish interviewed population, it has to be pointed out that beliefs about healthiness of food were not always related to the frequency of consumption of healthy food, as observed by Aikman et al., (2006) who studied food attitudes and eating behavior in USA population.

Table 5. Most frequently consumed food consumption frequency for the whole sample and for the each of the identified clusters (CI). Chi-square values.

Food item¹	Whole sample N = 200	Cluster 1 N = 72	Cluster 2 N = 27	Cluster 3 N = 101	X²
Non-fat milk					15.58*
Daily	44	51	19	45	
Most days	5	6	4	4	
More than once a week	3	0	7	4	
At times or seasonally	11	13	7	12	
Rarely or never	37	30	63	35	
Minerals and vitamins enriched milk					10.50 ^{ns}
Daily	14	17	8	13	
Most days	4	3	4	4	
More than once a week	4	1	0	6	
At times or seasonally	15	11	7	20	
Rarely or never	63	68	81	57	
Milk fiber					6.64 ^{ns}
Daily	1	1	4	2	
Most days	2	1	0	2	
More than once a week	2	4	0	1	
At times or seasonally	5	8	4	3	
Rarely or never	90	86	92	92	
Non-fat yogurt					29.46 ^{***}
Daily	17	31	4	11	
Most days	11	10	7	13	
More than once a week	15	15	4	18	
At times or seasonally	21	22	15	21	
Rarely or never	36	22	70	37	
Sugar free yogurt					29.72 ^{***}
Daily	14	29	4	6	
Most days	8	10	4	8	
More than once a week	13	8	11	17	
At times or seasonally	23	18	15	29	
Rarely or never	42	35	66	40	
Probiotics milk food					10.44 ^{ns}
Daily	8	14	4	5	
Most days	6	7	0	6	

More than once a week	7	7	4	8	
At times or seasonally	17	11	26	20	
Rarely or never	62	61	66	61	
Low fat cheese					35.89 ^{ns}
Daily	8	14	0	5	
Most days	10	14	0	10	
More than once a week	21	28	11	19	
At times or seasonally	25	26	11	29	
Rarely or never	36	18	78	37	
Ham					8.96 ^{ns}
Daily	7	7	8	6	
Most days	19	24	11	17	
More than once a week	40	29	59	42	
At times or seasonally	24	28	15	27	
Rarely or never	10	12	7	8	
Turkey ham					9.44 ^{ns}
Daily	8	7	4	10	
Most days	18	21	15	17	
More than once a week	30	31	19	32	
At times or seasonally	24	29	29	20	
Rarely or never	20	12	33	21	
Luncheon meat					6.35 ^{ns}
Daily	11	10	4	13	
Most days	17	13	15	21	
More than once a week	31	32	30	30	
At times or seasonally	32	33	44	29	
Rarely or never	9	12	7	7	
Bread					3.28 ^{ns}
Daily	64	58	67	66	
Most days	17	19	19	14	
More than once a week	11	13	4	12	
At times or seasonally	5	6	7	5	
Rarely or never	3	4	3	3	
Brown bread					17.15 [*]
Daily	16	25	11	11	
Most days	9	14	0	8	
More than once a week	11	4	15	15	
At times or seasonally	32	31	30	34	
Rarely or never	32	26	44	32	
Low sugar cookies					14.64 ^{ns}
Daily	4	6	0	3	

Most days	7	8	4	7	
More than once a week	10	13	4	9	
At times or seasonally	27	36	15	25	
Rarely or never	52	37	77	56	
Breakfast cereal without sugar					14.9 ^{ns}
Daily	9	13	7	7	
Most days	5	6	0	6	
More than once a week	9	14	4	6	
At times or seasonally	17	9	11	25	
Rarely or never	60	58	78	56	
Juice without added sugar					17.78 [*]
Daily	18	13	8	25	
Most days	9	8	7	9	
More than once a week	11	14	11	10	
At times or seasonally	27	28	11	31	
Rarely or never	35	37	63	25	

Note: ns no significant differences, * P < 0.05, **P < 0.01, *** P < 0.001

1 The original study included thirty products, which those with higher than 4% daily consumption frequency are shown in the table.

In more concrete terms, cluster 1, composed mainly by women and showed a higher consumption frequency of healthy products. Similarly, Bakker (1999) have reported that women consume more “light” products than men. Accordingly, the higher penetration of low-fat products than those with low-sugar in Spanish and other European countries’ market is well-known. In addition, the present results are in good agreement with Mahanna et al., (2009) who studied consumer expectations for food bars and suggested that women are more interested in low-calorie bars than men.

For the overall population, the food consumption survey showed that light dairy products (non- or low-fat, and non- or low-sugar) exhibited the highest consumption frequency, particularly yogurt. Earlier studies indicated that yogurt is perceived as healthy as a consequence of the strong health image conveyed by marketing strategies (Saba et al., 2010, Östberg, 2003). In addition, the data

showed that people consumed low- or non-fat yogurt more than non-sugar. This result is in accordance with the positive relation between “Low fat” and “Weight control” in consumers’ attitudes for food choice.

One of the most promising group of foods because of their health benefits beyond the nutritional value are the so-called functional food (pre- and/or probiotic) (Urala & Lähteenmäki, 2004). The present results showed that most of the population (61-66%) rarely consumed probiotic milk foods, or fiber-enriched with (85-93%). This is in agreement with previous results (Martínez-González et al., 2000) reporting the scarce knowledge of Spaniards about healthiness of fiber in food. Although probiotics have been related to the host’s health benefits, the low consumption frequency suggested the low perception on this matter by the consumers interviewed. The perception towards healthiness of functional foods has been further studied in Denmark, Finland and USA, where health claims were reported as important determinant of the perception of functional food (Bech-Larsen & Klaus, 2003). In addition, the latter and other studies concluded that the healthiness perception of functional food also depends on the type of carrier or product (Urala & Lähteenmäki, 2004; Ares & Gámbaro, 2007). There are still scarce studies leading with the consumption frequencies for functional foods.

One of the food items mostly consumed by Spanish population was starchy foods: regular bread (white, French bread) was consumed on a daily basis by the 64% of the interviewed consumers; brown bread (whole grain bread) having a much lower frequency of consumption (16%). Pork ham, turkey ham and luncheon meat exhibited a more than once a week consumption frequency, typical of a Mediterranean diet, which is relatively low in the intake of meat in relationship with other European countries (Martínez-González et al., 2000). Other products also poorly consumed were low-sugar cookies, non-added sugar cereals breakfast and non-added sugar fruit juice.

4. CONCLUSIONS

The most important factors conditioning the Spanish consumers' attitudes to food choice were the items "tastes good", "is good value for money" and "keeps me healthy". Although this last item obtained a high score value, the factor "Health" was not the most important factor pointed out by Spanish consumers, suggesting that they considered their daily diet ("Mediterranean diet": high consumption of olive oil, legumes, unrefined cereals, fruits, and vegetables, a moderate to high consumption of fish, moderate consumption of dairy products and wine, and low consumption of meat and meat products), is healthy enough. They not necessarily recognize or know the health benefits associated with the presence of some individual components (proteins or fiber) or with the reduced levels of others (fat and sugars). Nonetheless, these facts suggested additional research to know the nutritional knowledge and the effect of health claim associated to the labeling. Additionally, another interesting point would be to analyze the relationship between "It is good value for money" item and the income level.

On the other hand, this study confirmed that Spanish, as in other western societies, women are more concerned about health and weight control than men, especially adult women. This study also reveals that (1) low-fat food items were more frequently consumed and mostly associated to weight control than low-sugar food; and (2) probiotic food were not frequently consumed neither food containing particular ingredients such as fiber.

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CAPÍTULO II

**INFLUENCIA DE LOS CONOCIMIENTOS
NUTRICIONALES EN EL USO DEL
ETIQUETADO NUTRICIONAL**

Influence of nutritional knowledge on the
use and interpretation of Spanish
nutritional food labels

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ABSTRACT

The present study analyzed the nutritional knowledge of Spanish consumers and its relationship with the correct use of food labels. Consumers were asked about their nutritional knowledge and some functional foods and about their understanding of food labelling and their use of it to select healthy food. A two-part questionnaire was employed. The first part concerned their knowledge of nutritional facts, including their knowledge about macronutrients and perception of certain functional foods, while the second part addressed some questions regarding food labels. The results revealed no statistically significant differences in nutritional knowledge by either age or gender, but a direct relationship with educational level. The association between nutritional knowledge and the perception and understanding of food labelling showed that the nutritional label rarely influenced the food purchases of the group with low nutritional knowledge, who considered that this information was too technical. More than half of the consumers did not consider the calorie or sugar content important for selecting food. In addition, the group with low nutritional knowledge stated that they never or rarely looked at the food labels to check whether it was low-fat food that they were buying.

Keywords: Nutritional knowledge, food labelling, nutrients, consumers

Practical application: Knowing the status of the consumer's nutritional knowledge allows health campaigns to be designed; considering the influence of cultural factors and the perception of food labelling is very useful for promoting better nutritional information.

1. INTRODUCTION

The consumer's nutritional knowledge and use of food labelling are considered important tools for providing information and encouraging dietary patterns to shift towards healthy attitudes about food consumption (O'Brien and Davies 2007; De Vriendt and others 2009). Nutrition-related health problems have a marked impact in developed societies, leading to a growing prevalence of obesity, attributed to the overconsumption of high-energy foods, being considered the epidemic of the 21st century (WHO, 2003; Fisberg and others 2004). Due to the economic health cost of obesity and overweight, public organizations have taken action through communication strategies to deliver health messages on diet, to encourage the choice of a healthier diet (Martínez-González and others 2000; Cowburn and Stockley 2004; Tudoran and others 2009).

For consumers to improve the quality of their diet, it is important for them to understand the effects of the different macronutrients in the diet (fats, carbohydrates and proteins). Previous studies have indicated that the influence of nutritional knowledge on food preferences and selection is rather small (Shepherd 1992; Wardle and others 2000; Räsänen and others 2003); however, some other authors consider that nutritional information plays a key role in access to healthy lifestyle choices (Wills and others 2009; Grunert and Wills 2007), so more research is needed in this area. Furthermore, specific information on different populations could be helpful to allow cross-cultural comparisons of food consumption habits and to link these data to healthier dietary habits, considering that cultural values have a big impact on food choice (Rozin 1996).

The knowledge of consumer behavior is helpful not only to food manufacturers but also to the authorities, as it is a driving force behind food regulation. Consumer science allows information to be obtained about consumer attitudes toward diet and understanding the link between food and health (Köster 2009;

Lähtenmäki and others 2010). Healthy eating knowledge is commonly acquired from the family or gained through experience (Kümpel and Brunsø 2009). Currently, food packaging labels have become a major instrument for providing information to consumers about nutritional aspects such as the product's energy value, fat, protein and carbohydrate content (Wills and others 2009; Visschers and Siegrist 2009). Many packaging designs highlight nutritional information on the front of the package in order to make these values easier for consumers to understand (Grunert and others 2010; Borgmeier and Westenhoefer 2009).

EU legislation states that health claims on food products must be based on reliable scientific evidence (Regulation (EC) No 1924/2006). In this context, health claims attributed to several specific food components are indicated on the food label; and very often functional food and functional components and their beneficial properties are also present on the package through claims. In Spain, nutritional information has been added to packaged foods relatively recently, since 1999 (Real Decreto 1334/1999). In a recent study the health factor was identified as only 7th in importance in Spanish consumers' food choice decisions, following sensory factors, convenience, and others. In addition, these consumers did not necessarily associate terms with the presence or with the reduced levels of some individual components (Carrillo and others 2011). Specific nutritional education topics started to be included in primary Spanish school curricula in the late 1990s (Hernández & Sastre, 1999), so it might be that in the next few years more nutritionally educated adult consumers will reach the market; however, the initiatives depend on each region rather on the central government so their success could vary. On the other hand, previous studies have shown the importance of the mass media in industrialized countries in promoting health and nutritional education (US, UK, Australia). This type of campaign has not yet been promoted by the Spanish government (Bello-Luján et al., 2009). These observations seem to indicate that more understanding concerning consumers' nutritional knowledge is needed. In

addition, some educational activities on perception and the use of food labels would be beneficial.

The objective of this study was to evaluate Spanish consumers' knowledge of the major characteristics of food that affect health and wellbeing, their beliefs about certain food components and about some functional foods, and their perception and understanding of the nutritional label information in relation to that knowledge.

2. MATERIAL AND METHODS

2.1 Participants

The survey data were collected in Valencia (Spain) over three months of 2010, through randomly interviewing 200 consumers recruited at universities, coffee shops and public places. The participants were recruited using purposive convenience sampling with predetermined quotas (Guerrero and others 2010).

Table1. Demographic characteristics of the respondents.

Consumers	Percentage of the sample (n=200) (%)
Gender	
Male	50
Female	50
Age (years)	
18-29	33
30-44	34
>45	33
Educational level	
Primary	14
Secondary	34
University degree	52
Families	
With children under 18 years old	27
Without children under 18 years old	73

Convenience sampling of consumers is a normal practice in qualitative studies when the aim of the research is to get a gross estimate of results related to a research subject; it involves recruiting available participants who meet specific criteria (Kinnear & Taylor, 1993). In the present study the sample selection criterion was to obtain a balanced distribution by age and gender. The main characteristics of the sample are described in Table 1.

2.2 Questionnaire

All the subjects completed a two-part questionnaire.

First part. The Knowledge of Nutrition questions were based on the Nutrition Knowledge Questionnaire (NKQ) designed by Parmenter and Wardle (1999), a useful tool for identifying consumers' knowledge about nutritional and dietary behavior. The original questionnaire comprised four subsections ("Dietary Recommendations", "Sources of nutrients", "Choosing Everyday Foods" and "Diet-Disease Relationships"). Two of these subsections were used in the present study: the first subsection consisted of the NKQ Dietary Recommendations questions 1 and 3 and the second of the NKQ Sources of Nutrients questions 1, 2, 3, 5, 7, 8, 11, and 13 to 21; some of these questions require answers to several sub-items. This selection was based on the main objective of the present study, namely to obtain information on specific food components such as fat, protein, vitamins, minerals, and sugar, and was also intended to reduce the time needed to complete the questionnaire.

In addition, 2 additional questions about the perception of health benefits over and above nutrition (more than the macronutrient content) attributable to specific food components were added to the Source of Nutrients subsection. The first was: "Do you consider that functional foods have a positive effect on your health?". The second question consisted of a list of different enriched foods, selected from other studies (Silveira and others 2003; Canene-Adams and others 2005), with components providing further health benefits in addition to nutrition. The participants were asked to mark all the items that they

considered functional foods. They were not given the definition of functional foods in advance. For the selection of foods, the definition considered was that “a food can be regarded as “functional” if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutritional effects, in a way that is relevant to either an improved state of health and well-being and/or reduction of risk of disease” (ILSI Europe, 1999).

In total, the 20 questions in the first part of the questionnaire were composed of 54 items and sub-items with multiple options from which to tick one; the answers could be correct or incorrect, or consumers could choose “not sure/I don’t know” (Table 2).

Second part. This part consisted of 9 questions about labeling, developed specifically for this survey, and focused on fat, sugar and fiber contents (Figure 1).

The answers to the questions ranged from “never” (1) to “always” (5) and were quantified based on the frequency of each score. In addition, the participants had to identify specific ingredients (fat and fiber) from the nutrition facts tables copied from two yogurt labels. While both tables were for low-fat yogurts that differed by only 0.1 total fat percentages, one was fortified with fiber.

Table 2. Questions included in the first part of the questionnaire, Knowledge of Nutrition (dietary recommendations and sources of nutrients).

No.	Questions
	<i>Dietary Recommendation</i>
1.	Which fat do experts say is most important for people to cut down on? (tick one)
2.	What version of dairy foods do experts say people should eat? (tick one)
	<i>Sources of Nutrients</i>
3.*	Do you think these are high or low in added sugar? (high, low, not sure) 3.1 Bananas/ 3.2 Unflavored yogurt/ 3.3 Ice-cream/ 3.4 Orange squash/

3.5 *Tomato ketchup*/ 3.6 *Tinned fruit in natural juice*.

- 4.* Do you think these are high or low in fat? (high, low, not sure)
4.1 *Pasta without sauce*/ 4.2 *Baked beans*/ 4.3 *Luncheon meat*/ 4.4 *Honey*/ 4.5 *Potato omelette*/ 4.6 *Nuts*/ 4.7 *Bread*/ 4.8 *Fresh cheese*/ 4.9 *Polyunsaturated margarine*.
- 5.* Do you think experts put these in the starchy foods group? (yes, no, not sure)
5.1 *Cheese*/ 5.2 *Pasta*/ 5.3 *Butter*/ 5.4 *Nuts*/ 5.5 *Rice*/ 5.6 *Porridge*
- 6.* Do you think these are high or low in protein? (high, low, not sure)
6.1 *Chicken*/ 6.2 *Cheese*/ 6.3 *Fruit*/ 6.4 *Baked beans*/ 6.5 *Butter*/ 6.6 *Cream*.
- 7.* Do you think these fatty foods are high or low in saturated fat? (high, low, not sure)
7.1 *Mackerel*/ 7.2 *Whole milk*/ 7.3 *Olive oil*/ 7.4 *Red meat*/ 7.5 *Sunflower margarine*/ 7.6 *Chocolate*.
8. Some foods contain a lot of fat but no cholesterol (agree, disagree, not sure)
9. Saturated fats are mainly found in: (tick one)
10. There is more protein in a glass of whole milk than in a glass of skimmed milk (agree, disagree, not sure)
11. Polyunsaturated margarine contains less fat than butter (agree, disagree, not sure)
12. Which of these breads contain the most vitamins and minerals? (tick one)
13. Which do you think is higher in calories: butter or regular margarine? (butter, margarine, both the same, not sure)
14. A type of oil which contains mostly monounsaturated fat is: (tick one)
15. There is more calcium in a glass of whole milk than a glass of skimmed milk (agree, disagree, not sure)
16. Which *one* of the following has the most calories for the same weight? (tick one)
17. Harder fats contain more: (tick one)
18. Polyunsaturated fats are mainly found in: (tick one)
-

-
19. Do you consider that functional foods have a positive effect on your health?
- 20.* Which of the following foods do you consider functional?
20.1 Milk enriched with omega 3, 20.2 Yogurt enriched with probiotic bacteria; 20.3 Bread enriched with folic acid; 20.4 Wine; 20.5 Tomatoes; 20.6 Juice enriched with vitamins & minerals, 20.7 Fish
-

Note: All questions were multiple choice and consumers had to tick only one answer per question.

* Questions with sub-items that were included in the count. Total no. of questions used in the analysis: 54.

2.3 Data analysis

The data were analyzed using the XIStat statistical software package (Addinsoft-Barcelona-Spain, version 2009, 4.03).

In the First part of the questionnaire (Knowledge of Nutrition questions) the number of correct responses was calculated for each question and for each consumer. Numerical values were assigned to the answers: incorrect = 0, correct = 1, not sure/I don't know = 2. The number of each was counted for each question, and these values were then used to calculate their frequencies. The two-proportion z test was used to determine significant differences between genders, and the k-proportion test was employed to analyze frequency data taking age and educational level into account.

To establish the relations between nutritional knowledge and the use of food labels, the consumers were grouped according to their nutritional knowledge (number of correct answers). These groups were low (0-18), medium (19-36) and high (37-54) nutritional knowledge. A chi-squared test was only applied to the correct label question answers to establish statistical differences in the distribution of these three groups. Likewise, the responses about frequency of reading the label to select low-fat food were compared with the questions about fat from the nutritional questionnaire to establish the relationships between

nutritional knowledge and frequency of selecting low-fat foods. It was decided to use yogurt labels because this food is generally recognized as healthy.

1. Does the nutritional labelling affect your food purchase?
2. How often do you read the nutritional labelling?
3. Do you consider the nutritional labelling too technical?
4. Does the calorie content affect your food purchase?
5. How often do you look at food labels to select foods that are low in sugar?
6. How often do you look at food labels to select foods that are low in fat or without cholesterol?
7. Please read these yogurt labels and answer the following questions:

A

NUTRITION FACTS	
Mean values	Per 100 g
Calories (Kcal)	39 Kcal/165 KJ
Protein	4.4 g
Total Carbohydrates	4.9 g
Sugars	4.6 g
Total Fat	0.1 g
Saturated fat	< 0.1 g
Dietary fibre	0 g
Sodium	0.04 g

B

NUTRITION FACTS	
Mean values	Per 100 g
Calories (Kcal)	43 Kcal/183 KJ
Protein	4.5 g
Total Carbohydrates	5.0 g
Sugars	3.8 g
Total Fat	0.2 g
Saturated fat	0.0 g
Monounsaturated	0.1 g
Polyunsaturated	0.0 g
Dietary fibre	2.2 g
Sodium	0.06 g

g: grams; Kcal: kilocalorie; KJ: kilojoules

- 7.1 Which do you consider contains a larger quantity of fat?
- 7.2 Which do you consider contains a larger quantity of dietary fibre?
- 7.3 Which would you choose?

Figure 1. Second part of the questionnaire: Food label questions. Answers to questions 1 to 6 were on a scale of five points from “never” to “always”.

3. RESULTS AND DISCUSSION

3.1 First part of the Questionnaire: Nutritional knowledge

• Dietary Recommendations and Sources of Nutrients subsections

The percentages of correct answers in both the Dietary Recommendations and Sources of Nutrients subsections were analyzed according to the demographic characteristics of the respondents.

The nutritional knowledge of the whole sample, in terms of the percentage of correct answers, is shown in table 3. The results indicated a similar level of knowledge for both subsections of the questionnaire (dietary recommendations and sources of nutrients), with about 60% of correct answers. Neither gender nor age presented statistically significant differences in the nutritional knowledge of the participants, with 95% confidence; however, the data suggested that females might have slightly better nutritional knowledge when considering their scores (90% confidence). Previous studies have indicated that women have better nutritional knowledge than men (Misra 2007; Gracia and others 2007).

Drichoutis and others (2005) suggested a positive relationship between nutritional knowledge and age because people over 40 years old have more restricted diets as a result of medical advice or health problems. However, age-dependent differences in nutritional knowledge were not found in the present study.

Regarding educational level, consumers with secondary studies showed a significantly higher frequency of correct answers for the Dietary Recommendations subsection than the other two educational-level groups of consumers; however, educational level was not significant for the Sources of Nutrients subsection. Gracia and others (2007) studied consumers' perceptions for a mandatory nutritional labeling program, finding a direct relationship between educational level and knowledge, suggesting that the population with a higher educational level could be more aware and select healthier foods than

those with little education. De-Vriendt and others (2009) studied determining factors for nutritional knowledge in Belgian women and Dichoutis et al. (2005) studied the nutritional knowledge and use of food labels among Athenian consumers, reaching the same conclusions. These studies are in accordance with the present study, in which Spanish consumers with primary education only recorded the lowest frequency of correct answers for the two subscales analyzed. However, it is noteworthy that consumers with university degrees scored significantly lower for Dietary Recommendations than those with secondary studies, although still higher than consumers who had only attended primary school (Table 3).

Table 3. Nutrition knowledge. Percentage of correct answers for “Dietary Recommendations” and “Sources of Nutrients”.

Sample composition	Dietary recommendations		Sources of nutrients	
	%	p-value	%	p-value
Whole Sample	60	-	62	-
Gender				
Female	66	0.061	64	0.56
Male	53		60	
Age				
18-29	66	0.50	67	0.30
30-45	58		63	
> 45	54		57	
Educational level				
Primary	44	0.039*	44	0.15
Secondary	71		65	
University degree	56		64	
Families				
With children under 18 years old	62	0.63	64	0.64
Without children under 18 years old	59		61	

* Significant difference ($P \leq 0.05$)

Nonetheless, it must be pointed out that a balance of educational levels was not among the sample selection criteria.

Due to the previously reported close relationship between the diet of parents and their children (Sealey and Farmer, 2011), in the present study the potentially higher nutritional knowledge of consumers with children compared to those without children was checked. The results were segmented according to whether or not the respondents had children under 18 years old and no significant differences were encountered. However, since this was not among the initial objectives of this work the consumers selected did not represent a balance between the two populations, so more research would be needed to prove this point.

The respondents were divided into three groups according to their frequency of correct answers. The total number of correct answers (n=54, considering all the sub-items) of the Knowledge of Nutrition questionnaire were divided into low (0-18 correct answers), medium (19-36) and high (37-54) nutritional knowledge levels.

Table 4 summarizes the demographic characteristics of each of these groups of consumers (expressed as % of correct answers).

No significant differences in gender distribution were found in any of the different knowledge-level groups. However, looking at the trends, 60% of the low knowledge group was made up of men and women comprised 59% of the high knowledge group, while medium knowledge was more evenly divided, again in accordance with previous comments. Regarding age, significant differences were found for the group with low nutritional knowledge, where consumers over 45 years old constituted the majority; however, this group only made up 8% of the whole sample.

Table 4. Demographic characteristics (%) of the groups with low, medium and high nutritional knowledge (number of correct answers to the nutritional knowledge questionnaire). Number of consumers = 200

Consumers	Low knowledge (N=15)	Medium knowledge (N=103)	High knowledge (N=82)
Gender			
Female	40 ^{ns}	45 ^{ns}	59 ^{ns}
Male	60 ^{ns}	55 ^{ns}	41 ^{ns}
Age (years)			
18-29	13 ^{**}	29 ^{ns}	41 ^{ns}
30-44	20 ^{**}	37 ^{ns}	32 ^{ns}
>45	67 ^{**}	34 ^{ns}	27 ^{ns}
Educational level			
Primary	47 ^{ns}	18 ^{***}	1 ^{***}
Secondary	13 ^{ns}	32 ^{***}	40 ^{***}
University degree	40 ^{ns}	50 ^{***}	59 ^{***}

Statistical analyses performed in each demographic group (^{ns} no significant differences, * P < 0.05, ** P < 0.01, *** P < 0.001).

Statistically significant differences in educational level were found for the medium- and high-knowledge groups. In Table 4 statistical differences are displayed, marked with asterisks those demographic characteristics that were significant within the low, medium, and high nutritional knowledge groups.

• Sources of Nutrients and energy consumption subsection

To assess the consumers' knowledge of nutrients, the questions were broken down and grouped by the food components they mentioned and the packaged food label promoted, taking into account the correct/incorrect/I don't know responses to the questions directed to particular components.

Starch, sugar, proteins, vitamins and minerals. The consumers' knowledge about these macro components was: starch 73%, added sugar 71%, and

proteins 61%, slightly better than the 61% for fat and 55% for vitamins & minerals.

Calories. The results showed that only half of the population could recognize the specific food component that provided a high quantity of calories. Another study reported that two thirds of the respondents from a UK population gave correct answers to questions about awareness of health experts' recommendations to have more, about the same, less or try to avoid a series of nutrients in relation to calorie intake (Grunert and others 2010). The differences between that study and the present one might be attributable to the different cultural background of the UK and Spain: because of their healthier environment, societies which follow a Mediterranean diet might not worry as much as others about the individual caloric characteristics of specific food components. Also, in recent years the UK government and institutions have encouraged a large number of healthy eating messages and campaigns in the media and major stores ("five-a-day", FOP labeling, etc.) (Cox and others 1998; Grunert and others 2010).

Fat. A comparison of the consumers' knowledge about different fats revealed that 43% of them indicated that harder fats contained more saturates. In addition, only 38% knew of the presence of saturated fat (SFA) in dairy products and 41% of the consumers answered this question incorrectly, indicating that they did not identify animal sources as the main contributors of SFA in the diet (Figure 2). However, 48% of the consumers answered correctly that polyunsaturated fats (PUFA) are mainly found in vegetable sources. Regarding monounsaturated fat (MUFA), 38% of the consumers answered that these fats are found in olive oil. The smaller number of incorrect responses about PUFA (10%) and MUFA (25%) than about SFA suggests that in Spain, an olive-producing country where olive oil consumption is very high, consumers are more familiar with its benefits and composition.

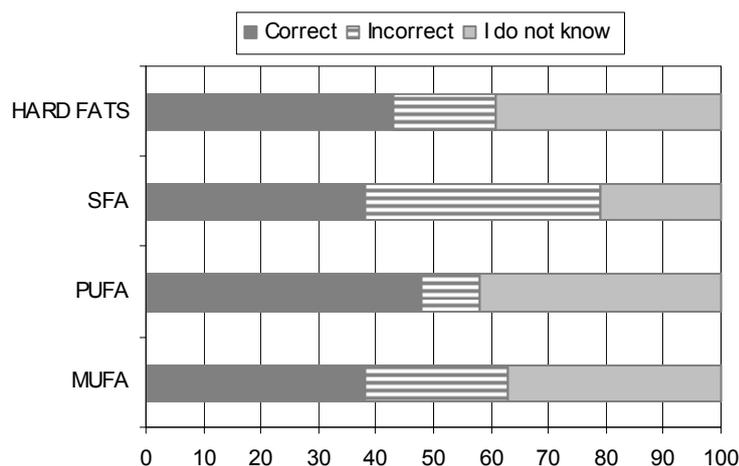


Figure 2. Consumers' knowledge about fats. Percentage of correct, incorrect, and do-not-know answers to questionnaire questions 9, 14, 17, and 18.

Functional foods. The participants were asked to indicate whether they considered that functional foods provided health benefits (agree/ do not agree/ do not know), in order to gain insights into their perception of functional foods. 65% of consumers indicated that they considered this food group beneficial to their health, and 32% of the participants said they did not know. Ares and others (2008) studied the perception of functional foods in Uruguayan consumers; they highlighted that 12.5% of the participants had heard of them and 38% mentioned that functional foods have some influence on health. The differences found in the present study may be because the functional food market is more highly-developed in European countries. There are just two previous functional food related studies of Spanish consumers, from Madrid (capital of Spain, urban consumers) and Navarra (a more rural consumer oriented sample), both by Barrena and Sánchez (2004). When asked whether they thought that functional foods were needed to enhance health, only 65% of the consumers in Madrid and 47% in Navarra answered positively. The reasons behind the negative responses were related to the perception that they were nothing more than a fashion. The present results also suggest that to achieve success, new healthy

product options would still require further consumer education about what a functional food is, especially for foods with high levels of non-added functional components. However, to the best of our knowledge no study has been made of Spanish consumers' awareness of what a functional food is. This was not part of the present study, but would certainly be a topic of interest for further study.

A list of different kinds of food was added to the questionnaire and the participants had to tick those which they considered functional foods (Figure 3). Milk with omega-3 and yogurt made with probiotic bacteria (*Bifidobacterium sp*) obtained 67% and 70% of correct answers respectively.

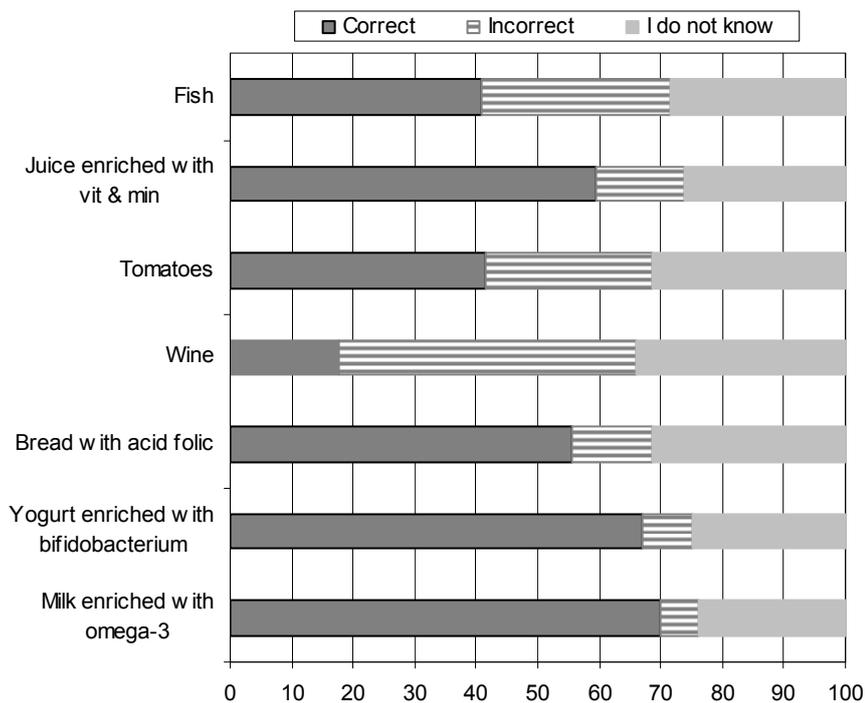


Figure 3. Responses to the question regarding functional foods and a non functional food (fish) (question 20 in the first part of the questionnaire). The answers were classified as correct, incorrect, or I do not know.

This suggests that dairy products were the foods best recognized as functional, which could partly be due to the launch of a huge number of functional dairy products in the European markets in recent years (Menrad 2003). Omega-3 and probiotics have also been quite heavily promoted in the media as functional ingredients.

The products containing the word “enriched” were marked as functional foods (milk, yogurt, juice and bread) more frequently than tomatoes and wine, which also contain naturally-occurring functional components. Previous studies have noted that extra information on the package can be expected to increase the perceived healthiness of products (Urala and others 2003; Van Trijp and Van der Lans 2007); however, Lähteenmäki and others (2010), who studied the impact of health-related claims on the perception of other product attributes, stated that health claims had a moderate but mostly negative impact in this respect. These researches attributed the negative effect to the fact that consumers had not previously been exposed to the functional ingredient.

- **Second part of the questionnaire: perception of food labels**

The previously-mentioned classification into low, medium and high nutritional knowledge was also employed to reach a better understanding of the relationship between knowledge and the use of nutritional information (Figure 1, table 5). The frequency of consumers who declared that they were influenced by the nutritional labels on their intended purchase and that of respondents who stated that they read the nutritional label were significantly different in relation to the nutritional knowledge of the consumers.

The present results showed that 54% of the high knowledge group “often” or “always” took their decision based on the nutritional label. In contrast, 67% of consumers with low nutritional knowledge indicated that they were “never” or “rarely” influenced by nutritional labeling. These results suggest a clear relationship between nutritional knowledge and the importance given to the nutritional label information (question 1) when purchasing. It has been

suggested that nutritional knowledge does not have a significant effect on the use of the label because of the weak link between knowledge and purchase behavior (Nayga, 2000). In contrast, other authors have highlighted that consumers with higher nutritional knowledge were more likely to use nutrition label information when shopping (Barreiro-Hurlé and others 2010; Dichoutis and others 2005); also, a study of French consumers found that 24% of the respondents based their choice on nutritional labels (Consommation, Logement et Cadre de Vie, 2004). The latter statements are in accordance with the results of the present study. It is noteworthy that only 5% of the consumers with higher nutritional knowledge stated that they were “never” influenced by the nutritional labelling and that a low percentage (13%) of these consumers stated that the label “rarely” influenced them. These low percentages, with consumers' moving towards searching for healthier food choices, suggest that nutritional knowledge has a positive effect and could play an important role in purchase decision; more importantly, it indicates that stronger consumer nutritional education strategies might lead to consumers' being better able to understand food labelling and, therefore, to take informed, responsible decisions when choosing food items.

Table 5. Frequencies of labelling perception responses by nutritional knowledge score group (200 consumers).

QUESTION	Low knowledge (N=15)	Medium knowledge (N=103)	High knowledge (N=82)	p-Value	X ²
1. Influence of nutritional label on purchase intention				0.003	16.30
Never	47	11	5		
Rarely	20	21	13		
Sometimes	13	40	28		
Often	7	17	44		
Always	13	11	10		
2. Frequency of nutritional label reading				<0.0001	26.10
Never	40	14	2		
Rarely	13	23	11		
Sometimes	27	32	21		

Often	7	24	43		
Always	13	7	23		
3. Food label information considered too technical				0.826	1.50
Never	0	6	7		
Rarely	7	18	18		
Sometimes	33	46	48		
Often	7	22	23		
Always	53	8	4		
4. Importance of calorie content for food purchase				0.048	9.60
Never	53	22	12		
Rarely	0	24	13		
Sometimes	27	32	38		
Often	7	19	32		
Always	13	3	5		
5. Frequency of reading the food label to choose low-sugar food				0.470	3.57
Never	53	26	16		
Rarely	7	28	27		
Sometimes	27	23	27		
Often	0	21	26		
Always	13	2	4		

Values in bold type presented significant differences ($P \leq 0.05$)

When considering the frequency of reading of nutritional labelling (question 2), the results again showed a direct relationship with the consumers' nutritional knowledge. The group with the highest nutritional knowledge read the nutritional labels significantly more frequently, with 66% reading labels "often" or "always". The group with the lowest nutritional knowledge showed a lower label reading frequency, reflected by the 53% answering "never" and "rarely".

The group of consumers with medium knowledge showed intermediate behavior, with medium frequencies of reading nutritional labels, as 79% of the consumers fell into the rarely/sometimes/often categories.

Similarly, food labelling was considered too technical by the lower knowledge group (question 3); in fact, more than half of this group (53%) “always” considered it difficult to understand the information on the food label. This is in accordance with previous studies that pointed to the direct relationship between lower education and difficulty in understanding the terms used in food labels (Cowburn and Stockley 2004).

The influence of calorie content on food purchases (question 4) seemed to be weaker than that of other factors analyzed. At all three nutritional knowledge levels, the frequency of “always” answers was low; however, more than 50% of the consumers in the medium and high nutritional knowledge groups indicated that the number of calories was “sometimes” or “often” important in their choice, while more than half of the consumers in the lower knowledge group never paid any attention to this information when buying the food.

With regard to the frequency of consumers who read the label to select food with less sugar (question 5), the difference in distribution between the three groups was not significant and the frequency of answers from “never” to “always” was balanced, showing that purchasing behavior was not clearly affected by sugar content; nevertheless, it is worth noting that 53% of the consumers with low nutritional knowledge never considered this aspect.

To analyze the answers on fat content in relation to the use of nutritional labeling, the correct answers to the questions concerning fat were selected from the Knowledge of Nutrition section of the questionnaire and compared with label use. The frequencies of consumers using the food label to select low-fat food are shown in Table 6. Among the consumers with low nutritional knowledge, 49% answered that they “never” or “rarely” checked the food labels for low-fat food when buying. Again, consumers with higher nutritional knowledge more frequently read the label to choose low-fat food; in fact 65% of them “often” or “always” did. Medium knowledge consumers selected intermediate behavior responses.

Table 6. Relationship between correct response to questions on fat and frequency of reading food label. N=200

Question	Low frequency (N=93)	Medium frequency (N=81)	High frequency (N=26)	p-Value	χ^2
Frequency of reading the food label to choose low-fat food				0.082	8.27
Never	25	15	0		
Rarely	24	25	8		
Sometimes	25	25	27		
Often	17	31	46		
Always	10	5	19		

These findings are also consistent with Martínez-González and others (2000) who studied definitions of healthy eating in Spain compared to other European countries and indicated that 29.5% of Spanish consumers considered it healthy to eat less fat, in contrast with other, northern countries that agreed with this statement more frequently (40.3%).

The perceived understanding and decision-making based on the nutritional label information was used to obtain information on the consumers' interpretation of two yogurt labels (question 7, figure 1). The participants had to answer questions on the quantities of fat and fiber given on the food labels. The results showed that 81% of the consumers recognized correctly which of the two yogurts contained the highest amount of fat. Fiber has acquired an important role in the diet due to its beneficial properties (Baixauli and others 2008). In the present study, it was found that 94% of the subjects interviewed were able to use this nutritional information and recognize the fiber among the nutritional facts on the food label. Additionally, the amount of fiber influenced the decision of 35% of the consumers to choose yogurt B; on the other hand, 49% were more influenced by the fat content and chose yogurt A (Figure 1). Despite the consumers' recognizing the presence of fiber on the label, those who based their decision on the products' fiber content were in the minority,

suggesting that the total fat content had a greater influence than the addition of fiber (or, indeed, the composition of the fat, since this yogurt contained less saturated fat). This perception was similar to previously reported data for Spanish consumers (Martínez-González and others 2000), who were either unable to identify the healthiness of fiber or, if they did, gave more weight to the negative effect of fat in the diet than to the positive effect of fiber. An opportunity to introduce knowledge about fiber is to give information about its functional benefits. Tudoran and others (2009) explored the lack of effect of the presence of health-benefit information on the product in changing the importance that individuals assigned to their health; however, these authors indicated that the reason could be associated with the type of food under discussion.

4. CONCLUSIONS

Nutritional knowledge was not clearly associated with gender or age, although a direct link with educational level was observed. The results confirmed that consumers with primary education presented lower nutritional knowledge; however, this group made up only 14% of the sample population and more research would be needed to confirm this point. Regarding knowledge about sources of nutrients, the results suggested that consumers had a better knowledge of food components such as carbohydrates, added sugar, starch and protein than of vitamins & minerals and fat. The consumers' recognition of vegetable oils such as olive oil as a primary source of MUFA can probably be attributed to the habitual intake of olive oils in the Mediterranean diet. When considering functional foods, these were recognized more easily as providing health benefits if presented with the word "enriched".

The results suggest that Spanish consumers were able to understand nutritional labels to a certain extent and to recognize specific functional components such as fiber. However, a clear relationship was found between nutritional knowledge and the importance given to the nutritional label information. Also, less educated consumers found the nutritional information too technical.

In short, most consumers cannot see the implicit benefits of reducing their intake of certain fats and sugar, and consequently the calorie content of their food, whereas, for example, they can appreciate and judge its sensory properties for themselves, so better nutritional education would lead to consumers' being able to take better decisions about their diets and prevent nutritional disorders. A possible course of action would involve campaigns to better communicate nutritional aspects, in a more easily understood way than “nutritional facts” on the pack, trying to avoid the marked influence of education in the use and understanding of food labels so as to reach a wider population. Governments have expended considerable effort in regulating labelling, which is indeed good, but it has to be ensured that labelling is used and understood by the majority of consumers.

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CAPÍTULO III

**INFLUENCIA DE LOS FACTORES
INTRÍNSICOS Y EXTRÍNSECOS DEL
PRODUCTO EN LA PERCEPCIÓN DEL
CONSUMIDOR**

Packaging information as a modulator of
consumers' perception of enriched and
reduced-calorie biscuits in tasting and
non-tasting test

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ABSTRACT

The first contact between consumers and the food product is normally the packaging and its labelling. The objective of this study was to investigate consumers' perceptions of the package and the expectations raised by nutritional and health claims and the nutrition panel, among other cues – and their influence on the sensory perception of enriched and reduced-calorie biscuits. Twenty three enriched or low-calorie biscuits were assessed by 90 consumers who employed the projective mapping technique to evaluate the similarities and differences between the biscuits in four different scenarios. Two sessions were conducted without tasting the product to ascertain how consumers perceived the nutrition information panel and nutrition and health claims, among other packaging cues, and how they use these inputs to classify the biscuits. Ten samples were then selected for tasting in two further sessions: with and without information on the nutrition information panel and claims. The results showed that consumers were greatly influenced by the claims highlighted (colour, size) on the front of the package, particularly nutrition claims. In addition, non-sugar biscuits raised negative expectations and were associated with people with sugar metabolism disorders. Comparison of the two tasting sessions found that the information clearly had a negative influence on the perception of hedonic sensory characteristics.

Keywords: Nutrition and health claims, nutrition information panel, consumer perception, projective mapping technique.

1. INTRODUCTION

Food selection and consumption is a complex phenomenon, influenced by sensory and non-sensory food characteristics and also by labelling, which plays an important role in consumer responses, influencing the expectations and perceptions of the product (Chiou, Yeh, & Chang, 2008; Shepherd, Sparks, & Raats, 1991).

Due to the growing interest in health and wellbeing, the food market has reacted by adopting terms such as “healthy food” that, in general, imply enrichment by adding beneficial ingredients to foods (lycopene, calcium, omega-3, fibre, etc.) or the reduction or elimination of specific components (such as fat or sugar) with the purpose of reducing the calorie intake. These modifications are communicated through claims on the package. In 2006 the first European regulation specifically addressing nutrition and health claims was introduced to avoid misunderstanding and to protect consumers against false information (Regulation EC No. 1924/2006). This regulation made a distinction between “nutritional claim” and “health claim”: a nutritional claim “states, suggests or implies that a food has particular beneficial nutritional properties due to presence, absence, increased or reduced levels of energy or of a particular nutrient or other substance”, while a health claim “states, suggests or implies that a relationship exists between a food category, a food or one of its constituents and health”.

In recent years, efforts have been made to interest consumers in reading the nutritional information (nutrition facts or claims) displayed on the food package. The purpose of this information is to give consumers the possibility of choosing according to the best criteria, particularly regarding their health and wellbeing. Some studies have pointed out that different factors such as age, social status, interest in healthy eating and nutritional knowledge influence the use and understanding of food labelling (Carrillo, Varela, & Fiszman, 2011; Grunert, Wills, & Fernández-Celemin, 2010).

In relation to consumer perceptions of nutrition and health claims, one concern has been what specific information is perceived and understood by consumers. Previous studies have indicated that consumers cannot appreciate the difference between nutrition and health claims (Verhagen, Ellen, Francl, Heinonen, & Van Loveren, 2010). Also, it has been reported that the perception of nutrition and health claims depends on the type of claim, the carrier of the ingredient/component used (it is seen as logical for products with a healthier image such as yogurt to contain an extra health benefit), and familiarity with the ingredient/component (Ares & Gámbaro, 2007; Verbeke, Scholderer & Lähteenmäki, 2009). In addition, it would appear that women and older people perceive health claims positively and show interest and a willingness to buy such products (Dean, Lähteenmäki, & Shepherd, 2011; Siegrist, Stampfli, & Kastenholz, 2008).

Consumers have to trade off various sensory and non-sensory factors when making their everyday food choices (Jaeger, 2006). They draw important cues about the product from the package information and design (Moskowitz, Reisner, Lawlor, & Deliza, 2009), which in turn raise sensory and hedonic expectations of the product. That means that just by looking at the package, the consumer would probably be imagining how the product would taste and how much he/she would like it. A mismatch between the expectations raised and the perceived characteristics of the product would lead to positive or negative disconfirmation, depending on whether the product is better or worse than expected (Cardello, 1994). The package or label also generates expectations related to health benefits and these can influence hedonic and sensory appreciation (Varela, Ares, Giménez, & Gámbaro, 2010). Healthy food choices are often viewed as being in conflict with enjoyable eating (Baixauli, Salvador, Hough, & Fiszman, 2008), as many consumers feel that sensory pleasure may have to be sacrificed in order to achieve the goal of a healthy diet, and this effect is dependent upon the specific nature of the expected health benefit (Tuorila & Cardello, 2002).

Napping®/projective mapping could be an interesting tool for acquiring a better understanding of the consumers' perceptions of the information displayed on the package due to projective techniques yield more spontaneous and affective answers from consumers (Guerrero et al., 2010). The projective mapping technique was developed by Risvik, McEwan, Colwill, Rogers, and Lyon (1994), and more recently reintroduced by Pagès (2005) under the name of Napping®, derived from the French word for tablecloth (*nappe*). It is based on projection onto a two-dimensional perceptual map. Consumers are asked to locate the products in a two-dimensional space (a sheet of paper) according to their perceptions of the characteristics of the product, placing the samples they find similar closer on the sheet and those they find different further away. The products can also be grouped together if they have very similar characteristics. Nestrud and Lawless (2010) and Perrin, Symoneaux, Maître, Asselin, Jourjon, and Pagès (2008) used this approach, coupled with ultra-flash profiling, to enrich the characterisation of wines, Moussaoui and Varela (2011) employed it to characterize hot beverages and Albert, Varela, Salvador, Hough, & Fiszman (2011) applied it to the characterization of foods with complex textures.

The interest of using Napping® to map the perception of packages, claims and labels, in comparison with other descriptive or evaluative methods, lies in its being an intuitive, less rational method for consumers to use (Ares, Varela, Rado, & Giménez, 2011). Due to its holistic nature, consumers think of the package as a whole rather than about particular individual attributes, which is closer to what happens in front of the supermarket shelf. To the best of the authors' knowledge, this technique has not been used previously to evaluate food packaging information and its interaction with sensory perception.

The objectives of the present work were (1) to study consumers' perceptions and expectations raised by package, nutritional and health claims and the nutrition panel information in a descriptive way through a semi-quantitative approach and (2) the influence on the sensory and non-sensory characteristics in the perception of enriched and reduced-calorie biscuits.

2. MATERIAL AND METHODS

2.1 Samples

Twenty-three enriched and reduced-calorie sweet biscuit samples were selected on the basis of the nutritional and health claims and information given on the packages. Biscuits with pieces of fruit or chocolate or with fillings were not included in the study in order to avoid distracting factors. The samples were purchased from a variety of Spanish supermarket chain stores located in Valencia (Spain). As shown in Table 1, they were classified according to their composition into traditional, digestive, added fibre, and no added sugar biscuits.

2.2 Consumers

The consumers included in the study totalled 120, divided into four groups. They were recruited from the laboratory database and those that mentioned being biscuits consumers at least three or more times per month were selected. The evaluations were carried on during September to December of 2010 in Valencia, Spain. Each group participated in one of the four separate sessions (thirty persons per session). The participants were aged between 22 and 66 years old. Each session lasted between 15 and 30 minutes.

Table 1. Information displayed on the package of the 23 biscuit samples and used for the test with experimental cards.

Biscuit type**	Code*	Health and nutrition claims	Nutrition panel information
Added fibre			
Whole fibre with soya	C1	62% cereal and 9% fibre Contains three cereal Helps to care for the intestinal tract	CAL:460 Kcal; CH:63; SU:19; TF:18; SF: 4; DF:9; Na:0.3
Active soya	C2	With isoflavones 16% soya High oleic content	CAL: 440 Kcal; CH:55.8; SU:17; TF:18; SF:2; DF:8; Na:0.21
Rich in fibre	C3	--	CAL:457 Kcal; CH:

and soya			57; SU:17; TF:18; SF:9; DF:8; Na:0.21
Double fibre	C4	With three cereal: wheat, oats and rye 62% cereal and 9% fibre High fibre content	CAL:460 Kcal; CH:64; SU:20; TF:18; SF:4; DF:9; Na:0.3
Fibre line	C5	57% cereal and 9% fibre. 8 vitamins and calcium. Contains green tea	CAL:451; CH:64; SU:22 TF:17; SF:3; DF:9; Na:0.3
Diet muesli fibre	C6	Cholesterol-free, high oleic, oats and raisins	CAL:442; CH:64; SU:23; TF:17; SF:2; DF:5; NA:0.43
Diet fibre	C7	No added sugar, prebiotic (23% fibre), high oleic	CAL:405; CH:49; SU:2; TF:16; SF:2; DF:23; NA:0.20
With fibre	C8	Helps to care for the heart, with folic B	CAL:432; CH:73; SU:19; TF:12; SF:3; DF:5; NA:0.2
Fat burning	C9	Whole wheat, with inulin and fructose, high fibre content, helps to burn fat	CAL:448; CH:60; SU:18; TF:20; SF:10; DF:6; NA:0.2
With apple and green tea	C10	High fibre content	CAL:442; CH:64; SU:23; TF:17; SF:2; DF:5; NA:0.43
Keep fit	C11	High in fibre, with cereal, calcium, iron and vitamins, high oleic	CAL:443; CH:66; SU:19; TF:16; SF:2; DF:6; NA:0.3
María with fibre	C12	66% cereal, whole wheat, source of fibre, helps to keep fit because of fibre content	CAL:455; CH:66; SU:24; TF:18; SF:9; DF:5; NA: 0.4
Digestives			
Digestive	C13	With soya and orange	CAL:473; CH:64; SU:17; TF:21; SF:11; DF:4; NA:0.5
Digestive	C14	With omega 3	CAL:474; CH:66; SU:16; TF:20; SF:10; DF:3; NA:0.65
Digestive	C15	Whole wheat	CAL:484; CH:66; SU:16; TF:21; SF:11; DF:3; NA:0.66
Digestive	C16	61% cereal, source of fibre.	CAL:468; CH:63;

oats		Nutritionally improved. Less than 50% of saturated fat	SU:22; TF:21; SF:5; DF:5; NA:0.38
Digestive Go!	C17	69% cereal. Source of fibre	CAL:469; CH:62; SU:15; TF:21; SF:5; DF:4; NA:0.63
No added sugar			
Biscuits without added sugar	C18	Low in salt, with wheat and oats	CAL:482; CH:68; SU:<0.5; PO:16; TF:20; SF:5; DF:2.7; NA<0.12
Natural diet	C19	Without sugar, with sweeteners, high oleic	CAL:453; CH:69; SU:<0.5; PO:16; TF:19; SF:2; DF:3; NA:0.16
Natural active	C20	No sugar added	CAL:448; CH:69; SU:3; TF:16; SF:2; DF:3; NA:0.5
Sugar-free María	C21	No sugar added, low salt content	CAL:437; CH:63; SU:5; PO:7; TF:14; SF:2; DF:5; NA:0.11
Traditional			
Oven-baked María	C22	With folic B and non-visible fibre. Delicious way to help care for the heart	CAL:439; CH:77; SU:24; TF:11; SF:4; DF:3; NA:0.3
Whole wheat María	C23	Source of fibre. High oleic	CAL:441; CH:74; SU:19; TF:12; SF:1; DF:4; NA:0.43

* The samples with codes in bold type are those included in all four evaluation scenarios.

** Biscuit type as described on the package

CAL: Calories; CH: Total carbohydrates; SU: Sugars; TF: Total fat; SF: Saturated fat; DF: Dietary fibre; PO: Polyols (sugar alcohol); Na: Sodium. CAL expressed as Kcal/ 100 g and all other components expressed as g/100g. *All nutrition panel information values are expressed in grams.

2.3 Projective mapping technique

All the participants were instructed in the use of the projective mapping technique coupled with ultra-flash profiling and in the experimental procedure to evaluate the different aspects or characteristics of the target product. The theory of the technique was explained to the participants through an example

employing geometric shapes with different colours and patterns, without any mention of biscuits. After the explanation of the technique, the participants received a 42 x 59.4 cm (A2) sheet of graph paper on which to locate the samples according to the principle that samples with similar characteristics should be placed close to each other, with the possibility of grouping very similar samples, while different samples should be placed farther away (Napping®). They also had to write all the terms that they perceived in connection with each sample or group of samples on the sheet, beside the position of the respective samples (ultra-flash profiling).

2.4 Evaluation sessions

Four sessions (different evaluation scenarios, as described below) were held with the four groups of participants, employing a different group in each session.

2.4.1 Session1: Whole package observation. No tasting

Numerical codes were randomly assigned to the twenty three biscuit packages and these were presented to the participants. The codes were placed on each package using small adhesive flags (Post-it®). The participants only had contact with the package and did not see or taste the biscuits. All the information on the outside of the package was considered for this evaluation. The participants were asked to stick the adhesive flag from each sample on the A2 sheet according to the similarities or differences in the characteristics perceived for the packages, using their own criteria, and to write the characteristics used in this placement and grouping on the sheet, near the code flags.

2.4.2 Session 2: Experimental cards containing the nutrition information panel and nutrition and health claims. No tasting

Experimental cards were prepared containing only the nutrition information panel and the health and nutrition claims information on each biscuit package (23 samples) (see the example in Fig. 1). The 23 cards were presented for evaluation to the participants, who were informed that the information on the

cards corresponded to the package information. The participants had to flick through the cards and place them on the A2 sheet according to the similarities and differences they perceived in the information on the cards, using their own criteria. They then had to write on the sheet the characteristics they had used to position the cards or groups of cards employed in the Napping® task.

C7 Diet fiber	
<ul style="list-style-type: none"> • Without sugar added • Prebiotic (23% of fiber) • High Oleic. Made with sunflower oil 	
Nutrition facts	
Serving size	100 g
Energy	405 Kcal / 1689 Kj
Protein	6.5 g
Total carbohydrates	48.7g
Sugars	1.8 g
Total fat	16.4 g
Saturated fat	1.6 g
Monounsaturated fat	12.8 g
Polyunsaturated fat	2.0 g
Cholesterol	<5 mg*
Dietary fiber	23 g
Sodium	0.20 g

Figure 1. Example of an experimental card.

2.4.3 Session 3: Blind tasting, no information

Ten samples were selected for the session 3 evaluation. The reasoning behind reducing the number of samples was that the 23 initially employed would be too many for the participants to taste, remember and group, while ten samples

would not saturate or overwhelm them. Replicate samples in order to check the performance of the consumer panel were not employed in this study since the biscuit can be easily recognized by their appearance. Based on the results of sessions 1 and 2, two or three samples were selected from each of the different clusters found in the consensus grouping of the two previous scenarios (when all the biscuits were taken into consideration). The idea was to attempt to achieve the best possible representation of the complete perceptual space of the original sample set with the advantage of a smaller number of samples. The samples were presented to the participants for tasting, placing on an A2 sheet, grouping, and generating terms according to their own criteria (the same technique as in sessions 1 and 2: Napping® coupled with ultra-flash profiling).

The ten biscuits were presented simultaneously for direct comparison. Each was presented in a transparent container coded with a Post-it® flag. This type of presentation facilitated the location of the samples on the A2 sheet. The participants had to observe, smell and taste the biscuits then place the code flags on the A2 sheet, locating those of similar biscuits close to each other and those of dissimilar ones farther away. As in session 1 and 2, they also had to write the terms describing the perceived characteristics of the sample or group of samples close to the corresponding code.

2.4.4 Session 4: Informed tasting using experimental cards with nutrition panel information and claims

The participants simultaneously received 10 selected samples (the same selection as in session 3). This time each transparent container contained one biscuit and the corresponding experimental card (the nutrition panel information and nutrition and health claims from the package used in session 2). The participants performed the test in the same way as in session 3 but this time they had to consider both the information received and the sensory characteristics perceived. As before, they had to position the codes of the samples on the A2 sheet and write the terms used to place them alongside.

2.5 Data analysis

All the words provided by the participants in the ultra-flash profiling step following the projective mapping task were qualitatively analyzed for each session separately. The terms elicited to describe a sample or group of samples were grouped, using synonymous and derived words, by consensus between the three researchers. The frequency of mention was determined by counting the number of mentions of the same term in each session. Only terms that had been mentioned at least 5 times were used for the analysis and a frequency table was built for each session. In addition, the terms mentioned were classified into four categories (“sensory”, “nutrition and health characteristics”, “composition/ingredients” and “use and attitudes”). Within each category, differences in the frequency of mention of the terms were analysed by using the chi-squared test to establish statistical differences.

A Multi Factor Analysis (MFA) for each session was performed on the X and Y coordinate values for the samples on each consumer's individual map, as suggested by Pagès (2005). The frequency table containing the terms generated by the consumer and their frequency of mention was considered a set of supplementary variables and did not contribute to the construction of the MFA factors.

In addition, a hierarchical cluster analysis (HCA) was carried out in order to identify samples with similar characteristics within each of the sessions. The analysis was performed on the X-Y values of the sample positions, using Euclidean distances and Ward's aggregation criterion.

MFA was also carried out to compare the biscuit sample positions on the maps generated in the four sessions. This analysis was performed on a table composed of ten rows for the ten biscuit samples used throughout the 4 sessions and four columns for the X-Y data from the four sessions. Values of Rv coefficient were obtained for comparing data from each session. They range between 0 and 1; the closer to one, the greater the similarity between the

configurations of the data tables. All the data were analyzed using the XLStat statistical software package (Addinsoft, Barcelona, Spain, version 2009 4.03).

3. RESULTS AND DISCUSSION

The terms mentioned most often (the 3 most frequently mentioned in each session and those that were repeated in at least two of the four sessions) were classified into four categories, (“sensory”, “nutrition and health characteristics”, “composition and ingredients” and “use and attitudes”). They are shown in Table 2. The terms elicited and the maps generated by the Napping® exercise will be discussed by session.

3.1 Session1: Whole package observation. No tasting

The participants were asked to map and group the biscuit packages, with no particular instructions on what they should focus on, just as though they were comparing them in a supermarket at the time of purchase. However, they were asked not to use the package design (colours, shape, or size) as their focus when distributing and grouping the samples on the A2 sheet.

In this first session, the participants generated 54 different terms in their mapping and grouping task, based on the information and characteristics of the biscuit packages. The terms obtained were classified into four categories: sensory (17 different terms generated in total), composition/ingredients (15), nutrition and health characteristics (12), and use and attitudes (10). Table 2 shows the greatest frequency of mention corresponded to nutrition and health characteristics; however, the widest varieties of descriptors were related to sensory perception. The variety of terms describing sensory characteristics were probably induced by looking at the images of biscuits on the packages, and also by the sensory expectations created by reading them. The sensory terms used to explain the groupings were mostly hedonic (delicious) but also described specific attributes (insipid, apple flavour, different flavours, and little salt). This shows how the package raises sensory and hedonic expectations,

which could well be important when consumers classify products in their minds and, in turn, would be likely to influence their purchase decisions.

Table 2. Main descriptors generated by the consumers in the projective mapping task coupled with ultra-flash profiling in the four sessions and times that each term was mentioned in each session (all samples). Only the three terms most frequently mentioned in one session and the terms mentioned in more than one session are included.

Descriptors	Session 1	Session 2	Session 3	Session 4
Sensory Characteristics (*)				
Little salt	31	-	-	-
Delicious	25	-	49	55
Round shape	16	-	-	-
Different flavours	11	19	-	-
Good flavour and texture	-	15	-	-
Similar shape	-	8	-	-
Inspid	6	-	42	30
Fibre flavour	-	-	49	6
Disgusting flavour	5	6	22	26
Little sweetness	-	-	42	14
Butter flavour	-	-	23	11
Fruit flavour	-	-	26	6
Right sweetness	-	-	18	11
Dry	-	-	17	12
Too much sugar	-	-	16	18
Good texture	-	-	13	18
Not very tasty	5	7	9	13
Crispy	-	-	7	11
Salty	-	-	7	7
Apple flavour	6	-	4	6
Nutrition and health characteristics (*)				
No added sugar	122	76	-	6
Digestive	103	53	5	-
Healthy	63	46	36	34
High in fibre	-	209	38	63
High in fat	4	50	-	4

Low fat	6	11	5	5
Low in fibre	-	47	-	21
Functional	52	7	-	8
High oleic	24	25	-	-
High in calories	19	-	-	3
Low calorie	24	-	-	7
Satiating	12	-	7	7
Composition/ Ingredients (*)				
Whole wheat	67	18	27	3
Cereal	40	25	14	7
With soya	71	35	-	7
Omega 3	7	11	-	-
Diverse ingredients	20	46	-	11
Contains fibre	228	-	-	-
Use & Attitudes (*)				
Traditional	31	28	40	15
Boring	13	14	15	12
Excessive marketing	12	18	-	-
Helps care for your body	53	38	8	-
I would buy it	-	25	12	5

(*) Asterisk means significant differences between frequencies of mention of the terms within each category.

Concerning the terms, higher frequencies of mention were obtained for “contains fibre” (228 mentions), “no added sugar” (122 mentions), and “digestive” (103 mentions), which belong to the nutrition and health characteristics and composition/ingredients categories. These terms played an important role in differentiation between biscuits (table 2). “Digestive” is the name of a type of biscuit (as in many other countries). The very similar Spanish adjective “*digestiva*” also means “promoting digestion”. Both “digestive” and “*digestiva*” were mentioned on the same package, indicating no net differentiation between the biscuit type and a health benefit which the participants expected to receive from a “digestive” biscuit. It is noteworthy that some of the terms, such as “healthy” or “functional”, were not directly derived

from the package, indicating that the participants could assume from some food components or claims that a health benefit would ensue.

Some of the claims on the packages belong to the health claims group, but only two, “helps care for your body” and “cares for your heart”. Participants grouped “help to burn fat” and “helps to keep fit because of fibre content” under the mentioned term as can be observed in table 1. The others belonged to the nutrition claims. This confirms previous research by Wansink, Sonka and Hasler (2004), who stated that participants generate more positive inferences from short claims than from long claims on the front label.

In addition, much of the information on the front of the package concerning nutrition and health claims was perceived negatively and terms such as “excessive marketing” were obtained. A previous study noted that a medium amount of information rather than a large amount produced a positive image of the product (Kimura, Wada, Tsuzuki, Goto, Cai, & Dan, 2008). However, it was also observed that health claims that were not located on the front of the package were not mentioned, suggesting that this information is less often read. Previous research has studied the effectiveness of the location of nutrition facts, noting minor differences in consumer friendliness between front of package and back of package and recognizing that the front-of-package position is appropriate in a shopping environment where quick decisions are required (Feunekes, Gortemaker, Willems, Lion, & Van den Kommer, 2008).

The plot of the samples and terms resulting from multi factor analysis (MFA) and hierarchical clustering analysis (HCA) are shown in Figure 2. The twenty-three samples were plotted on the first two axes, which together explained 41.86% of the variability of the sample set.

Cluster analysis indicated that in the projective mapping task, the samples were separated into three groups. Cluster 1 included samples C13-C17, which belonged to the digestive-type group.

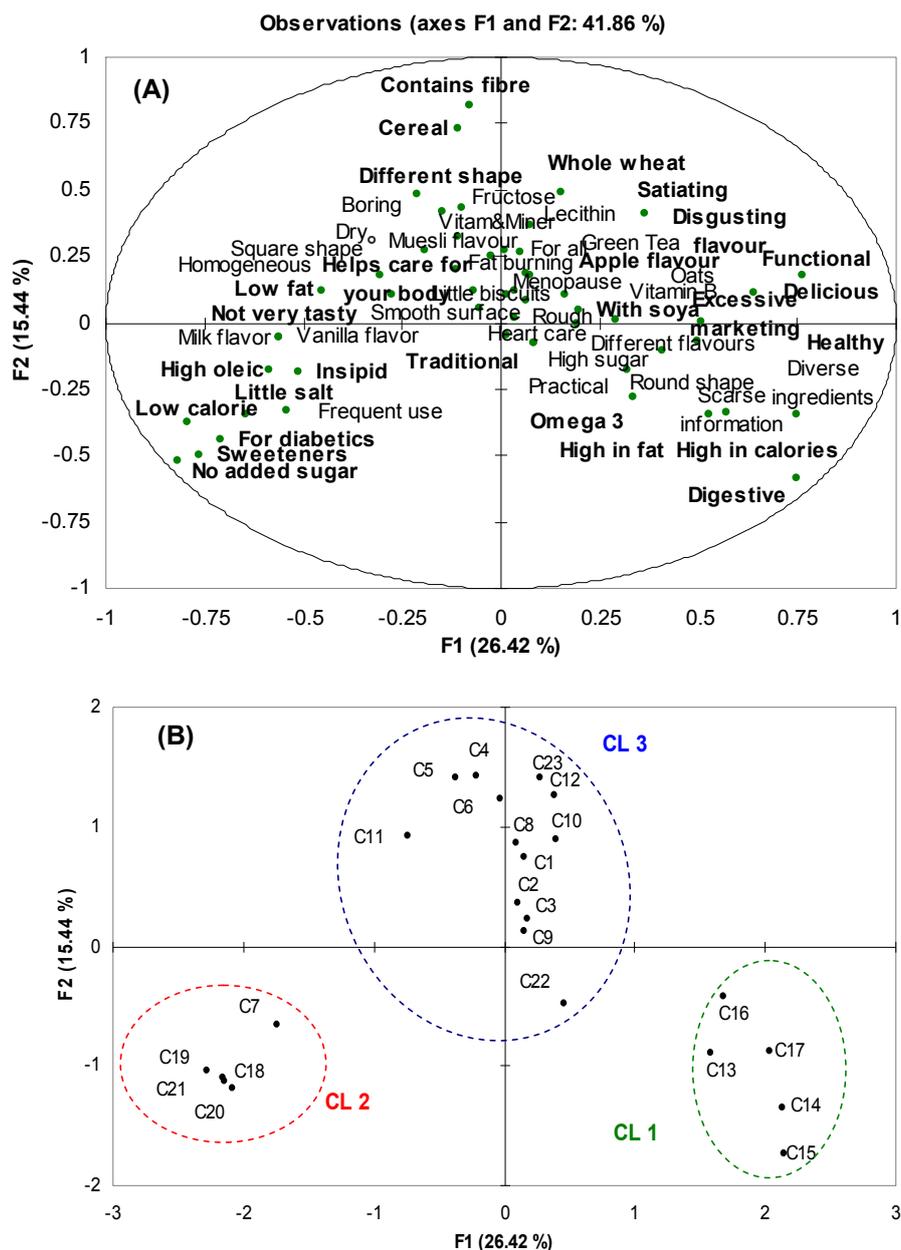


Figure 2. Multiple factor analysis of the results obtained in session 1.
 a) Representation of the terms obtained. The terms most frequently mentioned are shown in bold type. b) Representation of the samples (23 biscuits). Groups of samples identified by hierarchical clustering analysis.

Positive hedonic characteristics were associated with these biscuits, as they were described as functional, healthy and delicious, although they were also described as high in fat, high in calories and high in sugar.

Cluster 2 was comprised of low-sugar biscuits (C7, C18-C21) and was described by the terms "no added sugar", "sweeteners", "for diabetics", "low calorie", and "little salt". These terms were negatively correlated with factor 1. In addition, the terms mentioned suggested that participants perceived these biscuits as being intended for people with sugar metabolism disorders (diabetics) and expected them not to have sufficient taste to be pleasing.

Cluster 3 (C1-C6, C8-C12, and C22-C23) contained the greatest number of samples and was located on the positive side of the second dimension of the MFA, positively correlated to the following terms: "contains fibre", "cereal", "whole wheat", "satiating" and "different shape". This cluster is mostly made up of fibre-added biscuits. The participants associated fibre with satiating effects. This could suggest that participants have some knowledge, acquired through the media or previous exposure to this kind of biscuit. However, a negative attitude to this particular group was observed, with mentions of attributes such as "boring" and "disgusting flavour", suggesting that the addition of fibre could raise negative expectations regarding the sensory attributes of these biscuits. A previous study by Carrillo, Varela, Salvador & Fiszman (2011) suggests that Spanish consumers do not select their food based on fibre content. This could be associated with a lack of sufficient knowledge about the link between fibre and health benefits, and it also suggests that consumers need to receive more information on the benefits of adopting a fibre-rich diet.

3.2 Session 2: Experimental cards containing the nutrition information panel and nutrition and health claims. No tasting

In this second session, all the information about nutrition and health claims was included on experimental cards, together with the nutrition information panel that appears on the biscuit packages. The same size, typography, and format

were used for all the cards so that the design features (position, size, font colour, etc.) would not influence the mapping and grouping of the cards.

Forty-nine different terms were obtained from ultra-flash profiling after the mapping, whereas more terms had been obtained in session 1. This is logical, since the information alone did not raise hedonic expectations as the packaging had. Regarding the categories, more varied terms were observed for use and attitudes (19 different terms) and nutrition and health characteristics (18) than for the sensory (5) and composition/ingredients (7) groups. Not surprisingly, the terms mentioned more frequently in this session belonged to the nutrition and health characteristics category: "high in fibre" (209 mentions), "no added sugar" (76), "digestive" (53), "high in fat" (50) and "low in fibre" (47). Despite the similar results of sessions 1 and 2 regarding the focus on fibre content, in session 2 the participants mentioned the terms "high in fibre" and "low in fibre" instead of only "contains fibre". This means that the participants had even compared the numerical values in the nutrition information panel. In addition, this behaviour showed how the participants paid attention to the details when they were not distracted by the global visual impact of the package information, such as claims in large letters, colours, images, etc. Faced with the experimental cards, they considered all the information in detail. It is noteworthy that even when only the cards were provided (giving the type of biscuit, claims and nutrition information panel but no pictures or any other description), expectations of sensory and hedonic characteristics were raised among some participants ("different flavours", "good flavour and texture", "similar shape").

The 23 samples were mapped and displayed on the first two MFA axes, which together explained 38.77% of the variability (Fig. 3).

In general, the hierarchical clustering analysis mostly showed very similar groups of biscuits to those of session 1. However, 4 clusters were obtained from the analysis in this session, probably because the participants focused on certain characteristics in more detail.

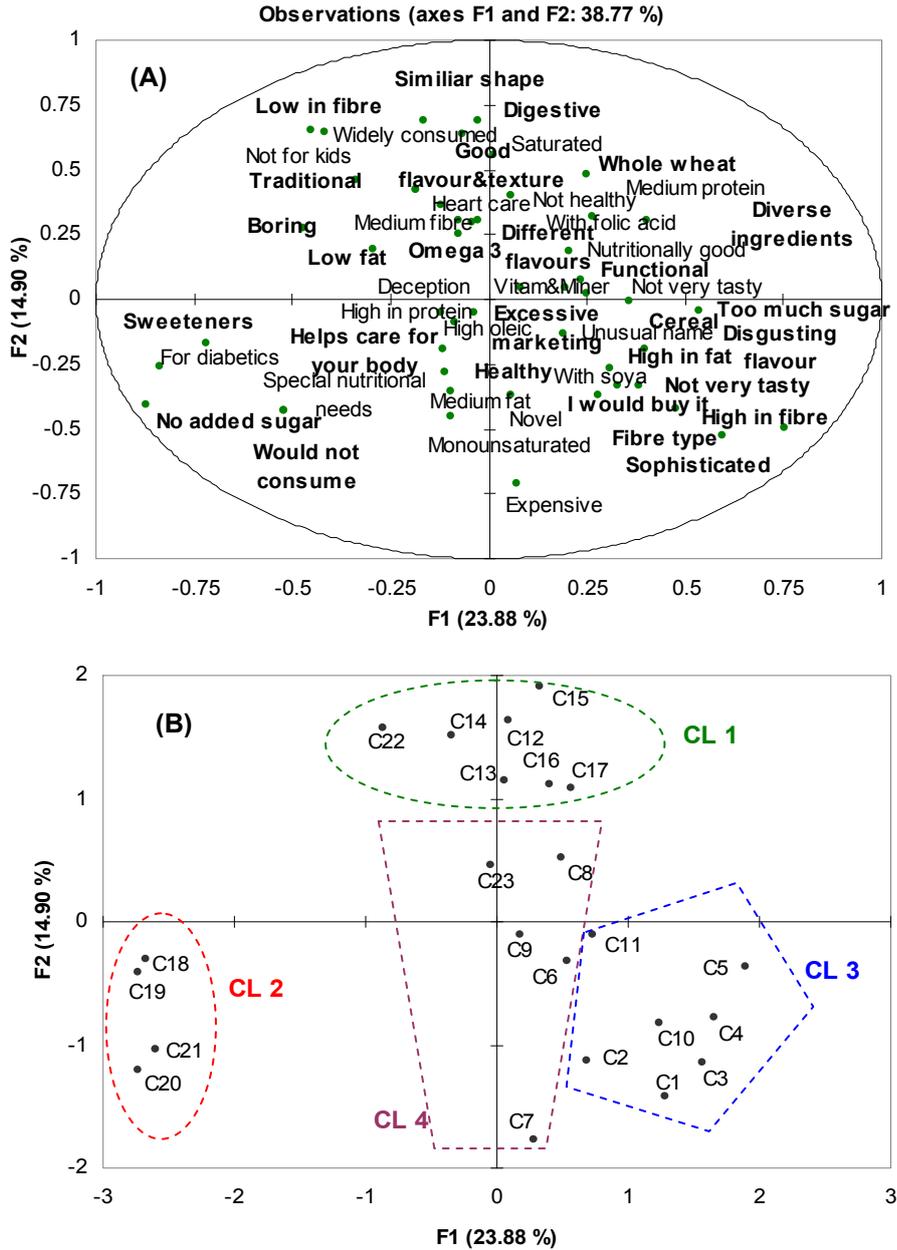


Figure 3. Multiple factor analysis of the data obtained in session 2.
a) Representation of the terms obtained. The terms most frequently mentioned are shown in bold type. b) Representation of the samples (23 biscuits). Groups of samples identified by hierarchical clustering analysis.

The use of experimental cards only provided the participants with specific written information, so to establish their placing and grouping criteria they had no choice but to centre on reading the cards and comparing them.

Cluster 1, formed by C12-C17 and C22, was located on the positive side of the second factor of the MFA, positively correlated to the terms "digestive", "traditional", "saturated fat", "similar shape" and "whole wheat". These samples were mostly the same as in Cluster 1 from session 1 and were described in similar terms. Samples C12 and C22 were the exceptions: in session 1 they had been placed in cluster 3, mostly composed of fibre-added biscuits, but in session 2 they were grouped with the digestive type, probably because they were of the María type, which is traditional and very popular in Spain. However, the term traditional was not correlated to the first 2 factors of the MFA in session 1. Another interesting reading from sample C12's not being clustered with the fibre-added biscuits in session 2 is related to two claims in large letters on the front of the C12 package: "66% cereal" and "whole wheat". The change of group suggests that in session 2, without the influence of the lettering size, both were given the same importance, whereas in session 1 the participants paid more attention to the claims highlighted on the package than to the nutritional information panel.

Cluster 2 included samples C18-C21 and was located towards the negative side of the first two factors of the MFA, mainly correlated to the terms "no added sugar", "for diabetics", "sweeteners", "special nutritional needs" and "would not consume". As in session 1, these samples also raised negative expectations regarding their sensory character ("would not consume"). Most of the samples were the same as in cluster 2 in session 1. However, sample C7 moved to a different cluster in this session (Cluster 4). C7 was an added-fibre, no added sugar biscuit. It would appear that in session 1 the no added sugar characteristic played an important role (large-font claim on the front of the package), while in session 2 the fibre-added characteristic acquired more weight in its description and defined its positioning. This demonstrates again

that participants were highly influenced by the size of lettering and the frontal position of the claims on some of the packages, suggesting the greater strength of visual communication compared to the nutrition information panel on the food packages. This result is consistent with previous research by Reinhardt, Schmidt, Childs, Meunier, and White (2008), who studied consumer perceptions of graded, graphic and text label presentations.

Cluster 3 was made up of C1-C5, and C10. It was located on the positive side of the first factor of the MFA and on the negative side of the second factor and was positively correlated with the terms "high in fat", "high in fibre", "too much sugar", "fibre type", and "sophisticated". Compared to session 1, the results were similar, although it contained fewer samples, mostly because a fourth cluster was obtained.

Cluster 4 was a set of biscuits with intermediate characteristics (C6-C9 and C23), being high in fibre but also possessing additional nutrition or health claims that gained more importance in this grouping scenario, which allowed participants to become more aware of some claims (without cholesterol, high oleic, prebiotic, with folic acid, heart care) or nutrition facts because of having to read the experimental cards in detail.

From the observations of the session 2 scenario, the conclusion is that if participants are required to read the claims and nutrition table with no differences in font type or size, colours, etc., they do not focus on the same information as they would naturally when shopping, when the highlighted claims on the package seem to play a more important role.

3.3 Session 3: Blind tasting, no information

Ten samples were presented all together (C1, C2, C7, C9, C10, C12, C14, C18, C19 and C22). These samples were chosen from the results of the hierarchical cluster analyses in sessions 1 and 2 and were selected to give the best possible

representation of the complete perceptual space of the original sample set with the advantage of a smaller number of samples.

In this session, 43 terms were obtained in the four categories. Their distribution was as follows: sensory (29 different terms), nutrition and health characteristics (7), use and attitudes (5), and composition/ingredients (2). As expected, the sensory attributes were the principal drivers of sample grouping, as there was obviously no possibility of terms inferred from the packaging or information being grouping factors in this session. Sensory characteristics were also the category mentioned by far the most in this blind evaluation. The sensory terms were both hedonic and descriptive and were very varied. Regarding the frequency of mention of terms, "delicious" (49 mentions), "fibre flavour" (49 mentions), "insipid" (42 mentions) and "little sweetness" (42 mentions) were the most frequent, while "traditional" (40 mentions), "high in fibre" (38 mentions) and "healthy" (36 mentions) were the non-sensory terms most often elicited.

The samples were mapped and displayed on the first two MFA axes, which together explained 40.33% of the variability and three groups were obtained after the hierarchical cluster analysis obtained (Fig. 4). As expected, the grouping was very different to either of those obtained in sessions 1 and 2.

Cluster 1 (C9 and C10) was described by the terms "whole wheat", "satiating", "fruit flavour", "apple flavour" and "fibre flavour" and by the hedonic terms "delicious", "good texture" and "I would buy it".

Cluster 2 (C12, C19 and C22) was described by the terms "not healthy", "traditional", "without fibre taste", "butter flavour" and "crispy". C19 and C22 did not have visible fibre, which could be linked to the "without fibre taste" and "not healthy" associations, although the latter could also have been mentioned because of the association with "butter flavour", as participants might have assumed that these biscuits had a high fat content.

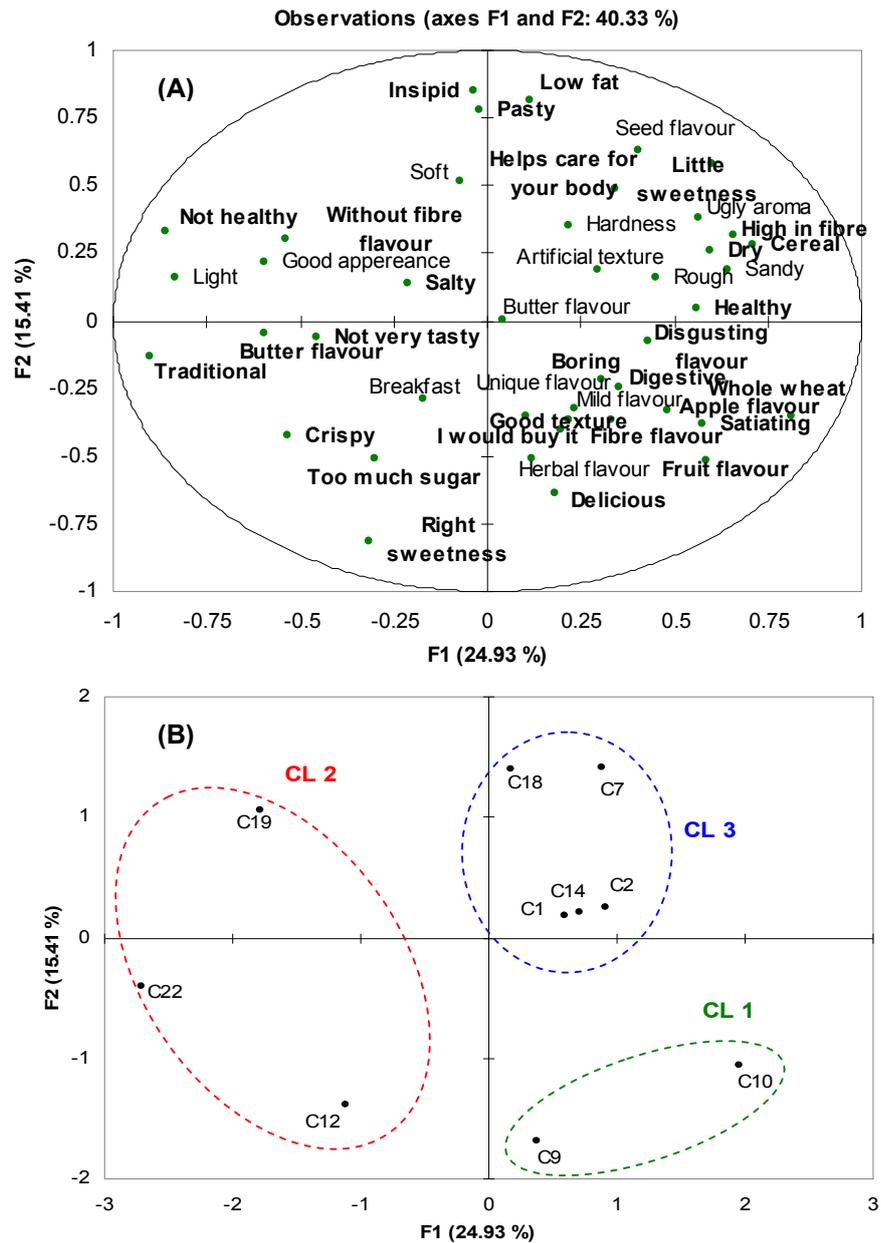


Figure 4. Multiple factor analysis of the data obtained in session 3.

a) Representation of the terms obtained. The terms most frequently mentioned are shown in bold type. b) Representation of the samples (10 selected biscuits). Groups of samples identified by hierarchical clustering analysis.

Cluster 3 was composed of biscuits C1, C2, C7, C14, and C18, and was described by the terms "insipid", "low fat", and "pasty", positively correlated with the second factor of the map, as well as "high in fibre", "cereal", "dry", "little sweetness" and "healthy". It may be noted that negative sensory terms were obtained for this cluster (dry, pasty, insipid), which together with the low fat and high in fibre perceptions can be potentially related to the perception of "healthy". This is in agreement with the statement by Baixauli, Salvador, Hough, and Fiszman (2008) that healthy food choices are often viewed as being in conflict with enjoyable eating, on the same lines as the "not healthy" perception of cluster 2. It is interesting to observe how sensory and hedonic perceptions also set up non-sensory expectations, particularly this association with healthy/not healthy products.

3.4 Session 4: Informed tasting using experimental cards with nutrition panel information and claims

Participants received the same ten samples as in session 3, but this time each sample was accompanied by the experimental card used in session 2 (containing the nutrition and health claims and nutrition panel information). In this session, 50 terms were obtained. Their distribution in the four categories was: sensory (25 different terms), nutrition and health characteristics (13), use and attitudes (9), and composition/ingredients (3). The terms most frequently mentioned were: "high in fibre" (63 mentions), "delicious" (55 mentions), "healthy" (34) and "insipid" (30). In contrast with session 3, although the participants generated a wider variety of sensory terms the term most often mentioned belonged to the nutrition and health category, clearly showing the influence of the written information on the participants' perceptions. "High in fibre" was also the term most frequently mentioned in session 2, indicating that the participants had again read and compared the fibre percentage on the experimental cards.

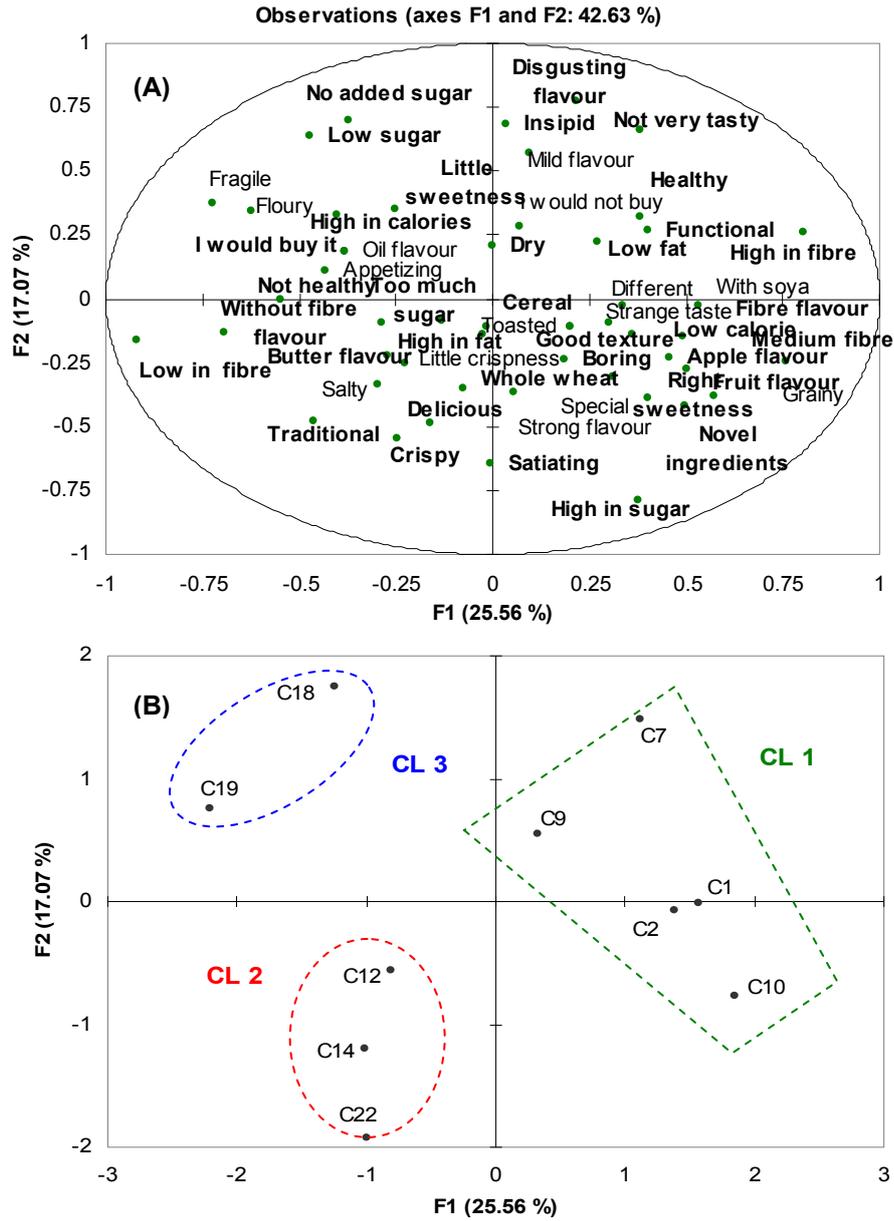


Figure 5. Multiple factor analysis of the data obtained in session 4.
 a) Representation of the terms obtained. The terms most frequently mentioned are shown in bold type. b) Representation of the samples (10 selected biscuits). Groups of samples identified by hierarchical clustering analysis.

The 10 samples were displayed on the first two MFA axes, which together explained 42.63% of the variability (Fig. 5). The hierarchical cluster analysis highlighted three groups where the information clearly influenced the responses. The sample groupings were driven by both the sensory characteristics and the written information. Comparison with session 3 found differences, indicating that the information had a strong influence.

Cluster 1 (C1, C2, C7, C9, and C10) was described as "high in fibre", "medium fibre", with apple and fruit flavours, "low fat", "with soya", "novel ingredients", and "healthy". All these biscuits contained added fibre, the main driver of this grouping. Again, negative sensory descriptors ("not very tasty", "disgusting flavour") were associated with healthiness. It is noteworthy that in the blind tasting session (session 3) C9 and C10 were associated with positive hedonic terms such as "delicious", suggesting that the invisible fibre (not whole wheat) achieved better acceptability, whereas in session 4, when participants were informed of the fibre content, a negative hedonic perception was observed.

Cluster 2 (C12, C14, and C22) was described by the terms "crispy", "satiating", "butter flavour", "without fibre flavour", "high in sugar" and "traditional". These are the María and plain digestive (not whole wheat) biscuits. In this session the term "delicious" was linked to this group of samples, accompanying the perceptions of "traditional" and "without fibre flavour", and negatively correlated to the term "healthy".

Cluster 3 (C18 and C19) comprised the biscuits with no added sugar, the main characteristic used to group them together. The terms employed to describe this group were "no added sugar", "low sugar" and "insipid". These biscuits had also been clustered together in session 2, but had been placed in different clusters in session 3.

On contrasting this session with sessions 2 and 3, it could be considered to confirm the important role of information on consumer perceptions, influencing

sensory and hedonic judgements and frequently linking negative sensory and hedonic associations with the perception of healthy. Although it was noticed that the experimental cards represented a somewhat artificial way of presenting information to participants, the information on nutrition and health consequences and on composition was clearly shown to set up hedonic and sensory expectations.

3.3 Comparison of the four sessions

The superimposed representation of the samples in the multiple factor analyses (MFA) made it possible to evaluate the proximity between the four evaluation instances for each evaluated sample (Fig. 6). The MFA was performed on the X-Y coordinate values of the 10 samples that were the same in all the sessions.

Observing the underlying structure of the four evaluation instances and their proximities it can be inferred that the effect of package information is really a “modulator” of consumer perception, becoming different without permanently losing its former characteristic. As a whole, the perception of the overall evaluated category has not changed dramatically between sessions, but it was more a sample – dependant effect. Depending on the product, the distance and correlation between sessions was different, suggesting that each different product produced different consumer perceptions in relation to the four sets of evaluation conditions.

Looking at the Rv coefficients obtained in the MFA, this fact was confirmed, Rvs ranges from 0.7 to 0.9, showing the underlying structure of the four maps is basically similar. The greatest differences were observed for session 1 (Fig. 6) being it the one with the lowest Rv= 0.7 value against the other 3 sessions, while the rest of the scenarios presented Rv coefficients between 0.8-0.9, showing higher correlations.

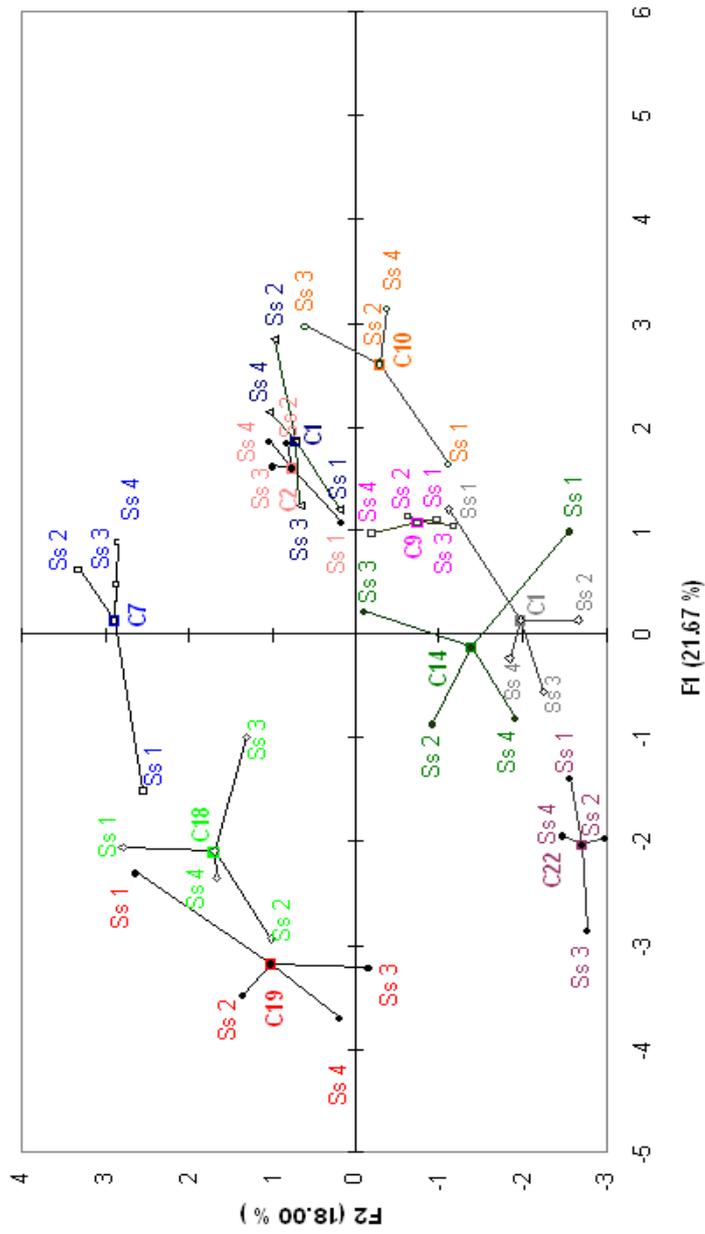


Figure 6. Superimposed MFA representation of the 10 selected samples. Each sample is represented by four points, corresponding to the four evaluation instances. The consensus representation that takes into account the four evaluation instances simultaneously is also represented for each of the 10 samples.

This indicates that the more natural evaluation scenario where participants had to judge the whole biscuit package by observation and comparison, as they would when buying in a shop, was indeed different to the other evaluation conditions, where they had to focus on information on the product's composition and nutrition characteristics to evaluate their perceptions, as this was all they had, or just taste the product, or both taste and evaluate the information. Sessions 2 and 4 were the closest ($R_v=0.9$), showing when artificially focusing consumers attention on the nutritional panel, the influence of nutritional info and claims is strong, irrespectively if they are tasting or not.

Some of the cases are worth observing in more detail. For C7, for example, the sessions that were farther away in the MFA, sessions 1 and 2, showed the effect explained above when the clustering differences between the two scenarios were analyzed: the type of claim on the packages and their size or colour seem to have had a big influence in participants' perception. However, participants described C7 in a similar way in sessions 3 and 4 (very close in the MFA) irrespectively of the information received, probably because this biscuit had a distinct, striking sensory profile, described in the mapping as "insipid", "little sweetness", "disgusting" or "ugly".

In addition, biscuits in the no added sugar category presented big differences between the four sessions, suggesting different consumer perceptions and the lack of association between low sugar and reduced energy content, and consequently an association with nutritional disorders or problems rather than with low-calorie or healthy biscuits.

On the other hand, only minor differences between the four sessions were observed for samples C2, C9, C1 and C22. These biscuits mainly belong to the added-fibre group and the participants were probably familiar with the term fibre. However, further studies of acceptability are required.

It is worth noticing that the projective napping® tasting exercises (blind and informed) were manageable for the participants to perform. Thus, changes in product configurations deriving from these two scenarios could be interpreted.

4. CONCLUSIONS

The projective mapping technique was successful to reveal the influence of nutritional and health claims together on the pack and in tasting and non-tasting conditions. It was a useful, flexible tool easily understood by consumers that can be applied for explorative purposes.

The information on the biscuit packaging had a strong influence on the consumers' perceptions. This information was clearly observed to influence consumer expectations and to constitute a force for grouping the different samples in the consumer's mind. The consumer's familiarity with each product also proved important; in fact, participants mentioned the descriptor "traditional" in all the sessions demonstrating that this factor highly influences the consumer perception. In addition, the location of the advertising on the package contributed to enhancing the impact of the message, front-of-package being the most effective place to catch the consumers' attention.

A clear impact of nutrition claims was observed. Participants paid attention to this type of claim and terms regarding health claims were produced, although not as frequently as others. In addition, biscuits with too much information were perceived negatively and with distrust.

Regarding specific components, "contains fibre" was the term mentioned most even though the participants in session 3 did not possess the fibre content information, indicating that they clearly perceived the fibre sensorially. Although this biscuit ingredient seemed to be well positioned in the Spanish market, negative hedonic terms were obtained. Moreover, biscuits with no added sugar

were linked to sugar-related health problems rather than to a healthier product. Acceptance tests will be necessary to confirm this point.

Participants' perceptions were greatly modified when the biscuits were tasted, manufacturers should be aware of these differences, as it would be dangerous if positive consumer expectations were disconfirmed. Familiarity with each kind of biscuit is also an important factor to consider. It is worth mentioning however, that the influence of pack information and claims could be highly dependent on the food category, so more studies would be needed in other categories to draw general conclusions about the modulating effect of pack and health claims in consumer's perception.

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Effects of food package information and
sensory characteristics on the perception
of healthiness and the acceptability of
enriched biscuits

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ABSTRACT

The aim of the present work was to study the interaction between sensory and non-sensory characteristics that influence the overall acceptance and perceived healthiness of enriched biscuits and/or biscuits with reduced levels of high energy components. Three different scenarios (blind, informed and expected conditions) were analyzed. The participants mapped the samples in Napping® tests and rated the overall acceptance and perceived healthiness of ten biscuits. The results showed that overall acceptance was higher for almost all the biscuits in the blind test, whereas seeing only the package showed a trend towards higher perceived healthiness, suggesting that non-sensory factors could influence the first buy and sensory characteristics could determine loyalty and repeat consumption of certain enriched or reduced-calorie biscuits. It was observed that participants were not willing to compromise sensory characteristics for health even though they considered that some food components were beneficial for the diet. The study showed how sensory and non-sensory cues interact to build consumer perception and how, depending on the particular product, parameters like the brand, category, familiarity with the product, familiarity with the claim or sensory profile can influence product assessment (acceptance and healthiness perception) in different ways.

Keywords: Biscuits; consumers; acceptance; perceived healthiness; non-sensory; nutrition claims; health claims

1. INTRODUCTION

Giving consumers what they want and expect, based on the relationship between sensory and non-sensory factors, is the primordial aim of food producers and many efforts are made to satisfy consumers' requirements and ensure the success of a product in the marketplace (Mueller & Szolnoki, 2010). Due to the growing interest in healthy food, manufacturers offer a diversity of food categories that produce health benefits. The biscuit market, in particular, is an example of the increasing enrichment of foods or reduction of unhealthy components taking place nowadays (Šebečić, Vedrina, Vitali, Hečimović & Dragičević, 2007).

Acceptance of a food depends on the interactions between intrinsic and extrinsic factors and sensory attributes are the principal factor that plays a significant role in its overall acceptance (Cardello, 1994 & 2003; Torjusen, Lieblein, Wandel & Francis, 2001). Non-sensory factors influence consumers' expectations, which can be confirmed or disconfirmed (Jaeger, 2006). This means that the higher the level of expectation about the product, the greater the opportunities for food selection and consumption. Conversely, low expectations could lead to the product's being ignored (Deliza & MacFie, 1999; Vidigal, Minim, Carvalho, Milagres & Goncalves, 2011).

After the food is tasted, the initial expectations of sensory and hedonic characteristics can be confirmed or disconfirmed. Confirmation can lead to high acceptance and repeated consumption and can also confirm the perception of food quality (Deliza & MacFie, 1999). Moreover, the perception transmitted by the visual appearance of the food package is the first contact between the consumers and the food (Shepherd, Sparks & Raats, 1991). Varela, Ares, Giménez and Gámbaro (2010) studied the influence of brand and pack on consumers' expectations and liking of orange-flavoured powdered drinks. They showed that in some cases these can have a large impact on consumers' liking scores. In addition, external information stated on the packages is a way for

manufacturers to communicate food benefits through claims and for consumers to infer hedonic expectations. Some studies note that because consumers generally understand the link between food and health, the use of food labels would positively influence the intention to follow healthier diets. However, the degree of interest differs between different consumers, situations and products (Barreiro-Hurlé, Gracia, De-Magistris, 2010; Grunert & Wills, 2007). The information given by the package is an extrinsic factor and a quality cue that influences consumer behaviour and could be an opportunity to encourage the intake of healthy and safety food (Grunert, 2002; Steenkamp & Baumgartner, 1998; Tudoran, Ottar-Olsen & Dopico 2009; Vidigal, Minim, Carvalho, Milagres & Goncalves, 2011). However, while the information (health benefit) can influence food acceptance, this depends on the knowledge and beliefs of the consumer (Baixauli, Salvador, Hough & Fiszman, 2008; Verbeke, 2005). Furthermore, other authors have pointed out that even though consumers know about health benefits, that does not mean that the food will be eaten (Aikman, Min & Graham, 2006).

Due to some of the information given in claims not having been scientifically proven, in 2006 the first European regulation specifically addressing nutrition and health claims was introduced to avoid misunderstanding and to protect consumers against false information (Regulation EC No. 1924/2006). This regulation made a distinction between “nutritional claims” and “health claims”: a nutritional claim “states, suggests or implies that a food has particular beneficial nutritional properties due to the energy (calorific value) it provides, provides at a reduced or increased rate or does not provide; and/or the nutrients or other substances it contains, contains in reduced or increased proportions or does not contain”, while a health claim “states, suggests or implies that a relationship exists between a food category, a food or one of its constituents and health”. In this context, health claims have been attached to functional foods. Several studies have been made to determine different factors that influence the perception of nutrition and health claims and the acceptance of functional foods such as: the enrichment-product type combination (Berch-Larsen & Grunert,

2003), more preference toward physiology-based health benefits than psychology/behaviour (Van Kleef, Van Trijp, Luning, 2005), type of benefit (Verhagen, Vos, Francl, Heinonen & Loveren, 2010), familiarity with the ingredients (Grunert, 2010), gender, age, country differences and cultural values (Ares & Gámbaro, 2007; Siegrist, Stampfli & Kastenholz, 2008). Preliminary studies made on Spanish consumers regarding functional foods indicated that 32% of the participants did not know about the positive effect over health that this type of foods produces (Carrillo, Varela & Fiszman, 2011b).

The projective mapping technique was developed for sensory analysis and consumer research by Risvik, McEwan, Colwill, Rogers, and Lyon (1994) and more recently reintroduced by Pagès (2005) under the name of the “Napping®” procedure. The technique consists of placing a set of products on a two dimensional perceptual surface according to their similarities. They can be grouped together if they have very similar characteristics. This technique has been employed in products such as citrus fruit (Nestrud & Lawless, 2010), coupled with ultra-flash profiling in wines (Perrin et al., 2008), hot beverages (Moussaoui & Varela, 2011), fish nuggets (Albert, Varela, Salvador, Hough & Fiszman, 2011) and orange-flavoured powdered drinks (Ares, Varela, Rado & Giménez, 2011). In addition, previous research on consumers’ perceptions of enriched and reduced-calorie biscuits has been conducted using the projective mapping technique (Carrillo, Varela, Salvador & Fiszman, 2012). The napping® technique proved to be an intuitive, less rational method for the consumers, who thought of the product as a whole. This situation is in a way comparable to what happens in the supermarket. In light of the above, three scenarios were established: blind tasting, informed tasting and expected condition that integrate sensorial and non-sensorial factors that influence the consumers’ behaviour.

The objective of the present work was to study the relation of the sensory characteristics, packaging and label information of enriched and reduced calorie biscuits with the overall acceptance and perceived healthiness.

2. MATERIAL AND METHODS

2.1 Samples

Ten enriched and reduced-calorie sweet biscuits were employed in the present study. The samples were purchased from a variety of supermarket chain stores located in Valencia (Spain). They were selected on the basis of the nutritional and health claims and information given on the packages and to certain degree maintaining some homogeneity regarding shape and size (there were differences because of being commercial samples). Biscuits with pieces of fruit or chocolate or with fillings were not included in the study in order to avoid distracting factors. Also, the ten biscuits were selected to avoid having the brand name on them, only two of the samples had the type of the biscuit write them ("Digestive" and "Maria"). The selection of the ten biscuits was based on a previous study (Carrillo, Varela & Fiszman, 2012) which employed 23 enriched and reduced-calorie biscuits in order to achieve the best possible representation of the complete perceptual space of the category of enriched and reduced-calorie plain biscuits. In addition, the ten biscuits were used in order to avoid participants' fatigue in the tasting sessions due to this study started with the projective mapping exercise and participants could handle ten samples without difficulty. In fact, a previous study reported that "a limitation of the projective mapping technique is the number of products which, according to our experience in the case of wines, cannot be much higher than 12" (Pagès, 2005). Table 1 shows the characteristics of the ten selected biscuits with the claims and nutrition information panel as stated on the package.

2.2 Participants

A total of 90 consumers were included in the study. The participants were divided into three different groups (30 participants each) in order to obtain more spontaneous information in each scenario. They were recruited from volunteers from the laboratory database with the condition that they were regular biscuits' consumers and had at least a secondary education level in order to facilitate the comprehension of the preliminary study (projective mapping technique). The

participants were aged between 22 and 66 years old, and approximately seventy percent were women and thirty percent men. All the participants were responsible for shopping in their households that is why the majority were women.

Table 1. Information displayed on the packages of the 10 biscuit samples and used for the test with experimental cards (Informed conditions).

Biscuit type as described on the package	Code	Nutrition panel information	Health and nutrition claims on the package
Traditional			
Oven-baked María	B1	CAL:439; CH:77; SU:24; TF:11; SF:4; DF:3; NA:0.3	With folic B and non-visible fibre: Delicious way to help care for the heart
María with fibre*	B2	CAL:455; CH:66; SU:24; TF:18; SF:9; DF:5; NA: 0.4	66% cereal; Whole wheat; Source of fibre; Helps you keep fit because of fibre content
Digestives			
Digestive	B3	CAL:474; CH:66; SU:16; TF:20; SF:10; DF:3; NA:0.65	With omega 3
Added Fibre			
Whole fibre with soya	B4	CAL:460 Kcal; CH:63; SU:19; TF:18; SF: 4; DF:9; Na:0.3	62% cereal and 9% fibre; Contains three cereals; Helps to care for the intestinal tract
Active soya	B5	CAL: 440 Kcal; CH:55.8; SU:17; TF:18; SF:2; DF:8; Na:0.21	With isoflavones; 16% soya; High oleic content
Fat burning	B6	CAL:448; CH:60; SU:18; TF:20; SF:10; DF:6; NA:0.2	Whole wheat; With inulin and fructose; High fibre content; Helps to burn fat
With apple and green tea	B7	CAL:442; CH:64; SU:23; TF:17; SF:2; DF:5; NA:0.43	High fibre content

No added sugar			
No sugar added (diet-fibre)	B8	CAL:405; CH:49; SU:2; TF:16; SF:2; DF:23; NA:0.20	No added sugar; Prebiotic (23% fibre); High oleic
Biscuits without added sugar	B9	CAL:482; CH:68; SU:<0.5; PO:16; TF:20; SF:5; DF:2.7; NA<0.12	Low in salt; No added sugar; With wheat and oats
Natural diet	B10	CAL:453; CH:69; SU:<0.5; PO:16; TF:19; SF:2; DF:3; NA:0.16	Without sugar; With sweeteners; High oleic

CAL: Calories; CH: Total carbohydrates; SU: Sugars; TF: Total fat; SF: Saturated fat; DF: Dietary fibre; PO: Polyols (sugar alcohol); Na: Sodium. CAL expressed as Kcal/100 g and all other components expressed as g/100g.

*Sample B2 was included in the “Maria” category because the word “Maria” is written on the biscuit itself.

2.3 Consumer tests

Three sessions were held in three different sessions (scenarios): 1) blind tasting condition 2) informed tasting condition and 3) expected condition only (seeing the biscuit packages). Each session consisted of two parts, before starting each session; the participants were explained the tests. The first part was the use of the projective mapping, locating the biscuits on an A2 paper sheet according to their similarities and differences. Following this, they were asked to write down the criteria used for placing and grouping the samples on the sheet; they could write any word, association or description that came to their minds (ultra-flash profiling). In the second part of the session, the participants received a score sheet to evaluate their overall acceptance and perception of the healthiness of each sample. In the three scenarios, structured 9-point hedonic scales (box-scales) were used, labelled from “dislike extremely” to “like extremely” for overall acceptance and from “unhealthy” to “very healthy” for perceived healthiness.

In the first session (blind tasting), each participant received ten biscuits without any information. The samples were presented in a coded transparent container. It should be emphasised that this type of presentation facilitated both of the two

tests carried out: 1) the projective mapping and profiling exercise and 2) the evaluation of the overall acceptance and perceived healthiness. Participants received a score sheet with the numerical code of each biscuit and rated their overall acceptance and perception of healthiness.

In the second session (informed tasting), the participants received the same ten samples in coded transparent containers plus one card per each biscuit. These cards contained the nutritional fact Table and the nutrition and health claims from the packages (the information showed in Table 1). The same font size, typography, and format were used for all 10 cards so that the design features (position on the package, size, font colour, etc.) would not influence the exercise. As in session 1, the participants employed the projective mapping and profiling technique and then rated their overall acceptance and perception of healthiness on a score sheet that showed the numerical code of each biscuit. These sessions (blind and informed) were carried out in a standardized test room (ISO 2007) in groups of 10 participants due to the number of available booths, during three consecutive mornings.

In the third session (seeing the biscuit packages only), the ten coded empty biscuit boxes were presented to the participants. This test was made individually in order to avoid comments among participants, as they performed it outside the booths. The packages were placed on a table and the participants were free to observe, touch, and move the packages around. The sizes of the ten boxes were the reason for performing the mapping exercise on a bigger table than a sensory booth. The numerical code of each package was provided on a small adhesive flag (Post-it®) so that it could be stuck on an A2 sheet according to the similarities or differences used by the participant to place the boxes on the table. They could also write the associations related to each placement or grouping on the same A2 sheet. In this session, the projective mapping took all the external information on the packages into account (biscuits were not given). After this, the participants received a score sheet with a photograph of the front of the package and its corresponding numerical code

and were asked to evaluate the overall acceptance and perceived healthiness of each biscuit.

During session 3 the participants were also asked to rate the importance they placed on a number of claims when choosing biscuits. The claims were taken from the packages of various biscuits sold on the Spanish market (those most frequently found are shown in Fig. 1). For this task the participants used nine point scales (box-scales) anchored from “unimportant” to “very important”.

2.4 Data analysis

Data from the three scenarios (blind, informed, and expected) were analyzed for samples and scenarios, considering interactions, using analysis of variance performed with the XLStat statistical software package (Addinsoft, Barcelona, Spain, version 2009 4.03). The mean differences between samples were compared using Tukey’s test for a 5% significance level ($p \leq 0.05$). Previously, the homogeneity of the variance was checked using Levene’s statistic.

Napping® and hierarchical clustering was used in this work as a means of obtaining consumers’ description of the samples, in an exercise independent from the assessment of liking and perceived healthiness. The description could be used to explain the differences in hedonic and healthiness perception.

A Multi-Factor Analysis (MFA) was performed on the X and Y coordinate values for the samples on each of the participants’ individual maps for the three scenarios, the data table consisted in 10 rows representing the biscuits and 30 X and Y coordinates for each scenario (participants) as suggested by Pagès (2005). All the words provided by the participants in the ultra-flash profiling step following the projective mapping task were qualitatively analyzed for each scenario separately. The terms elicited to describe a sample or group of samples were grouped, using synonymous and derived words, by consensus between three researchers. The frequency of mention was determined by counting the number of mentions of the same term in each session. This

information was used as supplementary variables that did not contribute in the construction of the MFA factors. In addition, MFA was also carried out to compare the biscuit sample positions on the 3 maps generated in the three sessions.

A hierarchical cluster analysis (HCA) was also carried out in the data table to identify samples with similar characteristics within each of the scenarios. The analysis was performed using Euclidean distances, Ward's aggregation criterion, and automatic truncation.

The importance given to claims was analyzed using one-way analysis of variance.

3. RESULTS AND DISCUSSION

The descriptors obtained in the projective mapping and profiling exercise for each scenario are shown in Table 2. It should be noted that the descriptors for a cluster do not all describe all the samples in that cluster, as hierarchical cluster analysis was applied to samples with similarities between the X and Y coordinates. The descriptors were correlated with the samples according to the multi-factor analysis, based on the number of times that a descriptor was mentioned for each sample.

In the blind scenario, the samples were grouped by similarities between their sensory characteristics. In the informed scenario, the information played an important role in grouping the samples. In this exercise, it was observed that while information was the most important factor, some sensory descriptors were also obtained.

In the expected scenario, only Samples B2 and B8 changed cluster. In the case of Sample B2, it was the excessive information on the package that determined its change of location to cluster 2, while Sample B8 was transferred to the "no

added sugar” group because this claim was bigger than that announcing “Prebiotic (23% fibre)”, demonstrating the effect of the size of the claim.

Table 2. Main descriptors generated by the participants in the projective mapping task coupled with ultra-flash profiling for each cluster in the three scenarios.

Scenario	Cluster	Samples	Descriptors
Blind	1	B1, B2, B10	Traditional (40); Butter flavour (23); Not healthy (7); Good appearance (6); Without fibre flavour (6); Crisp (7); Breakfast (7)
	2	B3*, B4*, B5*, B8**, B9	Little sweetness (42); Insipid** (42); Butter flavour* (23); Rough surface (13); Low fat (5); Pasty (4); Helps care for your body (8)
	3	B6, B7	Delicious (49); Fruit flavour (26); Fibre flavour (49); Whole wheat (27); Good texture (13); Herbal flavour (4); Satiating (7); Digestive (5)
Informed	1	B1, B2, B3	Delicious (55); Low fibre (21); Traditional (15); Crisp (11); Butter flavour (11)
	2	B4, B5, B6, B7, B8**	High in fibre (63); Healthy (34); Insipid**(30); Disgusting flavour** (26); Novel ingredients (11)
	3	B9, B10	No added sugar (10); Floury (16)
Expected	1	B1, B3*	Healthy* (25); Digestive* (25); Traditional (24); Functional (20); Heart care (19)
	2	B2, B4, B5, B6, B7	Contains fibre (88); With soy (37); Whole wheat (35); Cereals (11); Excessive marketing (9)
	3	B8, B9, B10	No added sugar (72); Little salt (14); Low calories (13); Diabetics (3)

Descriptors marked with a symbol are closely related to the samples with the same symbol and not to other samples in the same cluster. Values between brackets are the number of mentions by the participants in each scenario.

3.1 Overall acceptance and perceived healthiness in the blind scenario (blind tasting condition)

As shown in Table 3, statistically significant differences were observed for Sample B8; this sample was rated with the lowest acceptance score due to its sensory characteristics: this biscuit had a very different appearance (rough surface) to that of the other samples and was described in the profiling exercise as "not very tasty" and with "disgusting flavour" (Table 2).

Table 3. Acceptance ratings in three scenarios: 1) blind tasting, 2) informed tasting, and 3) expected acceptance when only seeing the biscuit packages.

Samples	Blind	Informed	Expected
B1	5.5 ^{a,B}	5.4 ^{b,c,B}	6.9 ^{a,A}
B2	6.9 ^{a,A}	6.6 ^{a,b,A}	6.2 ^{a,b,A}
B3	6.9 ^{a,A}	6.2 ^{a,b,c,A}	6.0 ^{a,b,A}
B4	6.2 ^{a,A}	6.2 ^{a,b,c,A}	5.7 ^{a,b,A}
B5	6.2 ^{a,A}	5.2 ^{b,c,A}	5.4 ^{a,b,A}
B6	6.0 ^{a,A}	5.5 ^{a,b,c,A}	5.2 ^{a,b,A}
B7	5.8 ^{a,A,B}	7.0 ^{a,A}	5.4 ^{a,b,B}
B8	3.7 ^{b,B}	3.2 ^{d,B}	5.6 ^{a,b,A}
B9	5.7 ^{a,A}	4.9 ^{c,A}	4.6 ^{b,A}
B10	6.4 ^{a,A}	5.3 ^{b,c,A}	5.7 ^{a,b,A}

Evaluated using a 9 point hedonic box scale.

Different lowercase superscripts within a column indicate significant differences according to Tukey's test ($p \leq 0.05$).

Different capital superscripts within a row indicate significant differences between scenarios according to Tukey's test ($p \leq 0.05$).

Regarding the perceived healthiness, more discrimination was observed between the samples (Table 4). It was observed a trend to relate the dark-brown colour, which is typical of fibre containing biscuits, with the perceived healthiness. The samples with the lowest perceived healthiness scores were B10, and B1. These samples were described in the blind mapping exercise as "not healthy" and "without fibre flavour" (Table 2).

3.2 Overall acceptance and perceived healthiness in the informed scenario (Informed tasting condition)

Analysis of the variance within this scenario showed major differences between the Samples B7, B8 and B9 (Table 3). However, the only sample that presented a major change in overall acceptance score compared with the blind scenario was B7. This biscuit pack stated that had “high fibre content” (9.8%) and with “apple and green tea flavour”. The mention of this “sophisticated” flavour could have enhanced its score in comparison with the blind scenario. Similarly to the blind scenario, Sample B8 obtained a significantly lower acceptance score than the rest of the samples due to its sensory characteristics and was described as “disgusting” and “insipid” in the mapping and profiling exercise (no sugar added and 23% fibre).

Regarding the perception of healthiness, significance differences in the score were observed between Samples B8 and B3. The first one was rated as the healthiest while Sample B3 as the least healthy (Table 4). The latter could be associated by the amount of the fat in the digestive type.

3.3 Expected overall acceptance and perceived healthiness of the biscuits on seeing the biscuit packages (Expected condition)

Table 3 summarizes the information obtained from the expected overall acceptance ratings generated by seeing only the biscuit packages of the ten samples. Major differences between Samples B1 and B9 were observed. Sample B1 was scored as the highest in terms of expected acceptance. This sample is a traditional type of biscuit and this characteristic seemed to have played an important role in setting the consumers' expectations. On the contrary, Sample B9 obtained the lowest expected acceptance scores. This biscuit is a no added sugar, suggesting that this characteristic could have negatively influenced the participants' hedonic expectations. The latter could mean that participants would normally think of sweet biscuits and link the lack of sugar with people that suffer from certain nutritional disorder, as can be observed in Table 2. This sample also received a low score in the informed

scenario, suggesting that neither its sensory characteristics nor its nutritional ones would have been capable of raising these expectations.

Regarding the perception of healthiness, the sample with the highest score was B8; however, this sample did not obtain a high acceptance score in this scenario, indicating that the participants did not take their decision on the sole basis of the product's healthy characteristics and their acceptance was mainly driven by the sensory cues (Table 4).

Table 4. Perceived healthiness rating in three scenarios: 1) blind tasting, 2) informed tasting, and 3) expected perception when only seeing the biscuit packages.

Sample	Blind	Informed	Expected
B1	4.7 ^{c,A}	4.9 ^{b,c,A}	5.4 ^{b,A}
B2	5.6 ^{a,b,c,B}	4.9 ^{b,c,B}	6.6 ^{a,b,A}
B3	6.5 ^{a,A}	4.6 ^{c,B}	6.1 ^{a,b,A}
B4	6.6 ^{a,A}	6.1 ^{a,b,A}	6.8 ^{a,b,A}
B5	6.6 ^{a,A}	6.2 ^{a,b,A}	6.1 ^{a,b,A}
B6	5.1 ^{b,c,A}	5.5 ^{b,c,A}	5.9 ^{a,b,A}
B7	6.3 ^{a,b,A}	6.1 ^{a,b,A}	6.1 ^{a,b,A}
B8	5.8 ^{a,b,c,B}	7.0 ^{a,A}	7.1 ^{a,A}
B9	6.1 ^{a,b,A}	5.0 ^{b,c,B}	6.5 ^{a,b,A}
B10	4.5 ^{c,B}	4.9 ^{b,c,B}	6.2 ^{a,b,A}

Evaluated using a structured 9 point hedonic scale.

Different lowercase superscripts within a column indicate significant differences between scenarios according to Tukey's test ($p \leq 0.05$).

Different capital superscripts within a row indicate significant differences according to Tukey's test ($p \leq 0.05$).

The sample with the lowest perceived healthiness score was B1. This package contained the claim "delicious way to help care for the heart" on the front of the package and "contains fibre" on one side. The score suggests that because the latter information was not located on the front of the package, it was left out of the healthiness rating, which was drawn only from the photograph of the front rather than taking the whole package into account. Previous research has studied the effectiveness of the location of nutrition facts and suggested the

positive impact of the front when quick decisions are required (Feunekes, Gortemaker, Willems, Lion & Van den Kommer, 2008). It was assumed that the participants would remember much of the information they used in the mapping exercise when rating the packages, but it seems that this was not always so.

3.3.1 Importance given to some biscuit characteristics

The importance given to various claims was measured in the expected scenario (Fig. 1). The participants indicated that the most important characteristic for selecting a biscuit was “source of fibre”, followed by “source of cereals” and “no added sugar”; while, “with green tea” was not regarded as important.

The importance given to the different claims is in line with what the participants perceived as healthier. They described Sample B8 as “with no added sugar” and Samples B4 and B2 as “containing fibre”, “with soy”, “with wheat and “with cereals” as can be observed in Table 2. The latter suggested that the familiarity and the time of exposure with the claim could have influenced the acceptance.

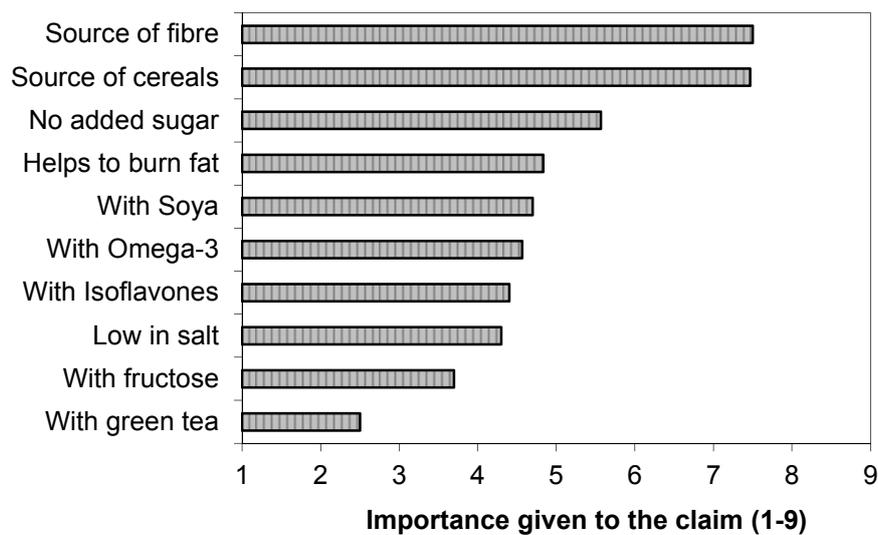


Figure 1. Importance given to biscuit package claims in scenario 3.

This observation is in accordance with Derby and Levy (2005) who pointed out that the consumers who were more knowledgeable about specific substance/disease relationships were more likely to trust in it.

Although participants rated the importance of the claim in accepting a biscuit, they were unwilling to sacrifice taste for health. This observation could be attributable to the healthy image of the product. Previous studies indicated that products with healthy images such as yogurt were more accepted (Kleef, Van Trijp & Lunning, 2005). In addition, the results suggested that the presence of these claims might influence decision making at the first buy; however, an excess of information or a high number of claims on the pack proved to have a negative influence on the perception and expected acceptance of the biscuits. This fact was reflected in Sample B6, which was described in the ultra-flash profiling as “excessive marketing” and the perception of healthiness rate was low and it is in line with a previous study who pointed that consumers prefer split claims, with a succinct statement on the front of the package and more detailed information provided elsewhere on the package (Williams, 2005).

3.4 Comparison between the three scenarios

Fig. 2 shows the superimposed representation of the samples given by the X, Y coordinate data from the projective mapping technique employed in the three scenarios. This representation allows the distance between the three scenarios to be interpreted for each sample. As shown in Fig. 2, major differences were observed for Samples B3, B8, B9, and B10. This result is in agreement with the samples that presented significant differences in overall acceptance and perceived healthiness scores between the three scenarios, suggesting that both hedonic and non-hedonic cues might have influenced the perception of the samples. However, the behaviour of the samples cannot all be explained in the same way. In some samples the informed and blind scenarios were closer to the description than the expected scenario (Samples B10, B5, B8 and B2). Sample B10 presented a high expected healthiness rating that was disconfirmed when the detailed nutritional information was given, which may be

the reason for the differences in the mapping exercise. In the case of sample B8, both the expected and informed perceptions of healthiness were high (nutritional information and package claims were in line) but the blind session biscuit raised lower expectations of healthiness. At the same time, the expected acceptance of Sample B8 was high but was disconfirmed (very low) when the sample was tasted, whether informed or blind. This means that the sensory cues were more important when characterizing and grouping Sample B8 in the mapping exercise. The next two sections discuss the expected effects in greater detail.

3.4.1 Overall acceptance

Significant differences between the three scenarios (blind, informed and expected) were observed for Samples B1, B7 and B8 (Table 3). Samples B1 and B8 presented significantly higher expected overall acceptance based on the package than in the blind and informed conditions.

The high expected acceptance score for Sample B1 suggested that familiarity and frequency of exposure (a very well know category called Maria) were very important for acceptance. Familiarity as an important factor in food choice has been discussed by several authors (Carrillo, Varela & Fiszman, 2011a; Steptoe, Pollard & Wardle, 1995). It is associated with people who opt for traditional/known food and this consumption habit is frequently transferred from one generation to the next (Guerrero et al., 2009; Pieniak, Verbeke, Vanhonacker, Guerrero & Hersleth, 2009). Furthermore, Sample B1 is a very well-know brand and is linked to different categories of functional foods for cholesterol management, which could also have influenced the high expectation. This is in agreement with Di Monaco, Cavela, Di Marzo and Masi (2004), Varela, Ares, Giménez and Gámbaro (2010), who suggested that well-known brands usually generate the highest hedonic expectations. The influence of non sensory factors in the perception of functional food has been studied by Ares, Giménez and Deliza (2010), who pointed out that brand and price could affect the interest toward functional foods. This observation is confirmed with

the present results; however the price was not considered in this case. In addition, Sample B1 obtained a low score in the blind scenario and a middling score in the informed one. Sample B1 package (good brand + “folic acid” + “non-visible fibre” + “delicious way to help care for the heart”) aroused positive expectations towards the product, as mentioned before, but its sensory characteristics disconfirmed the initial expectations. This observation is in agreement with Deliza and MacFie (1996), who studied external cues (advertising, packaging and information) that generate sensory expectation, influencing the sensory perception at the time of consumption.

Sample B8 also presented higher expectations that were disconfirmed in the blind and informed conditions. Insipid flavour was the most important characteristic describing this Sample in the profiling exercise (Table 2). This is in accordance with Aikman, Min, and Graham (2006), who pointed out that taste significantly predicts the acceptance and consequently the selection of most food. However, it may be noted that food is rarely eaten without any information, although the role that information played in the participants' perception of this particular product was less important than that of the sensory characteristics. When sensory and hedonic cues are particularly striking, either because of high liking or high disliking, presumably the non-sensory cues would become less important.

For Sample B7, the expectations when seeing the package scored less than in blind conditions and the expectations were more than fulfilled by the sensory profile. Also, the liking was even enhanced when the biscuit was tasted in informed conditions, suggesting that consumers were positively influenced by the detailed information on the cards, whether because the level of some nutrient was not expected or was not seen on the package information, or because the combination of the information and the sensory profile enhanced their liking. The “sophisticated” flavour (apple with green tea) may possibly have raised the score for this biscuit.

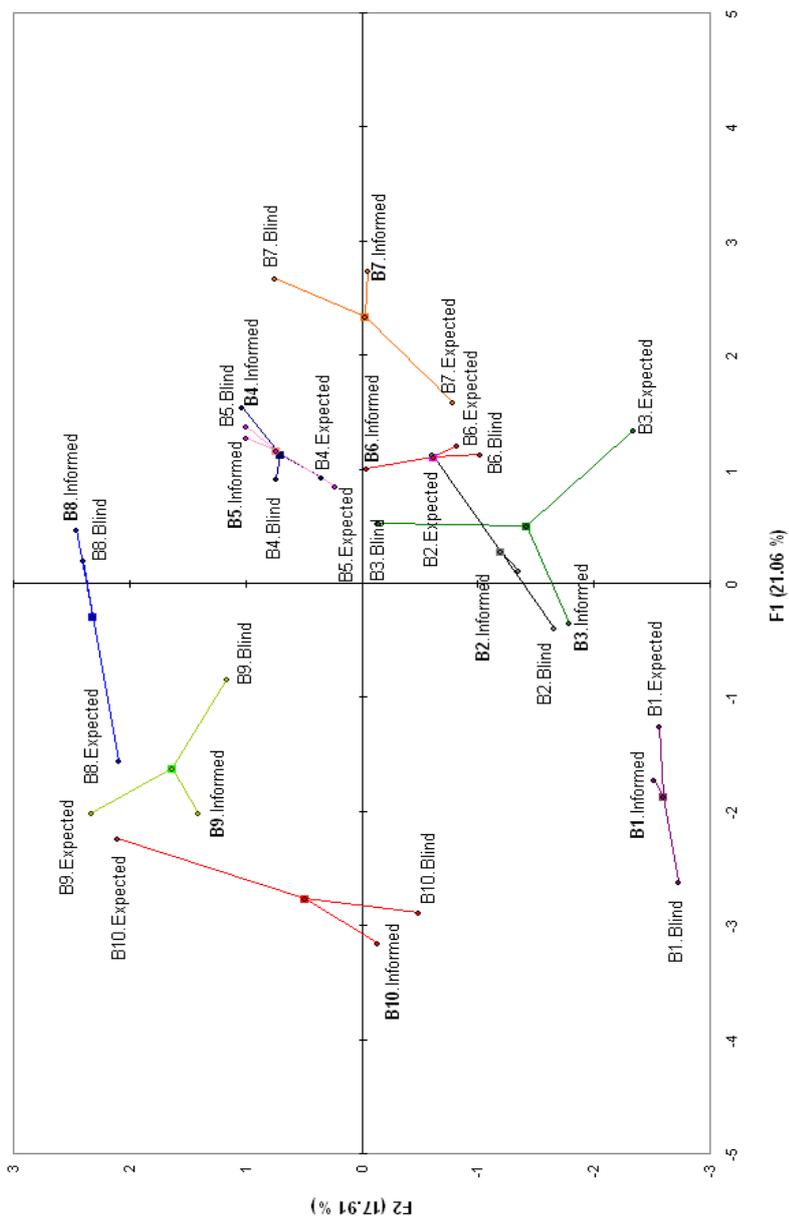


Figure 2. Superimposed MFA representation of the ten biscuits in the 3 scenarios. Each sample is represented by three points, corresponding to the three evaluation scenarios in the mapping tests.

In principle, the participants were not very interested in the green tea as a claim (Fig. 1) and they could have been not very confident or even suspicious of how the biscuit would taste, but they could have been “positively surprised” when they tasted it. It may be noted that this sample is a private label, which could also have influenced their low expectations when looking at the pack only. In general, overall acceptance ratings in the expected scenario tended to be lower for almost all the biscuits. This suggests that participants do not particularly regard this category of biscuits as a treat or a highly liked food, but rather consider that the addition of functional components or reduction of sugar can affect the sensory and hedonic characteristics. Package and claims weighed negatively in the overall assessment of liking

3.4.2 Perceived healthiness

Samples B2, B3, B8, B9 and B10 presented statistically significant differences between the three scenarios. As shown in Table 4, a trend of higher healthiness scores was observed in the expected scenario (only seeing the packages) than in the other scenarios; however, only significant differences were obtained in two samples. This suggests that the package as a whole could raise high expectations of healthiness in the biscuits, which could change when participants see and taste the biscuits and/or read the information, or participants could not recognize or understand the nutrition and health claim. In particular, B8 obtained the highest perceived healthiness score in the informed and expected scenarios, meaning that the pack and the nutritional information are in line with each other and transmit similar messages regarding health and nutritional benefits. However, the sample was regarded as less healthy when tasted blind, as its sensory profile is not aligned with what it is trying to sell. Also, it was the least acceptable sample in the informed scenario too, which could mean that the participants did not want to sacrifice taste for health benefits. This observation was in accordance with Gilbert (2000) who indicated that taste is the primary obstacle to making healthy food and consumers are not willing to sacrifice this characteristic. In contrast, Reineccius (2000) pointed out that functional food consumers are willing to sacrifice taste in

order to achieve a desired health benefit, and some studies have even shown that consumers sometimes “need” to compromise the sensory aspect to believe the nutritional benefits (Baixauli, Salvador, Hough & Fiszman, 2008). In more concrete terms, the results are in accordance with previous observations in Spain, a traditional society where taste is the principal reason for accepting food. This behaviour could be associated with the influence of the Mediterranean diet and heritage (Carrillo, Varela & Fiszman, 2011a). It may be noted that the participants perceived high fibre content and no added sugar as being beneficial to health, as reflected by the high scores in the informed and expected conditions and by the descriptors obtained in the ultra-flash profiling, but this did not necessarily influence acceptance (Table 2). This observation is in line with Dean et al. (2011) who pointed out that health claims could be perceived as credible, but this not means that consumers are willingness to buy the food. As discussed above, this can also be a case where the sensory character is dominant because of strikingly bad hedonic characteristics.

Significant differences between the three scenarios were also observed in Sample B3. In the blind and informed scenarios this sample was perceived as being among the healthiest. Sample B3 was a “digestive” type of biscuit (with high fat and low fibre content). It could be that the “digestive” category was recognized in the blind conditions and linked to a positive effect on health, influencing the healthiness score, setting aside any potential prior knowledge about its fat and fibre content, or else, that the participants did not link this sample with a high fat content and mistakenly attributed health properties to a certain category. The same happened in the expected scenario, as consumers assessed the category rather than the nutritional information when evaluating the whole pack. However, in the informed scenario this sample was rated as the least healthy one, demonstrating that participants could recognize the high fat and low fibre content and the claim “omega 3” did not significantly influence the score. This is a further example of how non-sensory cues could influence perceptions of food and how a concept of nutritional value can be attached to a certain category. Again, although Sample B3 was perceived as the least healthy

in informed conditions, it obtained a good overall acceptance score. Furthermore, it was among the samples with the highest acceptance ratings in all the conditions, probably through the influence of familiarity together with its positive sensory characteristics.

Equally, Samples B10 and B2 scored higher in the expected scenario than in the blind and informed conditions. This suggests that the package (claims plus brand) influenced the expected perception of healthiness, which was disconfirmed when focusing on the detailed nutritional information. In particular, Sample B2 is a “Maria” type of biscuit, suggesting that familiarity played an important role in its perceived healthiness. This factor could influence the perception of healthiness due to the role that this biscuit plays in everyday life, which makes it easy to consider as a good carrier for enrichment. This observation is in accordance with a previous study on the perceived fit of different combinations of carriers made by Krutulyte et al., (2011), who pointed out that perceived carrier-ingredient fit was related to familiarity with the combination and to the healthiness of the carrier food.

4. CONCLUSIONS

In the present study it was observed that the participants were not able to sacrifice taste for health in this kind of product. In the expected scenario, brand, familiarity with the product and familiarity with the claim were found to play an important role in enhancing the overall acceptance of some biscuits. These non-sensory cues could potentially influence the first buy. A trend to higher score the perceived healthiness in the expected condition was observed suggesting that not only claims but also brand or category could potentially mislead consumers into thinking that some products are healthier than they actually are.

This study is another example of how complicated food choice and consumer perception are. Sensory and non-sensory cues all interact to build consumer perception and, depending on the particular product, parameters like the brand,

category, information or sensory profile can influence product assessment differently. One limitation of this study was the numbers of the participants; however, it is a first approach to better understanding consumers' behaviour and the interaction of sensory and non-sensorial factors.

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CAPÍTULO IV

**INFLUENCIA DE LAS CARACTERÍSTICAS
PERSONALES DEL CONSUMIDOR EN LA
ELECCIÓN DE ALIMENTOS REDUCIDOS EN
CALORÍAS**

How personality traits and intrinsic
personal characteristics influence the
consumer's choice of reduced-calorie
food

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ABSTRACT

Nowadays, the consumption of low-calorie foods is being taken into account as a tool for reducing the incidence of certain nutrition-related health disorders. In this context, several factors were used to model low-fat (LF), low-sugar (LS) and high-calorie (HC) food consumption behavior. These factors were: personality traits (neuroticism and conscientiousness), food choice motives (health and weight control) and intrinsic personal characteristics such as self-esteem and satisfaction with life. The results indicate a good fit for the proposed model. Weight control was the best predictor of consumption of this kind of product, and health was a less strong predictor. In addition, correlations between the constructs indicated that LF and LS had the strongest correlation with each other and with weight control ($P < 0.01$). Surprisingly, the correlation between health and LF and LS product consumption was low. As regards differences in gender, women showed more concern about weight control, as expected.

Highlights:

- Weight control is a good predictor of LF and LS consumption.
- Self-esteem only predicts LF consumption.
- Women are more concerned with LF and LS consumption.

Keywords: Personality traits, Low calorie – reduced fat, Low calorie – reduced sugar, Self-esteem, Satisfaction with life, Health, Weight control.

1. INTRODUCTION

Reducing high-energy foods has been considered an important tool for lowering the risk of obesity and overweight, which are growing health problems worldwide (Drewnowski, 2003). Furthermore, imbalances between the recommended intake and consumption of calories – overconsumption – can also lead to diseases such as non-insulin dependent diabetes, hypertension, atherosclerotic cardiovascular disease, endometrial cancer and gall-stones (Frazao, 1999; Stein, & Colditz, 2004). There is general agreement that cutting sugar and fat consumption is a way to reduce the risk of suffering from these diseases and to help body weight control (Trevison et al., 1990). Taking these facts into account, public health policies encourage lower consumption of these components. However, this is not so simple, as fats and sugars provide the most palatable foods, with the highest hedonic values, that are readily accessible and inexpensive. In fact, sweet and other high-energy food, such as foods with fatty textures, can improve moods and mitigate the effects of stress via brain opioidergic and dopaminergic neurotransmission (Gibson, 2006; Davis, Levitan, Smith, Tweed, & Curtis, 2006; Drewnowski, 2009). In more concrete terms, a rise in obesity that appears to be unrelated to the human genome has been observed in the Spanish population.

Food choice has been described as a complex function of preferences for sensory characteristics combined with the influence of non-sensory factors (Rozin, 1996; Prescott, Young, O'Neill, Yau, & Stevens, 2002). A previous work that studied the main factors underlying consumers' food choice in Spanish consumers (Carrillo, Salvador, Varela, & Fiszman, 2011) suggested that the principal factor in food choice is its sensory characteristics, although the health factor ranked sixth. Despite this result, health is considered an important factor nowadays and its role in the diet is inherent to wellbeing. To understand consumers' behavior better and be able to provide food that contributes to wellbeing, further studies on the role of health in the diet are required. Spanish consumer behavior is continually changing as Europeanization and

globalization, mainly influencing the younger population, bring about the adoption of new foods. To design nutritional campaigns, it is essential to discover reliable consumption patterns in young people, the consumers of the near future. In consequence, this study focused on people born in the 1980s and 1990s.

The structural equation modeling (SEM) technique makes it possible to use different variables to test for causal relations. In the present study, this method was used to model theoretical relationships in order to contribute to an understanding of some of the intrinsic characteristics of consumers that influence reduced-calorie food consumption. SEM uses latent variables (constructs), which are unobserved variables that correspond to theory-based concepts. A number of indicators (observed variables) are taken into account to create these constructs (Saba & Vasallo, 2002; Davis, Levitan, Smith, Tweed, & Curtis, 2006). Since few studies on this topic, to our knowledge, have modeled consumption behavior that could influence the consumption frequency of low fat, low sugar and high calorie foods, the following theoretical hypotheses were established, taking the relationships between personality traits, intrinsic characteristics, and food choice motives into account in order to model consumption behavior.

Hypothesis 1: Personality has a mediating effect between food choice motives (health and weight control) that influence the consumption of reduced-calorie or high-calorie food

Nowadays, the link between health and diet is well known and consumers sometimes take health considerations into account to establish their food preferences and guide their food choice. Although weight control is related to a slim figure, it also has a part in wellness and healthiness considerations, so it is relevant in this respect.

It has been proposed that broad personality traits taken from the field of psychology, summarized into five categories called “The Big Five” personality dimensions (Extraversion, Neuroticism, Conscientiousness, Agreeableness and

Openness to experience) (Goldberg, 1981; Costa & McCrae, 1985; John & Srivastava, 1999), could be reliable predictors of health behavior patterns. Research has suggested that conscientiousness, neuroticism and agreeableness are the best personality predictors of health behavior (Booth-Kewley & Vickers, 1994). A neurotic person has been described as vulnerable to stress and experiencing negative emotions, and has been associated with harmful health practices and the absence of positive health behavior (Brook, Whiteman, Gordon, & Cohen, 1986; Coan, 1973; Mechanic & Cleary, 1980; Spielberger & Jacobs, 1982; Tappan & Weybrew, 1982). Conscientiousness is related to wellness behavior and has been found to be the best personality predictor of healthy behavior (Wiebe & McCallum, 1986; Conway, Vickers, Wallston, & Costa, 1992; Booth-Kewley & Vickers, 1994). Agreeable people tend to be tolerant; this personality factor may be related to better exercise habits, self-care, and better dietary control (Leiker & Hailey, 1988).

Based on these traits, the relationship between personality and health motives for choosing food has been considered to model low-calorie and high-calorie food selection behavior.

Hypothesis 2: Intrinsic characteristics such as self-esteem and satisfaction with life have a positive influence on the consumption of reduced-calorie or high-calorie food

Currently, young people are bombarded with media messages that the ideal body is almost thin, especially for women and, in the case of men, that being athletic and having well-developed muscles is the ideal image for success. Furthermore, it has been suggested that obese people are more negatively stigmatized than almost any other social group, which affects self-esteem adversely, and are linked with a poor body image (Klaczynski, Goold & Mudry, 2004; Schwartz & Brownell, 2004). Both characteristics (self-esteem and satisfaction with life or SWL) represent global life evaluations. The former is a judgment of oneself, and the latter a person's evaluation of their entire life (Diener & Diener, 2009).

A study of self-esteem has related it to wellbeing and has observed a causal relation between personality characteristics and the emotional gratification of eating (Barrón & Sanches, 2003). As a result, it would be reasonable to think that self-esteem and SWL could play a part in the consumption of low calorie foods. Consequently, these variables were introduced as constructs in the proposed model.

The objective of the present study was to analyze the influence of consumers' intrinsic characteristics and personality traits on their health concerns (food choice motives) and their consumption of low-sugar and low-fat products, through structural equation modeling based on these two hypotheses.

5. MATERIAL AND METHODS

2.1 Participants

Three hundred and fifty-six (356) young people between 18 and 36 years old (mean= 24.42 years; SD= 5.05) participated in this study (Table 1). The participants were randomly recruited from an official consumers' association database and in university areas, based on their interest in participating. The questionnaire was self-administered and was completed via online forms and on paper.

Table 1. Summary of participants' demographic data

Participants' data	Number of consumers	%
Sex		
Female	251	71
Male	105	29
Education level		
Primary	9	3
Secondary	213	60
University	80	22
Postgraduate	54	15

2.2 Procedure

The data used in this study were collected from September to December 2011. Preliminary testing of the questionnaire obtained information regarding the time required to complete it and the participants' comprehension of all the questions.

The questionnaire was composed of 6 parts. In the first part, the participants answered socio-demographic questions about their age, sex and educational level. In the second part, they answered questions about the consumption frequency of some food items, with special emphasis on low-calorie and high-calorie foods. The low-calorie foods comprised low-sugar (LS) and low-fat (LF) items: low-sugar biscuits, yogurt and breakfast cereals, low-fat biscuits, and non-fat milk and yogurt. The high-calorie (HC) foods were composed only of high fat items: whole milk, butter, and bakery goods. The HC items were introduced for comparison with the reduced-calorie foods and were limited to high-fat items because most reduced-calorie foods focus on reducing the fatty components. All these food products were chosen for their high consumption in Spain. The participants answered the question: "How often do you consume the following food?" by evaluating their frequency of consumption on a 5-point scale (1=daily, 2=most days, 3=more than once a week, 4=at times or seasonally, 5=rarely or never).

For parts three through six of the questionnaire, four validated scales were used. These were adapted following the International methodological standards recommendations of the ITC (International Test Commission) for proper adaptation of an instrument to another linguistic context (Hambleton, 1994, 1996, Muñiz & Hambleton, 2000). They are described below.

2.2.1 Food Choice

The Food Choice Questionnaire (FCQ) used was adapted from the one previously developed for English consumers by Steptoe, Pollard and Wardle (1995), which involved nine motivational dimensions or factors regarding health and non-health considerations in food choice. Each of these motivational factors

(health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity and ethical concern) comprises three to six items. The participants answered the question: “It is important to me that the food I eat on a typical day...” using a seven-box scale ranging from 1 (strongly disagree) to 5 (strongly agree). The original four-box scale was replaced with a seven-box one to increase the questionnaire's ability to discriminate between food choice motives (Fotopoulos, Krystallis, Vasallo, & Pagiaslis, 2009; Pohjanheimo & Sandell, 2009; Carrillo et al., 2011). According to the original authors, the questionnaire presents adequate psychometric properties. In the present study, only the factors of health ($\alpha = 0.81$) and weight control ($\alpha = 0.85$), were taken into account as constructs for modeling low-calorie food consumption behavior.

2.2.2 Satisfaction with Life

The validated Satisfaction with Life (SWL) Scale, developed by Diener et al., (1985) was also used in the present study. This scale consisted of five statements, with a five-box scale ranging from 1 (strongly disagree) to 5 (strongly agree). This scale presents good psychometric properties ($\alpha=0.87$) and has been widely used in the social sciences, proving its influence in measuring attitudes and behavior.

2.2.3 Self-esteem

The Rosenberg self-esteem scale (RSES) (1989) employed in this part of the questionnaire is composed of 10 items grouped into one factor. The participants answered these items using a five-box scale ranging from 1 = strongly disagree to 5 = strongly agree. According to the original authors and other researchers, the scale presents adequate psychometric properties ($\alpha=0.87$) and has been widely used in the social sciences, proving its influence in measuring attitudes and behavior.

2.2.4 Personality Traits

To test the personality structure, the “Big five Inventory” (BFI) scale developed by John and Srivastava (1999) was used. This scale was developed to test

Extraversion, Neuroticism, Conscientiousness, Agreeableness, and Openness to Experience (Costa & McCrae, 1992) and has been shown to have strong predictive validity across cultures (Hofstee, Kiers, de Raad, Goldberg, & Ostendorf, 1997; Ozer & Benet-Martínez, 2006). The participants answer twenty items using a five-box scale ranging from 1 = strongly disagree to 5 = strongly agree. For the present study, only conscientiousness, neuroticism and agreeableness were used as constructs for the proposed model, owing to their close relationship with health behavior as posited in hypothesis 1.

2.3 Data Analysis

SEM is a very useful tool to model consumer behavior for being an extension of the multivariate techniques of multiple regression and factorial analysis that enables the analysis of latent variables and their relationships using manifest or observable indicators (questions, items), which permits to compare a theoretical model or framework with the data. It is very flexible, because it deals not only with a single simple or multiple linear regressions, but with a system of regression equations In contrast to ordinary regression analysis. The same variable may represent a predictor in one equation and a criterion in another equation. In food science, this technique has been applied to study the quality in fresh peaches, attitudes toward tomatoes, attitudes to organic products or agro-biotechnology (Saba & Vassallo, 2002; Mora, Espinoza, Schnettler, Echeverría, Predieri, & Infante, 2011; Midmore, Francois, & Ness, 2011).

Before testing the proposed model by SEM, descriptive statistics were drawn up to describe the respondents' socio-demographics. A descriptive analysis of the items was performed and the Cronbach's alphas were analyzed in order to evaluate the internal consistency of the factors belonging to each scale, which were employed as constructs to estimate the theoretical model. Pearson correlations between these constructs were investigated and significant differences by gender were analyzed by the U Mann-Whitney-Wilcoxon test. In addition, linear regressions between the constructs, considering gender, were also employed. These analyses were performed using SPSS V.20. The

structural equation modeling was done through a path analysis using a maximum likelihood (ML) estimator with robust correction (to fix the non-normality of the data), employing EQS 6.1 structural equation modeling software.

The goodness of fit of the model was evaluated by observing the following indicators: chi squared (χ^2), Satorra-Bentler scaled chi squared (S-B χ^2), Satorra-Bentler scaled chi squared divided by degree of freedom (S-B χ^2 /df) (as both of the first two are affected by sample size), and the robust fit index, root mean square error of approximation (RMSEA), non-normed fit index (NNFI), comparative fit index (CFI) and Bollen's Increment fit index (IFI).

6. RESULTS AND DISCUSSION

Nine constructs were established according to the proposed theoretical hypothesis for modeling LF, LS and HC food consumption frequency. These constructs showed an acceptable internal level of consistency (Table 2).

Table 2. Constructs used in the model, with the number of indicators, mean scores (\bar{x}), standard deviation (Sd), and Cronbach's alpha coefficient (α).

Constructs	Number of Indicators	\bar{x}	Sd	α
Neuroticism	3	2.98	0.92	0.54
Conscientiousness	3	3.40	0.98	0.76
Satisfaction with life	5	3.70	0.71	0.82
Self-esteem	10	3.99	0.67	0.86
Health-FCQ	3	3.60	1.22	0.79
Weight control-FCQ	4	4.57	1.37	0.85
High calorie	3	2.16	0.78	0.52
Low fat	3	2.16	0.96	0.52
Low sugar	3	1.93	0.89	0.52

FCQ: Food choice questionnaire

Their Cronbach's alphas ranged from 0.52 to 0.86. It should be mentioned that the constructs that belonged to a validated scale presented higher Cronbach's alpha values than the others, showing the reliability of the factors.

The correlation matrix of the constructs is shown in Table 3. A high correlation between LS and LF consumption frequency was observed (0.62; $p < 0.01$). This is obviously because both LS and LF are associated with "light" products. In addition, both LS and LF were correlated with weight control, LF more so than LS. Bakker (1999) suggested that the market penetration of low-fat products was significantly higher than that of low-sugar products. In addition, HC presented a negative correlation with weight control (-0.39; $p < 0.01$). Carels, Konrad and Harper (2007) pointed out that overweight participants were more likely than non-overweight participants to mention high sugar when commenting on weight loss foods, showing the greater concern of overweight participants to reduce the sugar content of their food. These studies are in good agreement with the present results, showing a tendency to associate LF with weight control more than LS, possibly because LF items are more familiar.

A moderate correlation between health and weight control was also observed (0.42; $p < 0.01$). This suggested that not all the participants were clear about the relation between health and weight control, and that weight control, for Spaniards, is probably more strongly associated with a slim figure than with health issues. In contrast, a study of American consumers concluded that people perceive health and obesity to be strongly related and may consider not only weight gain but also poor health to be the long-term consequence of regular consumption of high-fat food (Carels et al., 2007).

Low correlation between health and LS and LF consumption frequency was found (0.21, $p < 0.01$), suggesting that campaigns advising consumers to cut down on fatty and sugary foods have been insufficient so far. A previous study of Spanish consumers suggested that the association between "less fat" and a healthy diet was low. This could be attributed to the influence of the

Mediterranean diet, which is rich in monounsaturated lipids (essentiality olive oil) (Martínez-González, Holgado, Gibney, Kearney, Martínez, 2000).

Table 3. Correlation matrix for the constructs employed in the model proposed.

Constructs	1	2	3	4	5	6	7	8	9
1. Neuroticism	-								
2. Conscientiousness	-0.07	-							
3. Satisfaction with Life	-0.28**	0.16**	-						
4. Self-esteem	-0.32**	0.26**	0.56**	-					
5. Health-FCQ	0.16**	0.05	0.001	-0.06	-				
6. Weight control-FCQ	0.10	0.15**	-0.07	-0.09	0.42**	-			
7. High-calorie	0.01	-0.11*	-0.03	-0.06	-0.08	-0.39**	-		
8. Low-fat	-0.05	0.04	-0.005	0.03	0.21**	0.42**	-0.23**	-	
9. Low-sugar	-0.03	0.06	-0.07	-0.007	0.21**	0.38**	-0.15**	0.62**	-

* $p < 0.05$; ** $p < 0.01$; FCQ: Food choice questionnaire

A high correlation between satisfaction with life (SWL) and self-esteem (0.56; $p < 0.01$) was also observed. This is in good agreement with Diener et al. (2009), who pointed out that SWL and self-esteem are correlated because, in an individualistic context, both characteristics are positive feelings and represent global evaluations.

3.1 Testing the Theoretical Model

Taking into account the hypothetical relationships that could be involved in LS and LF consumption, nine variables presented a good fit in the modeling results. The standardized solution is shown in Figure 1. The fit of the model was

strong according to χ^2 (1496.98, $df=608$ $P<0.001$), $S-B\chi^2/df$ (960.84/608=1.58), RMSEA=0.040, NFI=0.901, CFI=0.900, and IFI=0.902. All of these indicators are in good agreement with values recommended in the literature: χ^2/df was below 3 (Carmines & Mclver, 1981), the RMSEA index presented a value lower than 0.08 as proposed by Browne and Cudeck (1992), and the NNFI, CFI and IFI indices all had values higher than 0.90 (Bentler, 1990).

3.1.1 Predicting LF, LS and HC consumption frequency: Effect of personal traits as mediators in food choice

Weight control was a good predictor of LF ($\beta=0.66$) and LS ($\beta=0.61$) consumption and a negative predictor of HC consumption ($\beta=-0.65$). Health seemed to be poor predictor of LS and LF consumption, although positive in the case of LF ($\beta=0.10$) and negative in LS ($\beta=-0.06$).

Regarding personality traits, a moderate effect as a predictor of LF, LS and HC consumption was observed. The neuroticism variable presented a positive effect on health ($\beta=0.19$) and weight control ($\beta=0.18$), while conscientiousness only had effect on weight control ($\beta=0.20$). It should be mentioned that agreeableness was introduced into the proposed model but did not contribute to the model fit and was taken out. While these results suggest that the neurotic dimension has a positive effect on health and weight control, a previous study has indicated that a neurotic personality is associated with the absence of positive health behavior (Booth & Vickers, 1994).

3.1.2 Predicting LF, LS and HC consumption: Effect of the intrinsic characteristics of Satisfaction with life and Self-esteem

SWL presented a positive effect on LF ($\beta=0.46$) and HC ($\beta=0.44$) consumption but a negative effect on LS consumption ($\beta=-0.12$). The health and SWL constructs also had a negative effect on LS consumption. The latter could suggest that participants associated LS consumption with diabetes or other

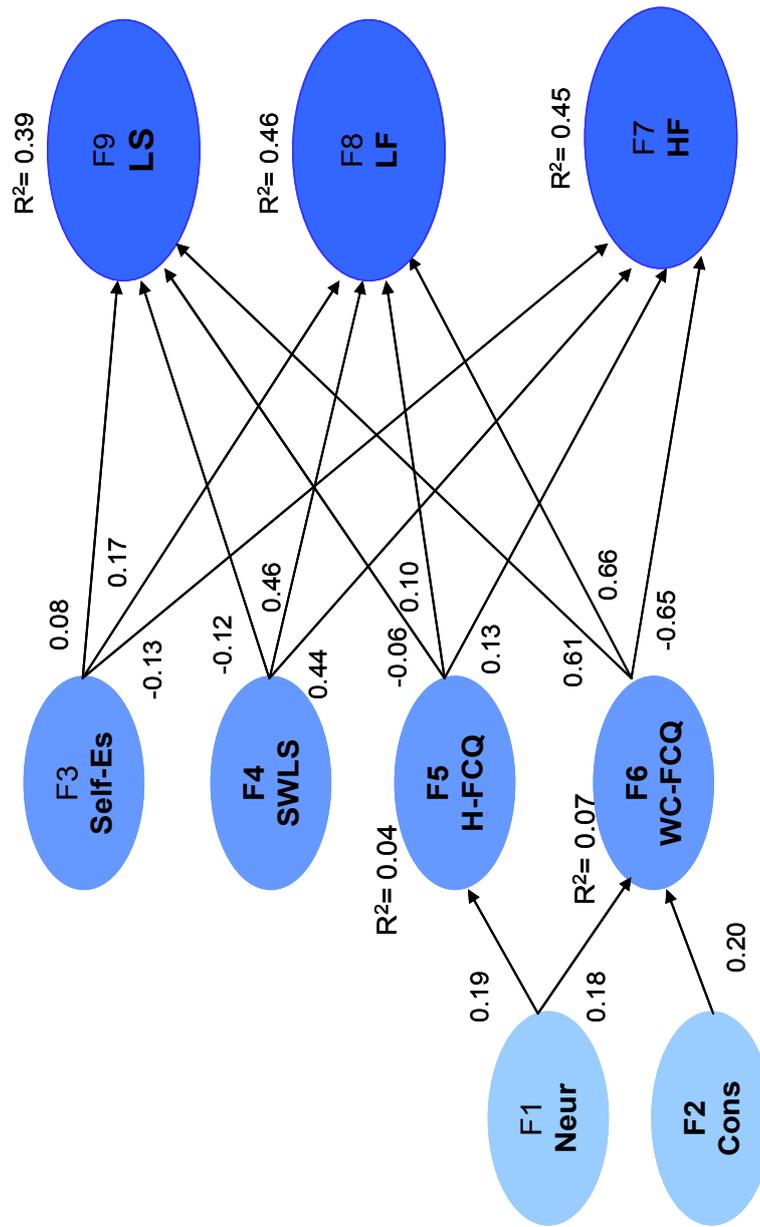


Figure 1. Standardized solution for modeling LS, LF and HC consumption behavior Neur= Neuroticism; Cons= Conscientiousness; Self-Es= Self-esteem; SWL= Satisfaction with Life; H-FCQ= Health (Food Choice Questionnaire); WC-FCQ= Weight Control (Food Choice Questionnaire); HC= High-calorie; LF= Low-fat; LS= Low sugar.

nutrition-related health disorders, as observed in a previous study (Carrillo et al., 2011).

Self-esteem presented a positive effect on LF consumption ($\beta= 0.17$), but a negative one on HC ($\beta= -0.13$).

This is in good agreement with a previous study which suggested that self-esteem is linked with body image (Miller & Downey, 1999).

3.2 LS, LF and HC consumption frequency behavior by gender

Considering that the consumption of low calorie food is different in men and women, statistical differences were also calculated for the constructs (Table 4). The results confirmed that women are more concerned about health and weight control than men. In fact, women consume more low-calorie foods. Regarding personality, women scored higher values for neuroticism and conscientiousness, in good agreement with previous studies (Schmitt, Realo, Voracek, & Allik, 2008).

Table 4. Gender differences in the constructs used in the model: mean scores (\bar{x}), standard deviation (Sd), and T-test (df).

Constructs	Men n=105		Women n=251		T test (df)
	\bar{x}	Sd	\bar{x}	Sd	
Neuroticism	2.74	0.89	3.08	0.92	-3.05(307)**
Conscientiousness	3.08	0.95	3.51	0.97	-3.61(307)**
Satisfaction with life	3.60	0.74	3.72	0.70	-1.35(354)
Self-esteem	3.97	0.69	4.01	0.66	-0.59(308)
Health-FCQ	3.24	1.17	3.76	1.22	-3.63(352)**
Weight control-FCQ	4.17	1.30	4.74	1.38	-3.60(353)**
High calorie	2.22	0.73	2.13	0.80	0.96(353)
Low fat	1.91	0.86	2.27	0.99	-3.24(353)**
Low sugar	1.68	0.77	2.04	0.93	-3.56(353)**

* $p < 0.05$; ** $p < 0.01$; FCQ: Food choice questionnaire

Correlations were also analyzed to compare gender. It was found that only women related weight control with LS consumption (0.4, $p < 0.01$) and, negatively, HC with weight control (-0.38, $p < 0.01$). This result confirmed that women are more concerned about weight control, as reflected in their consumption behavior. Some previous studies suggested that women and girls show pro-health eating behavior; furthermore, it has been suggested that women perceive a direct relationship between weight and a healthier lifestyle (Wądołowska, Babicz-Zielińska, & Czarnocińska, 2008; Carrillo et al., 2011).

Due to the sample size, multiple regression analysis was used instead of SEM to examine the role of gender in LS, LF, and HC consumption frequency. None of these regressions explain more than 20% of the variance (Table 5). In spite of this limitation, some differences were found when gender was taken into account: for example, weight control only affected the consumption of LS in women.

Table 5. Regression analysis of LS, LF and HC consumption frequency with self-esteem (SE), weight control (WC), health (H), neuroticism (N), and conscientiousness (C).

Gender	Predictive variables (Std β)	Criterion	R_2 adj	F	$Df(n)$
Men	WC (-0.38); SE (-0.24)	HC	0.17	10.57	2(91)
Women	WC (-0.47); H (0.16)	HC	0.18	24.11	2(214)
Men	WC (0.42); N (-0.25)	LF	0.18	11.25	2(91)
Women	WC (0.15)	LF	0.15	38.05	1(214)
Men	-	LS	-	-	-
Women	WC (0.43)	LS	0.18	46.84	1(214)

4. CONCLUSIONS

The LF factor showed the highest correlation with weight control, indicating that this category is better perceived or known than LS. In addition, a moderate

correlation between health and weight control was observed, suggesting that the latter is associated with a slim figure. Consequently, through structural equation modeling (SEM), it was observed that weight control was the best predictor for consumption of LF and LS food. Also, the SEM results reflect how some personality traits (neuroticism and conscientiousness) affect the motives underlying food choice (health and weight control) and, consequently, the consumption of LS, LF and HC food. Although this effect was not very strong, it is an interesting pointer for further studies going deeper into personality, as to the best of the authors' knowledge this is still an unknown area. Remarkably, it was observed that neurotic personality was related to both of the food choice motives considered (weight control and health). In addition, it was confirmed that women are more concerned with LF and LS consumption and their influence on health. Finally, the results suggest that consumers need more campaigns to advise them to cut down on fat and sugary foods in their diet.

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CAPÍTULO V

**FACTORES NO SENSORIALES QUE INFLUYEN
EN LA ELECCIÓN DE ALIMENTOS
FUNCIONALES**

Why buying functional foods?
Understanding spending behaviour
through structural equation modelling

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ABSTRACT

The market for functional foods has been growing steadily in recent years, as it is linked to a healthier diet and adds value to food products. However, more information regarding aspects that influence functional food (FF) spending behaviour is needed to gain a better understanding of what underlies FF choice and avoid product failure. The objective of this study was to build a structural equation model of Spaniards' FF spending behaviour, based on individual characteristics such as satisfaction with life, decision-making styles, gender, age and some attitudes towards food choice. This required prior validation of the functional food questionnaire for a Spanish context, which was another objective of the present work. The findings suggest that a positive attitude (reward, necessity, confidence) and novelty are good predictors of FF spending.

Keywords: Functional foods, structural equation modelling, spending behaviour, attitudes

1. INTRODUCTION

The increasing number of functional foods (FFs) on the market reflects a trend towards innovative food marketing. It is associated with satisfying the consumers' demands and, particularly, with helping to improve their health. Functional foods have been appearing since the mid 1990s, offering not only general well-being but also specific health benefits (Menrad, 2003). Functional food has been described as food that has been satisfactorily demonstrated to beneficially affect one or more target functions in the body beyond adequate nutritional effects in a way that is relevant to either an improved state of health and well-being and/or to a reduction of the risk of disease (Margaret, 2002). Functional foods must demonstrate their effects in amounts that can normally be expected to be consumed in the diet. However, this concept is not an official one, due to the lack of any specific legislation or recognized international definition (Krystallis, Maglaras, & Mamalis, 2008).

The various studies conducted in different countries have observed diverse attitudes towards FFs, such as a positive attitude towards certain product type/enrichment type combinations (Berch-Larsen & Grunert, 2003), a greater preference for physiology-based health benefits than for psychology/behaviour-based ones (Van Kleef, Van Trijp, & Luning, 2005), or differences according to the type of health benefit (Verhagen, Vos, Francl, Heinonen, & Van Loveren, 2010), familiarity with the ingredients added (Grunert, 2010), or gender, age, country and cultural values (Ares & Gámbaro, 2007; Siegrist, Stampfli, & Kastenholz, 2008). In addition, it is known that FF are not perceived as an homogeneous group because of being a diverse category of enriched food, however, the attitude to the global idea of this food market trend is still studied (Urala & Lähteenmäki, 2003). In particular, interest in FF is higher in Central and Northern European countries than in Mediterranean countries (Menrad, 2003). All the above factors affect the consumption of FFs.

The Spanish Ministry of Agriculture, Food and the Environment has conducted consumer studies which reveal that thirty percent did not know the term “functional food”, but when provided with specific examples of these foods, they stated that they consumed them. Probiotic FFs were the highest-consumption category, consumed by sixty percent of Spaniards (Ministerio de agricultura, alimentación y medio ambiente, 2004).

The structural equation modelling (SEM) technique allows the inclusion of different variables to test for causal relations. In the present study, it was used to model theoretical relationships that contribute to an understanding of functional food spending behaviour. SEM uses latent variables (constructs), which are unobserved variables that correspond to theory-based concepts. To create these constructs, several indicators (observed variables) are taken into account (Saba & Vasallo, 2002; Costa-Font & Gil, 2009). Based on the theoretical relationships between different factors that influence FF spending behaviour, the following hypotheses were formed:

Hypothesis (HP1): *Positive attitudes towards FF increase their consumption*

In the developed world eating no longer just satisfies hunger, it is also associated with a requirement for happiness and wellbeing. Eating is a social and cultural act and consumers want to experiment new sensations of pleasure and new flavours (Grunert, Dean, Raats, Nielsen, & Lumbers, 2007). In addition, consumption of an adequate diet could be influenced by satisfaction with life, which has been defined as “an overall assessment that the person does on his life”. This definition says that people examine the tangible aspects of their lives, weighing up the good against the bad (Pavot, Diener, Randall, & Sandvik, 1991). This judgment includes evaluating one’s health, wealth, friendship and romantic relationships (Diener, Emmons, Larsen, & Griffin, 1985). Based on this context, satisfaction with life has been used as an indicator of self-rated well-being. Furthermore, satisfaction with life could be related to being positive towards life and health, and tending to prevent rather

than cure diseases (Muñoz-Sastre & Ferriere, 2000; Veenhoven, 2008). It means looking for better alternatives which help to prevent health problems. Given this fact, FF consumption matches satisfaction with life. Another aspect that influences positive attitudes is the perception of the specific concept of FF, which is influenced by the length of exposure to FFs and by the cultural values that are inherent to each country (Siro, Kápolna, Kápolna, & Lugasi, 2008).

Hypothesis 2 (HP2): *The importance placed on the health component of food choice has a positive effect on consumers' decisions and behaviour in relation to functional food*

Health has been acquiring an important role in food consumption because nowadays consumers are interested in feeling well. Based on this interest, the market has reacted by offering foods that go beyond feeding people. In more concrete terms, it has been suggested that belief in health benefits plays an important role in FF acceptance (Lappalainen, Kearney, & Gibney, 1998; Saher, Arvola, Lindeman, & Lähteenmäki, 2004; Verbeke, 2005). Given this context, the present research studied the perceived role of health in influencing behaviour towards functional foods.

Hypothesis 3 (HP3): *The importance placed on the natural component of food choice has a positive effect on consumers' decisions and behaviour in relation to functional food*

The fact that FFs require the addition of new ingredients and modern technology to achieve the promised benefits arouses distrust among consumers. In a previous study it was concluded that one of the most important factors for FF acceptance is the naturalness perceived by consumers (Urala & Lähteenmäki 2004, 2007).

Hypothesis 4 (HP4): *The consumers' novelty/fashion orientation predicts their FF consumption*

A consumer decision-making style has been defined as a mental orientation characterizing a consumer's approach to making choice (Sproles & Kendall,

1986). FFs could still be considered a novelty product and a trend in the food market for which a perfect marketing strategy has been developed by creating differentiated, value-added products and influencing attitudes towards FFs (Bakewell & Mitchell, 2004; Verbeke, 2005; Grunert, 2010; Falguera, Aliguer, & Falguera, 2012). Based on this, a hypothesis was established about how their novelty predicts functional food spending behaviour.

The objective of the present study was to model the Spaniards' functional food spending behaviour, based on individual characteristics such as satisfaction with life, decision-making styles, gender and some attitudes towards food choices (natural content and health factors). Another objective of the study was to validate the functional food questionnaire for a Spanish context in order to use it in the model.

2. MATERIALS AND METHODS

2.1 Participants

The sample of the study consisted on 517 university students and consumers randomly choose from different consumers' associations and universities.

Table 1. Summary of participant data. Whole sample (N=515) and the participants that have heard of functional foods and consumed them, that participated in SEM model (N=197).

Participant data	N=515	%	N= 197	%
Sex				
Female	352	68	147	75
Male	163	32	50	25
Age				
18 – 34	341	66	110	56
35 - 76	174	34	87	44
Education level				
Primary	31	6	13	7
Secondary	246	48	67	34
University	128	25	52	26
Post-graduate	110	21	65	33

The participants' age averaged 32.6, with a standard deviation of 14.1, and ranged between 18 and 76 years. They were selected according to their knowledge about FF and their consumption (question 1 of the questionnaire) for participating in the SEM model (final sample included in the model: 197, age averaged 36.49, standard deviation 14.31, ranged between 18 to 70 years) (Table 1). To modelling the “spending behaviour of FF”, only participants that knew what functional foods were and expressed that they also consumed some functional foods, were taken into account; otherwise it would not have been possible to model this behaviour.

2.2 Application of structural equation modelling

Structural equation models (SEM) are widely used in empirical research to investigate relationships among variables, which could be measured variables (observed) or unmeasured (unobserved) variables. The last ones could be: a) the latent construct itself (generally called factors), designated as F; b) a residual associated with the measurement of each observed variable (V), designated as E and c) a residual associated with the prediction of each factor, designated as D (Figure 1). The path diagram showed in figure 1 is represented by circles or ellipses that represent unobserved variables while squares or rectangles represent the observed variables. Single headed arrows represent the impact of one variable over another and double-headed arrows represent covariances or correlations between a pair of variables. Bentler (1980) suggested that any variable that has a unidirectional arrow aimed at it represented a dependent variable, and if not, it is considered as independent.

SEM is a family of multivariate models that focus on series of regression equations, which analysed covariance structures. Furthermore, the core parameters in this covariance structures are the regression coefficients and the variances and covariances of the variables, meaning that SEM considers the error of the measurements. One example of the language utilised, that is a simple regression could be written as $V1 = b_{11}F1 + E1$, where b_{11} represents the unknown beta weight associated with the predictor F1 and E1 represents

relative fit indices (McDonald and Ho, 2002) is relatively independent of sample size and it is favoured by some researchers for that reason (Byrne, 1998; Hyun-Woo et al., 2011).

SEM permits to work with large number of groups, large sample sizes in each group and non-normality in manifest variables. One example of such SEM use is in behavioural research, when studying the relationship between “attitude” and “behaviour” concerning specific issues (Pieters, 1988). Recently, this technique has been used in consumer science for example to find a model that predicted the intention to consume genetically modified food (Prati et al., 2012; Costa & Gil, 2009), factors that are determined in the behaviour of fast-food consumption (Dunn et al., 2011), or how the personal traits and intrinsic personal characteristics influence the consumer’s choice of reduced-calorie food (Carrillo et al., 2012).

2.2 Measurements

The data used in this study were collected from September to December 2011. The questionnaire was tested beforehand to obtain information on the time required to complete it and the participants’ comprehension of all the questions.

The questionnaire began with the following question “Have you heard of functional foods (FFs)?” with three possible answers options: 1) Yes, I have heard of FFs and I consume them; 2) Yes, I have heard of FFs but I do not consume them; 3) No, I have never heard of them.

The FF definition was then given to the participants, who had to choose one of the following options: 1) This definition did not add anything because I already knew it; 2) This definition has helped me find out more about FFs; 3) This definition told me what FFs are, which I did not know before. In addition, participants were asked “How much do you spend in a week in food? and, What percentage of your food spending is for buying functional foods?” Some socio-demographic questions were also included at the end of the questionnaire

(Table 1). It took the participants approximately 30-40 minutes to complete the whole questionnaire. The questionnaire was designed to test the hypotheses. Four scales (Attitudes towards Functional Foods, Food Choice, Satisfaction with Life and Decision-Making Styles) were employed as indicators for the following constructs: “Attitude towards functional food”, “Satisfaction with life”, “Health”, “Natural Content”, “Positive attitudes” and “Novelty/ Fashion” (Table 2). These scales were employed because they have been previously applied in various research studies showing good adaptability (Urala & Lähteenmäki, 2007; Honkanen & Frewer, 2009; Ares & Gámbaro, 2007; Chen, 2009; Carrillo et al., 2012; Cowart & Goldsmith, 2007). All the questionnaires (comprising the scales under their original names) were adapted for the final study in accordance with the International methodological standards recommendations of the International Test Commission for proper adaptation of an instrument from one linguistic context to another (Hambleton, 1994, 1996; Muñiz & Hambleton, 2000). The used scales (five- and seven-box) were employed according to those of the original or modified questionnaires.

2.2.1 Positive attitudes towards Functional Food (PAFF)

A direct measurement to create the “Positive attitude” (PAFF) construct was obtained through a semantic differential task, using 4 statements. This technique is a psychological evaluation created by Osgood et al. (1957) based on relating the statements to a concept. The semantic differential task was used to discover beliefs about functional food. In the four statements, the negative valence of the statements was located on the left and the positive on the right. (I do not believe it – I believe it; displeases me – pleases me; superfluous – necessary; bad – good) using a 5 -point scale.

The Attitudes towards Functional Foods (AFF) questionnaire developed by Urala and Lahteenmaki (2004, 2007) was also employed to build another construct that influenced the PAFF. This questionnaire consisted of 26 items grouped into four factors: “Reward from using functional foods”, “Necessity for functional foods”, “Confidence in functional foods”, and “Safety of functional

foods". Seven-box scales from "strongly disagree" to "strongly agree" were used to answer the items.

In addition, the validated Satisfaction with Life Scale (SWLS) developed by Diener et al., (1985) was used in the present study and influenced the PAFF. The SWLS scale consisted of five statements (Table 2); 5–box scales ranging from 1 (strongly disagree) to 5 (strongly agree) were used to record the responses.

Table 2. Constructs and indicators used in the model, with their mean scores (\bar{x}) and standard deviation (Sd).

Constructs	Indicators	\bar{x}	Sd	Skewness	Kurtosis
Attitude towards Functional Foods (AFF)	Reward* (RE)	4.11	1.00	0.17	0.18
	Necessity* (NE)	5.06	1.18	-0.44	-0.29
	Confidence* (CO)	4.43	1.15	-0.26	0.02
Positive attitudes (PAFF)	I do not believe it – I believe it (PAFF1)	3.67	1.06	-0.71	0.15
	Displeases me – Pleases me (PAFF2)	3.69	0.99	-0.67	0.44
	Superfluous – Necessary (PAFF3)	3.51	1.15	-0.42	-0.61
	Bad – Good (PAFF4)	3.91	1.07	-0.84	0.26
Satisfaction with life scale (SWLS)	In most ways my life is close to my ideal (SWL1)	3.50	0.77	-0.03	-0.35
	The conditions of my life are excellent (SWL2)	3.62	0.77	-0.24	0.10
	I am satisfied with my life (SWL3)	3.88	0.80	-0.56	0.40
	So far I have gotten the important things I want in life (SWL4)	3.88	0.86	-0.46	-0.36
	If I could live my life over, I would change almost nothing (SWL5)	3.60	1.01	-0.53	-0.03

	Is high in fibre and roughage (H1)	4.08	1.60	-0.32	-0.69
	Is nutritious (H2)	5.60	1.17	-0.90	0.92
Health (H-FCQ)	Is enriched with soya (H3)	2.78	1.67	0.43	-1.08
	Is enriched with calcium (H4)	3.47	1.78	0.10	-1.05
	Keeps me healthy (H5)	5.68	1.19	-0.92	0.87
	Contains no additives (NC1)	4.69	1.55	-0.37	-0.54
Natural Content (NC-FCQ)	Contains natural ingredients (NC2)	5.85	1.07	-1.05	1.10
	Contains no artificial ingredients (NC3)	5.04	1.65	-0.81	-0.05
	I keep my wardrobe up-to-date with the changing fashions (NFA1)	2.97	1.07	-0.05	-0.59
Novelty / Fashion (NFA)	Fashionable, attractive styling is very important to me (NFA2)	2.83	1.17	0.14	-0.86
	It's fun to buy something new and exciting (NFA3)	3,16	1,14	-0,15	-0,72
Functional food Spending (FFSP)**	Spending in buying functional foods	19,70	22,72	3,17	16,13

According to original authors developers of the employed questionnaires a 7 –point scale were used for AFF, HFCQ, and NC-FCQ and a 5 –point scale for PAFF, SWLS and NFA.

* Correspond to the items in table 3

** Is not a latent variable

Letters in parenthesis are the nomenclature for figure 1

2.2.2 Health and Natural Content

The validated Food Choice Questionnaire (FCQ) was used to measure these two constructs. This questionnaire was developed for English consumers by Steptoe, Pollard, and Wardle (1995). The participants answered the items that followed the statement “It is important to me that the food I eat on a typical day

...” using seven-box scales labelled from “not at all important” to “very important”. The original four-box scale was changed to a seven-box one to increase the questionnaire’s ability to discriminate between food choice motives (Fotopoulos, Krystallis, Vasallo, & Pagiaslis, 2009; Pohjanheimo & Sandell, 2009; Carrillo, Varela, Salvador, & Fiszman, 2011).

The FCQ involves nine motivation factors regarding health and non-health considerations for selecting food; each factor comprises three to six items. From these nine factors, two were selected for the present study: health and natural content. In addition, some new items were introduced in the questionnaire related with the enrichment of food.

2.2.3 Decision-Making Styles

The scale used to determine the decision-making styles was developed by Sproles and Kendall (1986). Their Consumer Styles Inventory (CSI) is made up of forty-one items grouped into eight factors: “Perfectionistic”, “Brand conscious”, “Novelty/fashion”, “Recreational”, “Price conscious”, “Impulsive”, “Confused by overchoice” and “Habitual”. The CSI items were answered using five-box scales labelled from “strongly disagree” to “strongly agree”. Only the “novelty/fashion” (NFA) factor was used in the proposed model due to its hypothetical relationship with FF consumption (See Table 2, H3, H4, H5).

2.3 Data analysis

Before testing the proposed model by SEM, statistics were drawn up to describe the respondents’ socio-demographics. Differences in age and gender in relation to FF awareness, consumption (first question) were analysed using the Mann-Whitney U test. A descriptive analysis of the items was performed and the reliability and validity of the scales were studied. Although all the scales presented adequate psychometrics characteristics, according to their original authors, the functional foods questionnaire was studied in depth, as in the present study only this scale has been used in the model considering all the factors, while from the other scales only specific factors were selected. The

reliability of the functional foods questionnaire was checked through the Cronbach's alpha coefficient, while the validity of the scale was studied through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) with SEM. In addition, differences between the factors of the FF questionnaire by age and gender were calculated using the Mann-Whitney U test.

With the exception of the SEM model, all the analyses were performed with SPSS V.20.

To estimate the theoretical model and observe the factors that influence the FF spending behaviour, a variable was created based on the following questions "How much do you spend in a week in food?" and "What percentage of your food spending is for buying functional foods?" Furthermore, the different factors of the scales were used to establish the various relationships between the proposed hypotheses. This was done through a path analysis using a Maximum likelihood (ML) estimator with robust correction (to fix the non-normality of the data), employing EQS 6.1 structural equation modelling software.

The goodness of the model's fit was evaluated by the following indicators: chi squared (X^2), Satorra-Bentler scaled chi squared (S-B X^2), Satorra-Bentler scaled chi squared divided by degree of freedom (S-B X^2 /df) (as both of the first two are affected by sample size), root mean square error of approximation (RMSEA), non-normed fit index (NNFI), comparative fit index (CFI) and Bollen's Increment fit index (IFI).

3. RESULTS AND DISCUSSION

3.1 Consumer behaviour in relation to FF

In the first step of the study the participants answered some general questions regarding their FF awareness and consumption: 39% responded that they had heard of FFs and consumed them, 14% mentioned that they had heard of FFs but did not consume them and 47% said they had no knowledge of FFs. The awareness and consumption question was compared by gender and a

significant difference was found ($p < 0.05$), as women know about and consume FF (42%) more than men (30%). This result is in agreement with previous studies suggesting that women are more interested in healthy food consumption and health in general (Roininen & Tuorila, 1999; Niva, 2007; Urala & Lähteenmäki, 2007; Carrillo et al., 2011). The statistical analysis also found that age had a significant effect ($p < 0.05$). Young people (18-34) know about and consume FF more than old people (35-76). This could mean that older Spanish consumers have conservative cultural traditions and show a neophobic attitude towards the new thinking reflected by FF consumption, which is in agreement with Tuorila, Lahteenmaki, Pohjalainen and Lotti (2001), who concluded that older people are reluctant to try unfamiliar foods. However, while the present results suggest that young consumers possibly have a more open mind about novelty and changes, Poulsen (1999) mentioned that elderly people are more positive towards FF than young people.

Considering the current situation in relation to age and FF attitudes among Spaniards, it would seem to be more important to focus on young people, as they will be the potential FF consumers.

In the second step of the study, after reading the definition of FF, 21% of the participants said "It did not add anything because I already knew it", 33% said "It helped me find out more about FFs" and 46% said "It told me what FFs are". This confirms that most of the participants had a poor idea of what a FF is. It has been observed that Spanish consumers do not have any real FF culture (Barrena & Sanchez, 2004; Carrillo, Varela, & Fiszman 2012), and people tend to not consider or even know the importance of functional aspects in a healthy diet. In other European countries, the FF market has been considered an important part of daily food habits, an essential part of the cognitive structure of individuals and societies as a whole. This has been reflected in a remarkable increase in the number of studies that focus on attitudes and behaviour towards FFs (Bech-Larsen & Grunert, 2003; Menrad, 2003; Verbeke, 2005). Regarding consumers' cognitive structures themselves, in countries like Japan and the US

it has been found that FFs are part of the mental background and this is expressed both by positive attitudes towards FF and by buying decisions (Bech-Larsen & Scholderer, 2007).

In addition, consumers were asked about FF spending. Considering only those that consumed FF, the range obtained was between 1 and 35% (\bar{x} =14.11; Sd=9.56), although the most usual level was 10% of the budget. (Mode= 10).

All these results seem to agree with those previously discussed concerning the relatively low prevalence of FF awareness and consumption in Spain.

3.2 Attitudes towards Functional Foods

In order to test the proposed model, the AFF questionnaire was adapted for Spanish consumers. The descriptive statistics for the twenty-one items, grouped into four factors after adapting the original AFF for a Spanish population, are shown in Table 3. The reliability of the scale was checked using Cronbach's alpha test: good consistency (α =0.904) was obtained for the questionnaire. The internal consistency values of the AFF factors ranged from 0.651 to 0.823. Comparing the present results with those obtained by the original authors (Urala & Lahtemaki, 2007), which ranged between 0.75 and 0.85, similar results were obtained. Remarkably, in both studies the "Safety" factor was the weakest (0.75).

On balance, the questionnaire and its factors showed adequate reliability. Turning to the items, they all contribute to their respective factors, presenting a relatively high correlation with the whole questionnaire (Table 3). Only the removal of the "Functional foods can repair the damage caused by an unhealthy diet" item seems to increase reliability, although not strongly enough to be taken into account. In order to respect the internal structure of the questionnaire, the present authors suggest not removing this item.

CFA was conducted on the AFF questionnaire and the following fit indices were obtained: RMSEA= 0.038, NNFI= 0.952, CFI= 0.958, IFI= 0.959 and S-BX²/df= (320.52/183=1.75).

Table 3. Final statements of the “Attitudes towards functional food” questionnaire adapted for Spanish consumers (n = 515). The total Cronbach’s alpha coefficient (α) of the scale was 0.904. Key: mean score (\bar{x}), Standard deviation (Sd), Item-total correlation (r_{jx}) and alpha if item is deleted (α -x).

FF Items	\bar{x}	Sd	r_{jx}	α -x
F1. Reward from using functional foods				
(α= 0.815)				
• The idea that I can take care of my health by eating functional foods gives me pleasure	5.10	1.60	0.57	0.79
• My performance improves when I eat functional foods	3.62	1.59	0.62	0.78
• Functional foods help to improve my mood	3.34	1.66	0.67	0.77
• Functional foods make it easier to follow a healthy lifestyle	4.60	1.52	0.63	0.78
• Functional foods can repair the damage caused by an unhealthy diet	3.88	1.72	0.40	0.82
• I can prevent disease by eating functional foods regularly	4.35	1.51	0.59	0.79
• I am prepared to compromise on the taste of a food if the product is functional	2.73	1.61	0.47	0.81
F2. Necessity for functional foods				
(α= 0.823)				
• For a healthy person it is worthless to use functional foods *	5.10	1.78	0.61	0.79
• Functional foods are consumed mostly by people who have no need for them *	4.32	1.71	0.51	0.81
• The growing number of functional foods on the market is a bad trend for the future *	4.84	1.75	0.69	0.77
• Functional foods are completely unnecessary *	5.35	1.65	0.71	0.77
• It is pointless to add health effects to otherwise unhealthy foods *	4.24	1.99	0.50	0.81
• Functional foods are a total sham *	5.44	1.50	0.54	0.80

F3. Confidence in functional foods**($\alpha = 0.813$)**

• Functional foods promote my well-being	4.44	1.57	0.67	0.74
• I believe that functional foods fulfil their promises	3.95	1.41	0.75	0.65
• The safety of functional foods has been very thoroughly studied	4.03	1.42	0.58	0.82

F4. Safety of functional foods ($\alpha = 0.651$)

• Using functional foods is completely safe	4.33	1.42	0.45	0.58
• The new properties of functional foods carry unforeseen risks *	4.94	1.48	0.40	0.60
• In some cases functional foods may be harmful for healthy people *	4.90	1.61	0.45	0.58
• If used in excess, functional foods can be harmful to health *	4.48	1.80	0.44	0.58
• Exaggerated information is given about health effects *	3.67	1.62	0.29	0.65

* = negative statement. These statements were recoded with reversed values before final data analysis.

The RMSEA index presented values of less than 0.08 according to the values proposed by Browne and Cudeck (1992). The NNFI, CFI and IFI indices had values higher than 0.90 (Bentler, 1990) and the X^2/df was below 3 (Carmines & McIver, 1981). All of these indices showed a good fit for the AFF questionnaire.

Subsequently, the AFF factors were correlated to observe the possible relationships between them (Table 4).

Table 4. Correlation matrix for the four Functional Food Attitudes factors.

	1	2	3	4
1. FF Reward	1			
2. FF Necessity	0.523**	1		
3. FF Confidence	0.706**	0.556**	1	
4. FF Safety	0.407**	0.649**	0.515**	1

p<0.05; ** p < 0.01

All the correlations were statistically significant ($p < 0.01$) and positive. A major significant association was observed between confidence and reward.

Finally, significant differences ($p < 0.01$) were found in relation to the sex of the participants. Women presented higher scores than men as shown in Table 5.

Table 5. Gender differences in the four functional food attitude factors, mean and standard deviations (Sd).

	Reward		Necessity		Confidence		Safety	
	\bar{x}	Sd	\bar{x}	Sd	\bar{x}	Sd	\bar{x}	Sd
Women	4.02*	1.13	5.02**	1.21	4.28**	1.25	4.54**	1.06
Men	3.81*	1.19	4.49**	1.36	3.88**	1.23	4.30**	0.98
18-34	4.01	1.11	4.97*	1.25	4.23	1.19	4.51	1.06
35-76	3.84	1.21	4.61*	1.32	3.99	1.35	4.37	1.00

* $p < 0.05$; ** $p < 0.01$

By age, (Table 1) the only statistically significant differences ($p < 0.05$) were found for the "Necessity" factor, where young people (18-34) obtained higher scores than the rest of participants, showing an interest in the beneficial effects of FF in promoting a healthy lifestyle (Table 5). Krystallis et al., (2008), using the Means End Chain technique, suggested that young adult people in particular are interested in improving their physical health. On the other hand, previous studies have suggested that elderly consumers show more interest in purchasing FFs to prevent diseases (Bhaskaran & Hardley, 2002; Urala & Lähteenmäki, 2007). The results for young people were consistent with those already mentioned, but a greater number of participants would be required before drawing further conclusions about the behaviour of older consumers .

On balance, all these results provide empirical evidence about the validity and reliability of this adaptation of the AFF questionnaire to a Spanish context. The resulting questionnaire has been shown to be valid and reliable in this context,

so it can be used for further work and could prove useful for finding out more about the relationships between FF and other factors.

3.3 The influence of hypothesis factors on FF spending behaviour, testing the model using SEM

Structural equation modelling (SEM) was applied to test the theoretical model and to discover the causal relationships among the constructs (SWLS and AFF, over PAFF and with others constructs H-FCQ, NC-FCQ and NFA predict the FF spending behaviour). As explained above, these constructs were considered for the proposed model due to their theoretical strong relation with consumers' FF spending behaviour. Table 2 shows the constructs and their respective indicators, mean scores, standard deviations, Skewness and Kurtosis statistics. Concerning the two latter, the obtained values did not identify any serious violations of normality, because all the coefficients were below ± 1.30 with the exception of the variable FFSP (Prati, Pietrantonio, & Zani, 2012). Some indicators were taken out of the model due to their negative contribution to model fitness, or its bad psychometrics properties in this research. In the case of AFF there were only taken into account the factors, not all the items, to form constructs, due to the good results obtained from CFA and the size of the sample. In addition, only those factors that presented better results in the EFA were introduced in the model.

Table 6. Correlation matrix for the constructs employed in the model proposed.

	1	2	3	4	5	6	7
1. AFF	1						
2. PAFF	0.575**	1					
3. SWLS	0.186**	0.149*	1				
4. H-FCQ	0.342**	0.388**	0.019	1			
5. NC-FCQ	0.105	0.198**	-0.157*	0.440**	1		
6. NFA	0.108	0.053	-0.014	0.198*	-0.102	1	
7. FFSP	0.292**	0.207*	0.005	0.108	-0.016	0.253*	1

*p<0.05; ** p < 0.01

Table 6 shows the correlation matrix between the constructs used in the model.

The strongest correlation ($p < 0.01$) was found between the two measurements used to describe attitudes to functional foods (AFF and PAFF). In addition, the results confirm the positive link between AFF and FFSP.

The regression equations for the proposed model are shown in Fig. 2. The chi squared ($X^2/df = 464.42/246$ (< 0.01)), the Satorra Scales Chi squared (SB- $\chi^2(df) = 343.64$ (246) < 0.01) and several robust fit indexes (RMSEA=0.045, CFI=0.90, IFI=0.91, have demonstrated the goodness of fit of this model.

Considering the different proposed constructs, it appears that SWLS and especially AFF are good predictors of PAFF (SWLS= 0.04; AFF= 0.67), showing their influence on spending behaviour, as hypothesized. Furthermore, it was observed that PAFF, and NFA, were good predictors of FFSP, while H-FCQ and NC-FCQ were not (NFA= 0.26; PAFF= 0.24; NC-FCQ= 0.01; H-FCQ= -0.06).

The results confirmed that the SWLS influenced the PAFF: as satisfaction with life is a cognitive component of wellbeing, and both can influence people's attitudes (Pavot & Diener, 1993), although the weight was low. The influence of AFF on FF purchasing behaviour through the mediating role of PAFF was also confirmed. The latter suggested that individual perceptions and necessities produce positive attitudes influencing FFSP. In short, it appears that PAFF was the best predictor of the consumers' FF spending behaviour. It was observed that for FF consumption to increase, consumer attitudes need to change. In concrete terms, clear information on the packaging or labelling (nutrition and health claims), better campaigns to inform consumers about the benefits of FFs in the diet (Leathwood, Richardson, Sträter, Tood, & Van Trijp, 2007; Verhagen et al., 2010) and a number of promotional activities should be considered to bring about cultural change and prevent FF product failure.

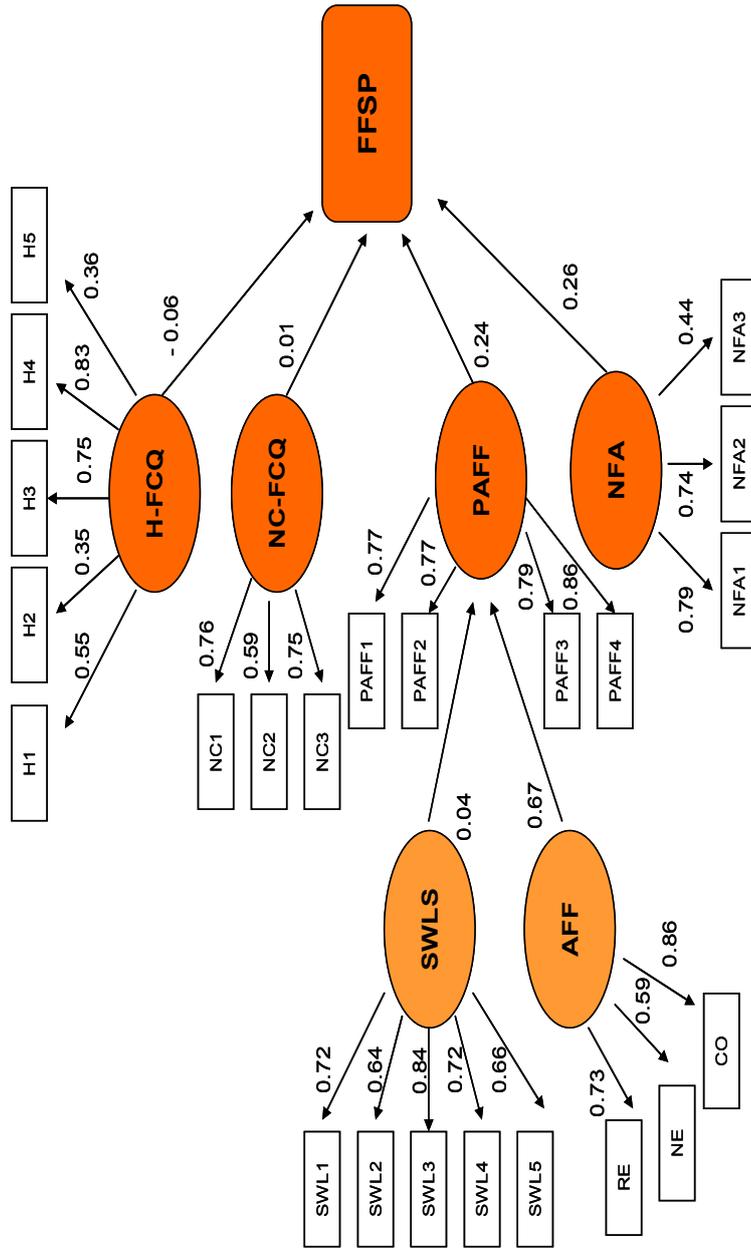


Figure 2. Structural equation model that explains the consumers' functional food spending behaviour with their beta coefficients.

• See table 2 for abbreviations of the variables.

Contrary to what was expected, the relationship between H-FCQ and FFSP appeared to be inverse, suggesting that the FFs spending behaviour was not predicted by this factor, disconfirming hypothesis number two. The obtained value could have been a consequence of the sample size or because participants in general were not particularly seeking for healthy food. Another reason could have been that consumers choose their food according to specific health necessities.

The standardized coefficients obtained for NC-FCQ as a predictor of FFSP were positive but low. This means that a tendency to look for natural products influenced the FFSP. This suggestion is in good agreement with Poulsen (1999), who studied Danish consumers' attitudes towards FF and concluded that perceived naturalness had an influence on positive attitude towards them. In general, it was observed that the weight of the food choice factors on purchasing behaviour was very low, and further research would be required to investigate this relationship in greater depth.

The hypothesis number 4 regarding the contribution of novelty to FFSP behaviour was confirmed as well. Saher et al., (2004) concluded that FFSP consumers are innovative, unlike conventional buyers. This result suggested that FFs are still considered new in the Spanish market and a culture of FFs consumption is not established.

4. CONCLUSIONS

It was observed that almost a half of the initial participants did not have enough knowledge about FF. Women were the most concerned with FF, this was not surprising as women are the responsible of purchasing in almost all households. The model proposed reflects, in a general way, how different variables that influence FF spending behaviour could be taken into account when designing and planning marketing campaigns. These perceived variables (positive attitude, novelty/fashion, health and natural content) show how non-

sensory factors create expectations that influence the choice of a FF. Thus, the results of structural equation analysis support the hypothesis that positive attitudes influenced by preconceptions about FF play an important role in FF spending behaviour. It is worth highlighting the power of the SEM to model a behaviour in consumer research and useful to approach for disentangling the structures underlying food choice and the consumer's response to new categories such as FF.

Future research should focus on the effect of other extrinsic and intrinsic factors in the model proposed and oriented to specific types of FF, in terms of motivational, cognitive or personality differences among consumers that can affect their attitudes towards FF and their purchasing behaviour.

Although the scope and representativeness of the sample need to be increased, these results present a first approach to the phenomena studied.

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RESUMEN Y DISCUSIÓN

La presente Tesis Doctoral demuestra la importancia que tiene el estudio del consumidor como parte de la estrategia del desarrollo de alimentos para conseguir que sean exitosos en el mercado. Además, se ha aportado importante información sobre el complejo proceso de elección de un alimento, en el que influyen tanto propiedades sensoriales como no-sensoriales, desempeñando ambas un papel importante.

En este contexto, la aplicación del cuestionario “Food Choice Questionnaire” formado por 9 factores globales compuestos por 37 ítems, demostró que el perfil sensorial de un alimento seguido de la relación calidad-precio y su influencia en la salud, fueron los ítems considerados por los participantes como más importantes para seleccionar un alimento. Sin embargo, tomando en cuenta los 9 factores globales, la salud obtuvo el sexto lugar. Los participantes restaron importancia a ciertos componentes como fibra y proteína, sugiriendo un bajo conocimiento nutricional. El control de peso tampoco se consideró importante y el azúcar no se relacionó con este factor, ni con el contenido de calorías.

Debido a los resultados obtenidos sobre la escasa relación que observaban los consumidores entre los componentes de los alimentos y su función o efecto sobre la salud, se aplicó un cuestionario (“Nutrition Knowledge Questionnaire”) dirigido a conocer sus conocimientos nutricionales. Los resultados revelaron que menos de la mitad de los participantes tenían conocimientos sobre el tipo de grasas saludables o qué alimentos aportaban mayor contenido calórico. Adicionalmente, en el cuestionario se introdujeron preguntas relacionadas con los alimentos funcionales y se obtuvo que el 65% de los participantes percibían los alimentos funcionales como saludables frente a un 32% que mencionó que no sabía si estos ejercían un efecto beneficioso hacia la salud. También se introdujo una lista de distintos tipos de alimentos funcionales y los resultados demostraron que los productos con la palabra “enriquecido” fueron mejor puntuados como alimentos que producían un beneficio.

Además se estudió el uso del etiquetado, resultando en una estrecha relación con el nivel de conocimientos nutricionales. Es decir, si el consumidor tenía mayor conocimiento sobre nutrición, usaría más frecuentemente la etiqueta, y la interpretaría mejor que uno con bajos conocimientos, que tendería no utilizarla en el momento de la compra. En este contexto, se demostró la importancia de las campañas nutricionales y de educación del consumidor para que la elección se realice con mayor responsabilidad.

Cuando un consumidor compra sus alimentos, el primer contacto con el producto es el envase y la información que se encuentra en el etiquetado. Con este antecedente se estudió la percepción sobre el envase centrada en la información que brinda el etiquetado aplicando la técnica de "Projective mapping" y utilizando galletas enriquecidas y/o sin azúcar como caso de estudio. Se plantearon 4 escenarios distintos, los dos primeros sin probar las galletas (1-Observación del envase, 2-Observación de tarjetas con la información del envase, 3-Probando el producto sin ninguna información, 4-Probando el producto con la información disponible). Los resultados demostraron como un envase creaba expectativas sensoriales sobre el producto y al mismo tiempo transmitía ciertas ideas que contribuían a la percepción de saludable. El comportamiento hacia cada tipo de galleta fue distinto dependiendo de los 4 diferentes escenarios; por ejemplo, se observaron mayores cambios de comportamiento en las galletas sin azúcar añadido. Nuevamente, se pudo ver que el papel del azúcar en los alimentos aún no se comprendía bien y la reducción se asoció con el padecimiento de enfermedades y no con el control de peso o beneficio para la salud.

Se estudió también la influencia de distintos escenarios como el envase, la información nutricional y las características sensoriales del producto (galletas enriquecidas y reducidas) en su aceptabilidad y la percepción de saludable. Nuevamente, se obtuvieron distintos comportamientos según el tipo de galleta. Se observó que la familiaridad hacia el producto y la marca, afectaban la aceptabilidad produciendo diferentes expectativas, que al probar el producto serían o no confirmadas; cuando el producto se probó la aceptabilidad

disminuyó en algunos casos ya que las características sensoriales no fueron satisfactorias en comparación con las expectativas generadas por la marca o el envase. Del mismo modo, se observó que la aceptabilidad de las galletas de marca blanca fue menor cuando los participantes sólo observaban el envase o la composición nutricional.

En cuanto a la percepción de saludable, ésta fue mayor cuando solo se observaba el envase, por la influencia de algunas de las declaraciones nutricionales. Aquellos envases que tenían las propiedades saludables en la parte frontal del envase y con letras más grandes fueron mejor puntuadas, así como también las galletas más familiares para los participantes. Se observó que el consumidor español no estaba dispuesto a sacrificar el sabor por un beneficio de la salud.

Una recomendación para una alimentación más saludable es disminuir el consumo de alimentos hipercalóricos, ya sea rebajando el contenido en grasa o en azúcar. La reducción de estos componentes en la dieta no es fácil debido a que proporcionan buenas texturas y son más apetecibles. El objetivo de este estudio fue predecir cómo ciertas características intrínsecas del consumidor como la autoestima, la satisfacción con la vida, la salud y el control de peso a su vez influenciada por perfiles de personalidad influían en la frecuencia de consumo de alimentos reducidos en grasa y azúcar. Los resultados demostraron que este tipo de alimentos reducidos en calorías se consumían por razones de control de peso y no por ser más saludables. El consumo de alimentos reducidos en grasa estuvo mejor correlacionado con el control de peso que los alimentos reducidos en azúcar. En cuanto a la personalidad, la responsabilidad influyó en el control de peso y por tanto en el consumo de alimentos bajos en calorías. Además se observó que la inestabilidad emocional predecía tanto el factor sobre la salud como el control de peso. El perfil de este tipo de personas es tal que se muestran preocupados por todo en general y el modelo reflejó su participación en la salud y en el control de peso.

La aplicación de ecuaciones estructurales es una técnica relativamente nueva en el ámbito de ciencia de los consumidores y su aplicación permitió modelar además el comportamiento de compra hacia los alimentos funcionales. Se estableció como hipótesis la relación entre ciertos factores no-sensoriales que podrían intervenir en la decisión, como la salud, el contenido natural, novedad y la actitud positiva. Se encontró que éstas a su vez estuvieron influenciadas por la satisfacción con la vida. Además, se estudió el conocimiento sobre alimentos funcionales y su consumo; el 47% respondió que los desconocían, mientras que un 39% mencionó que sabía lo que eran los alimentos funcionales y que los consumían. Se observó que las mujeres tenían más conocimiento, probablemente debido a que se preocupaban más por la salud. Los resultados del modelo indicaron que el interés por la salud no predeciría la compra de alimentos funcionales, mientras que la actitud positiva y la novedad sí serían factores determinantes. Esto sugirió que los consumidores necesitarían mayor educación relacionada con los alimentos para garantizar que productos, resultados de largas investigaciones, no fracasen en el mercado y que su concepto o propiedad saludable sea percibida correctamente.

CONCLUSIONES

Las principales conclusiones que se extraen de la presente tesis doctoral "Estudio de las actitudes, conocimientos y comportamiento de los consumidores. Parámetros sensoriales y no sensoriales que intervienen en la elección de alimentos bajos en calorías y enriquecidos con ingredientes funcionales", son:

- Los conocimientos nutricionales de los consumidores españoles limitan su percepción sobre la relación entre los alimentos y la salud. Los mensajes que reciben deberían ser más claros e informativos; de este modo, se lograría una selección y consumo más responsable.
- Un buen conocimiento nutricional implicaría un mejor uso del etiquetado de los alimentos. Se considera interesante que existieran medidas oficiales e iniciativas privadas enfocadas hacia una mejora en la interpretación de las tablas nutricionales y de ingredientes para mejorar la percepción de los alimentos saludables.
- El impacto visual de la información que se encuentra en el envase es una buena herramienta para modular la percepción inicial y las expectativas sobre el alimento.
- La comprensión de la declaración y propiedad saludable del producto, así como la familiaridad influyen activamente en el consumo de alimentos de bajo contenido calórico a través del desarrollo de expectativas positivas y en la percepción de alimentos enriquecidos o bajos en calorías. Lo mismo ocurre con factores propios del consumidor, como ciertos rasgos de personalidad u otras características intrínsecas. Resultaría de gran interés abordar estudios que consideren estos factores en otras categorías de alimentos para ahondar en los motivos de elección, compra y consumo.
- La presente tesis demuestra que un alimento no debe desarrollarse tomando en consideración únicamente sus características de calidad tradicionales

(propiedades sensoriales, nutricionales, etc.). Este enfoque clásico debe abandonarse para tomar en consideración otros valores añadidos como mejoras en la comunicación, o aumento de la personalización hacia grupos de consumidores diana.