

Available online at www.centmapress.org

*Proceedings in System Dynamics and Innovation in Food Networks
2019*

DOI: <http://dx.doi.org/10.18461/pfsd.2019.1911>

INTERNATIONAL
JOURNAL ON
FOOD SYSTEM
DYNAMICS

Nutraceutical Food: Testing The Consumer's WTP for Sunflower PUFA Oil

F. Rosa*, F. Nassivera*, L. Iseppi* and M. Taverna*

* University of Udine, Italy

Abstract

Nutraceutical foods are supposed to procure medical or health benefits beyond the effects of nutrients compounds alone. However, few of them are accompanied by convincing health claims, as the response to nutraceutical components varies from subject to subject, depends on the concentration of bioactive components and their efficacy must be tested in repeated clinical trials. Many medical studies have proved the non-substitutable roles of polyunsaturated essential fatty acids (PUFA) in many biological and regulatory patterns. The purpose of this research is to test the consumers' attitude to sunflower PUFA oil and their willingness to pay (WTP) a premium price for the quality of this nutraceutical food. The inference is based on the Structural Equation Modeling (SEM) able to capture the complexity of credence quality of this nutraceutical oil to influence the customer decisions. A survey with "ad hoc" questionnaire using CASI technique was submitted to a sample of consumers located in the northeast region FVG in Italy. The results confirmed the two above hypotheses and suggested to frame the communication strategy according with claim regulation to strengthen the customization for PUFA sunflower oil.

Key word: Nutraceutical/Functional food, sunflower PUFA oil, consumer preferences, WTP, SEM, market trend

1-Introduction

The stagnating markets in western countries due to saturated food demand, lowering birth rate, age composition, health concern, suggest to take account of the change in consumers' diet habits, and their growing interest for the nutraceutical/functional foods¹. These foods are expected to increase the market value, with product differentiation, fueling new market channels as pharma, chemical, medical and biological food. (Menrad, 2003). A long list of dietary supplement ingredients such as hydrolyzed protein and peptides, vitamins and mineral blends, herbals (Ayurveda extracts, plant extracts, algal extracts, garlic, ginger, aloe, phytochemicals, fatty acids and fiber), are used for reducing the risk of malnutrition in adults and infants and prevent diseases. This trend can be attributed to three key factors: i) increasing consumption of integrators in sports and energy drinks, particularly among youth, ii) rising preferences for

¹ Consumers are extremely receptive to the idea of health-enhancing foods and interested to learn more about such foods and how they might provide long-term health benefits. Research conducted by Dr. Childs and presented at the NUTRACON '96 conference in Nashville, Tennessee in July 1996 found that 55% of consumers believed that food or food products could help reduce the risk of degenerative disease. Focus group studies conducted by The International Food Information Council (IFIC) in June 1996 found that consumers view functional foods as a natural evolution of the traditional foods they have always eaten. In September 2004, the FDA announced to allow a qualified health claim for reduced risk of coronary heart disease (CHD) for those foods containing eicosanoids EPA and DHA derived from PUFA https://www.scienzavegetariana.it/nutrizione/VNPGI_IVD/functionalfoods.html

energy ready-to-drink beverages; iii) increasing care for long term effects of diet habits. The occurrence of chronic diseases and high healthcare costs are expected to boost the demand for nutraceuticals over the next decades period (Bhowmik et al, 2012). The nutraceutical food market (including functional food and beverage, dietary supplement) was valued 272.35 billion USD in 2016 and 383 billion in 2017, with an increase of 41% in two years, signaling a growing trend estimated 7.04% CAGR (composite annual growth rate) in the period 2016 – 2022. The nutraceuticals food growth is justified by their versatility in a number of industries such as pharmaceutical, food & beverages, animal feed additives, and personal care. A second reason is the dietary habits playing nowadays a major role in health and/or in promoting the development of chronic 'lifestyle' diseases favoring risky factors which plague the western society today. Ingestion of risky foods, exceeding quantity are among the major causes of the 'health risks' associated with the diet as do the specific nutritional components (nutrients, healthy components) which are present therein. Among the multiple factors which can markedly influence the health perceptions are personal preferences for taste, health, convenience, naturalness (including brand name establishment), perceived or actual nutritional value with health implications (Grunnert, 2010; Lebreque et al, 2006; Heralth et al., 2008). The term nutraceuticals, is a syncretic neologism of the words nutrient and pharmaceutical foods firstly coined by DeFelice (1989); these foods contain in variable quantity bioactive chemical constituents providing medical or health benefits, beyond basic nutrition, including the prevention and/or treatment of a disease.² The functional food is a synonymous of nutraceutical, defined by the Institute of Medicine of the US National Academy of Sciences as foods that encompass potentially healthful products, including any modified food or food ingredient that may provide a health benefit beyond the nutrients it contains. (Kalra, 2003)³ and the two terms are used often interchangeably.⁴ The nutraceutical foods must satisfactorily demonstrate to procure benefits on one or more target functions of the body that go beyond adequate nutritional effect in a way that is relevant to either an improved state of health and well being and/or a reduction of risk disease (see International Life Science Institute, Fufose project)⁵. However, the decision to purchase these food is more complicated as the food quality construct is intended "a complex bundles of credence attributes" and the amount of information provided by firms or markets is very specialized and difficult to be processed by customer with basic nutritional knowledge in food science. (Nuttavuthisit & Thøgersen, 2017; Rosa & Nassivera, 2011). The perceived healthiness of food as a determinant of purchase intentions of nutraceutical and functional foods, has been studied extensively (Bech-Larsen and Grunert 2003; Cox et al 2004; Urula and Lähteenmäki 2004; Verbeke 2005). The classification of goods based on consumers ability to evaluate their quality was originally proposed by Darbi and Karni

² [Regulation \(EC\) No. 178/2002](#) of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety (OJ L 31, 1.2.2002, p. 1). Important is the distinction between food and food supplement these last is a food category containing substances with a nutritional or physiological effect. and medicinal products. The product to be considered a supplement must be a concentrated form, to be taken in measured small unit quantities (capsules, tablets, tablets or pills). The regulation concerns also about health claims (claims that state, suggest or imply that a relationship exists between a food category, a food or one of its constituents and health) and reduction of disease risk claims (claim that state, suggest or imply that the consumption of a food category, a food or one of its constituents significantly reduces a risk factor in the development of a human disease. <https://www.cambridge.org/core/journals/british-journal-of-nutrition/article/global-view-on-functional-foods-european-perspectives/F10428415C059CD3F4B4C48E667BD045>.

³ The process of how the functional components are added, removed or modified is not relevant for the definition of function food having a positive impact on health only if relevant components (vitamins, eicosanoid, terpenoid, carotenoid, lycopene, and other bioactive non nutrients) are properly metabolized procuring benefits on health.

⁴ Aronson said that Nutraceuticals' and 'functional foods' are vague, nondiscriminatory, terms; the evidence suggests that they should be abandoned in favor of more precise terms. The term 'dietary supplement' is now widely used to designate formulations that are also called 'nutraceuticals' but it would be better restricted to individual compounds used to treat or prevent deficiencies. Also the term 'Fortified foods', sometimes called 'designer foods', are foods to which compounds of proven therapeutic or preventive efficacy has been proposed.

⁵ The nutraceutical group includes food as pre and probiotics, fortified foods, eicosanoid derived from PUFA, carotenoids, branded ionized salt, branded wheat flour market, and many others

(1973). They distinguished three types of quality: before consumption of a food (ex ante or search quality), after consumption and use (ex post or experience quality) and credence (trust) quality; for this last nutritional and health benefits, cannot confidently evaluated, neither ex ante nor ex post, even after one or more purchases. The existence of the market for credence goods is strongly dependent on the quality guarantee by a third party (or vendor brand), which defines the standard and/or monitors compliance (Caswell and Mojduszka's, 1996). Thus, buyers tend to rely on the reputation of the brand name, testimonials from someone they know or respect, or third party. Healthiness is an invisible quality construct (in economics defined a credence quality), not ascertained directly by the large mass of consumers, and discovered with quality cues indicators (Bonanno et al, 2014). These cues include nutritional information on the packaging, nutrition and health claims, ingredients lists, health logos, quality labels, brands, and product origin. In the abstract process of healthy quality inference, the consumer need to understand how nutraceutical benefits could be related to the healthy cues and relation between cues and healthy claim. The analysis starts with the perceived benefit (cues) classification: i) direct health benefits, ii) reduction of risk disease, iii) better life conditions (Van Kleef et al, 2005). The first class of cues are referred to nutraceuticals whose specific metabolic activity can claim direct beneficial health effects (Orsanova et al, 2015⁶). The second class concerns the risk reduction and improvement of life quality: these cues are described by press and medical literature: the proportion of disease assigned to diet has been estimated to be approximately 40 –50% for cardiovascular disorders (cardiovascular disease including risk factors–blood cholesterol, blood triglyceride, hypertension) and diabetes with 35-50% of all cancers directly caused by dietary factors (including colo-rectal, prostate, and breast cancers). (Kleingartner et al, 2002). Plant sources have genes potentially able to synthesize many active phytochemicals (including antioxidants, fibers, and other nutraceutical ingredients) whereas animal-derived food products can be favorably modified to prevent and/or manage disease according to the type of animal feedstuffs used at the farm gate (e.g., feeding flax or fish oil to introduce omega-3 eggs, meats, etc.). The agro-food sector can move away from a generally 'commodity-based' industry having difficulties in competing with foreign products made with cheaper labor, more tolerant food standards and pollution, etc., into a value-added functional food offering better profit margins and providing for a massive reduction in health care costs (Hobbs, 2002). The establishment (legislation) for the labelling of health claims on brand-specific brand-name products at point of purchase and the allowance for responsible advertising and marketing of these products, is essential for improving the consumers customization.⁷ The health claim needs to obtain authorization from EFSA in Europe, after a cause–effect relationship has been substantiated by clinical data (nutritional/clinical trials). Health claims consist generally of a front package information that link to specific health related function (Lahteenmaki, 2013; Grunnert, 2010). There are two main claims relevant to functional foods: enhanced functional claims and diseases reduced risk claims. The first one is responsible of improved metabolic functions, the second one is referred to increase immunity or lowering the risky factors. Claims are not allowed to include statements regarding the curing, treating, or prevention of diseases, but only about reduced risk of disease and improved state of health or well-being (Diplock et al., 1999). However, there are different restrictions in the EU regulation: the Finnish Food Legislation, in concordance with EU guidelines, allows to mention claims with improved

⁶). If there are vegetal supplements (in cases of vegetal origin), they can be covered by legislation for food supplements

⁷ Functional foods exist at the interface between food and drugs. There is no provision in our existing food regulations for foods intended to be consumed to prevent disease. The concept of "substantial equivalence" was developed as a practical approach for evaluating the safety of foods that contained or were produced from genetically modified organisms. This approach asks whether the novel food is substantially equivalent or sufficiently similar to its traditional counterpart. An International Life Sciences Institute-Europe technical committee established three different classes of equivalence and set up guidelines for safety assessments of novel foods:

Class I foods or food ingredients are those substantially equivalent to a traditional reference food or ingredient;

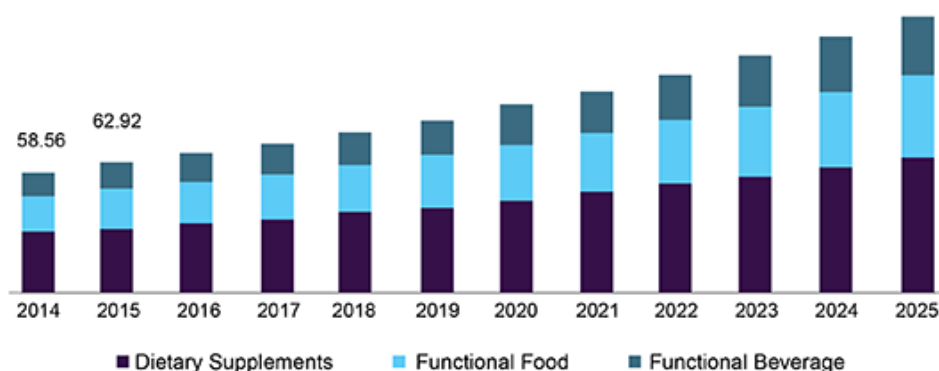
Class II are those that are sufficiently similar to a traditional reference food;

Class III are those that are neither substantially equivalent nor sufficiently similar to a traditional reference food or ingredient. In the US.

The 1990 Nutrition Labeling and Education Act allows, for the first time, health or disease prevention claims on a food label. Within this context the Food and Drug Administration (FDA) requires that health claims be supported by solid research and that the claims be approved by the FDA.

health and general well-being if the statement has been proved by the results of at least two independent scientific studies (Urala et al., 2003). Global trends are leading toward personalized nutrition, wherein nutraceuticals are expected to play a major role in health consumers' attitudes if they are able to fulfill consumer wants and needs including social and cultural ones (Diplock et al., 1999). Higher costs associated with traditional health care treatments for chronic diseases has addressed the consumer attention to nutraceuticals as they are expected to reduce the risk of health and medical treatments and enhance basic nutritive value of food. The perceived risk of diseases such as high blood pressure, obesity, diabetes, and cholesterol will boost the demand for the nutraceutical goods. The interest of this research is for those nutraceutical as omega 3/6/9 unsaturated fatty acids whose demand is expected to grow by 6.8% in next years. Individuals from different regions and demographics are growingly interested in omega products that suit optimally their nutritional/healthy needs. High birth rate, growing geriatric population, growing number of diseases related to malnutrition (diabet, cholesterol, blood pressure) will stimulate the consumption of nutraceutical foods. (Bigliardi B., Galati F., 2013). Therefore one important issue to display the healthy benefits to consumers in an appropriate way to increase their attention to healthy claims of PUFA properly conveyed in stimulating messages (Poulsen, 1999). There are two main types of healthy claims: enhanced functions related to the food attributes that contribute beneficially to health and reduced risk of disease or undesirable health conditions; the emphasis will depend on the persuasive impact of one of these two on consumer (van Kleef, van Trijp & Luning, 2005). In changing the sunflower oil composition it is needed to consider also the impact in consumer preferences caused by the method to increase PUFA: artificial enrichment or natural increase obtained by using non-GMO (Genetically Modified Organism) techniques. There is a change in consumer preferences from synthetic ingredients to natural and organic ingredients obtained with non-GMO (Genetically Modified Organism) extracts. Consumers prefer the nutraceutical foods to pharmaceutical drugs. Customers prefer to save their health with nutraceutical foods obtained with natural/biological methods instead of using pharmaceutical drugs or artificially enriched foods. Germany, the Netherlands and Sweden have emerged as the key nutraceutical innovation hubs in Europe, while the United Kingdom and Spain have emerged as the key test markets for new products, with the European consumers demanding energy providing products that promote healthy teeth, strong bones, prevent digestive health issues, boost immune system and lower cholesterol. Functional foods tend to be premium priced (Food Industry News, 1999) and offer attractive profit margins for food retailers by changing the food perception from commodity to specialty. If the market is to continue to develop, their appeal needs to be broadened to a much wider audience and reach those in society who suffer most from diseases of affluence, such as coronary heart disease and cancer. The current consumer trend is to prevent rather than react to the health issues, which involve huge healthcare costs in developed countries.

Fig 1 Trend in nutraceutical/functional foods and dietary supplements



Lipids contained in Sunflower oil are fatty acids (FAs) classified mostly according to the presence or absence of double bonds as saturated (SFAs—without double bonds), monounsaturated (MUFAs—with one double bond) and polyunsaturated fatty acids (PUFAs with two or up to six double bonds). Double bonds can be cis or trans due to their spatial configuration as n-3 or n-6 PUFAs depending on the position of the first double bond from the fatty acid methyl-end. The human body cannot synthesize PUFAs with the first double bond on C3 and C6 from the methyl-end because of the absence of appropriate enzymes. Thus, these fatty acids are essential (EFAs) and they have to be obtained from a diet, particularly by the consumption of fish and fish oils. The demand for functional foods in Europe

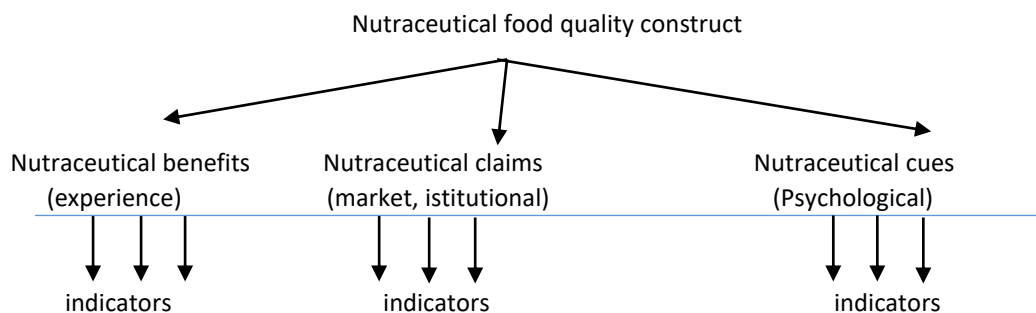
is steadily growing: according with the Food Safety Authority (EFSA); the high content of linoleic acid, essential fatty acids and vitamin E contained in sunflower oil makes this oil an ideal food for a healthy diet. The consumers informed about the healthy benefits are starting to prefer the sunflower oil to fulfil different uses: frying, dressing, functional. The aim of this study is to determine how consumers in Italy perceive the benefit of health-related claims that differ in strength, and how a consumer's gender, age, level of education, trust in food-related information and frequency of use of so-called functional foods affect the perceived advantageousness of the health claims.

2 - CONCEPTUAL MODEL AND RESEARCH design

In similar studies (see Grunnert, 2010) there are indicated four main attributes affecting the customers' food choices: taste, health, convenience and naturalness. The focus of this research is to test the consumer perceptions about the credence quality construct of NUSO and WTP an extra price for it (Di Pasquale et al.2011). The complexity of this quality perception is the background required to understand the role of some attributes as the complex metabolic pathway of eicosanoid derived from PUFA to generate prostaglandins, prostacyclins or thromboxane and their specific role in human health. The expected functional quality judgement at the point of purchase is based on perceptions of quality cues (Steenkamp, J.B.E.M.,van Trijp, J.C.M., 1986) ⁸.

Then cues are the psychological tool to ascertain the role of attributes in credence quality. Finally the third party (EFSA in EU, FDA in USA) regulate the claim message to make a generalized meaning of the eicosanoids in the process of credence quality judgement. Researchers have developed measures of food-related attitudes in order to understand how health-related benefits, claims and cues influence dietary choices related to nutraceutical food quality construct. This concept is illustrated in the following figure:

Fig 2 - Framing the nutraceutical food quality construct



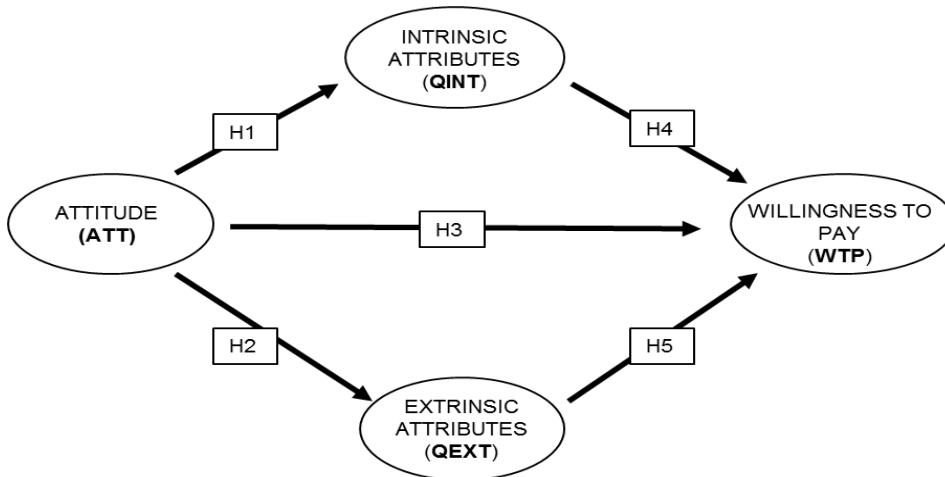
Source: Rosa

Step toe et al (1995) introduced a multidimensional measure of motives related to food choice, including nine factors labeled Health, Mood, Convenience, Sensory appeal, Natural content, Price, Weight control, Familiarity, and Ethical

⁸ In a two step product quality judgement (ex ante, ex post) perceptions of quality cues (intrinsic and extrinsic attributes to a food are utility generating based on expected functional and socio-psychological benefits) are integrated into a more abstract overall judgement about expected quality. Quality cues are any information stimuli (Steenkamp, 1990) that can be ascertained through the senses prior to consumption (search good) and according to consumers have a predictive validity for the product's quality performance upon consumption (experience quality). Intrinsic quality cues are prevailing in the formulation of quality judgement over the extrinsic quality. For the interest of this research we are interested in another category of cues, the credence attribute benefits that are distinguished from experience attribute benefits mentioned before because they cannot unambiguously verified through personal experience even after normal use for long time repeated purchases, nor without consulting an expert. Examples of credence quality attributes are the functional food naturally or artificially enriched with bioactive components. Quality cues and quality attribute perceptions: intrinsic cues perceptions are mainly derived from physical product attributes and processing technology; extrinsic cues perceptions are excited by marketing strategies (branding, pricing, labelling)

concern. Testing the associations between demographics and their measure of motives, these researchers found differences in motives for food choice associated with sex, age, and income (Roininen et al 1999; Rosa et al.,1996). The empirical research is addressed to test the hypothesis about consumers' willingness to pay a premium price (WTP) for sunflower nutraceutical oil. Starting with these premises, a theoretical model is proposed to analyze the relationships between latent constructs Attitude (ATT), Intrinsic Attributes of product perceived quality (QINT), Extrinsic Attributes of product perceived quality (QEXT) and Willingness to pay (WTP). (see fig. 3)

Fig 3 – The hypothesized causal model of quality perception and customer WTP for sunflower PUFA oil



Source: Nassivera & Rosa

Considering a measurement scale for each latent construct, the aim of his work is to test in the model the following hypotheses:

- Hypothesis 1 (H1): Attitude towards NUSU (nutraceutical sunflower oil with higher PUFA) named ATT has a significant impact on Intrinsic attributes of perceived product quality (QINT);
- Hypothesis 2 (H2): Attitude towards NUSU (ATT) has a significant impact on Extrinsic attributes of perceived product quality (QEXT);
- Hypothesis 3 (H3): Attitude towards NUSU (ATT) has a significant impact on Willingness to pay (WTP);
- Hypothesis 4 (H4): Intrinsic attributes of perceived product quality (QINT) of NUSU have a significant impact on Willingness to pay (WTP);
- Hypothesis 5 (H5): Extrinsic attributes of perceived product quality (QEXT) of NUSU play a significant role on Willingness to pay (WTP).

A questionnaire was administered to a non-probabilistic sample of students and employees of the University of Udine located in region FVG northeast part of Italy, to gather information about preferences for the proposed nutraceutical sunflower oil. The questionnaire was structured in four sections:

- section 1: reported questions related to awareness and attitudinal characteristics of respondents;
- section 2: concerned the intrinsic attributes affecting the credence health construct;
- section 3: concerned the extrinsic attributes affecting the product shelf life;
- section 4: attempted to understand the willingness to pay and to determine the premium price WTP response by bid value for nutraceutical PUFA sunflower oil (NUSO).

The reasons to select this sample of respondents are the following:

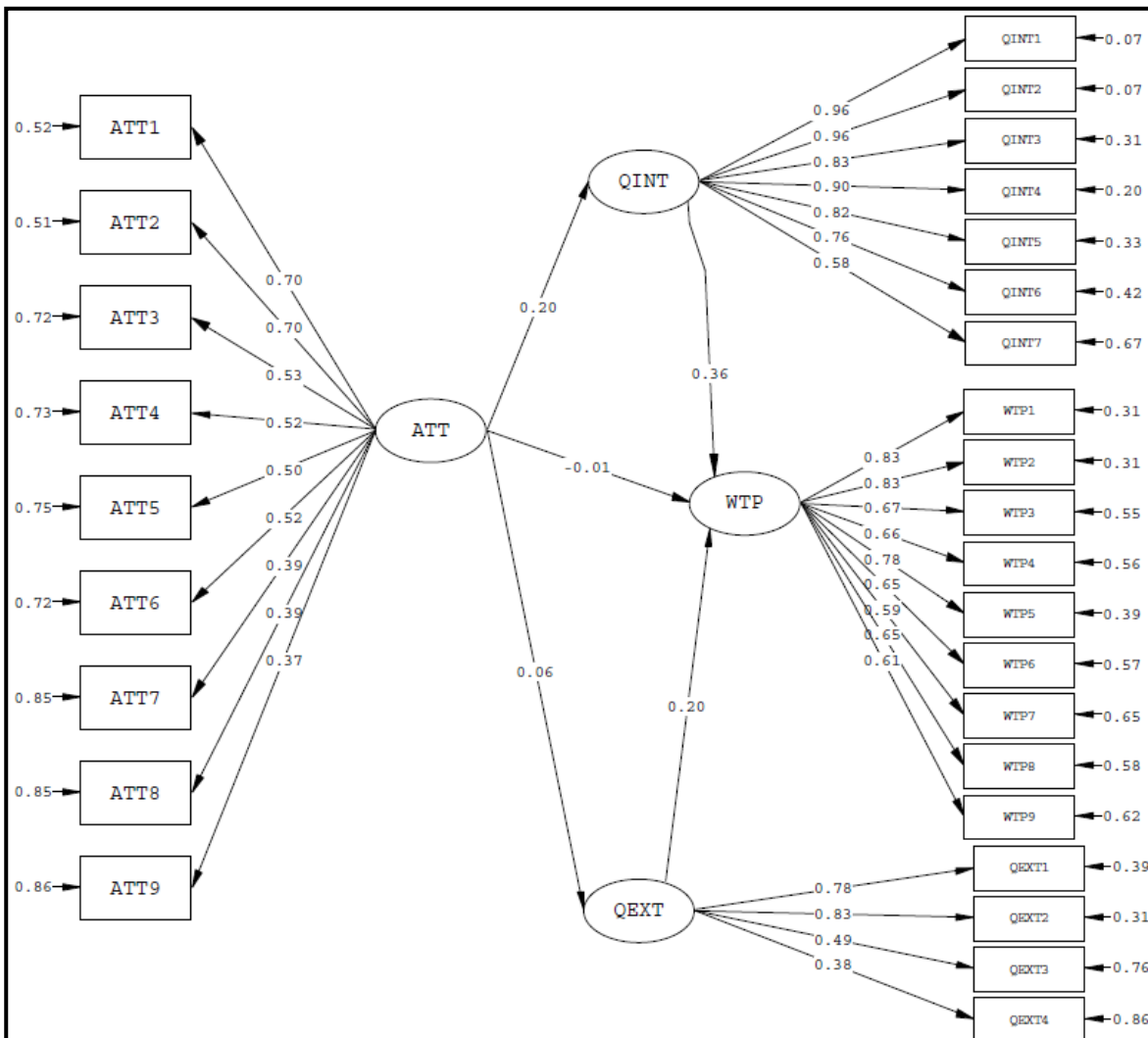
- i) they represent a significant quota of the population living in this region of Italy;
- ii) the higher education background allow them to be more concerned about their healthy life conditions and to perceive better the role of eicosanoid in credence quality;
- iii) the more stable income allows them to allocate higher budget in purchasing healthy food.

A number of 450 structured questionnaires were submitted during the period between September and December 2018, to collect information about sociodemographic profile, attitudes, shopping habits, preferences for healthy food and others to make a complete consumer's profile for predictable buying behavior. A seven point Likert scales was

used for measuring the indicators of construct framed in the theoretical model, according to the literature. To improve the reliability of the answers, the consumers were prepared to this topic with a short incipit at the beginning of the questionnaire describing the role of PUFA, along with the healthy benefits drawn from medical literature, the recommended quantity of daily PUFA and the nutraceutical quality of this oil by reporting the amount of PUFA acid and suggested optimal proportion ω_3/ω_6 . The majority of respondents were females (66%), with at least high school degree (52,8%), with a monthly net income in the range between one thousand and two thousands euros (36%), that is the average salary in this region. Most of the customers bought the sunflower seed oil at the supermarkets and hard discount covering in total the 65% of total purchases. Data were processed with the structural Equation Modelling (SEM) using the LISREL 9.1 software; a preliminary factor analysis was implemented with Varimax oblique rotation to reduce the original variables in four latent factors, resulting from the linear combination with minimum loss of information. These are: ATT, QINT, QEXT and WTP. The reliability of each factor was examined with the Cronbach's α , and the values were compatible with the threshold value 0,7. Four fit indices were calculated to verify how the model reproduced the observed covariance matrix. Specifically, we used the Goodness of Fit Index (GFI) and the Normed Fit Index (NFI) proposed by Bentler and Bonnet (1980), the Comparative Fit Index (CFI) proposed by Bagozzi (1992), and the Root Mean Square Error of Approximation (RMSEA) proposed by Browne and Cudek (1993). The statistical evaluation (RMSEA value equal to 0.08) suggested a reasonably good fitting of the model according to the quoted literature. The hypothesized direct causal effects among the latent variables ATT, QINT, QEXT and BI were confirmed with the fit indexes from the SEM analysis.

The figure 3 reports the path analysis, with standardized estimates of causal relationships between the latent quality constructs and their indicators.

Figure 4: Path analysis of the proposed model



3 – DISCUSSION OF THE RESULTS

The credence quality construct was tested with five hypotheses causally related to the quality construct. The statistical results suggested the following indications. The results suggest that only two hypotheses were not supported (H2 and H3) by statistical evidence respectively: the lack of evidence for i) extrinsic attributes on the perceived product quality (QEXT); ii) attitude towards NUSU (ATT) having significant impact on Willingness to pay (WTP). The first can be justified by the technicalities involved in understanding this argument. The presence of many double bonds in PUFA can cause oxidation and rancidity, then the dark color could contribute to elongate the lifetime.

The relationship between attitude (ATT) and Intrinsic attributes of perceived product quality (QINT) were positively correlated and significant ($\gamma = 0.20$, $t = 3.65$), supporting H1. The relationship between Intrinsic attributes of perceived product quality (QINT) and Willingness to pay was positive and significant ($\gamma = 0.36$, $t = 7.36$), supporting H4. In supporting the hypotheses, the model depicts a particular reactivity of consumers to this functional product: a significant insight comes from presence of ω_3 and ω_6 , having a positive influence on perceived quality of intrinsic attributes, and positively affect the willingness to pay up to 30% more for a sunflower seed oil, reporting in evidence the medical benefits, as expressed in the measurement scale WTP. Retailers of this food product can formulate their marketing strategy accordingly to the reactivity of the consumers for aspects related to PUFA enriched functional seed oil. Other remarks of the research, emerged from the measurement scale of WTP, are reporting that the genetic modification of the sunflower plant does not seem to create problems of acceptance for consumer.

CONCLUSIONS

The research has demonstrated that the judgement about credence quality of nutraceutical food products is complex for the majority of the persons forming the sample, for limited capacity to understand the role of attributes (PUFA, eicosanoid, and derived metabolites); despite these limits the consumers are growingly interest in this type of food product and believe in their nutritional and healthy claims.

The results confirm the positive consumers' attitude for nutraceutical food products and specifically about NUSU. An emerging result of interest is the persons with higher education and income, are more sensitive for healthy food, and are willingness to pay higher quota of their income for food that are expected to procure health benefits. One reason for the missed empirical evidence of hypothesis 2 (influence of extrinsic attributes) is the consumers ignore the light effect on the oil with higher content of PUFA that makes the product more instable. To extend the shelf life the industry suggests to use dark color bottle, an extrinsic attribute. The other hypotheses confirm that the consumers are able to understand the message about the role of PUFA in human metabolism and appreciate the presence of the naturally enriched PUFA sunflower oil. This change the order of preferences for the sunflower oil intended now as a specialty product and they are willing to pay an extra price for this nutraceutical product. Other important finding of this survey is that consumer care about the low impact techniques that is an indicator of naturalness. Another important observation is the consumers are not particularly adverse to the use of the new genetic techniques to implement the gene expression coupled with traditional breeding technique to create a new sunflower oil variety with higher PUFA composition. This is important result because many stores already trade the PUFA enriched sunflower oil obtained by mixing sunflower and other seed oils, however this procedure decrease the commercial value of the product.

These results suggest several managerial actions to take advantage of the potential market development. In the formulation of quality judgement are included the perception of experience attributes related to functional and environmental factors. Then the entire chain must be considered: sustainable cultivation method, seed selection, natural extraction, conservation, health claims, country of origin, diet culture safety and the quality image of products and claim formulation. These represent key success factors in this marketing type of food. Moreover, marketers should tailor product size to consumers' perceptions and use appropriate channels to reach them.

References

- Aronson, J. K., 2017, Defining 'nutraceuticals': neither nutritious nor pharmaceutical. *Br J Clin Pharmacol.* 2017 83 (1): pp 8–19
- Bagozzi, R.P., 1992, The self-regulation of attitudes, intentions, and behavior. *Social Psychology Quarterly*, 55: 178-204.
- Bech-Larsen, T. & Grunert K., 2003. The perceived healthiness of functional foods: A conjoint study of Danish, Finnish and American consumers' perception of functional foods. *Appetite* 40: 9–14.
- Bentler, P. M., & Bonnet, D. G., 1980, Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin* 88 (3): 588-606.
- Bhowmik, D., Gopinath, H., Pragati, B., Kumar, S., & Duraivel, K.P, (2013), The Pharma Innovation, Nutraceutical – A Bright Scope and Opportunity of Indian Healthcare market. 1 (11), on line - www.the-pharma-journal.com Page 29.
- Bigliardi, B., & Galati, F., 2013, Innovation trend in the food industry: the case of functional food. *Trend in Food Science and Technology* 31: 118-129.
- Bonanno, A., Bimbo, F., Costanigro, M., Oude Lansink, A., Visecchia R., 2014, Credence Attributes' Valuation and Price dispersion: Quantile Regression vs. Stochastic Frontier, an Application to Health Claims in Yogurts. Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's, 2014 AAEA Annual Meeting, Minneapolis, MN, July 27-29, 2014.
- Browne, M.W., & Cudeck, R., 1993, Alternative ways of assessing model fit. in: Bollen, K.A., Long, J.S. (Eds.), *Testing Structural Equation Models*. Sage, Beverly Hills, CA.
- Caswell, J.A. and Mojdzuska, E.M., 1996, Using informational labeling to influence the market for quality in food products. *American Journal of Agricultural Economics* 78: 1248-1253
- Cox, D.N., Koster, A., & Russell, C.G., 2004, Predicting intentions to consume functional foods and supplements to offset memory loss using an adaptation of protection motivation theory. *Appetite* 43: 55–64.
- Darby, M. & Karni, E., 1973, Free competition and the optimal amount of fraud. *Journal of Law and Economics* 16: 67-88.
- De Felice S., 1995, FIM Rationale and Proposed Guidelines for the Nutraceutical Research & Education Act NREA, Foundation for Innovation in Medicine: <http://www.fimdefelice.org/archives/arc.researchact.html>.
- Di Pasquale J., Adinolfi F. and Capitanio F. 2011. Analysis of Consumer Attitudes and Consumers' Willingness to Pay for Functional Foods. *International Journal Food System Dynamics*, 2 (2): 181-193.
- Diplock, A.T., Agget, P.J., Ashwell, M., Bornet, F., Fern, E.B., & Roberfroid, M.B., 1999, Scientific concept of functional food in Europe: consensus document. *British Journal of Nutrition*, 81, 127.
- Grunert, K.G., 2010 European consumers' acceptance of functional foods Issue: *Foods for Health in the 21st Century Ann. N.Y. Acad. Sci.* ISSN 0077-8923.
- Herath, D., Cranfield, J., & Henson, S. (2008). "Who consumes functional foods and nutraceuticals in Canada? Results of cluster analysis of the 2006 survey of Canadians' Demand for Food Products Supporting Health and Wellness", *Appetite*, 51: 256-265.
- Hobbs, J.E. (2002), Evolving supply chains in the nutraceutical and functional foods industry. *Canadian Journal of Agricultural Economics*, 50(4): 559-568.
- Kalra, E.K., (2003), Nutraceutical – Definition and Introduction. *Journal American Association Scientist* 2003; 5: 27-28.
- Kleingartner, L.W. (2002), "NuSun sunflower oil: Redirection of an industry". In: J. Janick and A. Whipkey (eds.), *Trends in new crops and new uses* p. 135–138, ASHS Press, Alexandria, VA.
- Labrecque, J., Doyon, M., Bellavance F., & Kolodinsky, J., 2006, Acceptance of Functional Foods: A Comparison of French, American, and French Canadian Consumers. *Canadian Journal of Agricultural Economics* 54: 647–661.
- Lahteenmaki, L., 2013, Claiming health in food product. *Food Quality and Preference*, 27: 196-201.
- Menrad, K., 2003. Market and marketing of functional food in Europe. *J. Food Eng.*, 56: 181-188.
- Nuttavuthisit, K., Thøgersen, J. 2017, The importance of consumer trust for the emergence of a market for green products: The case of organic food. *Journal of Business Ethics* 140 (2): 323-337.
- Orsavova, J., Misurcova, L., Vavra Ambrozova, J., Vicha, R., & Mlcek, J., 2015, Fatty Acids Composition of Vegetable Oils and Its Contribution to Dietary Energy Intake and Dependence of Cardiovascular Mortality on Dietary Intake of Fatty Acids. *Int. J. Mol. Sci.* 16: 12871-12890
- Poulsen, J., 2002, Danish consumers' attitudes towards functional foods", Report 2002. University of Connecticut Web site: <http://ideas.repec.org/p/hhb/aarmap/0062.html>.

- Roininen, K., Lahteenmaki, L., & Tuorila H., 1999, Quantification of consumer attitudes to health and hedonic characteristics of foods. *Appetite* 33: (7), 1–88.
- Rosa, F., & Nassivera, F., 2010, Assessment of the Customer satisfaction at the “Farmer’s Shopping Points”, 4th International European Forum (Iglis-Forum), Food System Dynamics and Innovation in Food Networks, IGLS.
- Rosa, F., Nassivera, F., 2017, Sunflower oil: from commodity to functional food for new customers and markets. First Joint Conference Sidea-Siea “Cooperative strategies and value creation in sustainable food supply chain.
- Rosa, F., Sanchez, M., & Barrena, R., 1996, Does the label affects the consumer’s confidence in the meat food? A compared analysis among Canada, Italy and Spain, 99th European Seminar of EAAE, Trust and Risk in Business Relations 1 -15.
- Steenkamp, J.B.E.M., van Trijp, J.C.M., 1989, A methodology for estimating the maximum price consumers are willing to pay in relation to perceived quality and consumers’ characteristics. *Journal of International Food and Agribusiness Marketing* 1: 7-24.
- Steptoe, A., Pollardand, T.M., & Wardle J., 1995, Development of a measure of the motives underlying the selection of food: The food choice questionnaire. *Appetite* 25: 267–84.
- Urula, N., & Lähteenmäki, L., 2007, Consumers’ changing attitudes towards functional foods. *Food Quality and Preference*, 18: 1-12.
- Van Kleef, E., van Trijp, H.C.M., & Luning P., 2005, Functional Food: Health Claim Food Product compatibility and impact of health claim framing on consumer evaluation. *Appetite* 44, 299-308.
- Verbeke, W., 2005, Consumer acceptance of functional foods: Socio-demographic, Cognitive and attitudinal Determinants. *Food Quality and Preference* 16: 45–57.

Appendix 1 – Construct and items of the SEM model

Constructs and items	label	λ
Attitude	ATT	
Sunflower seed oil is good for my health	ATT1	0,70
Doctor suggest the consumption of sunflower seed oil	ATT2	0,70
The production of sunflower seed oil is favorable to environment	ATT3	0,53
The high oleic sunflower seed oil can compete in quality with olive oil	ATT4	0,52
The sunflower seed oil doesn't contain chemical residual	ATT5	0,50
The sunflower seed oil is better than olive oil, for absence of additive and preservatives	ATT6	0,52
The sunflower seed oil is superior quality compared to other seed oils	ATT7	0,39
The sunflower seed oil is safe if obtained from controlled cultivation	ATT8	0,39
The sunflower seed oil improved with modern techniques is superior quality	ATT9	0,37
Intrinsic attributes of perceived quality	QINT	
When you buy a seed oil by observing the label are you influenced by the quantity of linoleic acid (omega 6).	QINT1	0,96
When you buy sunflower seed oil by observing the label are you influenced by the quantity of linolenic acid (omega 3).	QINT2	0,96
When you buy sunflower seed oil by observing the label are you influenced by the ratio omega 3/omega 6	QINT3	0,83
When you buy sunflower seed oil by observing the label are you influenced by the presence of antioxidants omega 3 e omega 6.	QINT4	0,90
When you buy sunflower seed oil by observing the label are you influenced by the quantity of Tocoferol (Vitamin E)	QINT5	0,82
When you buy sunflower seed oil by observing the label are you influenced by the quantity of oleic acid.	QINT6	0,76
When you buy sunflower seed oil by observing the label are you influenced by the quantity of total acid.	QINT7	0,58
Extrinsic attributes of perceived quality	QEXT	
When I buy the sunflower seed oil I am influenced by the color of the bottle	QEXT1	0,78
When I buy the sunflower seed oil I am influenced by the design of the bottle	QEXT2	0,83
When I buy the sunflower seed oil I am influenced by the store type.	QEXT3	0,49
When I buy the sunflower seed oil I am influenced by the producer's or industry brand.	QEXT4	0,38
Willingness to pay	WTP	
I am willing to pay the 30% more for a sunflower seed oil reporting in evidence the medical benefits	WTP1	0,83
I am willing to pay il 10% more for sunflower seed oil with clear medical information	WTP2	0,83
I am willing to pay the 50% more for sunflower seed oil reporting in the label the indication about health benefits (like antioxidant omega 3/omega 6)	WTP3	0,67
I am willing to pay the 30% more for a sunflower seed oil produced with lower impact technique	WTP4	0,66
I am willing to pay more for a sunflower seed oil with clear medical information	WTP5	0,78
I am willing to pay 5 € al litro for a sunflower seed oil with clear medical information reported in label	WTP6	0,65
I am willing to pay 3 € al litro for a sunflower seed oil obtained from low environmental impact techniques	WTP7	0,59
I am willing to pay 10% more for a sunflower seed oil obtained from low environmental impact techniques	WTP8	0,65
I am willing to pay more for a sunflower seed oil improved with modern techniques	WTP9	0,61