

Review

Functional Food and Organic Food are Competing rather than Supporting Concepts in Europe

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Abstract: A review of recent literature pertaining to organic and functional food was conducted according its conceptual background. Functional and organic food both belong to fast growing segments of the European food market. Both are food according to the European food regulations, but organic food is further regulated by the European regulation for organic agriculture and food production. This regulation restricts the number of food additives and limits substantial changes in the food. This may cause problems in changing the food based on single constituents or attributes when applying the concept of functional food to organic food production. Claims of the influence of the food positively on health can only be accepted as true when the claims have been tested and then validated by the EU-Commission. Whereas functional food focuses on product comparison based on specific constituents or attributes, organic food as a whole has no placebo for comparison and effects on environment and society are not part of the health claim regulation. Therefore it seems rather difficult to establish the health claims of organic foods. Consumers buy organic food out of an emotional attitude and associate the food with naturalness. In contrast, the decision for buying functional food is related to rationality and consumers associate functional food with a more technological approach. For this reason,

the authors conclude that the concept of functional food seems not to support organic food production in Europe.

Keywords: organic; functional; food; consumer; quality; concept

1. Introduction

Functional and organic foods are both segments of the food market in Europe and have been growing constantly within the last decade [1]. Whereas organic food covers the entire manner of production [2,3], functional food describes nutrition and/or health related product attributes [4,5]. Both foods are labeled and the labels send quality and/or health related messages that point towards high quality food and/or extra health benefits [6,7]. Although consumers perceive these messages in both types of foods [8,9], they are associated differently. Furthermore, the conceptual background of functional and organic food is different with respect to quality concepts [10,11], which reflect the difference in the underlying paradigms of these two different food segments [12]. The aim of this paper is to analyze the similarities and differences of functional and organic food in order to determine if the concept of functional food supports or contradicts organic food production. The work was done among members of the international association Food Quality and Health (FQH).

2. Organic Food in Europe

The market of organic food is constantly growing [13]. In 2009, the European turnover of the organic food market was 18.4 billion Euros, wherein Germany and France have the highest turnover of organic foods (in total 5.8 billion Euros and 3 billion Euros, respectively [14]), while the highest market shares were reached in Denmark with 7.2 percent of the total food turnover, followed by Austria with 6 percent [14]. In Europe, consumers buy organic food because they expect that it is “good” for their health, has less impact on the environment and the production respects animal welfare principles [15–18]. Results from scientific investigations on the quality of the food focus on organic *versus* non-organic production method comparisons. Process measurements (e.g., impact on environment) indicate less impact on environmental issues measured by Life-Cycle-Assessment [19–22]. Comparisons based on food constituents showed lower levels of residues in organic foods [23–25] but had no consistent answer related to nutrients and health related compounds [26]. Recent reviews on vegetables, fruits and milk showed significantly higher amounts of bioactive compounds in the organic food products [27,28]. The compounds found at a higher level in organic food are, for example, defense related secondary metabolites in fruits and vegetables and poly-unsaturated fatty acids (PUFAs) in milk. The effect of those compounds on health is still a matter of controversy [29–31]. Therefore expected health benefits can only be claimed on the basis of models [28].

Organic agriculture is defined as a “holistic production management system” [3], which takes into account soil, plant and animal health by applying natural methods and working in natural cycles [2,32]. Agricultural products should be further processed in order to maintain the “organic integrity and vital qualities” of the product in all stages [2,3]. Biological and mechanical methods should be applied in

food production “opposed to using synthetic materials” [3]. The production of organic food has been regulated in Europe since 1991 with the actual regulations Nr. 834/2007 and 889/2008. Organic food products are labeled with a standard European logo. According to the EC regulations, processing should be done with care and all kinds of synthetic substances used during processing should be kept to a small number compared with non-organic food production [33,34]. Primary production, as well as processing and retailing, is certified according to the EC-regulations. Furthermore, import from third countries is regulated according to the European organic requirements and should guarantee the same quality of organic food as under EC regulation 834/2007.

Kahl *et al.* [35] analyzed the different guidelines and regulations relating to organic food quality issues and concluded that the quality of the food is described according to process issues, rather than concrete product attributes. Even so, one goal of organic food production is high quality of the products [2] as well as maintenance of their “true nature” during the production process [2]. Kahl *et al.* [10] identified health and sustainability as underlying goals in organic food production. Furthermore, they defined a combination of process and product aspects necessary for the definition of organic food quality. This is supported by results from consumer surveys [17,36,37]. The conceptual background refers to a system approach that considers the food as a whole rather than just the sum of its constituents. Therefore, one of the major future challenges for organic food quality research is to develop systemic tools for food evaluation.

3. Functional Food in Europe

The European market for functional food is constantly growing [4,7]. The UK has the highest turnover of functional foods, reaching 3.3 billion Euros followed by Germany (3.02 billion Euros) and France (1.8 billion Euros). The main factor for market success is high quality, wherein a “holistic health image” of the product increases the market success [7]. Consumers buy functional food, because they believe it is healthy, while functional ingredients known by the consumers stimulate more market success than ingredients not well known to the general public (e.g., PUFAS *versus* selenium). Moreover, perceived relevance influences the willingness to buy products with health claims [38].

Diplock *et al.* [11] presented a first scientific concept of functional food in Europe. Functional food should contribute significantly either to enhancing health and well being or reducing risk of diseases. Functional foods can be divided into three categories according to the nature of the functional ingredients:

- a. natural food containing high levels of the functional ingredient or with high functionality;
- b. food to which functional ingredients were added or removed;
- c. food in which the nature of functional ingredients has been changed.

Functional food is not specifically regulated in Europe; neither does a uniform label exist. However, there are EC-regulations that cover this part of the food market: Firstly, the general food regulation in Europe (178/2002). This regulation describes the basic quality and safety requirements of European consumers and protects consumers against fraud. When the food is changed in its molecular structure or consists of ingredients not previously on the European market, the food falls under the *European Novel Food Regulation (258/97)*. The most important regulation regarding functional food in Europe is

the *Health Claim Regulation* from 2006 (1924/2006). All marketing referring to possible health implications of food is prohibited, unless the Commission, after recommendation by the European Food Safety Agency (EFSA), has authorized a defined and substantiated health claim through scientific evidence. Until 2011 only a few hundred health claims were authorized [39]. EFSA does not allow health claims for vegetables and fruits in general and for their processed products (e.g., apple juice). Furthermore, health claims cannot be made for fruits or vegetables due to a specific functional ingredient in the fruit or vegetable [39]. The main reason is that the food consumption patterns will be responsible for the potential health effect rather than specific varieties or amounts of the fruits and vegetables. Health claims are only authorized for processed products with one or more specific compounds and their evidenced effects on human health. Therefore it is still a major challenge for scientific research to identify and test the functionality of food compounds [4,5] and to make this information available to consumers [40].

4. Similarities and Differences

Both organic and functional foods intend to offer high quality products to the European consumer with added value related to health. Whereas functional food offers human health specific targets, organic food intends to combine the health of the consumer and the health of environment, animals and society. Both are defined as food according to the European food regulation (EC 178/2002). Claims relating to positive health effects, which should be labeled to inform the consumer, are regulated for both food segments under EC-regulation 1924/2006. Therefore in general, studies showing scientific evidence for a proposed health benefit must be carried out. Whereas for functional food a specific compound or food attribute can be tested (different levels of the compound in question), it is difficult to prove this in organic food, wherein the whole food instead of constituent parts has to be compared (what should the placebo be?). Organic and functional foods are both labeled. Functional food is labeled according to the potential positive human health function or product attribute (when authorized by EFSA). Here, specific claims are formulated for different products. Organic food is labeled according to the process of production by different labeling schemes [6] but there is also a standard European organic logo [41]. The effects of organic food are not limited to human health, but are also claimed to work on society and the environment (soil, plants, animals, atmosphere, *etc.*). For the marketing of functional food as well as organic food, consumer knowledge of the label or the specific product attributes is necessary [42–45].

One of the reasons that the European market for functional food is behind the US and Japanese markets may be due to the distrust of the consumers [1]. Consumers often do not believe in the additional health benefit, which may justify the higher price for these products [1]. Bech-Larsen and Scholderer [7] identified a paradox, wherein consumers on the one hand do not believe in these added values but on the other hand they feel unsupported by detailed research results. This paradox may become even sharper after the last decisions of the Commission (following EFSA recommendations), which restricts food claims to food products where substantial scientific evidence exists for a beneficial effect, based on single constituents or attributes.

Consumers believe that organic food has positive effects on health, environment and animal welfare [1,15,17], although only the production process is regulated, not the effects (e.g., levels of

health related constituents). Eden [8] investigated consumers' awareness of organic and functional food. The study underlines that organic food is associated with naturalness, whereas functional food is associated with scientifically and technologically complicated processes. When consumer behavior is analyzed, the decision to buy organic food tends to be emotional, whereas there seems to be a rational decision process in buying functional food [46,47]. Furthermore, some organic consumers do not accept specially highlighted functions of food [9,43]. The question whether or not functional foods would compete with organic foods still cannot be addressed because of a lack of study material. Stolz *et al.* [42] indicate that conventional food with a communicated additional benefit will compete with the conventional counterpart, not the organic one.

When the underlying paradigms of functional *versus* organic food are analyzed, they seem to reflect the different visions of the *European Knowledge-Based Bio-Economy* [12]. Whereas functional food, being part of the dominant industrial life science vision, connects food quality with decomposability, organic food connects food production with integral product integrity. Allaire and Wolf [48] identified these divergent socio-technical paradigms as a re-arrangement of food constituents *versus* a holistic quality view recognizable by consumers. Whereas functional food is focused on product related attributes represented by single constituents or functions, organic food also takes sustainability of the process of production into account.

5. Conclusions

Based on this review of recent literature we conclude that the concept of functional food does not support organic food production in Europe. Based on consumer behavior and the organic regulation, it seems full of contradictions. Although organic and functional foods can be grouped together with respect to the naturally increased levels of health related compounds, such as PUFAs and polyphenols, there will hardly be any health claims possible, as we discussed, with respect to the experimental design and recent decisions of the Commission. When food ingredients are added or changed in organic foods, it should be done within the frame of the European organic regulation, which is very strict. Only a few food additives are permitted so far and health related compounds such as bioactive compounds, antioxidants, *etc.* are not included (with the exception of vitamin C for specific purposes). Organic food may lose its "natural" image for consumers if producers follow the technological approach of re-designing food, as is done for functional foods. From their viewpoint, organic food derived from nature by a naturally sound agricultural system already contains all substances needed for human health and respects the health of the environment and society along the food chain. A key challenge for scientific research in both areas is the identification and validation of relevant indicators and parameters for the process (only organic) and product aspect (organic as well as functional) [10]. Furthermore, food seems to be the fundamental unit in nutrition and not only single constituents [49]. Health studies testing the effect of functional as well as organic food need approaches that reflect the dynamic reaction of a very complex system [50].

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References

1. The Nielsen Company. Organics and functional foods: A global Nielsen consumer report. Technical Report. Available online: http://pt.nielsen.com/documents/tr_0710_OrganicsFood.pdf (accessed on 3 July 2012).
2. Council Regulation (EC) No 834/2007. Available online: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:189:0001:0023:EN:PDF> (accessed on 3 July 2012).
3. *Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods* (GL 32-1999); Codex Alimentarius: Rome, Italy, 2010; Adopted 1999, Revisions 2001, 2003, 2004 and 2007, Amendments 2008, 2009 and 2010.
4. Kaur, S.; Das, M. Functional foods: An overview. *Food Sci. Biotechnol.* **2011**, *20*, 861–875.
5. Roberfroid, M.B. What is beneficial for health? The concept of functional food. *Food Chem. Toxicol.* **1999**, *37*, 1039–1041.
6. Janssen, M.; Hamm, U. Product labelling in the market for organic food: Consumers preferences and willingness-to-pay for different organic certification logos. *Food Qual. Pref.* **2012**, *25*, 9–22.
7. Bech-Larsen, T.; Scholderer, J. Functional foods in Europe: Consumer research, market experiences and regulatory aspects. *Food Sci. Technol.* **2007**, *18*, 231–234.
8. Eden, S. Food labels as boundary objects: How consumers make sense of organic and functional foods. *Public Underst. Sci.* **2011**, *20*, 179–194.
9. Mesias, F.J.; Martinez-Carrasco, F.; Martinez, J.M.; Gaspar, P. Functional and organic eggs as an alternative to conventional production: A conjoint analysis of consumer' preferences. *J. Sci. Food Agric.* **2011**, *91*, 532–538.
10. Kahl, J.; Baars, T.; Bügel, S.; Busscher, N.; Huber, M.; Kusche, D.; Rembialkowska, E.; Schmid, O.; Seidel, K.; Taupier-Letage, B.; Velimirov, A.; Zalecka, A. Organic food quality: A framework for concept, definition and evaluation from the European perspective. *J. Sci. Food Agric.* **2012**, doi:10.1002/jsfa.5640.
11. Diplock, A.T.; Aggett, P.J.; Ashwell, M.; Bornet, F.; Fern, E.B.; Roberfroid, M.B. Scientific concepts of functional foods in Europe: Consensus document. *Brit. J. Nutr.* **1999**, *81*, 1–27.
12. Levidow, L.; Birch, K.; Papaioannou, T. Divergent paradigms of European Agro-Food Innovation: The Knowledge-Based Bio-Economy (KBBE) as an R&D agenda. *Sci. Technol. Human Values* **2012**, doi:10.1177/0162243912438143.
13. Sahota, A. Global Organic Food & Drink Market. Available online: <http://www.fibl.org/fileadmin/documents/en/news/2011/sahota-2011-biofach-market.pdf> (accessed on 3 July 2012).
14. OSEC Website. Available online: http://www.sippo.ch/internet/osec/en/home/import/publications/food.-ContentSlot-98296-ItemList-61735-File.File.pdf/SIPPO_Manual_18.04.2011_final.pdf (accessed on 3 July 2012).

15. Kriwy, P.; Mecking, R.-A. Health and environmental consciousness, costs of behaviour and the purchase of organic food. *Int. J. Consumer Stud.* **2012**, *36*, 30–37.
16. Pino, G.; Peluso, A.M.; Guido, G. Determinants of regular and occasional consumers' intentions to buy organic food. *J. Consumer Aff.* **2012**, *46*, 157–169.
17. Zagata, L. Consumers' beliefs and behavioural intentions towards organic food. Evidence from the Czech Republic. *Appetite* **2012**, *59*, 81–89.
18. Torjusen, H.; Sangstad, L.; O'Doherty-Jensen, K.; Kjaernes, U. *European Consumers' Conceptions of Organic Food: A Review of Available Research*; Project Report 4-2004 for National Institute for Consumer Research: Oslo, Norway, 2004.
19. Mondelaers, K.; Aertsens, J.; van Huylenbroeck, G. A meta-analysis of the differences in environmental impacts between organic and conventional farming. *Brit. Food J.* **2009**, *111*, 1098–1119.
20. Gomiero, T.; Paoletti, M.G.; Pimentel, D. Energy and environmental issues in organic and conventional agriculture. *Crit. Rev. Plant Sci.* **2008**, *27*, 239–254.
21. Wood, R.; Lenzen, M.; Dey, C.; Lundie, S. A comparative study of some environmental impacts of conventional and organic farming in Australia. *Agric. Syst.* **2006**, *89*, 324–348.
22. Cederberg, C.; Mattsson, B. Life cycle assessment of milk production—A comparison of conventional and organic farming. *J. Clean. Prod.* **2000**, *8*, 49–60.
23. Lairon, D. Nutritional quality and safety of organic food: A review. *Agron. Sustain. Dev.* **2010**, *30*, 33–41.
24. Baker, P.B.; Benbrook, C.M.; Groth, E., III; Benbrook, L. Pesticide residues in conventional, integrated pest management (IPM)-grown and organic foods: Insights from three US data sets. *Food Addit. Contam.* **2002**, *19*, 427–446.
25. Kouba, M. Quality of organic animal products. *Livest. Prod. Sci.* **2003**, *80*, 33–40.
26. Dangour, A.D.; Dodhia, S.K.; Hayter, A.; Allen, E.; Lock, K.; Uauy, R. Nutritional quality of organic foods: A systematic review. *Am. J. Clin. Nutr.* **2009**, *90*, 680–685.
27. Palupi, E.; Jayanegara, A.; Ploeger, A.; Kahl, J. Comparison of nutritional quality between conventional and organic dairy products: A meta-analysis. *J. Sci. Food Agric.* **2012**, doi:10.1002/jsfa.5639.
28. Brandt, K.; Leifert, C.; Sanderson, R.; Seal, C.J. Agroecosystem management and nutritional quality of plant foods: The case of organic fruits and vegetables. *Crit. Rev. Plant Sci.* **2011**, *30*, 177–197.
29. Hollman, P.C.H.; Cassidy, A.; Comte, B.; Heinonen, M.; Richelle, M.; Richling, E.; Serafini, M.; Scalbert, A.; Sies, H.; Vidry, S. The biological relevance of direct antioxidant effects of polyphenols for cardiovascular health in human is not established. *J. Nutr.* **2011**, *141*, 989–1009.
30. Hoefkens, C.; Sioen, I.; Baert, K.; de Meulenaer, B.; de Henauw, S.; Vandekinderen, I.; Devlieghere, F.; Opsomer, A.; Verbeke, W.; van Camp, J. Consuming organic versus conventional vegetables: The effect on nutrient and contaminant intakes. *Food Chem. Toxicol.* **2010**, *48*, 3058–3066.

31. Erdman, J.W., Jr.; Ford, N.A.; Lindshield, B.L. Are the health attributes of lycopene related to IST antioxidants function? *Archiv. Biochem. Biophys.* **2009**, *483*, 229–235.
32. *IFOAM Basic Standards*; International Federation of Organic Agriculture Movements: Bonn, Germany, 2008.
33. Food Standards Agency. Current EU approved additives and their E numbers. Available online: <http://www.food.gov.uk/safereating/additivesbranch/enumberlist> (accessed on 3 July 2012).
34. EU Web site. Available online: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:250:0001:0084:EN:PDF> (accessed on 3 July 2012).
35. Kahl, J.; van den Burgt, G.-J.; Kusche, D.; Bügel, S.; Busscher, N.; Hallmann, E.; Kretschmar, U.; Ploeger, A.; Rembialkowska, E.; Huber, M. Organic food claims in Europe. *Food Technol.* **2010**, *3*, 38–46.
36. Hjelmar, U. Consumers' purchase of organic food products: A matter of convenience and reflexive practices. *Appetite* **2011**, *56*, 336–344.
37. Hughner, R.S.; McDonagh, P.; Prothero, A.; Shultz, C.J., II; Stanton, J. Who are organic consumers? A compilation and review of why people purchase organic food. *J. Consumer Behav.* **2007**, *6*, 94–110.
38. Dean, M.; Lampila, P.; Shepherd, R.; Arvola, A.; Saba, A.; Vassallo, M.; Claupein, E.; Winkelmann, M.; Lähteenmäki, L. Perceived relevance and foods with health-related claims. *Food Qual. Pref.* **2012**, *24*, 129–135.
39. EU Web site. Available online: <http://ec.europa.eu/nuhclaims/> (accessed on 3 July 2012).
40. Sahidi, F. Nutraceuticals and functional foods: Whole *versus* processed foods. *Trends Food Sci. Technol.* **2009**, *20*, 376–387.
41. Janssen, M.; Hamm, U. The mandatory EU logo for organic food: Consumer perceptions. *Brit. Food J.* **2012**, *114*, 335–352.
42. Stolz, H.; Stolze, M.; Janssen, M.; Hamm, U. Preferences and determinants for organic, conventional and conventional-plus products—The case of occasional organic consumers. *Food Qual. Pref.* **2011**, *22*, 772–779.
43. Markosyan, A.; McCluskey, J.J.; Wahl, T.I. Consumer response to information about a functional food product: Apples enriched with antioxidants. *Can. J. Agric. Econ.* **2009**, *52*, 325–341.
44. Verbeke, W.; Scholderer, J.; Lähteenmäki, L. Consumer appeal of nutrition and health claims in three existing product concepts. *Appetite* **2009**, *52*, 584–692.
45. Van Kleef, E.; van Trijp, H.C.M.; Luning, P. Functional foods: Health claim-food product compatibility and the impact of health claim framing on consumer evaluation. *Appetite* **2005**, *44*, 299–308.
46. Szakaly, Z.; Szente, V.; Köver, G.; Polereczik, Z.; Szigeti, O. The influence of lifestyle on health behaviour and preference for functional food. *Appetite* **2012**, *58*, 406–413.
47. Padel, S.; Foster, C. Exploring the gap between attitudes and behaviour: Understanding why consumers buy or do not buy organic food. *Brit. Food J.* **2005**, *107*, 606–625.
48. Allaire, G.; Wolf, S.A. Cognitive representations and institutional hybridity in Agrofood Innovation. *Sci. Technol. Human Values* **2004**, *29*, 431–458.
49. Jacobs, D.R.; Tapsell, L.C. Food, not nutrients, is the fundamental unit in nutrition. *Nutr. Rev.* **2007**, *65*, 439–450.

50. Huber, M.; Knottnerus, J.A.; Green, L.; van der Horst, H.; Jadad, A.R.; Kromhout, D. How should we define health? *Brit. Med. J.* **2011**, doi: <http://dx.doi.org/10.1136/bmj.d4163>.

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