beverages

MDPI

Short Note

Organic vs. Conventional Milk: Some Considerations on Fat-Soluble Vitamins and Iodine Content

Pamela Manzi * and **Alessandra Durazzo**

Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria—Centro di ricerca Alimenti e Nutrizione (CREA-AN), Via Ardeatina 546, 00178 Roma, Italy; alessandra.durazzo@crea.gov.it

* Correspondence: pamela.manzi@crea.gov.it; Tel.: +39-065-149-4499; Fax: +39-065-149-550

Academic Editor: Edgar Chambers IV
Received: 30 May 2017; Accepted: 27 July 2017; Published: 1 August 2017

Abstract: The organic food market is considerably expanding all over the world, and the related dairy market represents its third most important sector. The reason lies in the fact that consumers tend to associate organic dairy products with positive perceptions: organic milk is eco- and animal-friendly, is not produced with antibiotics or hormones, and according to general opinion, provides additional nutrients and beneficial properties. These factors justify its higher cost. These are the reasons that explain extensive research into the comparison of the differences in the amount of chemical compounds between organic and conventional milk. However, it is not simple to ascertain the potential advantage of organic food from the nutritional point of view, because this aspect should be determined within the context of the total diet. Thus, considering all the factors described above, the purpose of this work is to compare the amount of selected nutrients (i.e., iodine and the fat-soluble vitamins such as alfa-tocopherol and beta-carotene) in organic and conventional milk, expressed as the percentage of recommended daily intakes in one serving. In detail, in order to establish the real share of these biologically active compounds to the total diet, their percent contribution was calculated using the Dietary Reference Values for adults (both men and women) adopted by the European Food Safety Authority. According to these preliminary considerations, the higher cost of organic milk can mainly be explained by the high costs of the management of specific farms and no remarkable or substantial benefits in human health can be ascribed to the consumption of organic milk. In this respect, this paper wants to make a small contribution to the estimation of the potential value and nutritional health benefits of organic food, even though further studies are needed.

Keywords: organic milk; conventional milk; dietary assessment; chemical components

1. Introduction

Over the last decade, the organic market has broadly expanded [1]. The main world leaders in organic food are North America and Europe, and according to the projections, these food items will grow by 40% in the next decade [2]. In addition to the market of organic fruit and vegetables, the sectors of organic milk and meat have also developed extensively over the last decade. Sales of organic milk increased between 2006 and 2013 (with Germany and France leading the growth), and in the UK, organic milk consumption increased (by about 3%) in 2016, while the intake of conventional milk decreased (by about −1.9%) during the same period [3].

Consumers usually associate organic farming methods with ecological practices; i.e., attention to biodiversity, soil quality, and animal welfare, as well as low levels of pesticide residues. However, such techniques are expensive. Consequently, the final products have higher costs, which remain as the main barrier to purchase [4]. Generally, consumers have a positive perception of organic milk because—according to them—it is environmentally- and animal-friendly, it is not produced using antibiotics or hormones, and it is conceived as a source of additional nutrients or beneficial properties.

All these factors justify its higher cost. Nevertheless, the role of the cost of these products in the purchase decision is still a matter of debate.

As mentioned above, one of the reasons why the demand for organic food is now prevalent is the attention to environmental and animal welfare. In particular, it has been observed that local breeds of animals can adapt to the local environment and are more resistant to many diseases, even if organic farming does not protect dairy cows from mastitis [5,6]. In the study of Mueller et al. [7], the potential beneficial impacts of some organic dairy farms on the environment are analysed and compared, considering several environmental impact categories (such as energy consumption, climate impact, land demand, conservation of soil fertility, biodiversity, animal welfare, and milk quality). According to the results of this study, low-input farming had positive effects on animal welfare and milk quality. However, one of the main complications affecting organic farming concerns milk yield. Most studies available today [8–10] highlight that organic milk yield per animal is, on average, lower (by about 20%) than the yield derived from conventional milk.

In this context, this work has been developed to compare the amount of selected nutrients—i.e., fat-soluble vitamins (alfa-tocopherol and beta-carotene) and iodine—in organic and conventional milk, expressed as the percentage of recommended daily intakes in one serving. In detail, the percent contribution of these biologically active compounds both in organic and in conventional milk was calculated using the Dietary Reference Values for adults (men and women) adopted by the European Food Safety Authority, in order to establish the real contribution of the different compounds to the total diet.

2. Organic vs. Conventional Milk: Focus on Fat Fraction and Mineral Content

Many studies about the different concentrations of chemical compounds in organic and conventional milk have been conducted over the last years. Some authors [11] have highlighted how important it is that all factors influencing milk composition (with the exception of the farming system—organic vs. conventional) should be identical in research that evaluates the differences between organic and conventional milk.

The papers on milk proteins and carbohydrates are often contradictory [11], several studies agree on the fatty acid composition, because its proportion easily varies in milk along with changes in diet. Capuano et al. [12] showed some differences in the profiles of fatty acid and triglycerides s in three different kinds of milk: organic, conventional, and milk coming from grazing cows (at least 120 days per year and at least 6 h per day, labelled as "weidemelk"). The results of this study confirmed the presence of significant differences in the profile of fat components between conventional and organic milk. Moreover, according to the authors [12], the fatty acid profile can be used—to a certain extent—to certify organic milk to be sold.

From a nutritional point of view, according to some studies, organic milk contains less omega-6 fatty acids and more omega-3 fatty acids than conventional milk [13,14]. In detail, organic milk shows higher amounts of alpha-linolenic acid, eicosapentaenoic acid, and docosapentaenoic acid than conventional milk, even if some seasonal variability can occur. Likewise, some authors [15] observed similar results in conventional and organic milk produced in Poland. The authors [15] found higher contents of polyunsaturated and omega-3 fatty acids in organic milk than in conventional samples.

Among the fat components of milk, conjugated linoleic acid (CLA)—positional and geometric isomers of linoleic acid—have been the most studied compounds over the last years. CLAs are characterized by conjugated double bonds located at positions 8 and 10, 9 and 11, 10 and 12, or 11 and 13. In milk, the most abundant isomer is *cis*-9,*trans*-11 (rumenic acid, 75–90% of total CLAs). Numerous biological effects have been reported for CLAs: rumenic acid mainly has an anticarcinogenic property, while *trans*-10,*cis*-12 isomer is able to reduce body fat and influence blood lipids [16,17].

As reported by several papers, organic milk has a fatty acid profile richer in alpha-linolenic acid and isomers of conjugated linoleic acid [13,18] than milk from conventional farms. This difference can probably be attributed to the composition of dairy diets (grazing-based diets), with special reference to the different amounts of fresh forage and concentrates that are consumed. Milk from ruminants that are pasture-fed contains more *cis*-9,*trans*-11-CLA than milk from ruminants fed indoors, although some variations may occur depending on several factors: the diet, the individual parameters of cows, the stage of lactation, the feeding system, or the seasonal effects [19–22]. According to Butler et al. [13], CLA (as C18:2 *cis*-9,*trans*-11) present in milk from conventional (high-input) and organic (low-input) dairy production systems varies from 8.8 to 14.1 $g \cdot kg^{-1}$ milk fat, respectively, during the outdoor fresh forage-based feeding period. However, this difference is reduced (from 6.2 to 7.8 $g \cdot kg^{-1}$ milk fat) during the indoor (conserved forage-based) feeding period.

After investigating the fatty acid composition and the fat-soluble vitamin contents in organic and conventional Italian dairy products, some authors [23] concluded that among the several parameters, the *cis*-9,*trans*-11 C18:2 (CLA conjugated linoleic acids)/linolenic acid (LA) ratio value characterized better fat in organic than in conventional milk. In addition, this ratio can be used as a marker for the identification of organic dairy products.

It is interesting to mention the meta-analysis of Palupi et al. [24], which summarizes the results of 29 studies on milk fat. According to this study [24], organic dairy products contain greater amounts of ALA (alpha-linolenic acid), omega-3 fatty acid, *cis*-9, *trans*-11 conjugated linoleic acid, *trans*-11 vaccenic acid, eicosapentaenoic acid, and docosapentaenoic acid than conventional types. The same authors also observed that the former have significantly higher quantities of omega-3 to omega-6 ratio and Δ9-desaturase index than the latter. Likewise, the recent meta-analyses of [25], based on 170 published studies, confirmed that organic milk contains higher n-3 polyunsaturated fatty acids (PUFAs) and conjugated linoleic acid.

Some authors [14] studied omega-6/omega-3 ratios in the U.S. National Organic Program on fatty acids in order to verify the differences in the fatty acid content between organic and conventional milk. In this study [14], this ratio was higher in conventional (5.8) than in organic milk (2.3). Today, Western dietary patterns are characterized by a large quantity of omega-6 with a very high ratio of omega-6/omega-3 (15:1 or 20:1) instead of 1:1 [26], and the reduction of this ratio provides benefits to human health.

Concerning fat-soluble vitamin contents, a previous work by Manzi et al. [27] monitored the nutritional composition of milk obtained from four types of farming: (1) intensive farming with silage; (2) intensive farming with hay concentrate; (3) intensive farming with limited integration of hay concentrate; (4) only pasture. The amount of alpha-tocopherol and beta-carotene reached the highest value in Type 4 farming; a similar performance was detected in the Degree of Antioxidant Protection (DAP) index, calculated as a molar ratio between antioxidant compounds and an oxidation target [28].

A reworking of data by Manzi et al. [27] is reported in Figure 1. The principal component analysis (PCA) performed on analytical data concerning fat-soluble compounds of milk samples derived from four types of farming allowed to identify a partial separation between types 1-2-3 and type 4 (Principal Component 1: 47.6%; Principal Component 2: 27.6%). The loading analysis on the main components made it possible to identify the contribution of the original variables (that is, the analytical determinations that have been carried out) to the model of the principal components with special reference to alpha-tocopherol, beta-carotene, and DAP.

On this subject, it is worth mentioning a similar result described in a recent work of Puppel et al. [29], who applied the same index (DAP) to determine the nutritional value of milk produced in Poland during the indoor feeding season, the pasture feeding season, and the pasture feeding season with added corn grain. The results of Puppel et al. [29] proved that the content of fat-soluble vitamins (vitamin E, A, and beta-carotene) showed the highest values in milk from cows fed with pasture and pasture with added corn grain: as a result, the DAP index and the total antioxidant status (TAS) values were highest in these milks. Likewise, some authors [13,30] verified that concentrations of fat-soluble vitamins (alpha-tocopherol and carotenoids) were considerably higher in milk from low-input farming systems than in milk from high-input systems.

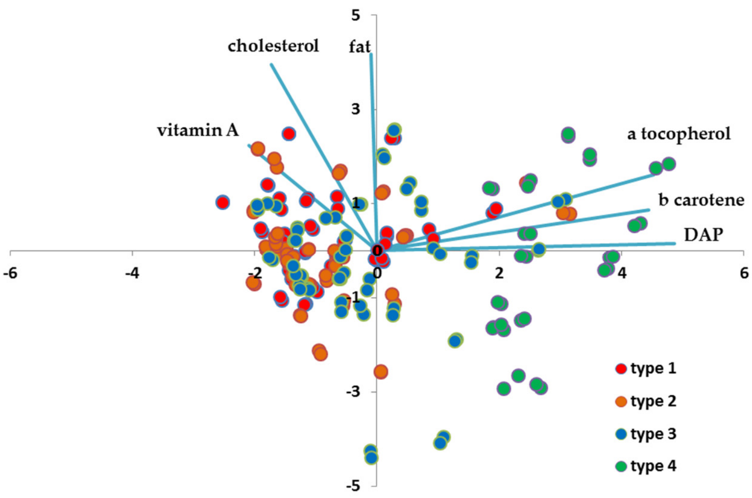

Figure 1. Principal component analysis (PCA) of milk samples from four types of farming: (1) intensive farming with silage; (2) intensive farming with hay concentrate; (3) intensive with limited integration of hay concentrate; (4) only pasture (modified from [27]). DAP: Degree of Antioxidant Protection index.

Generally, milk is considered to be the main source of minerals [31] in human nourishment. Therefore, a focus on the mineral content in organic milk is necessary. Whereas in conventional milk minerals come from concentrate feeds, in organic milk they derive mainly from soil—in particular, from the different pastures. This is a difference that explains why organic milk can display trace elements deficiencies. However, the study of Średnicka-Tober et al. [25] showed that the concentration of the main minerals (such as Ca, Mg, P, and K) does not vary substantially between organic and conventional milk, because the difference due to the farm management is relatively low [32]. Nevertheless, conventional milk showed higher concentrations of iodine and selenium than organic milk.

Among all minerals, iodine concentrations should particularly be monitored: human beings need to absorb trace elements from food, but their diets very often lack these substances. This is also the case for iodine. Iodine is essential for the synthesis of thyroid hormones, and its deficiency leads to hypothyroidism (goitre), irreversible brain damage, or mental retardation. Milk and dairy foods are among the main dietary sources [33] of iodine. The iodine content of milk is influenced by many factors: the contents of iodine in forages, the goitrogens in animal feeds (plants belonging to the cruciferous family or soybean, beet pulp, millet, linseed, etc.), the farm management (organic or conventional).

Concerning iodine contents, it has been observed that in organic milk they are present in concentrations of about 30–40% lower than in conventional milk [34,35]. In this regard, it is worth mentioning the study of Rey-Crespo et al. [36] on essential trace elements and some heavy metal residues in organic and conventional milk carried out in Spain, 2013. This study showed how some minerals (e.g., copper, zinc, iodine, and selenium) are higher in conventional milk than in organic milk because of their presence in the concentrate feeds [36].

3. Nutritional Evaluation of Organic Milk in the Diet: Some Considerations on Fat-Soluble Vitamins and Iodine

Generally, as highlighted by Givens and Lovegrove [37], it is important to evaluate the different nutritional values of organic and conventional milk in the context of the total diet; the same authors have reported that the supply of milk fatty acids in organic systems compared to conventional ones is extremely low when examined in the context of total diets. On the basis of data obtained from the meta-analysis of Średnicka-Tober et al. [25], they [37] calculated the real amount of PUFA in the context of the whole diet, and estimated that the percent variation between conventional and organic milk was 0.44 for polyunsaturated fatty acids, −0.04 for omega-6 fatty acids, and 1.86 for omega-3 fatty acids.

Taking into account the considerations above, in this work, the percent contribution of some active compounds (alpha-tocopherol and beta-carotene) and iodine content from one serving (125 g, according to the Italian dietary guidelines [38]) in both organic milk and conventional milk was calculated using the Dietary Reference Values adopted by the European Food Safety Authority (EFSA).

In order to perform the dietary assessment, the fat-soluble vitamin contents of organic and conventional milk obtained from two different studies [27,39] were considered. For the purpose of these works, organic milk was collected during spring and summer seasons from Apulian dairy farms (a region of southern Italy) [27], while different brands of conventional milk were collected from Italian grocery stores and supermarkets [39].

In Figure 2, the results of the real percent contribution of one serving to the requirement of vitamin E and beta-carotene (data from [27,39] for organic and conventional milk, respectively) are shown.

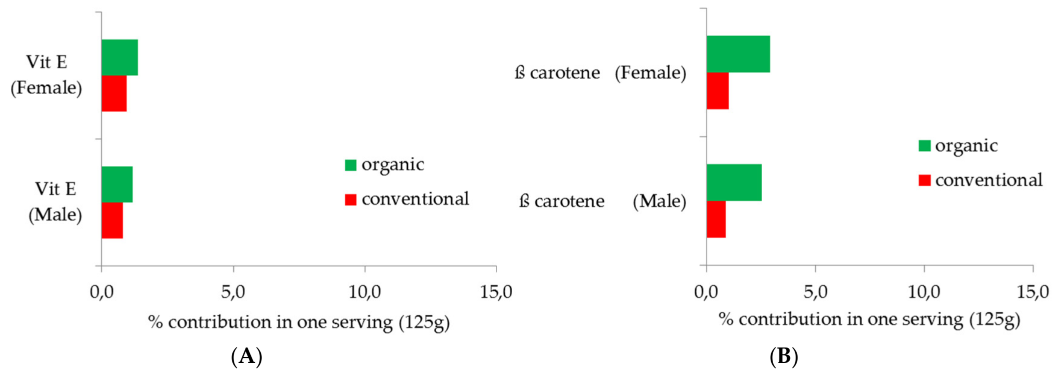

Figure 2. (**A**) Percent contribution in one serving (125 g) of milk to Adequate Intake for vitamin E; (**B**) Percent contribution of beta-carotene to the Population Reference Intake for vitamin A (data from [27,39] were used to achieve the estimate).

In particular, according to EFSA, the Population Reference Intakes (PRIs) for vitamin A are 750 µg RE/day for men and 650 µg RE/day for women [40]. Hence, the difference between organic and conventional milk concerning the contribution of beta-carotene to vitamin A for the recommended daily requirement was not consistent, even though there is a significant dissimilarity ($p < 0.05$) between organic and conventional milk (both in males and females).

According to the EFSA [41], the panel of experts deemed an Adequate Intake of vitamin E (as alpha-tocopherol) in healthy populations to be 13 mg/day for men and 11 mg/day for women. As a result, the differences between organic and conventional milk ($p < 0.05$) concerning the percent contribution of vitamin E for one serving were negligible but significant both in males and females, as reported in Figure 2.

Finally, the evaluation of the percent contribution of iodine in one serving (125 g) was considered. To obtain this information, the Population Reference Intake (150 µg/day for adults from 18 to >75 aged) of EFSA Panel was adopted [42].

The iodine content was obtained from two different studies [34,36]. For the study of Bath et al. [34], both conventional and organic milk was collected from supermarkets in the UK; while, for the study of Rey-Crespo et al. [36], organic milk was collected from dairy farms and conventional milk was collected both from dairy farms and supermarkets in Northern Spain. The percent coverage of iodine for one serving obtained from these researches [34,36] is reported in Figure 3. The results showed that the percent coverage of iodine was lower in organic (6.3% [36] and 12.7% [34]) than in conventional milk (17.1% [36] and 21.4% [34]).

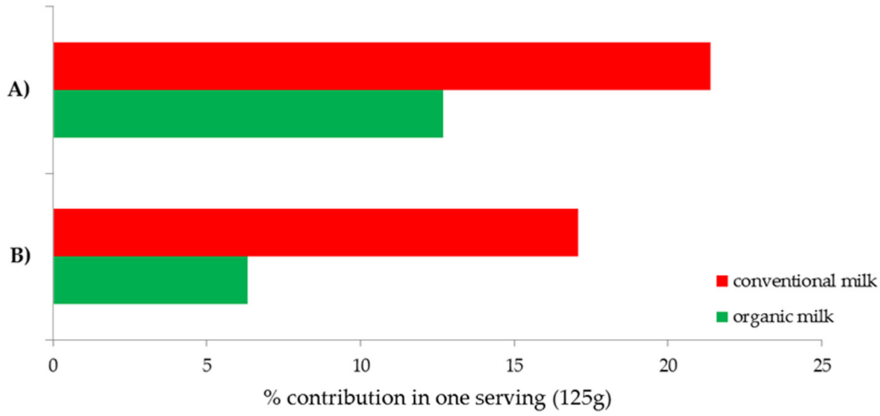

Figure 3. Percent contribution in one serving (125 g) to Population Reference Intake for iodine. (**A**) Data from [34] and (**B**) data from [36] were respectively used to achieve the estimate.

This work has concentrated on fat-soluble vitamins and iodine for two main reasons: 1. there are many studies in the literature concerning these molecules present in conventional and organic milk; 2. fat-soluble vitamins and iodine represent two examples of how organic and conventional milk provide different amounts of certain nutritious substances.

Concerning fat-soluble vitamins, it is important to note that dairy products are not the main source of vitamin E (present in large amounts in vegetable oils such as olive oil and oil seeds), while they are considered a good source of vitamin A. In particular, these fat-soluble vitamins present in organic milk are positively correlated with the animal feed, and the highest concentrations are found in grass, legumes, and other green plants [30,43]. Hence, as highlighted by many studies, organic milk is richer in alpha tocopherol and beta carotene (only present in cow's milk) than conventional milk. It seems necessary to assess whether a higher content of these molecules could somehow bring a considerable benefit to human health [44]. From these preliminary data for fat-soluble vitamins reported in this study and obtained from this nutritional evaluation, no clear indication emerges for recommending organic milk.

At the same time, regarding iodine, the evaluation of its nutritional contribution shows that organic milk cannot provide a satisfactory daily intake. Several factors influence the iodine content of cow's milk, such as the level of iodine supplements in feed, some iodine antagonists (such as glucosinolates) in the feed, or the farm management. The frequent practice of using mineral mixtures containing iodine in conventional farming is one of the reasons for the higher iodine content in conventional milk [45].

Iodine is a central element in human nutrition. It is essential in the regulation of thyroid hormones for cellular metabolism, as well as for the normal growth and development of the body. In this perspective, milk provides significant supplies of this chemical element. These considerations are not intended to convey the idea that the consumption of organic milk is ineffectual—they may motivate farmers to improve their products and the composition of animal feeds. They represent a suggestion to help choose a correct farming system design and maintain a high standard in animal welfare, in order to increase beneficial effects for human beings.

4. Conclusions

Nowadays, consumers are much more attentive to food quality and safety, and they are aware that organic food could meet these needs while restricting the usage of antibiotics and hormones. Hence, researchers' attention should focus on how the consumption of organic food brings benefits to human health.

Establishing whether there is a potential nutritional superiority of organic food is not simple, and there are increasing numbers of reviews available on this subject [46,47]. However, it is not simple to conduct epidemiological or intervention studies, because individuals that consume organic foods and dairy products usually have different lifestyles that should be taken into consideration in the definition of these kinds of researches. As recently reported by some authors [48], there are no long-term cohort studies or controlled dietary intervention studies comparing the effects of diets based on organic or conventional food. In this context, the higher cost of organic milk can be justified only by the high cost of the management of these farms.

Moreover, it is worthwhile mentioning that, according to some authors [49], organic farming practices generally have positive impacts on the environment. However, this consideration should not be generalized, because there is a wide and varied range of organic and conventional farms [49].

From a nutritional point of view, according to these preliminary results, no remarkable or substantial benefits to human health can be ascribed to the consumption of organic milk. In this respect, this paper aims to make a small contribution to the estimation of the potential value and nutritional health benefits of organic food, even though further studies are needed. Within this context, this study wants to point out that for an appropriate approach to the nutritional exploitation of organic milk, the evaluation of the real contribution of the different compounds of organic food to the diet should represent the first step.

Acknowledgments: This work was undertaken within the project QUALIFU, financed by the Italian Ministry of Agriculture, Food and Forestry. The authors thank Annalisa Lista for linguistic revision and editing of the manuscript.

Author Contributions: All authors contributed equally to this work: Pamela Manzi has contributed towards data collection, drafting and compiling of the manuscript; Alessandra Durazzo has critically reviewed the manuscript for its accuracy and completeness. All authors read and approved the final manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Willer, H.; Yussefi, M.; Sorensen, N. *The World of Organic Agriculture: Statistics and Emerging Trends*; IFOAM: Bonn, Germany; FiBL: Frick, Switzerland, 2009.
2. Costa, S.; Zepeda, L.; Sirieix, L. Exploring the social value of organic food: A qualitative study in france. *Int. J. Consum. Stud.* **2014**, *38*, 228–237. [CrossRef]
3. Organic Milk Market Report 2017. Available online: http://www.omsco.co.uk/marketreport (accessed on 24 July 2017).
4. Hughner, R.S.; McDonagh, P.; Prothero, A.; Shultz, C.J.; Stanton, J. Who are organic food consumers? A compilation and review of why people purchase organic food. *J. Consum. Behav.* **2007**, *6*, 94–110. [CrossRef]
5. Rosati, A.; Aumaitre, A. Organic dairy farming in europe. *Livest. Prod. Sci.* **2004**, *90*, 41–51. [CrossRef]
6. Bani, P.; Sandrucci, A. Yield and quality of milk produced according to the organic standards. *Sci. Tec. Latt.-Casearia* **2003**, *54*, 267–286.
7. Mueller, C.; de Baan, L.; Koellner, T. Comparing direct land use impacts on biodiversity of conventional and organic milk—Based on a swedish case study. *Int. J. Life Cycle Assess.* **2014**, *19*, 52–68. [CrossRef]
8. Sundberg, T.; Berglund, B.; Rydhmer, L.; Strandberg, E. Fertility, somatic cell count and milk production in swedish organic and conventional dairy herds. *Livest. Sci.* **2009**, *126*, 176–182. [CrossRef]
9. Müller-Lindenlauf, M.; Deittert, C.; Köpke, U. Assessment of environmental effects, animal welfare and milk quality among organic dairy farms. *Livest. Sci.* **2010**, *128*, 140–148. [CrossRef]
10. Stiglbauer, K.E.; Cicconi-Hogan, K.M.; Richert, R.; Schukken, Y.H.; Ruegg, P.L.; Gamroth, M. Assessment of herd management on organic and conventional dairy farms in the united states. *J. Dairy Sci.* **2013**, *96*, 1290–1300. [CrossRef] [PubMed]
11. Schwendel, B.H.; Wester, T.J.; Morel, P.C.; Tavendale, M.H.; Deadman, C.; Shadbolt, N.M.; Otter, D.E. Invited review: Organic and conventionally produced milk-an evaluation of factors influencing milk composition. *J. Dairy Sci.* **2015**, *98*, 721–746. [CrossRef] [PubMed]

12. Capuano, E.; Gravink, R.; Boerrigter-Eenling, R.; van Ruth, S.M. Fatty acid and triglycerides profiling of retail organic, conventional and pasture milk: Implications for health and authenticity. *Int. Dairy J.* **2015**, *42*, 58–63. [CrossRef]
13. Butler, G.; Nielsen, J.H.; Slots, T.; Seal, C.; Eyre, M.D.; Sanderson, R.; Leifert, C. Fatty acid and fat-soluble antioxidant concentrations in milk from high- and low-input conventional and organic systems: Seasonal variation. *J. Sci. Food Agric.* **2008**, *88*, 1431–1441. [CrossRef]
14. Benbrook, C.M.; Butler, G.; Latif, M.A.; Leifert, C.; Davis, D.R. Organic production enhances milk nutritional quality by shifting fatty acid composition: A united states-wide, 18-month study. *PLoS ONE* **2013**, *8*, e82429. [CrossRef] [PubMed]
15. Popovic-Vranjes, A.; Savic, M.; Pejanovic, R.; Jovanovic, S.; Krajinovic, G. The effect of organic milk production on certain milk quality parameters. *Acta Vet.* **2011**, *61*, 415–421. [CrossRef]
16. Kelley, N.S.; Hubbard, N.E.; Erickson, K.L. Conjugated linoleic acid isomers and cancer. *J. Nutr.* **2007**, *137*, 2599–2607. [PubMed]
17. Churruca, I.; Fernández-Quintela, A.; Portillo, M.P. Conjugated linoleic acid isomers: Differences in metabolism and biological effects. *BioFactors* **2009**, *35*, 105–111. [CrossRef] [PubMed]
18. Butler, G.; Nielsen, J.H.; Larsen, M.K.; Rehberger, B.; Stergiadis, S.; Canever, A.; Leifert, C. The effects of dairy management and processing on quality characteristics of milk and dairy products. *NJAS Wagening. J. Life Sci.* **2011**, *58*, 97–102. [CrossRef]
19. Kelsey, J.; Corl, B.A.; Collier, R.J.; Bauman, D.E. The effect of breed, parity, and stage of lactation on conjugated linoleic acid (CLA) in milk fat from dairy cows. *J. Dairy Sci.* **2003**, *86*, 2588–2597. [CrossRef]
20. Elgersma, A.; Tamminga, S.; Ellen, G. Modifying milk composition through forage. *Anim. Feed Sci. Technol.* **2006**, *131*, 207–225. [CrossRef]
21. Collomb, M.; Schmid, A.; Sieber, R.; Wechsler, D.; Ryhänen, E.-L. Conjugated linoleic acids in milk fat: Variation and physiological effects. *Int. Dairy J.* **2006**, *16*, 1347–1361. [CrossRef]
22. Butler, G.; Collomb, M.; Rehberger, B.; Sanderson, R.; Eyre, M.; Leifert, C. Conjugated linoleic acid isomer concentrations in milk from high- and low-input management dairy systems. *J. Sci. Food Agric.* **2009**, *89*, 697–705. [CrossRef]
23. Bergamo, P.; Fedele, E.; Iannibelli, L.; Marzillo, G. Fat-soluble vitamin contents and fatty acid composition in organic and conventional italian dairy products. *Food Chem.* **2003**, *82*, 625–631. [CrossRef]
24. 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**, *92*, 2774–2781. [CrossRef] [PubMed]
25. Srednicka-Tober, D.; Baranski, M.; Seal, C.J.; Sanderson, R.; Benbrook, C.; Steinshamn, H.; Gromadzka-Ostrowska, J.; Rembialkowska, E.; Skwarlo-Sonta, K.; Eyre, M.; et al. Higher pufa and *n*-3 pufa, conjugated linoleic acid, alpha-tocopherol and iron, but lower iodine and selenium concentrations in organic milk: A systematic literature review and meta- and redundancy analyses. *Br. J. Nutr.* **2016**, *115*, 1043–1060. [CrossRef] [PubMed]
26. Simopoulos, A.P. The importance of the ratio of omega-6/omega-3 essential fatty acids. *Biomed. Pharmacother.* **2002**, *56*, 365–379. [CrossRef]
27. Manzi, P.; Pizzoferrato, L.; Rubino, R.; Pizzillo, M. Valutazione di composti della frazione insaponificabile del latte vaccino proveniente da diversi tipi di allevamento. In *Atti del 10° Congresso Italiano di Scienza e Tecnologia Degli Alimenti*; Porretta, S., Ed.; Chiriotti: Pinerolo, Italy, 2012; pp. 482–486.
28. Pizzoferrato, L.; Manzi, P.; Marconi, S.; Fedele, V.; Claps, S.; Rubino, R. Degree of antioxidant protection: A parameter to trace the origin and quality of goat's milk and cheese. *J. Dairy Sci.* **2007**, *90*, 4569–4574. [CrossRef] [PubMed]
29. Puppel, K.; Sakowski, T.; Kuczynska, B.; Grodkowski, G.; Golebiewski, M.; Barszczewski, J.; Wrobel, B.; Budzinski, A.; Kapusta, A.; Balcerak, M. Degrees of antioxidant protection: A 2-year study of the bioactive properties of organic milk in poland. *J. Food Sci.* **2017**, *82*, 523–528. [CrossRef] [PubMed]
30. Mogensen, L.; Kristensen, T.; Søegaard, K.; Jensen, S.K.; Sehested, J. Alfa-tocopherol and beta-carotene in roughages and milk in organic dairy herds. *Livest. Sci.* **2012**, *145*, 44–54. [CrossRef]
31. Cashman, K.D. Milk minerals (including trace elements) and bone health. *Int. Dairy J.* **2006**, *16*, 1389–1398. [CrossRef]

32. Poulsen, N.A.; Rybicka, I.; Poulsen, H.D.; Larsen, L.B.; Andersen, K.K.; Larsen, M.K. Seasonal variation in content of riboflavin and major minerals in bulk milk from three danish dairies. *Int. Dairy J.* **2015**, *42*, 6–11. [CrossRef]
33. Chambers, L. Iodine in milk—Implications for nutrition? *Nutr. Bull.* **2015**, *40*, 199–202. [CrossRef]
34. Bath, S.C.; Button, S.; Rayman, M.P. Iodine concentration of organic and conventional milk: Implications for iodine intake. *Br. J. Nutr.* **2012**, *107*, 935–940. [CrossRef] [PubMed]
35. Payling, L.M.; Juniper, D.T.; Drake, C.; Rymer, C.; Givens, D.I. Effect of milk type and processing on iodine concentration of organic and conventional winter milk at retail: Implications for nutrition. *Food Chem.* **2015**, *178*, 327–330. [CrossRef] [PubMed]
36. Rey-Crespo, F.; Miranda, M.; López-Alonso, M. Essential trace and toxic element concentrations in organic and conventional milk in nw spain. *Food Chem. Toxicol.* **2013**, *55*, 513–518. [CrossRef] [PubMed]
37. Givens, D.I.; Lovegrove, J.A. Invited commentary: Higher pufa and *n*-3 pufa, conjugated linoleic acid, alpha-tocopherol and iron, but lower iodine and selenium concentrations in organic milk: A systematic literature review and meta- and redundancy analyses. *Br. J. Nutr.* **2016**, *116*, 1–2. [CrossRef] [PubMed]
38. SINU Società Italiana di Nutrizione Umana. *Larn-Livelli di Assunzione di Riferimento di Nutrienti ed Enregia per la Popolazione Italiana*; SICS: Milan, Italy, 2014.
39. Manzi, P.; di Costanzo, M.G.; Mattera, M. Updating nutritional data and evaluation of technological parameters of italian milk. *Foods* **2013**, *2*, 254–273. [CrossRef] [PubMed]
40. EFSA Panel on Dietetic Products, Nutrition and Allergie. Scientific opinion on dietary reference values for vitamin A. *EFSA J.* **2015**, *13*, 4028. [CrossRef]
41. EFSA Panel on Dietetic Products, Nutrition and Allergie. Scientific opinion on dietary reference values for vitamin E as α-tocopherol. *EFSA J.* **2015**, *13*, 4149. [CrossRef]
42. EFSA Panel on Dietetic Products, Nutrition and Allergie. Scientific opinion on dietary reference values for iodine. *EFSA J.* **2014**, *12*, 3660. [CrossRef]
43. Agabriel, C.; Cornu, A.; Journal, C.; Sibra, C.; Grolier, P.; Martin, B. Tanker milk variability according to farm feeding practices: Vitamins A and E, carotenoids, color, and terpenoids. *J. Dairy Sci.* **2007**, *90*, 4884–4896. [CrossRef] [PubMed]
44. Fiedor, J.; Burda, K. Potential role of carotenoids as antioxidants in human health and disease. *Nutrients* **2014**, *6*, 466–488. [CrossRef] [PubMed]
45. Flachowsky, G.; Franke, K.; Meyer, U.; Leiterer, M.; Schöne, F. Influencing factors on iodine content of cow milk. *Eur. J. Nutr.* **2014**, *53*, 351–365. [CrossRef] [PubMed]
46. Jensen, M. Comparison between conventional and organic agriculture in terms of nutritional quality of food—A critical review. *CAB Rev.* **2013**, *8*, 1–13. [CrossRef]
47. Huber, M.; Rembiałkowska, E.; Średnicka, D.; Bügel, S.; van de Vijver, L.P.L. Organic food and impact on human health: Assessing the status quo and prospects of research. *NJAS Wagening. J. Life Sci.* **2011**, *58*, 103–109. [CrossRef]
48. Baranski, M.; Rempelos, L.; Iversen, P.O.; Leifert, C. Effects of organic food consumption on human health; the jury is still out! *Food Nutr. Res.* **2017**, *61*, 1287333. [CrossRef] [PubMed]
49. Tuomisto, H.L.; Hodge, I.D.; Riordan, P.; Macdonald, D.W. Does organic farming reduce environmental impacts?—A meta-analysis of european research. *J. Environ. Manag.* **2012**, *112*, 309–320. [CrossRef] [PubMed]