Organic Food and Health: A Systematic Review

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Abstract

The current knowledge regarding effects of organic food on health is unclear. In this study we have focused to yield a consolidated knowledge on health related aspects of organic food. We searched for the MeSH term “organic food” in Pubmed search engine (other terms used for search are: Organic food-18296 articles, organic food and health-4018 articles). Studies done on organic food, related to health, free full papers available in English were included for review. From the total of 2,215 articles, 1805 were excluded due to studies which were not related to organic food, studies without abstracts. Of remaining 410 studies, 338 studies were excluded due to non-availability of full studies. Finally, 32 studies were selected after removal of articles not related to health. Out of 38 studies included, 9 studies focused on humans, in which 3 studies showed decreased pesticide content, 6 studies showed decreased risk of pre-eclampsia, hypospadias, cardiovascular diseases, etc. 14 studies focused on nutritional quality which showed increased lutein, PUFA and n-3 PUFA, antioxidants, analgesic and anti-inflammatory properties, etc. A total 9 studies focused on microbiological aspects which showed increased prevalence of microbial contamination, increased antibiotic susceptibility, etc. From the available studies, the effect of organic food on health is not convincing enough to recommend widely. More follow-up studies on humans, with large sample size might possibly enlighten the concept of organic food and its effect on health in future.

Keywords: Organic food; Health; Nutrition; Systematic review

Introduction

Malnutrition was one of the biggest problems faced by the world in 19th century. About 991 million people in the world did not have enough food to lead a healthy active life resulting in 5 million deaths per year in fewer than five populations. This problem of undernutrition was controlled with the help of green revolution, which led to increased Campylobacter levels are found in certain organic foods and meat varieties, which are injurious to health [14,15]. Some studies claim that there are no significant nutritional differences between organic and conventional foods [16]. The current knowledge regarding the effects of organic food on health is not clear. Therefore, a systematic review of the available literature was planned to yield a consolidated knowledge on health related aspects of organic food.

Methodology

We searched for the MeSH term ”organic food” in PubMed database from the time period of 1961 to 2016. Studies done on organic food, related to health, free full papers available in English were included in this study. From the total of 2215 articles, 1805 studies were excluded due to unavailable abstracts, not related to organic food and 410 studies were selected. From the 410 studies, 338 studies were excluded due to unavailability of free full texts and 72 full studies were selected. From the 72 full studies, 40 studies were excluded due to studies on production and detection of organic food, opinion based studies and other language studies. Thus, 32 full studies were selected for final review. Among the 32 studies selected, 9 studies were done on human regarding health aspects, 9 studies were done on microbiological aspects of organic food and 14 studies were done on quality related...
aspects of organic food. The above description is schematically represented in Figures 1 and 2.

Figure 1: Schematic representation of selection of studies based on “organic food”.

Figure 2: Classification of selected studies done on organic food.

Results

Results of this review have been discussed in three heads (Human health aspects, microbiological aspects, quality aspects of food) based on focus of the studies.

Studies done on human health aspects

Out of total 32 studies included in the review, 9 studies focused on health aspects of humans.

- Three studies showed decreased pesticide exposure by organic food consumption [17-19].
- Three studies were done on pregnant women,
  
  a. Torjusen et al. showed increased levels of nutrients such as folate, beta-carotene and vitamin C, and lower density of sodium [20],
  
  b. Torjusen et al. in another study showed decreased incidence of pre-eclampsia [10] and
  
  c. LiseBrantsæter et al. showed decreased incidence of hypospadias in male newborns [9]

- Three studies were focused on various aspects of health,
  
  a. Goncalves et al. showed, consumption of organic grape juice improved glucose homeostasis, antioxidant capacity, and microvascular function, which may be due to its high concentration of polyphenols [21],
  
  b. Bradbury et al. showed that, little or no decrease in the incidence of cancer associated with consumption of organic food, except possibly for non-Hodgkin lymphoma [22].
  
  c. Whittaker et al. showed that, decreased levels of circulating cardiovascular risk factors like total cholesterol, low density lipoprotein (LDL) cholesterol, Reactive oxygen species (ROS), lipoperoxidation of circulating monocytes and lymphocytes and Tumor necrosis factor–alpha (TNF-α) [23].

The above results are depicted systematically in Table 1.
Bradbury et al. 623080 middle aged women Disease Outcome UK, 2014 There was little or no decrease in the incidence of cancer, except possibly for non-Hodgkin lymphoma (RR=0.79, 95% CI: 0.65–0.96).

Whittaker et al. 22 ACS patients (9 Females; 13 Males). Disease Outcome Italy, 2015 Circulating cardiovascular risk factors, including lipid parameters, and markers of both oxidative stress and inflammatory status, were reduced (Total cholesterol (~6.8%), low-density lipoprotein cholesterol (LDL-C) (~8.1%) glucose (~8%) and insulin (~24.6%).

Table 2: Studies done on microbiological aspects.

Studies done on microbiological aspects

Out of total 32 studies included in the review, 9 studies focused on microbiological aspects of organic food.

• Three studies were done on prevalence of infection in organic food. They showed, same prevalence of salmonella in organic and conventional pigs [24] same prevalence of enterobacteriaceae in both organic and conventional chicken [25] and increased prevalence of Campylobacter in organic turkey farms [26].

• Andreas Hofmann et al reported that colonization potential is strongly depending on the plant species under consideration [27].

• Two studies were focussed on antimicrobial susceptibility among which, Bombyk et al. showed increased antimicrobial susceptibility of Staphylococcus in organic dairy farms [28]. Reinstein et al. showed no difference in antimicrobial susceptibility among organic and naturally raised beef cattle [29].

• Three studies focussed on contamination of organic foods among which, Loncarevic et al. reported occasional contamination of organic lettuce with E.coli and L. monocytogenes [30] while Walk et al. studies reported the pathogenic invasion of organic vegetables was dependent upon the usage of organic fertilizers, the bacterial inoculation dose and the plant species which varied widely [31]. Khalil et al. showed that potential fecal contamination of E.coli in both organic and conventional leafy greens in varied concentrations [32].

The above results are depicted systematically in the Table 2.

Table 1: Studies done on human health aspects.

Studies done on quality aspects

Out of total 32 studies included in the review, 14 studies focused on quality of organic food.

• Among these, three studies on crops showed possibility of introducing arsenic contamination in organic food [33], and other
studies showed increased antioxidants [34], lutein content [35], and decreased levels of cadmium, pesticide exposure [34].

- Three studies were done on milk which showed increased PUFA, conjugated linoleic acid (cis-9, trans-11), α-linolenic acid, α-tocopherol, iron and lower levels of iodine and selenium in organic milk [36-38].

- Three studies were done on vegetables, of which one showed increased carotenoids and vitamin C, second showed a healthy impact of pre-processed organic carrots on baby food and the third showed no quality differences between organic and conventional vegetables [39-41].

- Two studies were done on egg which showed increased serum lutein [42], anti-inflammatory and analgesic effects of oil produced from egg yolk [43].

- Reganold et al. focused on fruits, which showed increased quality of fruits when cultivated on organic farms [44].

- Średnicka-Tober et al. focused on meat, which showed decreased content of Saturated Fatty Acids (SFA) and Mono Unsaturated Fatty Acids (MUFA), increased content of Poly Unsaturated Fatty Acids (PUFA) and n-3 PUFAs when compared with conventional meat [45].

- Chhabra et al. focused on the health effects of organic food consumption which was demonstrated with a fruit fly (which is a convenient model system to experimentally test potential health effects of dietary components), which showed greater fertility and longevity [46].

The above results are depicted systematically in the Table 3.
The health effects of increased consumption of pesticides include increased prevalence of Non-Hodgkin's lymphoma, certain birth defects, multiple myeloma, low birth weight, etc. Certain studies reported anti-atherosclerotic properties for organic food. Torjusen et al. showed that consumption of organic food reduced the risk of pre-eclampsia in pregnant women [20]. Oken et al. showed that dietary intake of n-3 fatty acids reduced the risk of pre-eclampsia and hypospadias in the offspring, reported increased levels of n-3 fatty acids in organic food, which might indirectly relate to the reduced risk of pre-eclampsia after consumption of organic food [47]. Brantsæter et al. reported that organic food consumption reduced the prevalence of hypospadias [21]. Kort et al. in their study showed that there is association between dietary pattern of pregnant women and hypospadias [48]. Christensen et al. showed that there is association between hypospadias in the offspring and the mother not choosing the organic diet, and having a high intake of nonorganic butter and cheese [48].

Organic foods contain decreased content of pesticides and fertilizers. Lu et al., Cynthia et al., Bradman et al. in their studies showed that consumption of organic food reduces the risk of pesticide exposure which might indirectly relate to the decreased risk of ill effects due to the pesticide exposure, presence of which in conventional food was found to be high [17-19]. Biological plausibility for good health due to organic food is convincing. But its effectiveness in reality is yet to be proved. The evidence available till date on beneficial effects of organic food on health is not convincing enough to recommend it in a large scale. None of the studies looked into dose response relationship of the effects.

Studies done on microbiological aspects of organic food showed increase prevalence of microorganisms and increased susceptibility to antibiotics. The problem of antibiotic resistance in crops can be reduced greatly with usage of organic food. Many studies have shown that infections on organic food can be reduced with washing and maintenance of cleanliness.

Studies done on quality aspects of organic food samples showed that besides absence of pesticides and fertilizers, organic food is superior to conventional food in various parameters such as increased antioxidants, presence of healthy fatty acids etc. Flies raised on diets made from organically grown products had greater fertility and longevity.

Before recommending organic food in large scale we have to consider the following factors such as decreased production, increased pest attack etc. without the use of fertilizers and pesticides. The decreased production of food will have a negative impact both economically and adversely on health triggering the diseases related to malnutrition. The appearance of conventional food is better than organic food. Increasing price of food with organic tag and false labeling of organic food are next hurdles in implementation of organic food in large scale. So, we recommend more follow up studies on humans exploring different health aspects of organic food and further solid evidence can be generated for implementation in large scale.

**Limitation**

The articles are selected only from PubMed database and are not screened by any quality guidelines. But, considering the fact that PubMed database is a standard database, consisting of standard, peer-reviewed studies, the articles included in this study cannot be underestimated for their quality. Only free full texts are included in this study.

**Conclusion**

The current knowledge of health impact on organic food based on the available research studies is still primitive and not convincing enough to recommend organic food for the community. Before implementing organic food on a large scale apart from health aspects, other factors like economic, social, cultural factors, sensory attributes, food safety, and environmental friendly, nutritional factors have to be considered.

**Recommendations**

We recommend more follow up studies in humans on different health aspects of organic food thereby generating evidence will help in better understanding the benefits of organic food.

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