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Letter to the Editor

Should we recommend organic crop foods on the basis of health benefits? Letter to the editor regarding the article by Barański *et al.*

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I would like to point out several concerns that I have after reading the article 'Higher antioxidant and lower cadmium…' by Barański *et al.*[1], which lead to an alternative interpretation of the results presented by the authors. Previous studies[2,3] have shown that the nutritional content of organic crops is similar to that produced conventionally. Also, reports from consumer associations and national agencies have led to similar conclusions[4–6], the most recent one being reported by the Norwegian Scientific Committee for Food Safety[7]. The current report from Barański *et al.*[1] apparently leads to a different conclusion, namely that 'organic crops, on average, have higher concentrations of antioxidants, lower concentrations of Cd and a lower incidence of pesticide residues'. The authors explain this difference in the outcome of their study on the basis of differences in the methodology used, the inclusion criteria and the use of information published in the last 4–5 years. However, the inclusion criteria used in the article by Barański *et al.*[1] raise several concerns. The authors explain that the literature search was done between January 1992 (when the organic farming regulation was introduced in the European Union (EU)) and December 2011. However, the authors also consider some studies published before 1992 (including some published as far back as 1977), when regulatory legislation was not yet implemented. In addition, their analysis includes many studies from Eastern Europe, mainly from Poland (thirty-two studies) and the Czech Republic (sixteen studies). It must be noted that the EU organic production legislation was established in those territories in 2004. The organic farming regulations that apply in EU countries, and which is used as a reference in this study, may differ greatly from regulations implemented in the USA or Canada. For instance, the US regulations allow the use of antibiotics such as streptomycin in organic agriculture, while in Canada and Europe, their use is prohibited. In other countries included in this study, such as the Dominican Republic, there is no organic production legislation.

Therefore, before this date, the term 'organic' could include practices not allowed today, with a significant change in the method of production and pesticide use, which could significantly bias the results. The underlying problem is that the authors have considered the organic system of production as something universal, which it is not. Therefore, in their meta-analysis, they have classified crops produced by very different means together in the organic group. It would have been more accurate to perform the statistical treatment using the studies carried out under the same regulations, such as separating data obtained from studies carried out in the EU, USA and Canada, as well as in countries that do not have regulations in place.

Another aspect to be considered is that the authors state in the text that 'organic and conventional crop production may differ significantly in crop rotation designs and fertilisations and crop protection protocols as well as in the type of crop varieties used'. This statement could be misleading because the term 'organic' refers to the method of production and cultivation, but not to the crop itself. The same crop could be cultivated following the organic or the conventional system. The only limitation affecting the variety is the use of GM crops, which is forbidden for organic production in most of the regulations. However, given that in Europe there is only one GM variety in commercial use (MON810), this is unlikely to have a significant impact on the analysis of the results.

Assuming the validity of the statistical analysis presented in the report, even with the problem of considering all of the indicated studies as 'organic', which they may or may not be, the main conclusion of the paper is that there is an increase in antioxidant concentrations in organically grown crops. In the abstract, the authors state that 'Many of these compounds have previously been linked to a reduced risk of chronic disease including CVD and neurodegenerative diseases and certain cancers in dietary intervention and epidemiological studies'. This view is a matter for debate given that the role of antioxidants in health cannot be treated as a general phenomenon and must be evaluated case by case[8,9]. In fact, it has been shown that antioxidant intake could be detrimental for some cancer patients[10]. The authors suggest that 'a switch from conventional to organic crop consumption may have impacts similar to those of an increase in the intake of foods with high antioxidant/(poly)phenolic contents'; however, they also mention that 'the currently available data do not allow clear trends with respect to health markers and outcomes to be identified'. A recent large prospective study seems to support the previous data from Dangour *et al.*[2] and Smith-Spangler *et al.*[3], indicating that there is little or no decrease in the incidence of cancer associated with organic food consumption, with only weakly supporting evidence found in the

case of non-Hodgkin lymphoma[11]. Moreover, in 2010, the United States Department of Agriculture[12] recommended the withdrawal of oxygen radical absorbance capacity as a marker of antioxidant status of food, which was one of the parameters considered in the study of Barański *et al.*[1], because of increasing evidence that this marker is biologically invalid.

Another concern is that the authors state that their findings suggest that 'the consumption of organic foods is likely to reduce exposure to pesticide residues'. The authors cite the study of Smith-Spangler *et al.*[3], which they previously criticised in the text for its methodology[1], so the use of this report to substantiate this claim is contradictory. The other studies cited are, on the one hand, a non-peer review report by the organic centre[13], devoted to the promotion of organic consumption, and on the other hand, the study by Curl *et al.*[14] published in 2003, which is a local study carried out in the Seattle area. Thus, the authors fail to cite convincing evidence supporting this claim. In fact, the European Food Safety Authority published a report in 2013 stating that there is no evidence that pesticides used in agriculture are causing any health issues in Europe due to the fact that the levels are well below the established limits in almost all cases[15]. It is also surprising the way the authors interpret and present their own results. For example, the authors state that there is a slightly lower concentration of both proteins and amino acids in organic food. However, according to Fig. 3, this 'slight' decrease is similar, or even more pronounced than the increase in antioxidants. Moreover, it must be taken into account that antioxidant biodisponibility and absorption is very poor. In fact, one of the papers cited in the study explains that antioxidants can be found in plants at concentrations in the low μM to mM range, but that their presence in plasma after dietary intake rarely exceeds nM concentrations[16]. This implies that a 25% increase in many of the antioxidants considered in Fig. 3 would mean a change in the plasma levels between three to six orders of magnitude less, thus being negligible in most of the cases. In contrast, a decrease in amino acid content could be relevant, especially in strict vegetarian or vegan diets, where the supply of essential amino acids could be compromised[17].

In conclusion, after reading the paper of Barański *et al.*[1], it is not clear whether the observed changes in nutritional content are significant or whether they are the result of using the selection criteria that group together the crops produced under different organic regulations. Even if the results are indeed significant, there is no evidence to indicate that the observed increase in antioxidant content and the decrease in pesticide residues would have a significant impact on health. More importantly, the observed decrease in protein and amino acid content could be deleterious for some consumers (i.e. vegans). If we also consider that organic production is associated with an increase in price due to reduced productivity[18], which concomitantly increases the environmental impact[19], there is no scientific evidence to support organic food consumption as a dietary recommendation, and, therefore, switching to consuming organic foods, as the authors suggest, is not likely to have any positive impact on individual health status and should therefore be reconsidered.

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British Journal of Nutrition