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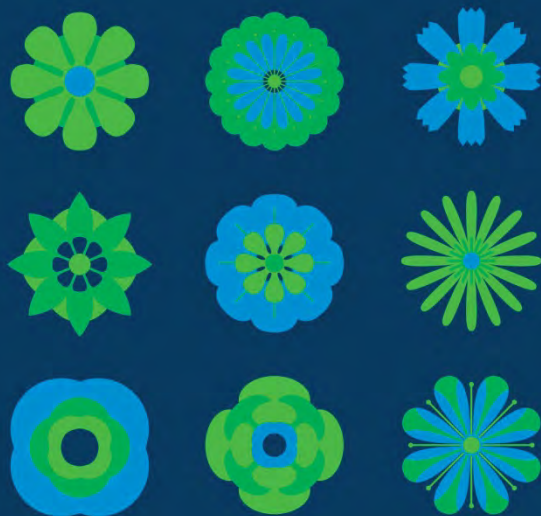
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What science says about organics



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# OP Pesticides in Children's Diet: The Effects of a Organic Diet

Conventional agricultural insects in vegetable crops surprise that foods contain pesticide residues. Exposures amount data are lacking, and levels in children's Atlanta characterize conventionally grown organophosphorus (OP) pesticides in children's bodies [EHP].

According to a 1997 study, *Pesticides in the Diet of Children's Exposures* (EHP), children's exposure to pesticides through diet is a significant health risk to children. Children consume more pesticides than adults, and consequently have higher blood levels of pesticides than adults.

The researchers found that children aged 3 to 11 years who switched to an organic diet during the study period. For their regular conventional diet, they substituted organic items (including fresh fruits, and grain-based products) and resumed their conventional diet.



**No beef here.** A study found that a conventional/organic diet can reduce pesticide exposure in children.

## Neurobehavioral Effects of Pesticides in Children

Raul Harari,<sup>1</sup> Joanne L. Kohn,<sup>2</sup> and Philippe Grandjean<sup>3</sup>

<sup>1</sup>Corporación para el Desarrollo de la Salud, Santiago, Chile; <sup>2</sup>Harvard School of Public Health, Boston, MA; <sup>3</sup>National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

**BACKGROUND:** The neurobehavioral effects of pesticides are unclear, but a previous study suggested that they may be related to the development of the nervous system.

**OBJECTIVES:** In this study, we carried out a case-control study of children aged 6–8 years of age.

**METHODS:** We examined the association between prenatal exposure to pesticides and the development of the nervous system.

**RESULTS:** Of 84 eligible children, 41 had been exposed to pesticides in utero. The results showed that children exposed to pesticides in utero had a higher risk of neurobehavioral problems.

**CONCLUSIONS:** The results suggest that prenatal exposure to pesticides may be a risk factor for neurobehavioral problems in children.

**KEY WORDS:** acetylcholinesterase, occupational exposure, pesticides, neurobehavioral effects, children.

During prenatal development, the fetus is particularly vulnerable to environmental agents (Andersen et al. 2006). Upon appropriate stimulation, growth, and malnutrition, can result in developmental delays (CDC 2006). The complex developmental processes that are involved in the development of the nervous system are not fully understood, but there is little doubt that the functional integrity of the nervous system is essential for the development of the individual (Porta 2000; Rice and Barone 2000). Nutritional deficiencies that affect the development of the nervous system can lead to developmental delays (Walker et al. 2007).

Acetylcholine is a neurotransmitter substance that plays a key role in the transmission of nerve impulses (Slorin 2004). In rodents, suggest that the use of pesticides during pregnancy can lead to developmental delays in children.

## Association of In Utero Pesticide Exposure with Global DNA Methylation

Keon-Yeop Kim,<sup>1</sup> David R. Jacobs, Jr., and Philippe Grandjean<sup>2</sup>

<sup>1</sup>Department of Preventive Medicine and Pathology, University of Medicine and Dentistry, Newark, NJ; <sup>2</sup>Harvard School of Public Health, Boston, MA

**BACKGROUND:** Global DNA methylation levels of persistent pesticides are unclear, but a previous study suggested that they may be related to the development of the nervous system.

**OBJECTIVES:** This study was carried out to investigate the association between prenatal exposure to pesticides and global DNA methylation.

**METHODS:** The amount of cytosine (5-mC) in DNA, organochlorine pesticides (OCPs), and organophosphorus pesticides (OPPs) were measured in cord blood samples.

**RESULTS:** Most OCPs and OPPs showed a positive correlation with global DNA methylation.

**CONCLUSIONS:** These results suggest that prenatal exposure to pesticides may be a risk factor for global DNA methylation.

**KEY WORDS:** epigenetics, prenatal exposure, pesticides, global DNA methylation, children.

Recent cross-sectional studies have shown that serum concentrations of organic pollutants (POPs) are associated with a variety of obesity-related diseases (Faria et al. 2009). In the U.S., general population dose exposure to POPs (Porta 2006b, 2007). In particular, the association between obesity and POPs became stronger as the dose of POPs increased, but not when type 2 diabetes was taken into account (Porta 2006b, 2007). Even though the mechanisms are largely unknown, the association between POPs and obesity has been suggested as a key mechanism in the development of the individual (Porta 2000; Rice and Barone 2000). Nutritional deficiencies that affect the development of the nervous system can lead to developmental delays (Walker et al. 2007).

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## Association of In Utero Pesticide Exposure with Global DNA Methylation

Jennifer Dantas Ferreira,<sup>1</sup> and the Brazilian Collaborators

<sup>1</sup>Environment and Public Health, Rio de Janeiro, Brazil; <sup>2</sup>Department of Preventive Medicine and Pathology, University of Medicine and Dentistry, Newark, NJ

**BACKGROUND:** An association between prenatal exposure to pesticides and global DNA methylation levels has been suggested.

**OBJECTIVES:** We investigated the association between prenatal exposure to pesticides and global DNA methylation.

**METHODS:** A hospital-based case-control study of children aged 6–8 years of age.

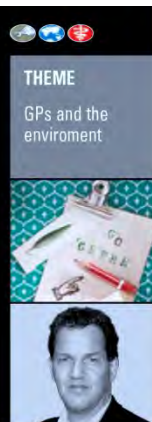
**RESULTS:** Associations with global DNA methylation were observed for organochlorine pesticides (OCPs) and organophosphorus pesticides (OPPs).

**CONCLUSIONS:** These results suggest that prenatal exposure to pesticides may be a risk factor for global DNA methylation.

**KEY WORDS:** child development, pesticides, global DNA methylation, children.

Pesticide exposure is a public health problem worldwide. In Brazil, a study of children aged 6–8 years found that 19% of them had been exposed to pesticides in utero (Faria et al. 2009). In the U.S., general population dose exposure to POPs (Porta 2006b, 2007). In particular, the association between obesity and POPs became stronger as the dose of POPs increased, but not when type 2 diabetes was taken into account (Porta 2006b, 2007). Even though the mechanisms are largely unknown, the association between POPs and obesity has been suggested as a key mechanism in the development of the individual (Porta 2000; Rice and Barone 2000). Nutritional deficiencies that affect the development of the nervous system can lead to developmental delays (Walker et al. 2007).

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**THEME**  
GP and the environment

## Dietary Intake and Its Contribution to Longitudinal Organophosphorus Pesticide Exposure in Urban/Suburban Children

Chensheng Lu,<sup>1</sup> Dana B. Barr,<sup>2</sup> Melanie A. Pearson,<sup>1</sup> and Lance A. Waller<sup>3</sup>

<sup>1</sup>Department of Environmental and Occupational Health, Rollins School of Public Health, Emory University, Atlanta, Georgia, USA; <sup>2</sup>National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, Georgia, USA; <sup>3</sup>Department of Biostatistics, Rollins School of Public Health, Emory University, Atlanta, Georgia, USA

**BACKGROUND:** The widespread use of organophosphorus (OP) pesticides has led to frequent exposure in adults and children. Because such exposure may cause adverse health effects, particularly in children, the sources and patterns of exposure need to be studied further.

**OBJECTIVES:** We assessed young urban/suburban children's longitudinal exposure to OP pesticides in the Children's Pesticide Exposure Study (CPES) conducted in the greater Seattle, Washington, area, and used a novel study design that allowed us to determine the contribution of dietary intake to the overall OP pesticide exposure.

**METHODS:** Twenty-three children 3–11 years of age who consumed only conventional diets were recruited for this 1-year study conducted in 2003–2004. Children switched to organic diets for 5 consecutive days in the summer and fall sampling seasons. We measured specific urinary metabolites for malathion, chlorpyrifos, and other OP pesticides in urine samples collected twice daily for a period of 7, 12, or 15 consecutive days during each of the four seasons.

**RESULTS:** By substituting organic fresh fruits and vegetables for corresponding conventional food items, the median urinary metabolite concentrations were reduced to nondetectable or close to nondetectable levels for malathion and chlorpyrifos at the end of the 5-day organic diet intervention period in both summer and fall seasons. We also observed a seasonal effect on the OP urinary metabolite concentrations, and this seasonality corresponds to the consumption of fresh produce throughout the year.

**CONCLUSIONS:** The findings from this study demonstrate that dietary intake of OP pesticides represents the major source of exposure in young children.

**KEY WORDS:** children, chlorpyrifos, dietary exposure, longitudinal pesticide exposure, malathion, organic diet, organophosphorus pesticides, urinary biomonitoring. *Environ Health Perspect* 116:537–542 (2008). doi:10.1289/ehp.10912 available via <http://dx.doi.org/> [Online 15 January 2008]

Organophosphorus (OP) pesticides, a group of cholinesterase-inhibiting insecticides, have been widely used both in residential and agricultural environments because of their broad spectrum of insecticidal activity and effectiveness. The widespread use of OP pesticides has led to frequent exposures in adult and child populations through multiple routes (Aprea et al. 2000; Hill et al. 1995; Lu et al. 2001). Infants and young children are often targeted for OP pesticide exposure assessment because of their susceptibility to possible neurologic and neurodevelopmental effects (Eskenazi et al. 2007; Whyatt et al. 2004). Although toxicologic and epidemiologic studies have demonstrated the association between acute and high levels of OP exposures and adverse health effects, the establishment of the relationship between neurologic impairments and repeated low-level OP exposure that does not induce symptoms of acute poisoning in humans is far less concrete (Eskenazi et al. 2007; Rauh et al. 2006; Ruckart et al. 2004). The epidemiologic challenges inherent in exploring linkages between chronic OP pesticide exposures and adverse health outcomes may likely be attributable to the collection of exposure data that are not representative of true exposure. The frequently used one-time or spot measurement of urinary OP pesticide

metabolites reveals only exposures that have occurred within a very short time frame and may provide very little evidence or insight regarding long-term or chronic exposures. Therefore, using spot biomarkers of OP pesticide exposure to examine the link between adverse health outcomes and cumulative OP pesticide exposure is an inadequate approach.

The objective of this article is to present the data assessing young urban/suburban children's longitudinal exposure to OP pesticides in a group of young children participating in the Children's Pesticide Exposure Study (CPES). The results from this study identify not only the predominant source of OP pesticide exposure but also the profile of exposures in children that are vital in formulating the strategies, for both regulatory policy and personal behavior change, in reducing children's exposures to OP pesticides.

### Materials and Methods

**Study design.** CPES was initially conducted in the suburban Seattle, Washington, area from summer 2003 through winter 2004 (CPES-WA) and was later repeated in Atlanta, Georgia, in 2006–2007 (CPES-GA) with the same study protocol. For both study locations, children participated in multiple consecutive-day sampling periods in each of

the four seasons. The data presented here are for the CPES-WA study.

Twenty-three children 3–11 years of age were recruited from two local public elementary schools and a Montessori preschool in the Seattle area. Schools did not provide assistance in recruiting subjects or granting permission to send home children a letter and a fact sheet about the study. Families that were interested in participating in this study then contacted the research group directly. A screening interview was conducted over the phone to determine eligibility, which included child's age, whether the child was currently attending school, and whether the parents or caregivers were willing to assist in collecting specimens. Once a participant was enrolled, an appointment was made to go over the protocol, to train the parents/caregivers on how to collect specimen samples, and to obtain written consent from the parent or caregiver. A questionnaire was also administered during this appointment about household pesticide use, to ascertain nondietary sources of pesticide exposure (University of Washington Human

Address correspondence to C. Lu, Department of Environmental and Occupational Health, Rollins School of Public Health, Emory University, 1365 Clifton Rd., NE, Atlanta, GA 30322 USA. Telephone: (404) 727-2131. Fax: (404) 727-8744. clu2@sphe.emory.edu

We express our sincere appreciation to the children who participated and to their parents who assisted in this study. We thank K. Toepel and P. Sande at the University of Washington for assistance in collecting daily specimen samples. We also thank A. Bishop, P. Restrepo, R. Walker, and D. Walden at the Centers for Disease Control and Prevention (CDC) for their help with sample collection and analysis. We thank C. Holbrook at Emory University for assistance in preparation of this manuscript. We also thank the Mercer Island School District in Mercer Island, WA, for granting our request to circulate study information to their elementary schools for subject recruitment.

This study was supported by the U.S. Environmental Protection Agency (EPA), Science to Achieve (STAR) program (RD-829364).

Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the U.S. EPA or the CDC.

The authors declare they have no financial interests.

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## Childhood Brain Tumor Metabolism Gene

Susan Searles Nielsen,<sup>1</sup> R. and Beth A. Mueller<sup>1,5</sup><sup>1</sup>Public Health Sciences Division, Center/Department of Preventive Medicine, University of Washington, Seattle, Washington; <sup>2</sup>Center for Ecogenetics and Environmental Health, University of Washington, San Francisco, San Francisco, California; <sup>3</sup>University of Washington, Seattle, Washington

**BACKGROUND:** Insecticides that target the acetylcholinesterase (AChE) enzyme are used in childhood brain tumors (CBTs). **METHODS:** We analyzed population-based data from the FMO<sub>3</sub>-9536A, FMO<sub>3</sub>-158K, and FMO<sub>3</sub>-158K birth screening archives for 2010. **RESULTS:** We observed no association between CBT risk and exposure during childhood. **CONCLUSIONS:** Based on known effects of organophosphorus and organochlorine pesticides, the ability to detoxify them may be as important as exposure. **KEY WORDS:** acetylcholinesterase, insecticides, pesticides, (2010). doi:10.1289/ehp.990122

Both environmental exposure and genetic factors are thought to contribute to the development of childhood brain tumor (CBT). Ionizing radiation to the head and heritable syndromes are established risk factors (Fisher et al. 2007). However, for only a small proportion of CBTs. Several epidemiologic studies suggest that pesticides might be associated with CBT (Rivard and Weichenthal 2007; relied on retrospective questionnaire data with little detail. One study that examined type and timing of pesticide exposure found an increased risk of CBT with exposure to flea/tick products, but not to fungicides, or molluscicides (Preston-Martin 1997). The specific finding is interesting because the use of insecticides—organophosphorus, organochlorine (OC), pyrethroid—readily cross the blood–brain barrier and target the nervous system. Because constitutive gene influences insecticide metabolism, we previously examined whether CBT with two single nucleotide po-

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## Abstract

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analysis.

- Study concept and
- Acquisition, analysis,
- Drafting of the manuscript
- Critical revision

Financial disclosures: none

Widely Used Pesticides with Previously Unknown Endocrine Activity  
Revealed as *in Vitro* Antiandrogens

Frances Orton, Erika Rosivatz, Martin Scholze, and Andreas Kortenkamp

Centre for Toxicology, School of Pharmacy, University of London, London, United Kingdom

**BACKGROUND:** Evidence suggests that there is widespread decline in male reproductive health and that antiandrogenic pollutants may play a significant role. There is also a clear disparity between pesticide exposure and data on endocrine disruption, with most of the published literature focused on pesticides that are no longer registered for use in developed countries.

**OBJECTIVE:** We used estimated human exposure data to select pesticides to test for antiandrogenic activity, focusing on highest use pesticides.

**METHODS:** We used European databases to select 134 candidate pesticides based on highest exposure, followed by a filtering step according to known or predicted receptor-mediated antiandrogenic potency, based on a previously published quantitative structure–activity relationship (QSAR) model. In total, 37 pesticides were tested for *in vitro* androgen receptor (AR) antagonism. Of these, 14 were previously reported to be AR antagonists (“active”), 4 were predicted AR antagonists using the QSAR, 6 were predicted to not be AR antagonists (“inactive”), and 13 had unknown activity, which were “out of domain” and therefore could not be classified with the QSAR (“unknown”).

**RESULTS:** All 14 pesticides with previous evidence of AR antagonism were confirmed as antiandrogenic in our assay, and 9 previously untested pesticides were identified as antiandrogenic (dimethomorph, fenhexamid, quinoxifen, cyprodinil,  $\lambda$ -cyhalothrin, pyrimethanil, fludioxonil, azinphos-methyl, pirimiphos-methyl). In addition, we classified 7 compounds as androgenic.

**CONCLUSIONS:** Due to estimated antiandrogenic potency, current use, estimated exposure, and lack of previous data, we strongly recommend that dimethomorph, fludioxonil, fenhexamid, imazalil, ortho-phenylphenol, and pirimiphos-methyl be tested for antiandrogenic effects *in vivo*. The lack of human biomonitoring data for environmentally relevant pesticides presents a barrier to current risk assessment of pesticides on humans.

**KEY WORDS:** antiandrogen, AR-Lux, biomonitoring, endocrine disruption, fungicide. *Environ Health Perspect* 119:794–800 (2011). doi:10.1289/ehp.1002895 [Online 10 February 2011]

Evidence suggests that prenatal and early-life exposure to pesticides may be causative factors in a variety of human disorders. For example, a meta-analysis by Wigle et al. (2009) showed that maternally exposed offspring have increased risk of childhood leukemia [odds ratio = 2.64; 95% confidence interval (CI), 1.4–5].

There are also indications that reproductive abnormalities, expressed as cryptorchidism, hypospadias, and decreased penile length, may be linked to pesticide exposure, most strikingly in maternally exposed boys (Andersen et al. 2008; Damgaard et al. 2006; Rocheleau et al. 2009). This is significant because male fertility is thought to be declining in many countries (Andersson et al. 2008), and perinatal hypospadias/cryptorchidism are risk factors for reduced sperm quality and testicular cancer in adulthood (Skakkebaek et al. 2001). Banned persistent organochlorines [*p,p'*-DDT (1,1,1-trichloro-2-[*o*-chlorophenyl]-2,2-[*p*-chlorophenyl]ethane), *p,p'*-DDE (*p,p'*-1,1-bis-(4-chlorophenyl)-2,2-dichloroethene),  $\beta$ -hexachlorocyclohexane, hexachlorobenzene,  $\alpha$ -endosulfan, *cis*-heptachloroepoxide, oxy-chlordane, dieldrin] were detected in all samples of breast milk in a case–control study of mothers in Denmark and Finland. Also, levels were significantly higher in samples from mothers of sons with cryptorchidism than in

samples from matched controls (1997–2001; Damgaard et al. 2006). Female Danish greenhouse workers exposed to current-use pesticides were more likely to give birth to a son with cryptorchidism than were a random sample of mothers from the Copenhagen area (6.2% and 1.9%). Furthermore, sons of mothers who directly handled treated plants or were engaged in spraying pesticides had significantly smaller penises than did sons of mothers who had noncontact roles in the greenhouse industry (Andersen et al. 2008). Last, in a recent meta-analysis of studies from the United States and Europe, Rocheleau et al. (2009) reported that maternal occupational exposure to pesticides was associated with a 36% increased risk of hypospadias relative to the risk in mothers without exposure (risk ratio = 1.36; 95% CI, 1.04–1.77). The risk of developing cryptorchidism (Pierik et al. 2004) and hypospadias (Brouwers et al. 2007) was also associated with paternal exposures to pesticides, mainly in greenhouses for the production of vegetables and flowers.

The term “testicular dysgenesis syndrome” (TDS) has been proposed to explain the interrelated nature of these abnormalities (Skakkebaek et al. 2001). It is conceivable that estrogenic and/or antiandrogenic contaminants play a role in TDS. Experimental studies with rats have shown that maternal

exposure to flutamide (a pharmaceutical antiandrogen) affects androgen-dependent developmental outcomes such as anogenital distance and nipple retention (McIntyre et al. 2001). However, ethinylestradiol has not been shown to affect these end points (Howdeshell et al. 2008). Furthermore, hormone receptor screening *in vitro* suggests a preponderance of antiandrogenic activity compared with estrogenic activity in nonorganochlorine (current-use) pesticides. For example, Kojima et al. (2004) screened 161 pesticides and reported that 52 were antiandrogenic, whereas only 29 were estrogenic, and Orton et al. (2009) reported that 6 of 12 pesticides screened were antiandrogenic and none were estrogenic. There is a good correlation between androgen receptor (AR) antagonist properties and *in vivo* antiandrogenic effects, and there is also good evidence that androgen-sensitive end points are demasculinized in male rats when exposed *in utero* to a wide range of pesticides. Antiandrogenic effects both *in vitro* and via maternal exposure *in vivo* have been reported in response to the herbicide linuron (Gray et al. 1999; Lambright et al. 2000); the fungicides prochloraz (Vinggaard et al. 2005), procymidone (Osby et al. 1999), tebuconazole (Taxvig et al. 2007), and vinclozolin (Anway et al. 2006; Uzunovic et al. 2004); the organochlorine insecticides DDE (Gray et al. 1999) and endosulfan (Sinha et al. 2001); the organophosphate dimethoate (Verma and Mohanty 2009); and the pyrethroid insecticide deltamethrin (Andrade et al. 2002). However, with the exception of linuron, dimethoate, deltamethrin, and tebuconazole, the pesticides listed above have not been authorized for use in Europe during the past 5 years, which should result in lower occupational, residential, and dietary exposures. Endocrine-relevant

Address correspondence to F. Orton, Centre for Toxicology, School of Pharmacy, University of London, 29/39 Brunswick Square, London, WC1N 1AX UK. Telephone: 02077535811. Fax: 02077535908. E-mail: francesorton@gmail.com

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«Have a **varied**  
and balanced  
diet!»

«Eating a **variety**  
of foods promotes  
good health and  
helps to **reduce**  
the risk of  
disease»

«Have a **varied** and balanced diet!»



«Eating a **variety** of foods promotes good health and helps to reduce the risk of disease»



Is really enough «eating a wide variety of foods»?  
And what's about «healthy food»?



«Eating a wide variety of foods» supports *markets in a balanced way*

«Eating a wide variety of *healty* foods» supports *consumers' wellbeing*

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# BMJ Open Reduced risk of pre-eclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study

Hanne Torjusen,<sup>1,2</sup> Anne L. Leiv S Bakkeiteig,<sup>4</sup> Geir Lie Gerd Holmboe-Ottesen,<sup>10</sup>

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For numbered affiliations see end of article.

**Correspondence to:** Hanne Torjusen; hanne.torjusen@sifo.no

BMJ

## ABSTRACT

**Objective:** Little is known about the effects of eating organic food either in population or during pregnancy. The was to examine associations between consumption during pregnancy and pre-eclampsia among nulliparous Norwegian women.

**Design:** Prospective cohort study.

**Setting:** Norway, years 2002–2008.

**Participants:** 28 192 pregnant women answered food frequency questionnaire health questionnaire in mid-pregnancy information on height, body weight or weight gain).

**Main outcome measure:** Relative as ORs by performing binary logistic pre-eclampsia as the outcome and organic consumption as the exposure.

**Results:** The prevalence of pre-eclampsia sample was 5.3% (n=1491). Women who have eaten organic vegetables 'often' or 'sometimes' (n=2493, 8.8%) had lower risk of pre-eclampsia than those who reported 'never/rarely' or 'seldom' (OR=0.76, 95% CI 0.61 to 0.96; adjusted CI 0.62 to 0.99). The lower risk associated with organic vegetable consumption was even after adjusting for overall dietary quality, assessed on a healthy food pattern derived by principal component analysis. No associations with pre-eclampsia for high intake of organic fruit, cereals or combined index reflecting organic consumption.

**Conclusions:** These results show that consumption of organically grown vegetables during pregnancy is associated with reduced risk of pre-eclampsia. The association between consumption of organic vegetables and use of organic vegetables could be explained by the exposure to secondary plant metabolites and/or the composition of the gut microbiota.

## INTRODUCTION

Pre-eclampsia is one of the most common complications of pregnancy, with maternal and perinatal morbidity and mortality.

## Effects of organic and conventional consumption of bioactive substances in four species of medicinal plants

Renata Kazimierzczak\*, Ewelina Hallman

Organic Foodstuffs Division, Department of Food and Nutrition, Faculty of Human Nutrition and Consumer Science, Warsaw University of Life Sciences, Nowoursynowska 166, 02-787, Warsaw, Poland

(Received 15 November 2013; accepted 14 October 2014)

This paper aimed to compare the content of four species of medicinal plants, rosemary, oregano, thyme and basil, under organic and conventional conditions. The total polyphenol content was determined by Folin-Ciocalteu method. The total flavonoid content was determined by high-performance liquid chromatography (HPLC). The total flavonoid content in conventional plants was significantly higher than in organic plants. A high content of beneficial bioactive compounds coming from organic farming, is an important factor in the choice of medicinal plants.

**Keywords:** carotenoids; medicinal plants; vitamin C

## Introduction

Medicinal plants have been used by humans for centuries, and also in cosmetics and in modern phytotherapy. Modern phytotherapy is based primarily on medicinal plants; therefore, it places great importance on the quality of the raw materials. Medicinal plants should contain the highest possible concentrations of active substances and be free from contaminants. Organic production often meets these requirements better than conventional ones. These plants contain polyphenols, vitamin C and carotenoids, and are free from pesticides (Mølgaard 2001; Brandt et al. 2011; Mølgaard 2011).

Greater abundance of bioactive compounds in organic production has been confirmed in various studies. For example, in potatoes, vegetables and fruits, cereals (Rembiałkowska 2007) reported that organic plants contained higher concentrations of phenolic compounds and minerals (Fe, Mn, Cu, Zn) than conventional plants. Hunter et al. (2011), who showed a high content of bioactive compounds in organic crops was also confirmed by Lai and Vianello (2011). The opposite views are also present in the literature (Mølgaard 2001; Brandt et al. 2011; Mølgaard 2011).

\*Corresponding author. Email: renata\_kazimierzczak@sggw.edu.pl

## Review

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# Comparison of nutritional quality between conventional and organic dairy products: a meta-analysis

Eny Palupi,<sup>a</sup> Anuraga Jayanegara,<sup>b†</sup> Angelika Ploeger<sup>a</sup> and Johannes Kahl<sup>a\*</sup>

## Abstract

As a contribution to the debate on the comparison of nutritional quality between conventional versus organic products, the present study would like to provide new results on this issue specifically on dairy products by integrating the last 3 years' studies using a meta-analysis approach with Hedges' *d* effect size method. The current meta-analysis shows that organic dairy products contain significantly higher protein, ALA, total omega-3 fatty acid, *cis*-9,*trans*-11 conjugated linoleic acid, *trans*-11 vaccenic acid, eicosapentanoic acid, and docosapentanoic acid than those of conventional types, with cumulative effect size ( $\pm 95\%$  confidence interval) of  $0.56 \pm 0.24$ ,  $1.74 \pm 0.16$ ,  $0.84 \pm 0.14$ ,  $0.68 \pm 0.13$ ,  $0.51 \pm 0.16$ ,  $0.42 \pm 0.23$ , and  $0.71 \pm 0.3$ , respectively. It is also observed that organic dairy products have significantly ( $P < 0.001$ ) higher omega-3 to -6 ratio (0.42 vs. 0.23) and  $\Delta 9$ -desaturase index (0.28 vs. 0.27) than the conventional types. The current regulation on organic farming indeed drives organic farms to production of organic dairy products with different nutritional qualities from conventional ones. The differences in feeding regime between conventional and organic dairy production is suspected as the reason behind this evidence. Further identical meta-analysis may be best applicable for summarizing a comparison between conventional and organic foodstuffs for other aspects and food categories. © 2012 Society of Chemical Industry

**Keywords:** nutrition; organic; comparison; dairy products; meta-analysis

## INTRODUCTION

The organic food market is growing and expanding all over the world,<sup>1</sup> and it has been the fastest-growing market in the food sector over the last decade.<sup>2,3</sup> This market was estimated to reach US \$55 billion in 2009.<sup>1</sup> As the third most important commodity after fruits and vegetables within the global organic food market, the organic dairy market is also increasing.<sup>4</sup> This suggests that the market players including consumers are becoming increasingly interested in this sector.

The lack of consumer confidence in conventional products due to issues such as mad cow disease, the dioxin scandal and effects of pesticide and antibiotic use is suspected as one of the driving forces of this trend.<sup>5</sup> Organic Monitor<sup>6</sup> reported that the sales growth of dairy products rose over 30% in some countries in Europe due to the BSE crisis. Apart from that, consumers are becoming more concerned about the health aspects.<sup>7,8</sup> It was shown that health is the second strongest consideration (after hedonism) for consumers in choosing organic dairy products, followed by animal welfare and environmental issues.<sup>2,7,9</sup> Consumers expect better quality in terms of health and nutritional properties from organic labelled products.<sup>10,11</sup>

On the other hand, consumers lack information beyond the food label. Scientific evidence is highly demanded in order to promote consumer confidence in organic foods.<sup>5,10</sup> However, the available evidence is not yet able to fill this lack.<sup>12</sup> There have been contrasting results among individual experiments. Furthermore, the final conclusions of some reviews are contradictory. Some of them inferred that organic products are healthier and have higher nutritional value than conventional ones,<sup>13–16</sup> but others

argued against that.<sup>2,17–19</sup> Although systematic reviews have been conducted on this issue,<sup>17,18</sup> most of them did not apply meta-analysis.<sup>19</sup> Therefore, a valid conclusion from the various studies has not been possible so far.<sup>20</sup>

Therefore, based on the description above, the main objective of this study was to compare the nutritional quality between conventional and organic dairy products. This was conducted by summarizing the related studies for a period from March 2008 to April 2011, which is not covered by the previous reviews<sup>17</sup> (the period from January 1958 to February 2008 was reviewed by Dangour et al.<sup>17</sup>), using a meta-analytical technique. The outcome is expected to provide new, additional scientific references in the organic food quality area.

\* Correspondence to: Johannes Kahl, Department of Organic Food Quality and Food Culture, University of Kassel, Nordbahnhofstrasse 1a, 37213 Wittenhausen, Germany. E-mail: kahl@uni-kassel.de

† Present address: ETH Zurich, Institute of Agricultural Sciences – Animal Nutrition, 8092 Zurich, Switzerland.

<sup>a</sup> Department of Organic Food Quality and Food Culture, University of Kassel, 37213 Wittenhausen, Germany

<sup>b</sup> Department of Animal Nutrition and Feed Technology, Bogor Agricultural University, 16680 Bogor, Indonesia

## Review

## Organic food and impact prospects of research

M. Huber<sup>a,\*</sup>, E. Rembiałkowska<sup>b</sup>

<sup>a</sup> Louis Bolk Institute, Driebergen, The Netherlands  
<sup>b</sup> Warsaw University of Life Sciences, Faculty of Human  
<sup>c</sup> University of Copenhagen, Department of Human Nut

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\* Corresponding author at: Louis Bolk Institute, De  
fax: +31 0 343 515 611.  
E-mail address: m.huber@louisbolk.nl (M. Huber)

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## Organic Foods (Certain Nutrients) and May Provide Consumer

Walter J. Crinnion, ND

## Abstract

The multi-billion dollar organic food industry is based on consumer perception that organic food is higher in nutritional value and fewer toxic chemicals. However, nutrient content in organic foods vary in relation to differences in the ground cover and fertilizer use in farming operation. Nutrient content also varies from farmer to farmer and year to year. However, reviews show that organic varieties do provide significant levels of vitamin C, iron, magnesium, and potassium compared to non-organic varieties of the same foods. With respect to pesticides, they are also significantly lower in organic foods. In addition, with wheat, oats, and wine, organic foods typically have a number of important antioxidants (anthocyanins, flavonoids, and carotenoids). Studies of organic fruits and vegetables have demonstrated that organic foods have greater antioxidant activity and are more potent suppressors of the mutagenic compounds, and inhibit the proliferation of cancer cells. *In vivo* studies of antioxidant activity have failed to demonstrate additional benefit. Claims that consuming organic dairy products has been associated in regard to allergic dermatitis. (*Altern Med Rev* 2010;15(1):4-12)

## Introduction

Organic food consumption is one of the fastest growing segments of U.S. domestic food sales. Sales of organic food and beverages were valued at \$11.9 billion in 1990 to \$21.1 billion in 2008, on track to reach \$23 billion in 2009.<sup>1</sup> Consumers generally perceive these foods to be healthier and safer for themselves and the environment. A plethora of studies in the last two decades have assessed whether organic foods have higher levels of vitamins, minerals, and phytochemicals than conventionally raised foods and whether they are

Walter Crinnion, ND—1982 graduate of Bastyr University; practice since 1982 with a special focus on treating chronic diseases caused by environmental toxic burden; conducts post-graduate seminars in environmental medicine; professor and chair of the Environmental Medicine Program, Southwest College of Naturopathic Medicine, Tempe, AZ; contributing editor, *Alternative Medicine Review*  
Email: w.crinnion@scnm.edu

# Organic Production Enhances Milk Nutritional Quality by Shifting Fatty Acid Composition: A United States–Wide, 18-Month Study

Charles M. Benbrook<sup>1\*</sup>, Gillian Butler<sup>2</sup>, Maged A. Latif<sup>3</sup>, Carlo Leifert<sup>2</sup>, Donald R. Davis<sup>1</sup>

**1** Center for Sustaining Agriculture and Natural Resources, Washington State University, Pullman, Washington, United States of America, **2** School of Agriculture, Food and Rural Development, Newcastle University, Northumberland NE, United Kingdom, **3** Organic Valley/CROPP Cooperative/Organic Prairie, Lafarge, Wisconsin, United States of America

## Abstract

Over the last century, intakes of omega-6 ( $\omega$ -6) fatty acids in Western diets have dramatically increased, while omega-3 ( $\omega$ -3) intakes have fallen. Resulting  $\omega$ -6/ $\omega$ -3 intake ratios have risen to nutritionally undesirable levels, generally 10 to 15, compared to a possible optimal ratio near 2.3. We report results of the first large-scale, nationwide study of fatty acids in U.S. organic and conventional milk. Averaged over 12 months, organic milk contained 25% less  $\omega$ -6 fatty acids and 62% more  $\omega$ -3 fatty acids than conventional milk, yielding a 2.5-fold higher  $\omega$ -6/ $\omega$ -3 ratio in conventional compared to organic milk (5.77 vs. 2.28). All individual  $\omega$ -3 fatty acid concentrations were higher in organic milk— $\alpha$ -linolenic acid (by 60%), eicosapentaenoic acid (32%), and docosapentaenoic acid (19%)—as was the concentration of conjugated linoleic acid (18%). We report mostly moderate regional and seasonal variability in milk fatty acid profiles. Hypothetical diets of adult women were modeled to assess milk fatty acid-driven differences in overall dietary  $\omega$ -6/ $\omega$ -3 ratios. Diets varied according to three choices: high instead of moderate dairy consumption; organic vs. conventional dairy products; and reduced vs. typical consumption of  $\omega$ -6 fatty acids. The three choices together would decrease the  $\omega$ -6/ $\omega$ -3 ratio among adult women by ~80% of the total decrease needed to reach a target ratio of 2.3, with relative impact “switch to low  $\omega$ -6 foods” > “switch to organic dairy products”  $\approx$  “increase consumption of conventional dairy products.” Based on recommended servings of dairy products and seafoods, dairy products supply far more  $\alpha$ -linolenic acid than seafoods, about one-third as much eicosapentaenoic acid, and slightly more docosapentaenoic acid, but negligible docosahexaenoic acid. We conclude that consumers have viable options to reduce average  $\omega$ -6/ $\omega$ -3 intake ratios, thereby reducing or eliminating probable risk factors for a wide range of developmental and chronic health problems.

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**Competing Interests:** CROPP Cooperative is among the core funders of the “Measure to Manage Program” at Washington State University. MAL is the Director of Research & Development and Quality Assurance at CROPP Cooperative. This does not alter the authors’ adherence to all the PLOS ONE policies on sharing data and materials.

\* E-mail: cbenbrook@wsu.edu

## Introduction

Dairy products contribute significantly to dietary intakes of saturated fat in the United States and Europe, which has led to widely endorsed recommendations to limit consumption of whole milk and other high-fat dairy products, in favor of low- and non-fat dairy products [1]. However, these recommendations are based primarily on the serum-LDL ("bad")-cholesterol-raising effect of dairy fat, a single marker of risk for cardiovascular disease (CVD). They give little or no consideration to the CVD-risk reducing components in milk fat, especially omega-3 (n-3) fatty acids (FAs), conjugated linoleic acid (CLA), the possibly beneficial *trans* FAs, *trans*-18:1 [2] and *trans*-16:1 [3], protective minerals, and a beneficial effect on serum HDL ("good") cholesterol [4].

Two recent reviews of epidemiological evidence question common beliefs about the health effects of dairy fat. One finds a contradiction between the evidence from long-term prospective

studies and perceptions of harm from the consumption of dairy products [5]. The other review highlights inconsistent evidence of harm [4]. Most of the reviewed studies began before low-fat dairy products became widely used. These reviews conclude that high consumption of milk and milk fat may be overall neutral [4] or beneficial [5] regarding all-cause mortality, ischemic heart disease, stroke, and diabetes. Most recently, Ludwig and Willett have questioned the scientific basis for recommending reduced-fat dairy products [6]. Additional studies have linked dairy fat consumption to diminished weight gain [7], attenuated markers of metabolic syndrome, including waist circumference [8], and reduced risk of CVD [9] and colorectal cancer [10].

Milk products are good sources of many nutrients, including several of concern in at least some U.S. population cohorts—calcium, potassium, vitamin D (in fortified milk products), vitamin B<sub>12</sub>, and protein [1,11]. Alpha-linolenic acid (ALA) and other ω-3 FA are also of concern, and are well recognized in milk products

## Review article

### Nutritional quality and safety

Denis Lairon

INRA, UMR 1260, Nutriments Lipidiques et Prévention des Maladies  
Faculté de Médecine,

(Accepted

**Abstract** – Food security, nutritional quality and safety vary widely around the world. Up to now, industrialized production methods have led to a food chain and water by persistent pesticide residues, and reduced nutrient processing. In line with several published literature reviews, the present report issued an up-to-date exhaustive and critical evaluation of the nutritional quality of food. The major points are: 1/ food contains more anti-oxidant micronutrients such as phenols and fatty acids, 2/ data on carbohydrate, protein and vitamin levels are in any pesticide residues, 3/ organic vegetables contain far less nitrates, mycotoxins as conventional ones. Thus, organic agricultural systems propose also improvements of organic production to achieve sustainable

sustainable agriculture / organic agriculture / human food / nutrition

## 1. INTRODUCTION

While mass foodstuff production was achieved in industrialized countries during the twentieth century, the limitations of such an intensive production system have been highlighted for decades by ecologists and numerous agronomists, nutritionists and medical doctors. Briefly, great concern has been caused by high energy and chemical inputs, worldwide contamination of the food chain and water by persistent pesticide residues and nitrates, and the reduced nutrient and flavor contents through low-cost and intensive food production and extensive milling or processing. Only recently has the combined awareness for environment protection, food safety and security and well-being markedly raised public concern and demand for ecologically grown staple foods (El-Hage Scialabba, 2007; Niggli et al., 2007). For developing countries, concern is also focused on the appropriate way to ensure present and future food security, the number of malnourished and undernourished people approaching one billion worldwide, with no decreasing trend for the coming decade (FAO, <http://www.fao.org>). Worldwide, emphasis is increasingly being put on the relationship between food, nutrition and health (WHO, 2004; WCRF, 2007).

\* Corresponding author: denis.lairon@univmed.fr

## Critical Reviews in Plant Science

### Volume 30, Issue 1-2, 2011 Special Issue: Towards a More Sustainable Agroecosystem Management Quality of Plant Foods: The Fruits and Vegetables

DOI: 10.1080/07352689.2011.554417

K. Brandt<sup>a</sup>, C. Leifert<sup>b</sup>, R. Sanderson<sup>c</sup> & C. J. S

pages 177-197

## Abstract

Organic and conventional crop management systems and protection methods used.

Ecological and agronomic research on the effect of increasing availability of plant available nitrogen on secondary metabolites and vitamin C, while the data that are not involved in defense against disease. In relation to human health, increased intake of cancer and cardiovascular disease.

This benefit may be primarily due to their content of most other constituents of fruits and vegetables shown to not provide health benefits when the

A meta-analysis of the published comparisons of the content of secondary metabolites in organically and conventionally produced food is 12% higher (0.0001).

This overall difference spans a large variation of 16% higher content for defence-related compounds for carotenoids, while vitamin C showed

Based on the assumption that increasing the content of vegetables by 12% would be equivalent to increasing the consumption of vegetables by 12%, a model developed to calculate the health benefits of vegetables was then used to tentatively estimate the health benefits that could be achieved by switching from conventional to organic consumption per day, to 17 days for women and 2

<sup>a</sup> School of Agriculture, Food and Rural Development, Newcastle upon Tyne, NE1 7RU, United Kingdom

<sup>b</sup> Nafferton Ecological Farming Group, Newcastle University

<sup>c</sup> School of Biology, Newcastle University, Newcastle upon Tyne

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## Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses

Marcin Barański<sup>1</sup>, Dominika Średnicka-Tober<sup>1</sup>, Nikolaos Volakakis<sup>1</sup>, Chris Seal<sup>2</sup>, Roy Sanderson<sup>3</sup>, Gavin B. Stewart<sup>1</sup>, Charles Benbrook<sup>4</sup>, Bruno Biavati<sup>5</sup>, Emilia Markellou<sup>6</sup>, Charilaos Giotis<sup>7</sup>, Joanna Gromadzka-Ostrowska<sup>8</sup>, Ewa Rembiałkowska<sup>8</sup>, Krystyna Skwarło-Sonita<sup>9</sup>, Raija Tahvonen<sup>10</sup>, Dagmar Janovská<sup>11</sup>, Urs Niggli<sup>12</sup>, Philippe Nicot<sup>13</sup> and Carlo Leifert<sup>1\*</sup>

<sup>1</sup>School of Agriculture, Food and Rural Development, Newcastle University, Nafferton Farm, Stocksfield, Northumberland, NE43 7XD, UK

<sup>2</sup>Human Nutrition Research Centre, School of Agriculture, Food and Rural Development, Newcastle University, Agriculture Building, Kings Road, Newcastle upon Tyne NE1 7RU, UK

<sup>3</sup>School of Biology, Newcastle University, Ridley Building, Newcastle upon Tyne NE1 7RU, UK

<sup>4</sup>Center for Sustaining Agriculture and Natural Resources, Washington State University, Pullman, WA, USA

<sup>5</sup>Department of Agricultural Sciences, School of Agriculture and Veterinary Medicine, University of Bologna, Viale Fanin 42, 40127 Bologna, Italy

<sup>6</sup>Department of Pesticide Control and Phytopathology, Benaki Phytopathological Institute, GR 14561 Kifissia, Athens, Greece

<sup>7</sup>Department of Organic Farming and Food Technology, Technological Educational Institute of Ionian Islands, Ioannina, Greece

<sup>8</sup>Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences, Nowoursynowska 159c, 02-776 Warsaw, Poland

<sup>9</sup>Department of Animal Physiology, Faculty of Biology, University of Warsaw, Miecznikowa 1, 02-096 Warsaw, Poland

<sup>10</sup>Biotechnology and Food Research, MTT Agrifood Research Finland, FI-31600 Jokioinen, Finland

<sup>11</sup>Department of Gene Bank, Crop Research Institute (CRI), Drnovská 507/73, 161 06 Praha 6 – Břevnov, Czech Republic

<sup>12</sup>Research Institute of Organic Agriculture (FiBL), Ackerstrasse 113, CH-5070 Frick, Switzerland

<sup>13</sup>INRA, UR407 Pathologie végétale, 67 allée des chênes, F-84143 Montfavet Cedex, France

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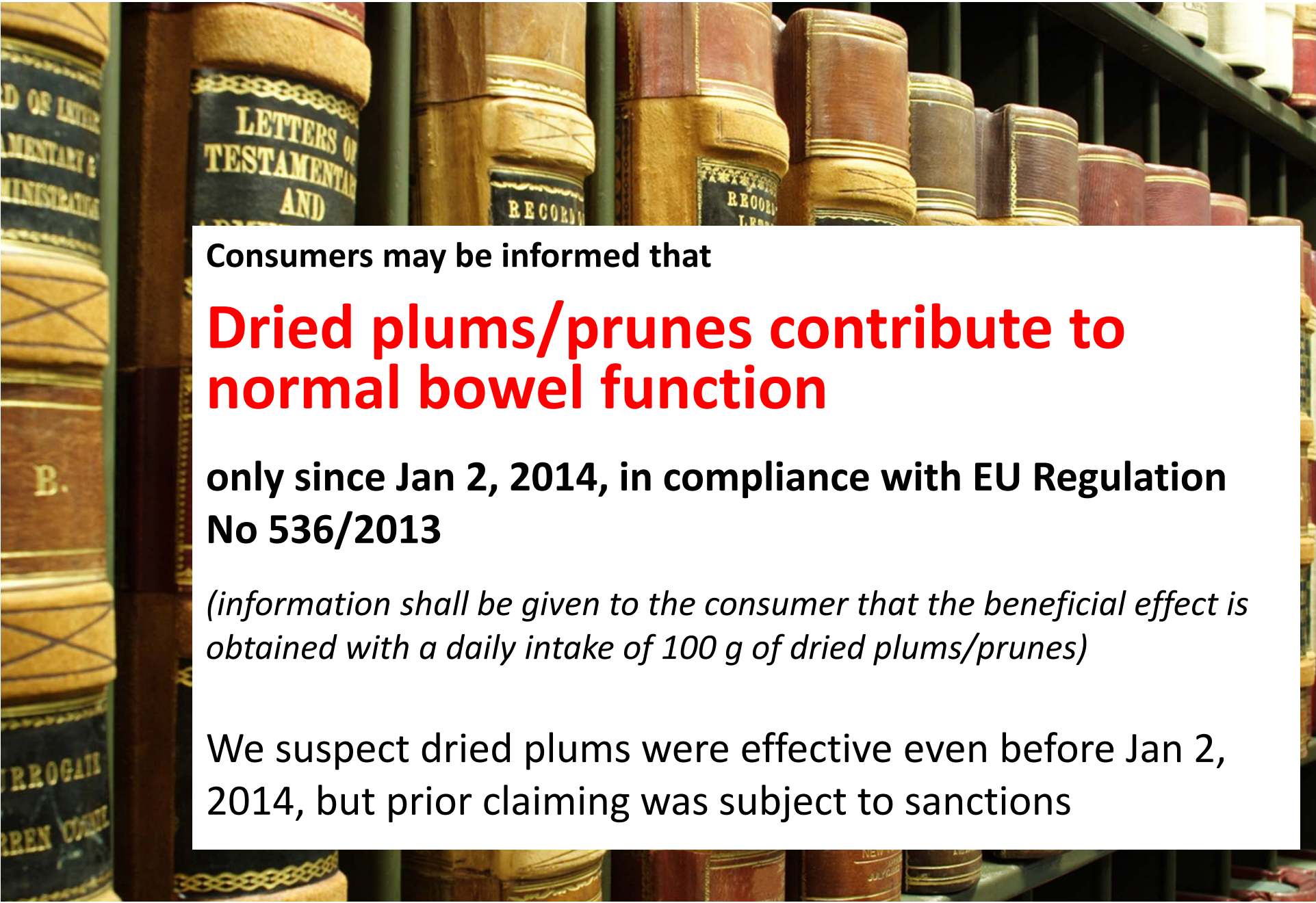
## Abstract

Demand for organic foods is partially driven by consumers' perceptions that they are more nutritious. However, scientific opinion is divided on whether there are significant nutritional differences between organic and non-organic foods, and two recent reviews have concluded that there are no differences. In the present study, we carried out meta-analyses based on 343 peer-reviewed publications that indicate statistically significant and meaningful differences in composition between organic and non-organic crops/crop-based foods. Most importantly, the concentrations of a range of antioxidants such as polyphenolics were found to be substantially higher in organic crops/crop-based foods, with those of phenolic acids, flavanones, stilbenes, flavones, flavonols and anthocyanins being an estimated 19 (95% CI 5, 33)%, 69 (95% CI 13, 125)%, 28 (95% CI 12, 44)%, 26 (95% CI 3, 48)%, 50 (95% CI 28, 72)% and 51 (95% CI 17, 86)% higher, respectively. Many of these compounds have previously been linked to a reduced risk of chronic diseases, including CVD and neurodegenerative diseases and certain cancers, in dietary intervention and epidemiological studies. Additionally, the frequency of occurrence of pesticide residues was found to be four times higher in conventional crops, which also contained significantly higher concentrations of the toxic metal Cd. Significant differences were also detected for some other (e.g. minerals and vitamins) compounds. There is evidence that higher antioxidant concentrations and lower Cd concentrations are linked to specific agronomic practices (e.g. non-use of mineral N and P fertilisers, respectively) prescribed in organic farming systems. In conclusion, organic crops, on average, have higher concentrations of antioxidants, lower concentrations of Cd and a lower incidence of pesticide residues than the non-organic comparators across regions and production seasons.

**Key words:** Organic foods; Conventional foods; Composition differences; Antioxidants/(poly)phenolics

**Abbreviations:** BS, basket study; CF, comparison of matched farms; EX, controlled field experiment; GRADE, Grading of Recommendations, Assessment, Development and Evaluation; MPD, mean percentage difference; MRL, maximum residue level; SMD, standardised mean difference.

\* Corresponding author: Professor C. Leifert, fax +44 1661 831 006, email [carlo.leifert@newcastle.ac.uk](mailto:carlo.leifert@newcastle.ac.uk)



Consumers may be informed that

## **Dried plums/prunes contribute to normal bowel function**

**only since Jan 2, 2014, in compliance with EU Regulation No 536/2013**

*(information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 100 g of dried plums/prunes)*

We suspect dried plums were effective even before Jan 2, 2014, but prior claiming was subject to sanctions



Consumers MAY NOT be informed that

## **Honey is a tool to soothe a sore throat**

as the European Food Safety Authority had never dealt with honey

In spite of the fact honey is a time-honored and scientifically proven effective cough suppressant, health claims on honey aren't in the official list of claims, are prohibited and subject to sanctions. In the official list you find a lot of other useful information such as «**Water contributes to the maintenance of normal physical and cognitive functions**» or «**Oat grain fibre contributes to an increase in faecal bulk**»



We MAY NOT claim about

**ORGANIC FOOD**

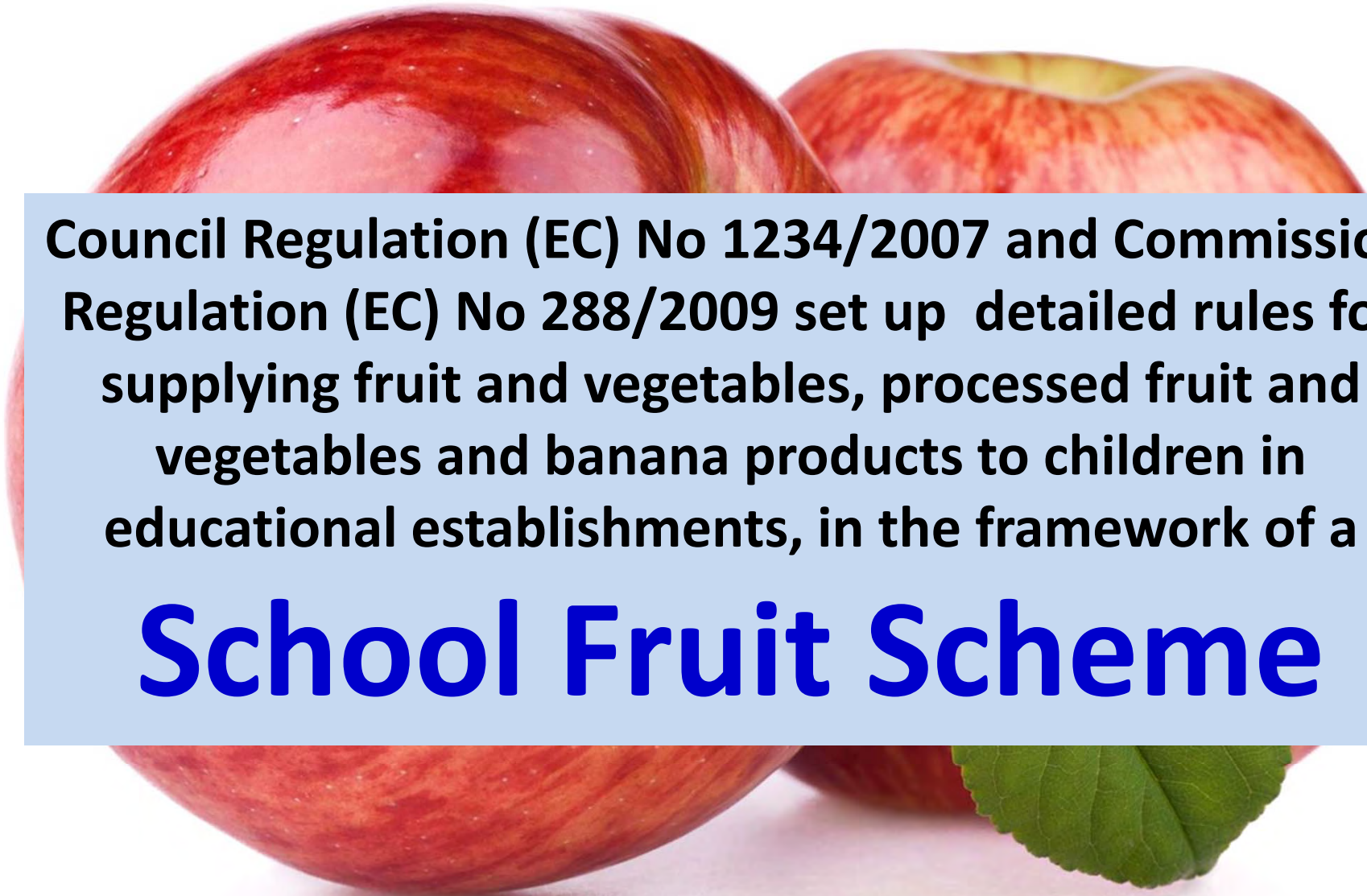
as the European Food Safety Authority had never dealt with organics

|              | REFERENCE<br>INTAKES | APPLE<br>INTAKES<br>(100 g) | % OF REFERENCE<br>INTAKES<br>(100 g) | KG OF APPLE TO<br>FULFILL REFERENCE<br>INTAKES |
|--------------|----------------------|-----------------------------|--------------------------------------|------------------------------------------------|
| Energy       | 2 000 kcal           | 52 kcal                     | 2.6%                                 | 3.8 kg                                         |
| Total fat    | 70 g                 | 0.2 g                       | 0.28%                                | 35.7kg                                         |
| Saturates    | 20 g                 | 0                           | --                                   | ∞                                              |
| Carbohydrate | 260 g                | 13.8 g                      | 5.3%                                 | 1.9 kg                                         |
| Sugars       | 90 g                 | 10.4 g                      | 11.6%                                | 0.9 kg                                         |
| Protein      | 50 g                 | 0.3 g                       | 0.6%                                 | 16,7 kg                                        |
| Salt         | 6 g                  | 0                           | --                                   | ∞                                              |
| Vitamin A    | 800 µg               | 0                           | --                                   | ∞                                              |
| Vitamin C    | 80 mg                | 2 mg                        | 2.5%                                 | 4 kg                                           |
| Thiamin      | 1.1 mg               | 0.017 mg                    | 1.5%                                 | 6.7 kg                                         |
| Calcium      | 800 mg               | 6 mg                        | 0.7%                                 | 14.3 kg                                        |
| Phosphorus   | 700 mg               | 11 mg                       | 1,6%                                 | 6.2 kg                                         |
| Iron         | 14 mg                | 0.12 mg                     | 0.9%                                 | 11.1 kg                                        |

## **NOT A NATURAL SOURCE OF**

|                   |                         |                   |
|-------------------|-------------------------|-------------------|
| <b>Vitamin A</b>  | <b>Folic acid</b>       | <b>Iron</b>       |
| <b>Vitamin D</b>  | <b>Vitamin B12</b>      | <b>Zinc</b>       |
| <b>Vitamin E</b>  | <b>Biotin</b>           | <b>Copper</b>     |
| <b>Vitamin K</b>  | <b>Pantothenic acid</b> | <b>Manganese</b>  |
| <b>Vitamin C</b>  | <b>Potassium</b>        | <b>Fluoride</b>   |
| <b>Thiamin</b>    | <b>Chloride</b>         | <b>Selenium</b>   |
| <b>Riboflavin</b> | <b>Calcium</b>          | <b>Chromium</b>   |
| <b>Niacin</b>     | <b>Phosphorus</b>       | <b>Molybdenum</b> |
| <b>Vitamin B6</b> | <b>Magnesium</b>        | <b>Iodine</b>     |

## **NOT A SOURCE OF FIBRE**

Two red apples are shown, one in the foreground and one slightly behind it to the right. A green leaf is attached to the apple in the background. The background is white.

**Council Regulation (EC) No 1234/2007 and Commission Regulation (EC) No 288/2009 set up detailed rules for supplying fruit and vegetables, processed fruit and vegetables and banana products to children in educational establishments, in the framework of a**

# **School Fruit Scheme**

The importance of fruit and vegetables as part of a healthy diet is advocated by the **Commission White Paper on Nutrition, Overweight and Obesity**, which stresses the need for coherent action at European level. It states that *“a School Fruit Scheme would be a step in the right direction”*.

*“Free provision of fruit and vegetables can contribute to better nutrition and may have a positive influence on learning ability, which is known to be affected by poor nutrition”*.

Consumption of fruits and vegetables across Europe is not sufficient, according to the **WHO**.

## WHY

eating fruit & vegetables is a good eating habit for young people if fruit & vegetables aren't a significant source of vitamins, minerals and other nutrients?

- ☐ The aim of EC Regulations is to contribute to balancing the **market** of fruit & vegetables and to stabilising the **market prices** through an aid scheme
- ☐ May be a wider range of nutrients and other substances including trace elements, amino acids, essential fatty acids, plant secondary metabolites with a nutritional or physiological effect is present in food

## WHY

**eating fruit & vegetables is a good eating habit for young people if fruit & vegetables aren't a significant source of vitamins, minerals and other nutrients?**

☐ **The aim of EC Regulations is to contribute to balancing the market of fruit & vegetables and to stabilising the market prices through an aid scheme**

☒ **May be a wider range of nutrients and other substances including trace elements, amino acids, essential fatty acids, plant secondary metabolites with a nutritional and physiological effect is present in food**



**Do European citizens have an interest in the relationship between diet and health and in the choice of an appropriate diet to suit their individual choices?**

**Do the provision of food information have to pursue a high level of protection of citizens' health and interests by providing a basis to make informed choices and to make safe use of food, with particular regard to health, environmental, social and ethical considerations?**



**MAYBE SOMETHING  
HAS TO CHANGE  
IN FOOD INFORMATION  
IN EUROPE?**

**Thanks for your attention!**



**info@federbio.it**  
**info@assobio.it**

**FEDERBIO**

**AssoBío**