

Organic Foods for Children: Health or Hype?

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Organic foods are promoted as superior and safer options for today's health-conscious consumer. Manufacturers of organic food claim it to be pesticide-free and better in terms of micronutrients. Consumers have to pay heavily for these products – and they are willing to – provided they are assured of the claimed advantages. Scientific data proving the health benefits of organic foods, especially in children, are lacking. Indian Government has developed strict guidelines and certification procedures to keep a check on manufacturers in this financially attractive market. American Academy of Pediatrics, in its recently issued guidelines, did not recommend organic foods over conventional food for children. Indian Academy of Pediatrics has not opined on this issue till date. In this perspective, we present a critical review of production and marketing of organic foods, and scientific evidence pertaining to their merits and demerits, with special reference to pediatric population.

Keywords: *Children, Health benefits, Nutrition, Pesticide.*

Concerns regarding quality of food are on the rise. A surge in diseases like cancers and atopic disorders has motivated health professionals, consumers, and policymakers to look for safe and healthy lifestyle measures. Organically grown foods are being promoted as a promising alternative by their manufacturers and certain activists and lobbies concerned with human health, environment and animal welfare [1]. As a result, the market is flooded with a variety of organic foods, including fruits, vegetables, cereals, dairy products and baby foods. Nutrition and safety are two important aspects that prompt the consumers to prefer organic over conventional foods. We intend to probe the status of organic foods, regulations governing their production, marketing and advertising, and whether these foods really hold an edge over the conventional foods, especially for the children in India.

PRODUCTION (ORGANIC FARMING AND REARING)

National Organic Program (NOP) was implemented in 2000 – by United States Department of Agriculture (USDA) to enforce regulations for certifying a food product as organic. National Program for Organic Production (NPOP) under the aegis of Ministry of Commerce and Industry, India released its recommendations in 2000, to provide standards for organic production to farmers, producers and traders. The certification scheme was initiated in 2002, with its logo of 'India Organic'. It defines organic farming as the process of developing a viable and sustainable agro-ecosystem

where the foods are grown without application of synthetic fertilizers, pesticides, fumigants (containing nitrogen or other heavy metals), human excreta, growth hormones or genetically engineered techniques [2,3]. The land has to be free of any of these substances for at least 3 years, before organic crop is grown. Organic production increases with suitable crop rotations, green manure, early and pre-drilling seed bed preparation, mulching, physical or mechanical control of pest and weeds, and disturbing the developmental cycles of the pest [2].

Organic animal products (milk, egg, chicken, meat, etc.) are produced from animals fed on 100% organic food for at least 12 months [2]. For organic animal rearing, biological needs (food, shelter, reproduction) of these animals should be met naturally, and in time. Diseased animals should be promptly and adequately treated. Antibiotics, synthetic growth promoters, hormones for heat induction, and genetically engineered vaccines to increase the yield are prohibited [2, 3].

Natural food is often confused with organic food. Natural food refers to minimally processed foods - free of synthetic preservatives, artificial sweetener, colors, flavors, additives, and stabilizers. Natural foods can be prepared through conventional means but are preserved with minimal artificial techniques. On the other hand, organic foods are prepared, processed, and preserved in natural environment [4].

THE GROWING MARKET FOR ORGANIC FOOD

Global organic food market has shown a boom over the

last two decades; United States, Germany, France, and Australia are the major consumers. The domestic market for organic foods in India was estimated to be of one billion rupees (2007-2008), and export market approximately 100 million USD [5].

According to the status report of National Program on Organic Production, 5.2 million hectares of land in India is currently undergoing organic farming, of which 0.5 million hectares is certified. More than 6,00,000 farmers are involved in organic farming. India's primary organic produce include cereals, pulses, oil seeds, spices, fruits and vegetables, nuts and dry fruits, sugar, honey, milk and milk products, poultry, and other animal products [5]. The major buyers are supermarkets, embassies, five-star hotels, hospitals, and Ayurveda clinics. The availability and consumption of organic products is primarily urban. Advertising and marketing strategies are evolving.

ORGANIC FOOD PRODUCTS FOR CHILDREN IN INDIA

There is a scope for a large market for organic food products meant specifically for infants and toddlers. These products include baby cereals, smoothie fruits, yogurts, toddler meals, biscuits, nibbles, cereal flakes, which are specially produced, flavored and packaged keeping in view the needs of children of different ages. A few of these products are available in the Indian market, mostly through online purchase. Most manufacturers are international. No Indian company, to the best of our market survey, is producing and marketing organic baby foods for the local consumer. India, due to its largest birth cohort in the world, is a luring proposition for the corporate world dealing in organic products. The need of the hour is therefore to be prepared for the onslaught, and have a clear-cut policy or guideline on the utility and consumption of organic foods by children in India. Parental education programs will also need to be developed accordingly.

Due to rigorous procedures required for organic farming and rearing, the price of organic foods is much higher than the conventional foods. Production cost is high because of requirements of farmer training, post-harvest handling, pesticide-free storage, segregated marketing and high retailer margin [6]. Additionally, organic foods have a shorter shelf-life. High cost of organic food is visualized as a major barrier for its widespread use. On the flip side, the higher cost is also perceived to be a marker of higher quality (in terms of nutritive value); but is it really true?

NUTRITIVE VALUE

Organic food is considered to be of higher nutritional value despite lack of high-quality scientific evidence.

Most of the research is observational; there is a lack of controlled trials on their health benefits. Organic foods are said to be rich in antioxidants, phenolics, vitamins A, C and E, potassium, phosphorus, and nitrates. Omega-3 fatty acids, and alpha linoleic acid (ALA) are also claimed to be in higher amount in the organic foods [7]. Worthington reported higher levels of vitamin C, iron, magnesium and phosphorus, lower quantities of proteins (though of better quality), lesser nitrates and lesser amount of heavy metals in crops produced by organic farming system [8]. A recent meta-analysis documented higher concentrations of protein, ALA, total omega-3 fatty acid, cis-9, trans-11 conjugated linoleic acid, trans-11 vaccenic acid, eicosapentanoic acid, and docosapentanoic acid in organic dairy products [9]. Rist, *et al.* [10] compared the levels of conjugated linolenic acid isomers (CLA) and trans-vaccenic acid (TVA) between breastmilk of mothers consuming organic or conventional foods. CLA is suggested to have anti-carcinogenic, anti-atherosclerotic, anti-diabetic and immune-modulating properties in animal models. It is also known to modify bone mass composition [11]. Rumenic acid – the most common isomer of CLA – and TVA were significantly higher in mothers on organic diet [10]. In a recent observational study, Vrèek, *et al.* [12] demonstrated lower levels of protein, calcium, manganese, and iron in organically grown wheat flour, in comparison to conventional one. The protein digestibility and levels of potassium, zinc, and molybdenum were significantly higher. Lombardi-Boccia, *et al.* [13] compared the composition of organic yellow plums with conventional plums. The authors found only marginal differences in levels of macronutrients, whereas antioxidant vitamins like vitamin C, vitamin E, β -carotene, and phenolic compounds showed significant differences. Interestingly, the levels also differed with the type of organic cultivation used.

An important nutritional advantage of organically produced foods is their antioxidant effect. It is hypothesized that organically grown foods develop the capability to produce more antioxidants than conventionally grown foods, as an adaptive response to fight insect and fungal attacks. However, Caris-Veyrat, *et al.* [14] failed to demonstrate significant difference in two major antioxidants, namely, vitamin C and lycopene, *in vivo*, in organically grown tomatoes.

Table I presents a comparison of macronutrient contents of commonly consumed foods (organic vs conventional) as available in the Indian market. There is hardly any difference between the calorie and protein content of organic and conventional foods. However, the fat content of baby food and egg appear to be somewhat lower than their conventional counterparts.

TABLE I MACRONUTRIENT CONTENT AND COST (PER 100 g) OF ORGANIC AND CONVENTIONAL FOOD ITEMS

<i>Food Item (per 100 grams)</i>	<i>Calories (kcal)</i>	<i>Protein (grams)</i>	<i>Fat (grams)</i>	<i>Cost* (INR)</i>
Chicken				
Organic	134	29.1	17	35
Conventional	119	21.4	3.1	23
Corn flakes				
Organic	383	8	1	66
Conventional	357	7.1	0	30
Mixed whole grain baby food				
Organic	393	14.3	5.4	156
Conventional	393	14.3	10.7	43
Mustard oil[#]				
Organic	884	0	100	28
Conventional	884	0	100	11
Poultry egg				
Organic	123	10.6	7.0	15
Conventional	135	11.4	9.0	10
Regular basmati rice				
Organic	345	6.8	0.5	18
Conventional	333	6.7	0	5
Toor dal				
Organic	335	22.3	1.7	16.5
Conventional	365	21.9	1.7	10
Wheat flour				
Organic	347	20.1	1.5	6
Conventional	380	20	0	3
Whole wheat bread				
Organic	225	10	2.5	16
Conventional	224	7.6	1.6	7
Ghee (cow's)[#]				
Organic	900	0	100	74
Conventional	900	0	100	30

*Costs are approximate costs in Indian market, and may vary with brands. Nutritive content is based on a market survey by the authors that recorded the display on packaged foods by the manufacturer; this may again vary with different brands. [#]per 100 mL.

HEALTH BENEFITS

A large number of studies have compared organic and conventional produces with respect to macro- and micro-nutrient composition, and their potentially harmful effects, but not many studies have evaluated the direct health benefits of organic foods on humans. Chhabra, *et al.* [15] used fruitfly (*Drosophila melanogaster*) model to assess the overall health benefits of organic fruits, and demonstrated improved fertility and longevity of the fly

on organic diet.

We could identify only one study evaluating organic vs conventional food in children. This questionnaire-based study from Netherlands conducted on a birth cohort of 2764 infants concluded that the risk of eczema was lowered (OR 0.64, 95% CI 0.44-0.93) in infants less than 2 years of age consuming organic dairy products [16]. However, the study could not demonstrate any association between consumption of organic meat, fruits and vegetables, eggs, or proportion of organic products within the total diet, with developing eczema, wheeze or atopic sensitization. Authors were uncertain whether their findings represented a true association and recommended further studies for confirmation.

Most of the international health authorities are silent on issues regarding benefits of organic food. American Academy of Pediatrics reviewed the scientific evidence available on the merits and demerits of organic produces with the aim to provide a recommendation for pediatricians and parents. In the absence of well-planned human studies showing any direct health benefit of organic foods, the report [17] supports incorporation of a wide variety of foods to provide a balanced nutrition to the children, which need not necessarily be organic. Facts about composition, pesticide residues, health benefits, and cost of organic foods should be widely available to parents [17].

ORGANIC FOODS: ARE THEY REALLY PESTICIDE-FREE?

Pesticide exposure and use of synthetic chemicals are a major concern with conventional farming. However, Gonzalez, *et al.* [18] reported contamination of organically grown crops of tomatoes with organochlorine pesticide (OCP) residues which were never used in these farms. Similar results were also reported by Baker, *et al.* [19], though less (one-third) often than conventional foods. The possible causes include previously contaminated fields, wind dispersion, surface run-off and volatilization. Interestingly, the levels in the crops grown by both conventional and organic methods are well below the safe limit of pesticide residues [20]. Recently, 61 commercially available brands of cheese were evaluated for OCPs and polychlorinated biphenyls (PCB) in Spain. The authors reported OCP levels to be lower than recommended total dietary intake (TDI) in both types of products, though the levels of PCBs were in the higher centile range of TDI [21]. Lu, *et al.* [22] in an interventional study, reported that urinary excretion of metabolites of commonly used organophosphorus pesticides (malathion and chlorpyrifos) were immediately and greatly reduced when the child switched from conventional to organic diets [22].

POTENTIAL RISKS OF ORGANIC FOODS

Microbiological safety of the organic animal foods is a questionable domain, the reason being prohibited use of antimicrobials. Cui, *et al.* [23] analyzed organic and conventional chicken samples for prevalence and antimicrobial resistance of *Campylobacter* and *Salmonella*. They found organic chicken to be more contaminated with these organisms, although the pathogen isolated from organic chicken were more susceptible to some antimicrobials. In a contradictory study, foods from conventional farms isolated *Salmonella* more frequently with higher level of resistance to streptomycin and sulphamethoxazole [24]. Contamination by mycotoxins has also been reported with organic farming [25,26].

CERTIFICATION

United States Department of Agriculture (USDA) certifies any food as '100% Organic', if it has 100% organically-produced ingredients and processing aids, and 'Organic', if it fulfills 95% of the above criteria. Remaining 5% should be non-agricultural substances approved in their national list. Another category with 70% organic components can use the label reading 'Made with organic ingredients', but cannot use USDA logo [27]. EU Organic is the certification given to products with more than 95% organic ingredients by European countries. 'India Organic' certification is provided to the organic products complying with the USDA standards by INDOCERT, the nationally and internationally operating certification body by NPOP. The certificate is valid for three years and needs to be renewed every three years [2]. Guidelines are available for ingredients, additives, processing, packaging, labeling, storage and transport to ensure the quality of products. The certification is liable to suspension or termination in the event of violation.

THE ROAD AHEAD

With the dramatic increase in the growth of organic food market globally, issues regarding nutritive value and safety need to be answered. The consumer is willing to pay a higher price for a healthier option. The literature shows that there are few qualitative differences between organic and conventional foods, but whether they actually produce a beneficial effect on human health is currently not known. Evidence available till date is insufficient to promote or refute the use of organic foods over conventional foods, with particular consideration of high cost involved. There is a need for controlled trials to study the actual health benefits with organic foods, and efforts to reduce the cost by working on organic farming techniques.

American Academy of Pediatrics issued its report on health and environmental advantages and disadvantages

of organic foods. The report gives the guidelines to pediatricians for the purpose of guiding the parents. Despite the increasing market of organic produces in India, Indian Academy of Pediatrics (IAP) has not formulated any guidelines for their use in children. The brands available in India should provide exact details of the composition of the product, to enable the consumers to compare and chose the option best suited to their pocket. Manufacturers should abide by the guidelines for factual display of contents in advertising, and not just use it merely to lure the consumers; IAP can play an important role in this regard.

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