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## Review Article

# Bisphenol-A: Legislation in Industrial Countries and in Algeria

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## Abstract

Bisphenol A (BPA) is a chemical compound extensively employed to manufacture certain plastics and epoxy resin. Due to its hormone-like properties, the BPA can disrupt endocrine function in humans and animals. The US Food and Drug Administration (FDA), the European Food Safety Authority (EFSA) and the International scientific community launched a broad program, to evaluate and investigate the adverse potential effect of BPA, on human endocrine pathways and health. Consequently, the BPA have been banned in several industrialized countries (France, Canada, Belgium, Denmark, Sweden etc.). However, in Algeria BPA still an unknown substance by the public and health professionals. This compound is not subject to any specific regulations. Currently, the debate concerning interdiction or/no interdiction is reported. The purpose of this mini-review is: (a) To provide the reader with the weight of evidence, current regulatory stance, regarding the safe use of BPA in industrial countries and (b) To show the absence of debate, evaluation and legislation in Algeria.

**Key words:** Bisphenol, endocrine disruptors, legislation, industrial countries, Algeria

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**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

The BPA is an estrogen-mimicking industrial chemical used to make polycarbonate plastics bottles, epoxy resins and food packaging. The BPA is found in human blood and urine due to its ubiquitous use in the production of water bottles, plastic food containers, linings of food and beverage cans and medical products, such as syringes and dental sealants. The BPA is used as an additive in plastics such as PVC. Halogenated derivatives of BPA are also widely used as flame retardants (<http://www.bisphenol-a.org>). Currently, a debate is witnessing around the use of BPA in commercial products. A number of scientists and activists have worked to highlight concerns about the potential effects of exposure to BPA on human health. In contrast, industry groups and their allies have emphasized uncertainty about the effects of BPA and pointed to studies that failed to find links between BPA exposure and human health (Brewer and Ley, 2014).

At the policy level, various governmental bodies in industrial countries have weighed proposals to ban the use of BPA in products. For their part, the news media have devoted considerable coverage to the controversy, much of it focusing on competing claims about what scientific research has shown regarding BPA and human health (Brewer and Ley, 2014).

Several *in vivo* studies have reported developmental and behavioral effects of low-dose BPA exposure depending on non-monotonic dose responses that contradict the logic of "The dose makes the poison" (Seta *et al.*, 2005; Melzer *et al.*, 2010; Ryan *et al.*, 2010; Xu *et al.*, 2011; Boudalia *et al.*, 2014; Jedeon *et al.*, 2013, 2014; Auxietre *et al.*, 2014).

In humans, recent reports have revealed a link between the endocrine disruptor levels in biological fluids and the prevalence of certain diseases, including heart disease, obesity and diabetes (Melzer *et al.*, 2010; Lang *et al.*, 2008; Shankar and Teppala, 2011) attention-deficit/hyperactivity disorder (Hong *et al.*, 2015), behavior problems, including anxiety and depression in children (Harley *et al.*, 2013) and other reproductive problems as sperm quality (Goldstone *et al.*, 2015).

As evidenced by *in vivo* studies, adverse reproductive and developmental effects of BPA can result from early exposure to very low doses, down to the no observable adverse effect level (NOAEL = 5 mg kg<sup>-1</sup> b.wt. day<sup>-1</sup>) (Salian *et al.*, 2009, 2011; Rubin *et al.*, 2001; Braniste *et al.*, 2010; Cabaton *et al.*, 2011; Boudalia *et al.*, 2014; Folia *et al.*, 2013; Jedeon *et al.*, 2013).

Similarly, prenatal daily exposure to BPA in the range of 1-50 µg kg<sup>-1</sup> b.wt. is associated with several behavioral disorders, including altered sexual, social, learning and maternal behaviors (Farabollini *et al.*, 2002).

Moreover, it is suspected that the adipogenic effect, induced by exposures to low doses of BPA in early life, could be related to neuronal disruptions of the brain areas involved in the regulation of food intake and choice (Rubin *et al.*, 2001; Somm *et al.*, 2009; Ryan *et al.*, 2010; Boudalia *et al.*, 2014; Miyawaki *et al.*, 2007).

These scientific findings indicate that exposure to BPA has adverse effects at various ages, for doses below the acceptable daily intake referenced as a "safe" dose for humans by the US Food and Drug Administration (FDA) and the European Food Safety Authority (EFSA).

This mini-review aimed (a): To provide the reader with the weight of evidence, current regulatory stance, regarding the safe use of BPA in industrial countries and (b): To show the absence of debate, evaluation and legislation in Algeria.

**Legislation on bisphenol-A in Europe:** The BPA was authorized in Europe in 2002 (European Commission, 2002) to be used as monomer and additive for the manufacture of 66 plastic materials and articles intended to come into contact with foodstuffs together with a specific migration limits of 0.6 mg kg<sup>-1</sup> food.

The European Food Safety Authority (EFSA) conducted several scientific assessments on BPA since 2006. In each case EFSA, reaffirmed that there is no concern for human health from BPA: Human exposure to BPA is far below the safe intake level and even lower than previously estimated. In its draft human health assessment of BPA published January, 2014, based on a comprehensive review of over 450 recent studies related to potential health hazards associated with BPA, EFSA again finds no concern for consumers health from BPA-based products (EFSA, 2014).

However, in late December, 2012, France officially passed a law suspending the production, trade and marketing of food containers containing BPA. Such containers are banned on January 1, 2013, for food products intended for infants (0-3 years) and on January 1, 2015, for all other products. Also and in several other industrial countries the same decision is adopted (Table 1).

**Algeria:** In Algeria BPA is an unknown substance by the public and health professionals and it is not subject to any specific regulations.

Also, outside the regulations concerning packaging products in the widest sense of the term, no legislation is made to regulate the use of BPA.

Table 1: The BPA legislation from industrial countries

Country	Legislation
Denmark	Restriction on the use of BPA in food packaging for children 0-3 years since July, 2010. This restriction is in conflict with EU law
Belgium	Restriction on the use of BPA in food packaging for children 0-3 years since January, 2013. This restriction is in conflict with EU law
Sweden	Restriction on the use of BPA in varnish and coatings of food packaging for children 0-3 years since July, 2013
Austria	Restriction on the use of BPA in pacifiers and teats since October, 2010. This restriction is in conflict with EU law
Colombia	Restriction of BPA in food contact plastics since June, 2013
Canada	Health Canada conducted several risk assessments on BPA and again in 2012 reconfirmed that consumer exposure to BPA is "Very low" and that BPA is "Not expected to pose a health risk to the general population." Nevertheless, the use of BPA in baby bottles is restricted in Canada since March, 2010
USA	The US Food Drug Administration (FDA) evaluated the available scientific studies and published their assessments on BPA since 2008. It saw no need to take regulatory action on BPA. July, 2013 as a reaction to changed marketplace conditions (BPA is no longer used to manufacture baby bottles and sippy cups or in infant formula packaging) and to clarify for consumers that BPA will not be used in these products in the future, BPA was removed from the Federal Register of approved substances for these applications. In 2013, FDA updated its position on BPA stating "BPA is safe at the very low levels that occur in some foods and "The use of BPA in food packaging and containers is safe"
Japan	The Japanese National Institute of Advanced Industrial Science and Technology concluded in its risk assessments of BPA in 2011 that The risk of BPA with regard to human health was believed to be very small. There is no use restriction on BPA in Japan. However, as a result of a different use pattern, Japanese producers phased out BPA-based products in food contact for children

In addition, the absence of agencies related to food security, human health, animal health and welfare and plant health. Equivalent to the French National Agency for Food Safety (ANSES) or the American Food and Drug Administration (FDA) amplify the problem.

Currently and to our knowledge we have only one law n°09-03 of February, 25, 2009 relating to the consumer protection and the repression of the frauds, which stipulates that "The equipment, materials, tools, packing and other instruments intended to be put in contact with the foodstuffs, must be made up exclusively of materials not being able to deteriorate these food products".

And the executive decree n°91-04 of 19 January, 1991 relating to materials intended to be put in contact with the foodstuffs and cleaning products of these materials, is the only payment, which exists concerning materials intended to come into contact with the foodstuffs, it specifies in article 05 that the materials intended to be put in contact with the foodstuffs must be elaborated exclusively with components not presenting any risk of attack at the health of the consumer.

Following scientific results alarming it is imperative to take preventive measures to protect public health.

### CONCLUSION AND FUTURE RECOMMENDATIONS

The absence of competent authorities, that can manage the questions of toxic chemicals, makes the task very difficult.

Also, BPA cannot be prohibited with just taking consideration of European and American studies; we must answer the following questions in future:

- What are the sources and the levels of exposure of Algerian citizen to the BPA

- Is the BPA largely used in local industry? Is there any control of the importing products
- Does Algeria have the necessary techniques which enable detection of these substances, to have a specific regulation
- Does the Algerian consumer know what is BPA? Is it conscious of the risks? Do we have the culture to seek what is hidden in packing

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