PERSPECTIVES

Plasticizer event in Taiwan

Jin-Ying Lu a,b

a Department of Laboratory Medicine, National Taiwan University Hospital, 7 Chung Shan South Road, Taipei 100, Taiwan
b Department of Internal Medicine, National Taiwan University Hospital, 7 Chung Shan South Road, Taipei 100, Taiwan

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The Department of Health in Taiwan pulled the trigger to destroy, simultaneously, up to 286,441 metric tons of plasticizer-containing food on June 11, 2011, in 11 counties and cities, under the supervision of the Bureau of Health Promotion and the Bureau of Environmental Protection. A total of 426 food producers and 965 food products were involved in the food safety scandal, which was initially investigated by the Taiwanese authorities on May 23, and represented the first reported event of a plasticizer being intentionally added to food.

The culprit plasticizer, di-(2-ethylhexyl)phthalate (DEHP), is an industrial chemical used mainly for making the polyvinyl chloride soft and flexible. DEHP was incidentally found initially in a probiotic powder and subsequently in many other food items and neuteartical products in Taiwan. DEHP is a potential human carcinogen that has, therefore, been banned from children’s toys in many countries, including Taiwan. The Taiwanese authorities discovered that some food-additive distributors had illegally added the banned industrial plasticizer to a stabilizing emulsifier, as a cheap substitute for palmitic acid. The resulting product, a clouding agent, was then used by many famous food manufacturers in fruit-flavored juices, jams and jellies, as well as in neuteartical pills/powders, sports drinks, tea drinks, and other beverages.

DEHP is, categorized as a phthalate belonging to a family of endocrine-disrupting chemicals, defined as exogenous substances that interfere with the synthesis, secretion, binding action, and metabolism of the natural endogenous hormones regulating homeostasis, reproduction, and developmental processes in the body.1 Phthalates are not only used for industrial purposes, but also added to polyvinyl chloride-containing plastics including children’s toys and medical devices, and to fragrant cosmetics and a variety of varnished household items. DEHP is the most widely used phthalate because of its low cost. Although exposure to DEHP can be oral, dermal, parenteral or inhalational, studies revealed that most exposure occurred by means of dietary routes, thought to be the result of leaching of DEHP from plastic wrappers or plastic materials in food production processes.2

The levels of DEHP in food rarely exceed 1.0 parts per million (ppm).3 However, analysis of flavored sports drinks produced in Taiwan revealed that many of them contained DEHP at levels above 14 ppm. Based on an example of a 14-kg 4-year-old child consuming around one 250-mL cup of the flavored sports drink each day, the daily DEHP consumption would be more than 10 times the safety reference value, i.e. the tolerable daily intake (TDI) of 25 μg/kg of body weight recommended by the World Health Organization Guidelines (Table 1).4 Such levels might be expected to have severe detrimental effects on human health.

DEHP has estrogenic and antiandrogenic properties, and has been shown to cause abnormalities in the male, but not female, reproductive system in prenatally-exposed animals.5,6 Because of the potential health concerns, various organizations have set TDIs for DEHP with the aim of reducing exposure levels (Table 1). Furthermore, biomonitoring equivalents for specific DEHP metabolites in urine, corresponding to the TDI estimates from these agencies, have been derived based on data for excretion fractions of the key urinary metabolites.2 These values may be useful for performing DEHP risk assessments.

E-mail address: jinyinglu@ntuh.gov.tw.
Epidemiologic studies in humans revealed that the DEHP exposure was associated with lower testosterone levels, sperm DNA damage, and poor semen quality. Exposure to DEHP also resulted in a shortened ano-genital distance, which has been linked to subfertility in men, and to early puberty, breast cancer, and endometriosis in women. DEHP negatively affected neurodevelopment in children, and might be associated with the development of attention deficit/hyperactivity disorder. Finally, respiratory symptoms, such as allergic rhinitis and bronchial asthma, have also been attributed to DEHP exposure.

Although DEHP is excreted in urine within 24–48 hours of ingestion and does not bioaccumulate in the body, food contamination with DEHP could still have a great impact on the Taiwanese population. Further investigation of the exposure status of DEHP and its potential adverse health effects on the Taiwanese population is definitely warranted.

### Table 1

<table>
<thead>
<tr>
<th>Organization</th>
<th>TDI (ug/kg body weight/d)</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>US-EPA</td>
<td>20</td>
<td>1991</td>
</tr>
<tr>
<td>Health Canada</td>
<td>44</td>
<td>1994</td>
</tr>
<tr>
<td>NL-RIVM</td>
<td>4</td>
<td>1997</td>
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<tr>
<td>EU-CSTEE</td>
<td>37</td>
<td>1998</td>
</tr>
<tr>
<td>WHO</td>
<td>25</td>
<td>2003</td>
</tr>
<tr>
<td>EFSA</td>
<td>50</td>
<td>2005</td>
</tr>
</tbody>
</table>

EFSA = European Food Safety Authority; EU-CSTEE = Europe Scientific Committee for Toxicity, Ecotoxicity and the Environment; NL-RIVM = Netherlands Rijksinstituut voor Volksgezondheid en Milieu; TDI = tolerable daily intake; US-EPA = United States Environmental Protection Agency; WHO = World Health Organization.

### References