Health Concerns Regarding Cooking with Plastic Bags

In February 2018, the Environmental Epidemiology Program (EEP) at the Utah Department of Health (UDOH) received a request for technical assistance from the Tooele County Health Department regarding the potential for adverse health effects from consuming food cooked in plastic bags at restaurants.

Sous vide means "under vacuum" in French. It is a cooking technique where raw food is cooked inside a vacuum-sealed plastic pouch in a water bath under controlled conditions of time and temperature. Temperature typically ranges from 125° F to 175° F and cooking times may go up to 48 hours. While chefs have used this technique since the 1970s, sous vide became more widely known and popular in restaurants and homes in the late 2000s and early 2010s (Baldwin, 2012). Concerns about this technique include the safety of cooking in plastic and that low cooking temperatures and cooking food under vacuum can encourage the growth of spore-forming bacteria. Botulism poisoning is caused by a toxin produced by *Clostridium botulinum*, a bacterium that grows when food is not prepared or stored properly under low oxygen conditions. Foodborne botulism can cause serious illness and death (CDC, 2017a). Studies have largely focused on understanding the cooking time and temperature to improve food safety and taste using sous vide. However, there is a growing concern regarding the leaching of chemicals from plastic bags into the food.

Plastic products are made of one or more resins and additives that could be released and potentially cause adverse effects. Some of these resins interfere with hormone activity in the body and have been reported to cause adverse health effects in mammals, including humans. Hormones are chemical substances that control physiological and behavioral activities. The most commonly affected hormone is estrogen, and chemicals that affect its activity are said to have estrogenic activity (Yang et al., 2011; Bittner et al., 2014). In females, estrogen regulates secondary sex characteristics and reproductive development. In males, it is important for erectile function, sperm production, and libido modulation. Chemicals that imitate or neutralize naturally occurring estrogens can cause early puberty in females, altered functions of reproductive organs, reduced sperm counts, and increased cancer risk, such as testicular, prostate, ovarian and breast cancers (Schulster et al., 2016).

One of the best studied and common base resins is bisphenol A (BPA), a chemical that leaches from some hard plastics like polycarbonate and is known to have estrogenic activity (Michalowicz, 2014). BPA-associated risks are currently being assessed. Animal studies suggest BPA exposure may disrupt brain development and behavior (Yeo et al., 2013, Kundakovic et al., 2013), and might play a role in the development of diabetes and increased body weight (Schneyer, 2011). The FDA has banned BPA from baby bottles, sippy cups, and infant formula packaging. However, it is still being used in other products such as receipt paper and coatings inside metal food and beverage cans (FDA, 2014). Another class of concern is phthalates, which is used to make plastics more flexible. Research has suggested that exposure to phthalates may

have negative reproductive and developmental effects (CDC, 2017b). There are many other compounds used in plastic products whose effects are not well understood.

Chemicals can be released from different plastic products, though typically at low concentrations. Yang et al. (2011) analyzed hundreds of plastic items and most of them leached chemicals with detectable estrogenic activity. The researchers also analyzed how common-use stresses such as moist heat via boiling, ultraviolet light, and microwave radiation affected some of the products. The study found that even some products advertised as BPA-free released chemicals with estrogenic activity, especially if they were exposed to one or more stresses. Polypropylene and polyethylene were two of the plastic compounds that did not release chemicals with estrogenic activity and are not known to exhibit other toxic effects.

Specific studies of sous vide bags leaching chemicals are very limited. In addition, there is little data on studies regarding daily intake of sous vide cooked food and the risks involved. A study analyzed trout fillets that were cooked using the sous vide technique in plastic vacuum bags made of polyamides and polyethylene; the bags were free of BPA, phthalates, and lead. The researchers found that cooked fillets contained detectable concentrations of BPA, with levels depending on cooking time and temperature. However, the study failed to use a control set and did not test BPA levels in uncooked fish samples, making it difficult to attribute detected BPA to a specific source (Oz and Seyyar, 2016). The most pressing concern with sous vide cooking remains the risk of botulism from improperly prepared and cooked foods.

There is a lack of data on the chemicals leaching specifically from sous vide bags. The EEP recommends the use of appropriate plastic bags for sous vide that follow current FDA guidelines and are free of BPA and phthalates. Bags and pouches used in sous vide should be made of food-grade plastics such as high density polyethylene, low density polyethylene, and polypropylene. These polymers are not known to have estrogenic activity and FDA considers them safe to be in contact with food (FDA, 2017). Another alternative is food-grade silicone bags, which are known to be more expensive but reusable and safe for food. We also strongly recommend anyone cooking with the sous vide technique to use appropriate equipment, cooking times, and temperatures to ensure food safety.

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