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Research report

Effects of a price increase on purchases of sugar sweetened beverages. Results from a randomized controlled trial☆

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ABSTRACT

Sugar sweetened beverage (SSB) taxes are receiving increased political interest. However, there have been no experimental studies of the effects of price increases on SSBs or the effects on close substitutes such as diet drinks, alcohol or sugary snacks. Therefore, the aim of this study was to examine the effects of a price increase on SSBs on beverage and snack purchases using a randomized controlled design within a three-dimensional web-based supermarket. The trial contained two conditions: experimental condition with a 19% tax on SSBs (to reflect an increase in Dutch value added tax from 6% to 19%); and a control condition with regular prices. $N = 102$ participants were randomized and purchased groceries on a single occasion at a three-dimensional Virtual Supermarket. Data were analysed using independent t-tests and regression analysis. Results showed that participants in the price increase condition purchased significantly less SSBs than the control group (B = –.90; 95% CI = –1.70 to –.10 L per household per week). There were no significant effects on purchases in other beverage or snack food categories. This means that the higher VAT rate was effective in reducing SSB purchases and had no negative side-effects.

Introduction

Health related food taxes are a potential effective strategy to improve dietary habits (McCarthy, 2004; United Nations General Assembly, 2011). Taxation has previously been successful in reducing the use of alcohol and tobacco (Chopra & Darnton-Hill, 2004) and price is one of the most important determinants in food choice, especially among lower socio-economic status (SES) groups (Steenhuis, Waterlander, & de Mul, 2011; Waterlander, de Mul, Schuit, Seidell, & Steenhuis, 2010). One food pricing strategy that received particular interest is sugar sweetened beverage (SSB) taxes. SSB consumption has increased considerably in the past decades and in the US it has been the single largest contributor of energy intake (Block, 2004; Duffey & Popkin, 2007). Likewise, in the Netherlands, SSB consumption has increased from 71 L per person per year in 1990 to 103 L in 2009 (Statistics Netherlands, 2010). There is strong evidence linking SSB consumption to an increased obesity risk and also to lower intakes of milk, calcium and other important nutrients (de Ruyter, Olthof, Seidell, & Katan, 2012; Malik, Schulze, & Hu, 2006; Vartanian, Schwartz, & Brownell, 2007).

Various leading public health researchers are advocating for soft drink taxes (Brownell et al., 2009) and a number of governments are considering or have already introduced some form of soft drink taxes (Brownell et al., 2009; Brownell & Frieden, 2009). One option is a relatively small tax increase mostly aimed at creating extra revenue. For example, many American states have a sales tax on soft drinks. The current mean tax rate is 5.2% which is too low to affect consumption rates, but the revenue could be invested in public health (Brownell et al., 2009; Brownell & Frieden, 2009). A second option is a heavier excise tax that is directed at lowering consumption rates. For example, in 2011 Hungary has introduced an excise tax on some foods, including an added tax on soft drinks of €.016/L (Villanueva, 2011). Likewise, France has introduced an excise tax on soft drinks of €.036/L (Villanueva, 2011). A final option is placing SSB in a special Value Added Tax (VAT) rate. Australia currently levies such a measure where soft drinks (and a number of other non-staple foods) are taxed at a 10% level (Mytton, Clarke, & Rayner, 2012). Besides, when this study was designed, the Dutch government considered moving soft drinks from the low VAT rate (6%) that applies

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for basic goods to the higher VAT rate (19%) that applies to goods such as tobacco and alcohol. Recently it was announced that the higher VAT rate will be further increased to 21%.

Evidence on the effects of soft drink taxes is limited. First, there is some evidence from natural experiments generally examining the association between soft drink tax rates and obesity levels in American states. However, in this uncontrolled design it is hard to disentangle the taxing effects from other changes. Moreover, evaluated tax rates (1–8%) are basically too low to result in any effects on population obesity (Kim & Kawachi, 2006; Mytton et al., 2012; Powell & Chaloupka, 2009; Powell, Chriqui, & Chaloupka, 2009). Other evidence comes from economic modelling studies. Generally these studies show that taxes have good potential to improve diets and health, especially when they are large (Eyles, Ni Mhurchu, Nghiem, & Blakely, 2012; Mytton et al., 2012; Thow, Jan, Leeder, & Swinburn, 2010). For example, a US study examining a 20% and 40% tax increase of SSB found a .32 (.09) and .59 (.16) kg per year per person weight loss, respectively (Finkelstein, Zhen, Nonnemaker, & Todd, 2010). However, modelling studies are limited by the quality of the input data and it is unsure how accurate data on small price fluctuations are to predict the effects of larger price changes (Thow et al., 2010). Moreover, modelling studies typically focus on one product category only (Dharmasena & Capps, 2012; Thow et al., 2010) and data on shifts to alcoholic drinks and close non-beverage substitutes such as sugary snacks are particularly lacking (Dharmasena & Capps, 2012). Finally, there is some evidence from randomized controlled trials (RCTS) which is the favoured study design for effectiveness studies. For example, an American study examined the effects of a price increase of 35% on soft drinks, an educational campaign and a combination of both on sales in a hospital cafeteria. The authors found a 26% decrease in soft drink sales due to the price intervention (Block, Chandra, McManus, & Willett, 2010). However, experimental evidence is limited since it is merely based on small controlled settings (such as cafeterias) and does often give no good insight into substitution effects (Mytton et al., 2012).

To our knowledge, there exist neither RCTs studying the effects of an SSB tax in larger settings (such as supermarkets) (Epstein et al., 2012) nor studying the effects on close substitutes such as milk, diet drinks, alcohol or candy (Edwards, 2011). Therefore, the aim of this study was to examine the effects of a 13% price increase on SSBs (to reflect an increase in Dutch value added tax from 6% to 19%) on beverage and snack-food purchases using a randomized controlled design within a three-dimensional web-based supermarket.

Methods

The 3-D virtual supermarket

This study was conducted in a retail setting, using a unique three-dimensional software application closely resembling a real supermarket: the Virtual Supermarket. The main features of the software are described below; additional information can be found elsewhere (Waterlander, Ni Mhurchu, & Steenhuis, 2012a; Waterlander, Scarpa, Lentz, & Steenhuis, 2011).

Virtual environments are computer-generated models in which participants can experience and interact with intuitively in real time (Nichols, Haldane, & Wilson, 2000). The Virtual Supermarket is a 3-D virtual environment designed in the image of an existent branch of the Dutch market leader supermarket (Fig. 1). The web-based shopping procedure closely mirrors a normal shopping trip; participants navigate a trolley along supermarket aisles and select products by a single mouse click. Food prices were updated for 2010 and were based on the prices of the two Dutch market leaders, and the stock was also based on an existing supermarket. In total, the web-based supermarket contained 512 different food products (see Waterlander, Steenhuis, de Boer, Schuit, & Seidell, 2012b), including 71 different types of beverages, modelling the actual distribution of store products and categories (Table 1). To date, the Virtual Supermarket has been successfully used in three different experiments and was found to be a valid platform for experimental research (Waterlander et al., 2012a, 2012b; Waterlander, Steenhuis, de Boer, Schuit, & Seidell, 2012c).

Fig. 1. Screenshots of the Virtual Supermarket. The lower image shows one of the major beverage isles.