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Food environments in Malta: Associations with store size and area-level deprivation

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ABSTRACT

Food environments are potential targets for interventions to reduce obesity prevalence, particularly in island settings that are typically dependent on food imports. This observational study aimed to characterise the availability, quality and price of foods and beverages in a nationally representative sample of grocery stores in Malta using the Nutrition Environment Measures Survey for Stores (NEMS-S) instrument, and to examine the association between area-level density of different types of food stores and the likelihood of children living in these areas being overweight or obese. Fieldwork was carried out between March and May 2014. There was a strong positive correlation between store size and NEMS-S score ($p = <0.001$), suggesting that smaller grocery stores generally offered a smaller range of products and fewer healthy food/beverage options than larger supermarkets. Across all stores, median prices of certain 'healthier' versions of foods were more expensive than their less healthy alternatives. A significant association between risk of childhood overweight, and density of confectionery stores in children's locality of residence, was found (OR 1.19; 95% CI: 1.04, 1.37). These baseline findings highlight opportunities to improve the food environment in Malta to support more healthful eating, and may be of particular interest to public health practitioners in island settings.

1. Introduction

Malta has one of the most obese populations worldwide (Ng et al., 2014). A recent national anthropometric survey which measured the height and weight of all school-aged children (up to 16 years of age) in Malta concluded that approximately 40% are overweight or obese according to WHO criteria (Grech et al., 2016). Maltese adults are also among the most overweight within the WHO European region (Verschuuren et al., 2015), with 2008 self-reported survey data suggesting that 58.5% were overweight (BMI > 25 kg/m^2) and 22.3% were obese (BMI > 30 kg/m^2) (Health Information and Research Directorate, 2008). Given the potential impact of the food environment – referring to the circumstances surrounding the procurement and consumption of food (Glanz et al., 2005) – on population weight (Chow et al., 2009; Holsten, 2009), measuring the nature of local food environments is important to determine what is available for purchase and develop obesity prevention strategies (Cerin et al., 2011; Cobb et al., 2015; Kelly et al., 2011). For example, greater availability of grocery stores may improve overall dietary quality and lower obesity prevalence (Morland et al., 2006; Powell et al., 2007). Conversely, a high density of outlets providing less healthy food such as fast food restaurants and convenience stores has been associated with increased obesity (Jeffery et al., 2006).

Marketing studies clearly show that the amount of shelf space, together with the location and number of displays allocated to food products within a store, are integral elements of the consumer food environment which have a significant impact on sales and potential consumption (Briesch et al., 2009; Curhan, 1972; Glanz et al., 2012; Inman et al., 2009; Wilkinson et al., 1982). The relationship between food availability, dietary habits, and weight status has not been clearly established, however availability and price of foods are likely to influence dietary behaviour and eventual risk of developing obesity (Cobb et al., 2015; Holsten, 2009; Mackenbach et al., 2014). This is also the case for children and adolescents, with a number of studies showing at least one positive association between food environment exposure and children's dietary outcomes (Engler-Stringer et al., 2014). Close proximity to convenience stores and a high density of fast-food outlets in adolescents' home and school environments has been associated with unhealthy dietary behaviour (He et al., 2012).

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Local food environments may also be related to neighbourhood socioeconomic level (Larson et al., 2009; Wang et al., 2007), as affluent areas may have better access and greater availability of healthy food compared to deprived neighbourhoods (Moore and Diez Roux, 2006). Objective documentation of potentially obesogenic food environments permits a more comprehensive understanding of potential dietary influences, consistent with an ecological approach (Egger and Swinburn, 1997). In turn, environmental interventions aimed at facilitating healthier food choices through the creation of supportive food environments may achieve more effective results than behavioural interventions that require significant personal motivation (Caspi et al., 2012; Story et al., 2008).

This is one of few studies to review an 'island food environment'. Pacific island research indicates that islands may be disproportionately influenced by the global food system due to their reliance on imported foods (Snowdon and Thow, 2013). Malta is similarly reliant on food imports (Cauchi et al., 2015), hence systematic documentation and assessment of local food environments may offer important insight into their potential effect upon food purchasing and dietary behaviour. Furthermore, research on the food environment in Malta has been specifically recommended as part of a national obesity strategy (Superintendence of Public Health, 2012). The aim of this study was to systematically document the food environment in a representative sample of localities in the Maltese islands. We characterised the environment in grocery stores – the most common outlets for food purchases (National Statistics Office (Malta), 2010) – and tested for differences by area-level deprivation. We also examined associations between area-level density of different types of food stores and the likelihood of overweight or obesity in children living in these areas, hypothesising that the density of stores which typically sell energy-dense food and beverages (e.g. fast food; sweets, soft drinks etc.) in a particular locality would be positively correlated with risk of being overweight or obese for children residing in that locality.

2. Method

The 'minimal' approach proposed by the International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support (INFORMAS) network was adopted (Lee et al., 2013; Ni Mhurchu et al., 2013). INFORMAS proposes a flexible approach towards the benchmarking of retail food environments that allows participating countries to monitor different indicators depending on local resources and capacity (Swinburn et al., 2013). The minimal approach involves monitoring availability and accessibility of key foods and beverages in one key type of food outlet for which evidence exists of an association with dietary outcomes, in a limited number of locations/areas. The foods to be monitored should link clearly with risk of obesity and NCDs, including healthy items such as fruits and vegetables; and unhealthy items such as sugar-sweetened beverages, energy-dense nutrient-poor foods (e.g. confectionery), and fast foods. Final selection of specific foods to be monitored should be based on local food consumption data.

A contextual analysis (Cauchi et al., 2015) was first carried out to determine the local context, as recommended by INFORMAS. Grocery stores were identified as the food outlet type accounting for >66% of food purchases in Malta (National Statistics Office (Malta), 2010). Consequently, two food environment sub-types, including the *community* (i.e. number, type, location, and accessibility of different types of food outlets in an area) and *consumer* (i.e. conditions that individuals encounter within grocery stores, including nutritional quality, price, promotion, and placement) food environments were selected for monitoring and assessment.

2.1. Sampling strategy

The 'minimal' INFORMAS approach proposes collection of data from representative locations within a country, however, no specific sampling strategy is recommended. A review of the literature was therefore carried out to identify validated environmental audit instruments that can be applied to Malta. The tool developed by the 'Consortium for the PREVention of OBesity through effective nutrition and physical activity actions' (EURO-PREVOB) was deemed to be the most appropriate. This instrument objectively assesses multiple environmental factors, focuses specifically on the obesogenicity of communities, and has been carried out in diverse European countries (Pomerleau et al., 2012). Pilot testing indicated that the instrument was suitable for the Maltese context. Following the validated environmental audit methods outlined by Pomerleau et al., all localities/local councils (n = 68) in Malta were ranked by median socioeconomic (SE) deprivation and stratified into quintiles. A diverse representative sample of ten localities was randomly selected, with two localities in each quintile undergoing a field audit. Quintile one (Q1) represents the most affluent localities, whereas quintile five (Q5) refers to the most deprived localities. Google Earth™ was used to plan walking routes in areas of around 0.5 km^2 (range: 0.3–0.7 km^2) in each locality, as recommended by EURO-PREVOB (Pomerleau et al., 2012) (Appendix 1). Each area encompassed the densest residential neighbourhoods within each locality, and in most cases contained a primary and/or secondary school. Interviews with secondary school students living in these areas were carried out as part of a larger PhD project. Only stores in these areas were assessed.

2.1.1. Community food environment

The location and frequency of all food stores within each audited area were recorded. Stores were categorized based on adapted, pre-existing food outlet classification criteria (Lake et al., 2010) (Appendix 2). Density (per km^2) of different store types in the audited areas was calculated and categorised into low, medium or high density, based on the observed distribution of each store type across all ten audited areas. Additionally, a database of all food outlets licensed up to January 2014 was obtained from the Environmental Health Directorate (Environmental Health Directorate, 2014). The total surface area occupied by each locality was calculated using Earth Point for Google Earth (http://www.earthpoint.us/Shapes.aspx). The Environmental Health Directorate database was then used to derive the overall density of different food store types in the ten localities, including those areas which were not audited.

2.1.2. Consumer food environment

Between March and May 2014, one small (1 checkout), one medium (2–4 checkouts) and one large (≥5 checkouts) grocery store was randomly selected in each locality to undergo consumer food environment assessment (n = 30) as recommended by the EURO-PREVOB consortium (Pomerleau et al., 2012). This ensured that a representative sample of grocery stores was obtained, given the limited resources available to the authors. The number of checkouts was used as a proxy for store size (Glanz et al., 2007; Horowitz et al., 2004; Kerr et al., 2012). For the purposes of this survey, the term 'grocery stores' referred to food outlets selling fresh fruit and vegetables (F&V) alone or in addition to other food products (Glanz and Yaroch, 2004), including specialized green grocers, discount stores and supermarkets. Data were collected through in-person visits by DC, assisted by a fieldworker.