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Research review

Construct and criterion-related validation of nutrient profiling models: A systematic review of the literature

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ABSTRACT

Nutrient profiling (NP) is defined as the science of ranking foods according to their nutritional composition for the purpose of preventing disease or promoting health. The application of NP is ultimately to assist consumers to make healthier food choices, and thus provide a cost effective public health strategy to reduce the incidence of diet-related chronic disease. To our knowledge, no review has assessed the evidence to confirm the validity of NP models. We conducted a systematic review to investigate the construct and criterion-related validity of NP models in ranking food according to their nutritional composition for the purpose of preventing disease and promoting health. We searched peer-reviewed research published to 30 June 2015 and used PUBMED, Global Health (CABI), and SCOPUS databases. Within study bias was assessed using an adapted version of the QUADAS-2 (Quality Assessment of Diagnostic Accuracy Studies -2) tool for all diagnostic studies and the Cochrane Collaboration's Risk of Bias tool for all non-diagnostic studies. The GRADE (Grades of Recommendation, Assessment, Development, and Evaluation) approach was used to guide our judgement of the quality of the body of evidence for each outcome measure. From a total of 83 studies, 69 confirmed the construct validity of NP models; however most of these studies contained methodological weaknesses. Six studies used objective external measures to confirm the criterion-related validity of NP models; which inherently improved quality. The overall quality of evidence on the accuracy of NP models was judged to be very low to moderate using the GRADE approach. Many carefully designed studies to establish both construct and criterion-related validity are necessary to authenticate the application of NP models and provide the evidence to support the current definition of NP.

Contents

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1. Introduction

Nutrient profiling (NP) is defined as the science of classifying or ranking foods according to their nutritional composition for reasons related to preventing disease and promoting health (Rayner, Mizdrak, Logstrup, & Kestens, 2013). Underpinning NP is a model that scores food based on a specific set of rules (an algorithm) to assess its suitability for a given purpose, according to its nutritional composition (Garsetti, de Vries, Smith, Amosse, & Rolf-Pedersen, 2007; Stockley, Rayner, & Kaur, 2008; Townsend, 2010). Internationally, NP models have recently proliferated (Rayner, Scarborough, & Kaur, 2013) and are used for a variety of purposes by the food industry as well as government and non-government organisations (Garsetti et al., 2007; Rayner, Mizdrak, et al., 2013; Sacks, Tikellis, Millar, & Swinburn, 2011b; Stockley et al., 2008). The most common use of NP is to inform nutrition signposting schemes aimed at helping consumers to make healthier food choices (Sacks et al., 2011a).

Considerable literature on NP models and their associated nutrition signposting schemes examines various consumer groups' use and understanding (Campos, Doxey, & Hammond, 2011; Gorton, Mhurchu, Bramley, & Dixon, 2010; Hawley et al., 2012; Mejean, Macouillard, Peneau, Hercberg, & Castetbon, 2013; Mhurchu & Gorton, 2007; Vyth et al., 2012a) (i.e., assessment of face validity). There has been less emphasis on the accuracy of the NP model itself (Chiuve, Sampson, & Willett, 2011; Rayner, Scarborough, et al., 2013; Townsend, 2010). Accuracy in this context refers to whether the NP model measures what it is designed to measure and can be assessed in various ways (Townsend, 2010) including construct validity (the correlation between how the NP model ranks the healthiness of foods in comparison to other measures (Arambepola, Scarborough, & Rayner, 2007; Townsend, 2010)) and criterion-related validity (the accuracy of the NP model scores based on an externally derived objective measure (Liamputtong, 2010; Townsend, 2010)). A review (Rayner, Mizdrak, et al., 2013) of the construct validity of NP models examined seven articles that investigated the agreement between two and six different models and concluded that an external reference is desirable for validation. Validation against objective measures of health, such as blood markers of nutritional status and medical records detailing incidence of chronic disease, would provide a reliable external reference (Drewnowski, Fulgoni, Young, & Pitman, 2008; Townsend, 2010). Confirmation of accuracy of a NP model is an obvious necessity prior to implementation (Tetens, Oberdorfer, Madsen, & de Vries, 2007) but many models are developed and applied with little testing to demonstrate validity (Chiuve et al., 2011; Hebden et al., 2010; Rayner, Scarborough, et al., 2013; Townsend, 2010). NP researchers suggest validity testing should be given the highest research priority (Drewnowski & Fulgoni, 2008) and it is the responsibility of researchers to ensure that the chosen measurement instruments demonstrate validity and reliability (Fullerton, 1993). While it is important that consumers can understand nutrition signposting schemes and be influenced to make healthier food choices, it is imperative that these schemes provide an accurate representation of the healthiness of food.

Three reviews (Garsetti et al., 2007; Institute of Medicine, 2010; Stockley et al., 2008) have identified and described existing NP models and another is expected to be released by the World Health Organisation (Rayner, Scarborough, et al., 2013). A review on the methodological quality of studies conducted to assess the impact that front-of-pack labels (FoPL) have on consumer behaviour, product reformulation and health outcomes, has also been published (Vyth et al., 2012a). The authors identified 31 studies (eight of which assessed the construct or criterion-related validity of NP models) and concluded that the methodological quality of FoPL studies was low to mediocre (Vyth et al., 2012a). To our knowledge there is no review that has comprehensively examined the research conducted on the construct and criterion-related validity of NP models. The aim of our systematic review was to identify the methods that have been used to assess the accuracy of NP models in preventing disease and promoting health and, for the first time, assess the quality of this body of evidence.

2. Methods

This systematic review adheres to the principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Statement (PRISMA) and conforms to its checklist (Liberati et al., 2009).

2.1. Eligibility criteria

We limited our review to those studies that provided a comprehensive explanation of the protocols followed to verify the construct or criterion-related validity of NP models. Papers on content validity (i.e. consideration and analysis of the components that make up the NP model with reference to current scientific literature (Deane, 1991; Hubley & Zumbo, 2010; Polit & Beck, 2006; Townsend, 2010)) were excluded. This is because this form of validation is assumed to be met in the early stages of model development (Townsend, 2010) and results from any further testing for accuracy will only be as good as the nutritional criteria underlying the model (Townsend, 2010). Hence, we assumed that NP models assessed for construct and/or criterion-related validity had already met the requirements of content validity. Studies investigating the face validity of NP models were not included in this review. We were guided by the results of a recent review (Peinemann, Tushabe, & Kleijnen, 2013) which encourages the inclusion of multiple study designs in systematic reviews in order to evaluate the many facets associated with health care interventions. Therefore, no restrictions were placed on study design as we were interested in all methods used to assess the construct and criterion-related validity of NP models. The inclusion criteria were created *a priori* by the authors specifically for this research (Table 1).

2.2. Information sources

Studies were identified by searching electronic databases, hand