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Research report

# Stakeholder reactions toward iodine biofortified foods. An application of protection motivation theory ☆

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ABSTRACT

*Objective/Purpose:* To use Protection Motivation Theory (PMT) to evaluate stakeholders' intention to adopt iodine biofortified foods as an alternative means to improve children's iodine status and overall school performance. *Methods:* A survey was administered with 360 parents of primary school children and 40 school heads. Protection motivation is measured through matching the cognitive processes they use to evaluate iodine deficiency (threat appraisal), as well as iodine biofortified foods to reduce the threat (coping appraisal). Data were analyzed through Robust (Cluster) regression analysis. *Results:* Gender had a significant effect on coping appraisal for school heads, while age, education, occupation, income, household size and knowledge were significant predictors of threat, coping appraisal and/or protection motivation intention among parents. Nevertheless, in the overall protection motivation model, only two coping factors, namely self-efficacy (parents) and response cost (school heads), influenced the intention to adopt iodine biofortified foods. *Conclusion:* School feeding programs incorporating iodine biofortification should strive to increase not only consumer knowledge about iodine but also its association to apparent deficiency disorders, boost self-efficacy and ensure that the costs incurred are not perceived as barriers of adoption. The insignificant threat appraisal effects lend support for targeting future communication on biofortification upon the strategies itself, rather than on the targeted micronutrient deficiency. PMT, and coping factors in particular, seem to be valuable in assessing intentions to adopt healthy foods. Nevertheless, research is needed to improve the impacts of threat appraisal factors.



## Introduction

Iodine deficiency, a well-known cause of preventable mental retardation, is still a major public health problem worldwide, e.g. 240.9 million school aged children are affected, of which 24% originate from Sub-Saharan Africa (Andersson, Karumbunathan, & Zimmermann, 2012). Given the profound effect of iodine deficiency on school performance (Pineda-Lucatero, Avila-Jimenez, Ramos-Hernandez, Magos, & Martinez, 2008; Qian et al., 2005) and the lack of iodine rich foods in East-African School Feeding Programs (Murphy, Gewa, Grillenberger, Bwibo, & Neumann, 2007), there is a need for novel strategies to improve iodine intake levels. Although Universal Salt Iodization has successfully reduced Iodine Deficiency Disorders (IDDs) in many countries, albeit more in developed than developing countries, a third of the world population is still unprotected, particularly in rural landlocked areas of developing regions where IDDs are still endemic (Zimmermann & Andersson, 2012). Therefore, biofortification of staple crops with iodine is a potential strategy to fill this gap, as is the case with other micronutrients, such as folate and vitamin A (Bouis, Hotz, McClafferty, Meenakshi, & Pfeiffer, 2011; De Steur et al., 2010; De Steur, Gellynck, Blancquaert et al., 2012; Lyons, Stangoulis, & Graham, 2004; Meenakshi et al., 2010). Increasing the iodine content of staple foods can be achieved through conventional plant breeding, provided there is genetic multiplicity, or by applying nutrient rich fertilizers to soils (Perez-Massot et al., 2013; Zhu et al., 2007). Otherwise genetic engineering is a viable alternative (Farre, Twyman, Zhu, Capell, & Christou, 2011; Yuan et al., 2011).

Nonetheless consumers are likely to have varying decisions about the acceptance and adoption of biofortified foods, once introduced to the market. Such food choices are a function of many

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personal factors, such as the level of health consciousness, the ability to overcome healthy eating barriers, nutrition knowledge, previous experience with similar foods, attitudes toward novel foods (technologies), and their perceived (adverse) health effects, religious and cultural beliefs, as well as external factors, such as the way these products are marketed (Mai & Hoffmann, 2012; Pounis et al., 2011; Verbeke, Scholderer, & Lahteenmaki, 2009). The introduction of iodine biofortification as a novel strategy to prevent IDDs will most likely involve a cognitive process leading to a motivated decision made by consumers. Thereby, Health Behavior Models such as the Health Belief Model (HBM), the Theory of Planned Behavior (TPB), the Social Cognitive Theory (SCT) and the Trans-theoretical Model of Change (TTM) are often used to explain people's motivational factors to perform or not perform health oriented behaviors (Baban & Craciun, 2007). However, since these models mainly focus on threats and often only partially incorporate efficacy factors, Protection Motivation Theory (PMT) is a potential candidate for this study because it additionally looks into coping factors as crucial persuasive communication elements for maintaining or initiating health behaviors (Milne, Sheeran, & Orbell, 2000) as well as helps to increase the general low explained variance. In addition, though a few studies have employed PMT to analyze consumer motivations to dietary change, i.e. functional foods (Cox & Bastiaans, 2007; Henson, Masakure, & Cranfield, 2008), none have been applied to biofortified foods, nor in the context of poor developing target regions. The present study therefore employs the PMT model to predict preferences of parents and school heads toward the potential use of iodine biofortified legumes in School Feeding Programs in Uganda. Many children in Uganda live around mountainous, rural areas with iodine depleted soils or further in-land without access to fish, sea food or iodized salt which are key sources of iodine (Acham, Kikafunda, Tylleskar, & Malde, 2012; Bimenya, Olico, Kaviri, Mbona, & Byarugaba, 2002; Ehrenkranz, Fualal, Ndizihiwe, Clarke, & Alder, 2011; FAO, 2010b; WHO, 2010).

*Protection motivation theory*

From its advent as a fear-arousing theory (Rogers, 1975), PMT evolved into a more comprehensive persuasion model explaining how the cognitive process of threat appraisal interacts with coping appraisal to generate an intention to a health related behavioral change (Maddux & Rogers, 1983). Protection motivation involves a decision making process by which an individual evaluates the gravity of, and exposure to, an imminent risk and chooses a suitable alternative to deal with the threat (Cameron, 2009; Cameron & DeJoy, 2006). The PMT incorporates maladaptive and adaptive behavior, which, respectively, constitute threat and coping appraisal. A threat follows arousal of fear for one to perceive danger (severity) and consider the extent of the risk involved (vulnerability) (Neuwirth, Dunwoody, & Griffin, 2000). The interaction among these three components decreases the probability that a maladaptive behavior occurs (threat appraisal). Similarly, one's confidence about the effectiveness of the proposed health behavior to cope with the threat (response efficacy) and one's belief about the ability to successfully undertake this health preventive action (self-efficacy) both increase the possibility that an adaptive behavior occurs (coping appraisal), while the evaluation of the costs involved in the execution of the health behavior (response cost) negatively affects the occurrence of the latter (Henson et al., 2008; Rogers & Prentice-Dunn, 1997).

This model has a superior capacity to determine and describe health preventive behavior because it covers more components that have been underpinned by a wide array of empirical and theoretical research, especially in the field of health behavior theory (Hodgkins & Orbell, 1998; Maddux & Rogers, 1983; Rogers & Prentice-Dunn, 1997). Therefore, the conceptualization of this model entails individuals' motivation to start or maintain, and select a specific action to protect themselves or others from a threat (Ch'ng & Glendon, 2013). Although health preventive intentions are associated with actual health behavior (Milne et al., 2000), the latter also depends on the stability of intentions over time which is in turn affected by a number of individual factors such as feelings of remorse for not performing an adaptive behavior (Cooke & Sheeran, 2004).

As was in the early years of its discovery, today PMT is still being used in health related research, such as genetic testing for breast cancer risk (Helmes, 2002), knowledge and risk perceptions of cervical cancer (Gu, Chan, Twinn, & Choi, 2012), consumption of omega-3 rich food (Cox, Evans, & Lease, 2008), selenium enriched foods (Cox & Bastiaans, 2007), or functional foods (Henson et al., 2008), and consumer compliance with dietary guidelines (Henson, Blandon, Cranfield, & Herath, 2010). Although both types of appraisal have shown a significant association with protection motivation intention, coping appraisal is a stronger predictor (Floyd, Prentice-Dunn, & Rogers, 2000; Milne et al., 2000). Thereby, self-efficacy is the strongest motivator of behavioral intention, although response efficacy may also be a crucial predictor for healthy foods, as shown by a study on foods rich in phytosterols to decrease the risk of cardiovascular diseases (Henson, Cranfield, & Herath, 2010). Cox and Bastiaans (2007) found that both appraisals explained no less than 36% of the variation in consumer motivation toward the use of selenium enriched foods. Still, other applications to food have reported significant effects of threat appraisal components. Henson et al. (2008), for example, examined purchase intention for three lycopene rich foods and showed that both appraisals positively affected the likelihood of Canadian men to consume tomato juice and the snack product but not the non-prescription pill.

Also socio-demographic characteristics, such as age (Henson et al., 2008) and gender (Cox & Bastiaans, 2007; Renner et al., 2008), may play a role in protection motivation research on foods. Talsma et al. (2013) found that increasing knowledge about vitamin A deficiency risks boosted consumer intentions to adopt biofortified cassava in Kenya. A similar effect is demonstrated for cereal fortification in Botswana (Mabaya, Jordaan, Malope, Monkhei, & Jackson, 2010), but not for foods with lycopene (Henson et al., 2008). This confirms the importance of knowledge when predicting preferences for nutritious foods and, thus, when developing interventions to improve awareness (Costa-Font, Gil, & Traill, 2008; Macharia-Mutie, Moreno-Londono, Brouwer, Mwangi, & Kok, 2009).

The aforementioned internal (threat and coping appraisal) and external factors (socio-demographics and knowledge) are incorporated in our conceptual framework to evaluate the reactions of parents and school heads toward iodine biofortified legumes for use in school feeding programs in order to prevent IDDs and improve school performance (Fig. 1). It hypothesizes that an individual will be first encountered with a threat of IDDs which in turn may translate into perceived fear, vulnerability and severity. Consecutively, protection motivation with regard to preference of iodine biofortified food will only be achieved when someone believes that continued practice of maladaptive behavior is of little benefit, that iodine biofortified foods will reduce the risk of IDDs, that the advocated adaptive behavior is effective and when he or she perceives only few hurdles such as time constraints and financial costs. The higher the threat and coping appraisal, the higher the protection motivation, shown by a positive intention to adopt iodine biofortified food in school feeding programs.

*School feeding programs in Uganda*

Uganda has a unique structure of education with 7 years of elementary education, 6 years of secondary education (4 years of lower and 2 years of upper secondary), followed by 3 to 5 years of post secondary education (Najjumba, Habyarimana, & Bunjo, 2013). The