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Factors affecting farmers' intention to engage in on-farm food safety practices in Iran: Extending the theory of planned behavior

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ABSTRACT

The main purpose of this study was to investigate the factors affecting the intention of lettuce producers to engage in on-farm food safety (OFFS) practices in Iran. A research-based model incorporating the psychology-based theory of planned behavior (TPB) was proposed to obtain a better understanding of motivational factors underlying intention to engage in OFFS practices. The data were collected from the survey conducted in four different counties of Alborz province located at northern part of Iran, with a total of 230 lettuce producers randomly selected from these counties. Empirical results of a structural equation modeling (SEM) analysis revealed that the three following components of the original TPB model had statistically significant positive relationships with farmers' engagement intention in OFFS practices and generally explained 41% of its variance. These components were attitude, perceived behavioral control (PBC) and social norms. Furthermore, after the inclusion of two constructs of moral norms and knowledge as additional intention predictors of the extended TPB model, the predictive power of the model was increased up to 16.4%, which is considerable. The findings provide valuable inputs to design effective approaches to motivate farmers' engagement in food safety behaviors. They furthermore help policy makers to support farmers in OFFS practices' accomplishment in Iran.

1. Introduction

Outbreaks of foodborne disease are a serious concern of public health officials around the world (Kuchenmuller et al., 2009; Talaei et al., 2015; Nayak, 2016) and occur on a daily bases in all developed and less-developed countries (Masoumi Asl et al., 2015). These diseases negatively affect individual health and wellbeing and also have a harmful impact on the society through the considerable costs related to both sick leave and medical expenses (Mullan, 2009). According to the WHO (World Health Organization, 2014), globally millions of people die every year from foodborne diseases caused by microbiological contamination of water and food. Fresh fruit and vegetables (FFVs) play a significant role in this regard (Center for Science in the Public Interest, 2008). These products are considered as a leading cause of outbreaks of foodborne illness in the United States and most countries worldwide (Tobin et al., 2013). For example, based on the newest available data, the most outbreak-associated illnesses in the United States in 2015 were linked to seeded vegetables (e.g., cucumbers or tomatoes, 1121 illnesses), pork (924), and vegetable row crops (e.g., leafy vegetables, 383) and in total, FFVs were the most common cause of outbreak-associated illnesses, accounting for 1649 (38%) illnesses (Centers for Disease Control and Prevention, 2017). The bad news is that, not only foodborne illness associated with FFVs has not decreased, but it has also dramatically increased over the last decade (Ezatpour et al., 2013; Zare Jeddi et al., 2014; Marine et al., 2016). In response to public concerns, market sensitivity and to reduce the incidence of foodborne disease, especially through production and consumption of healthy and safe crops, food safety must be considered at any point in the farm-to-fork continuum (Young et al., 2011; Parker et al., 2012). Since the key of the risks' reduction is to prevent contamination before it occurs, Rangarajan et al. (2000) believe that food safety begins on the farm and that the use of on-farm food safety (OFFS) practices would make it possible to prevent product contamination.

FFVs are an essential part of a healthy and balanced diet. They provide vitamins, minerals, dietary fiber and phytonutrients (Losio et al., 2015) in which their regular consumption can reduce the risk of cardiovascular disease, stroke and certain cancers (Garedaghi and Heikalabadi, 2015). Among fresh products, lettuce (*Lactuca sativa* L.) stands out because it is continuously available in the marketplace and its consumption is popular irrespective of age or economic group (Abreu et al., 2010). Despite the importance of FFVs in terms of economics and food value, these products are susceptible to contamination

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(Zare Jeddi et al., 2014). Hence, they play a significant role in foodborne disease in different countries (Gupta et al., 2009; Abougrain et al., 2010; Al-Megrin, 2010; Adenusi et al., 2015) and Iran is no exception. Ezatpour et al. (2013) showed that the contamination rate of fresh vegetables was about 79% in Lorestan province (a western Iranian province). Daryani et al. (2008) reported this to be 32.6% in Ardabil province in northwestern Iran. This rate is considerably high compared to those reported in other countries such as the 19.4% and 31.7% in Egypt (Said, 2012; Hassan et al., 2012), 58% in Libya (Abougrain et al., 2010) and 16.4% in Saudi Arabia (Al-Megrin, 2010). However, FFV contamination (such as of lettuce) can occur in different production stages (de Quadros Rodrigues et al., 2014). At the pre-harvest and post-harvest stages, FFVs are exposed to a spectrum of enteric pathogens such as viruses, bacteria, helminths, and protozoa (Fallah et al., 2016).

In recent years, programs and guidelines from the WHO and the Food and Agricultural Organization (FAO) have been developed in the form of OFFS practices in order to prevent or control conditions or factors leading to microbial contamination along the farm-to-fork continuum (Ssemanda et al., 2017). Such practices implemented by farmers can help contamination prevention or reduction in various products (Young et al., 2011; Ilic et al., 2012; Tobin et al., 2013; Nayak et al., 2015; Marine et al., 2016). Nevertheless, evidences show that farmers and producers are uncertain about the effectiveness of food safety programs and because of that they hesitate to adopt new standards or practices (Parker et al., 2016). Obviously, questions about the validity of the current practices and metrics of food safety would exist among farmers. Some are perceived to be arbitrary or excessive (Parker et al., 2012) and some others are supposed to be inadequately carried out on the farm (Nayak et al., 2015). This problem has been similarly observed in Iran, especially in Alborz province. For example, many lettuce producers in this province use sewage and contaminated wastewater for irrigation purposes and the percentage of toxic chemical substances, and animal manure is significantly high (Mianaji, 2018). Lack of attention to management practices and public health, including periodic testing of the soil and water on the farms, regular cleaning of agricultural machinery, lack of required equipment and tools and health criteria observation during product transportation are assumed as other problems which cause high contamination levels of lettuce production in Alborz province (Rouniasi and Parvizi Mosaed, 2016).

Parker et al. (2012) emphasized that there is a critical need to enhance food safety at all production scales and among all sectors involved in the production, distribution, and preparation of FFVs. This requires deep examination and understanding of the current OFFS programs and recognition of factors that affect engaging in OFFS practices. In recent years, many theories and models have been proposed by different researchers and experts to investigate people intention and identify the socio-psychological constructs that connect with intention and its antecedents with actual behavior. In this respect, one of the most useful frameworks is the theory of planned behavior (TPB) model, which is being increasingly applied in the broad range of fields and more specifically it has great applicability in the context of agriculture and rural development. A review of literature shows that the TPB model has long been successfully used to investigate a wide variety of farmers' intentions such as adoption of innovations and technologies (Lynne et al., 1995; Adnan et al., 2017), engagement in sustainable practices (Fielding et al., 2008; Menozzi et al., 2015; Zeweld et al., 2017), diversifying agricultural production (Senger et al., 2017) and businesses (Hansson et al., 2012), pesticide use (Bond et al., 2009), applying best management practices in the farm (Reimer et al., 2012), occupational safety and health behaviors (Colémont and Van den Broucke, 2008; Su et al., 2015), adaptation to climate change (Dang et al., 2014; Arunrat et al., 2017), engagement in pro-environmental activities (Wauters et al., 2010; Meijer et al., 2015; Borges et al., 2016; van Dijk et al., 2016), and using renewable energy and its related technologies (Liu et al., 2013). In the same vein, the TPB model has been applied to other types of behavior; for example, Bergevoet et al. (2004) provided support for the ability of the TPB model to explain farmers' complex economic behavior like entrepreneurship. Also, a number of scholars have focused on rural women via their TPB studies (Sun et al., 2006; Peyman et al., 2015). Despite general usefulness of the theory to identify and understand different behaviors of farmers and villagers, some of the studies have attempted to enhance the predictive power of the TPB model by including additional constructs such as past behavior (Bergevoet et al., 2004; Menozzi et al., 2015), social capital and training (Arunrat et al., 2017; Zeweld et al., 2017), actual control (Lynne et al., 1995), external and economic factors (Adnan et al., 2017), relative advantage, compatibility and observability (Reimer et al., 2012), social influence (Su et al., 2015), self-identity (van Dijk et al., 2016), and willingness to pay (Liu et al., 2013). However, to date, far too little attention has been paid to extend the TPB model by incorporating other rational variables particularly moral norms and knowledge in the context of agriculture and rural development. Thus, more research is needed to better understand the effects of these variables on farmers' intention and behavior.

Interestingly, most studies in which the TPB model has been applied to explain food safety behaviors, have focused on consumers for predicting their food choices and consumption habits (Kim and Chung, 2011; Chen, 2017; Song et al., 2017; Yadav and Pathak, 2017) and safe food handling behaviors (Byrd-Bredbenner et al., 2007; Mullan and Wong, 2009; Seaman and Eves, 2010; Fulham and Mullan, 2011; Shapiro et al., 2011; Mullan et al., 2013; Mullan et al., 2015a). For example, the empirical results of structural equation modeling (SEM) analysis accomplished by Chen (2017) revealed that attention to food safety scandal news, perceived credibility of information and perceived risk along with the original components of the TPB model (i.e., attitudes and perceived behavioral control/PBC, except subjective norms), had statistically significant effects on individuals' intention to take precautions to avoid consuming food with additives seriously. Shapiro et al. (2011) conducted a study investigating intentions' prediction to adopt safe home food handling practices including hand washing and food thermometer use. The TPB model explained 42% of the variance in intention to wash hands and 43% of the variance in intention to use food thermometers. Targeting young adult consumers, Mullan and Wong (2009) have shown the TPB model to predict 66% of the variance for intentions to prepare food safely and 21% of the variance in self-reported food safety behaviors. On the other hand, several studies have been conducted on farmers' food safety behaviors in which different variables have been identified as the principal influential factors such as farm scale (Armagan et al., 2009; Parker et al., 2016; Rouvière, 2016), food safety training (Rangarajan et al., 2002; Young et al., 2012), providing extension services (Nayak, 2016), market channel (Marine et al., 2016), knowledge and skills (Ivey et al., 2012; Tobin et al., 2013), and satisfaction with work performance (Ko, 2010). Conversely, very few studies have looked at farmers within the TPB theoretical framework in the context of OFFS behaviors (Lubran, 2010; Zhou et al., 2016). This highlights the need for further research in this field, particularly in developing countries.

The academic literature on food safety in Iran suggests that most studies have examined the technical aspects of agricultural products' contamination and foodborne illness (Jalalpour, 2012; Ezatpour et al., 2013; Zare Jeddi et al., 2014; Garedaghi and Heikalabadi, 2015; Masoumi Asl et al., 2015; Asadpour et al., 2016; Fallah et al., 2016; Rostami et al., 2016). Indeed, very few empirical studies have looked at behavioral, psychological and social aspects of food safety in Iran, and more specifically the majority of them have focused on consumers (Cheraghi et al., 2014; Talaei et al., 2015). To the best of our knowledge, no research has investigated OFFS behaviors of Iranian farmers based on a vigorous theoretical foundation and through the use of TPB model. Therefore, there is a serious research gap in this field.

The objectives of the present study were to: (1) measure intention of lettuce producers to engage in OFFS practices; (2) understand the socio-psychological factors affecting intention of lettuce producers to engage