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Factors affecting pesticide safety behaviour: The perceptions of Nepalese farmers and retailers

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HIGHLIGHTS

- Farmers misuse pesticides in vegetable farming in Nepal.
- A model was applied to study farmers' and retailers' pesticide safety behaviours.
- Farmers' and retailers' safety while handling pesticides is unsatisfactory.
- Farmers perceive lower pesticide threats and higher barriers.
- Awareness programs and social events are recommended.

GRAPHICAL ABSTRACT

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ABSTRACT

Indiscriminate use of pesticides in vegetable farming is an emerging problem resulting in increasing health and environmental risks in developing countries including Nepal. As there are limited studies focusing on farmers' and retailers' knowledge related to pesticide use and associated risks as well as safety behaviour, this study assesses their perceptions of pesticide use, associated impacts on human and environmental health and safety behaviours. This study is also intended to quantify pesticide use in vegetable farming. We used the Health Belief Model (HBM) to evaluate farmers' and retailers' safety behaviour associated with pesticides. We interviewed 183 farmers and 45 retailers. The study revealed that farmers applied pesticides at an average of 2.9 kg a.i./ha per crop per season; and insecticides, especially pyrethrins and pyrethroids as well as organophosphate, were the most frequently used. Retailers were more aware of the threats surrounding pesticide use and were thus more aware of the risks to their own health as well as to the health of animals, birds, fishes, and honey bees. Headache (73.8%) was the most commonly reported acute health symptom of pesticide use. Farmers often did not adopt the appropriate safety measures when handling pesticides sighting the constrained perceived barriers (direct path coefficient, DPC = −0.837) such as feeling uncomfortable and the unavailability of safety measures. Likewise, retailers lacked the incentive (direct path coefficient, DPC = 0.397) to adopt the necessary safety measures while handling pesticides. Training and awareness programs addressing safe handling practices and safety measures as well as education concerning the long-term risks of pesticide exposure on health and the environment, through radio, television and posters, may improve the safety behaviour of farmers and retailers.

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1. Introduction

The Health Belief Model (HBM) is a cognitive model that attempts to explain and predict health behaviours and has been used to understand the safety behaviour of farmers while handling pesticides (Khan, 2010; Raksanam et al., 2014b). The model (Fig. 1) says that in order to adopt safety behaviour, individuals need to perceive themselves susceptible to the possible illnesses and perceive the illnesses as serious (i.e. perceived threat), believe that the healthy behaviours are beneficial (i.e. perceived benefit), and believe that the benefits of healthy behaviours exceed the costs (i.e. perceived barriers) (Buglar et al., 2010; Coppens, 2016). If individuals believe themselves to be susceptible to a risky condition, think that the condition would have severe consequences, understand that adoption of available resources would beneficially reduce the condition of susceptibility and severity, and admit that the benefits of taking action outweigh the barriers to action, they are likely to follow safety behaviours that they believe will reduce their risk (Champion and Skinner, 2008).

Unsafe use of pesticides can be considered as a threat to human health and the environment and good safety behaviours can strongly reduce the threat (Damalas and Eleftherohorinos, 2011; Houbraken et al., 2016; Jin et al., 2017). Safety behaviour depends on the perceived susceptibility, the severity of the risks and benefits as well as the current inhibiting factors to adopting good safety behaviours (Abdollahzadeh et al., 2015; Sharifzadeh et al., 2017; Rezaei et al., 2018). Raksanam et al. (2012) found a strong relationship between farmers' perceived susceptibility to pesticide exposure, the perceived severity of the consequence of exposure and the perceived benefit of the farmers' safety behaviour. Farmers and retailers may perceive the threats from pesticide differently and thus their personal actions to reduce their risk vary accordingly. Some farmers perceive higher threats from pesticides and show more safety behaviours such as not drinking, smoking or eating during pesticide application as well as taking a bath and washing their cloths after spraying (Coppens, 2016). Similarly, farmers who had experienced health problems from applying pesticides may tend to adopt environmentally sound alternative pest management practices in order to reduce their pesticide risk (Lichtenberg and Zimmerman, 1999). The number of farmers who perceive higher threats from pesticide use corresponds to the increased use of safety measures such as gloves and shoes (Hernandez-Valero et al., 2001; Furlong et al., 2015). Considering this, our first hypothesis is that increased perceived threats from pesticide use is considered to have higher adherence to the safety behaviours.

Perceived barriers can affect the safety behaviours of farmers; the higher the perceived barrier, the lower the chances that farmers will report a higher adherence to safety behaviours (Khan et al., 2013; Toan et al., 2013; Raksanam et al., 2014a). Individual factors, such as the lack of time and comfort have been reported as barriers (Cabrera and Leckie, 2009; Levesque et al., 2012). Farmers may not use safety measures if they are an economical burden or a time restraint to performing the work (Snipes et al., 2009) or they are uncomfortable due to the heat stress and dampness experienced in the field (Walton et al., 2017). Factors such as the lack of training on safe pesticides use and the insufficient information provided on labels and package leaflets (normally in a foreign language) are considered the main barriers to the practice of good safety behaviour (Cabrera and Leckie, 2009; Khan and Damalas, 2015; Damalas and Khan, 2017; Damalas and Koutroubas, 2017). Likewise, farmers who perceive the benefits of safety measures wear a combination of recommended safety gear such as long pants, long-sleeved shirts, aprons, hand gloves, protective masks, and hats during pesticide application (Salvatore et al., 2008; Walton et al., 2017). Thus, our second hypothesis is that increased perceived barriers decreases safety measure adherence, and increased perceived benefits of safety gear use increases the adherence to safety measures.

The Health Belief Model (HBM) comprises two additional components: cues to action and self-efficacy (Hanson and Benedict, 2002). Cues to action works as a 'trigger' and thus motivates individuals to change behaviours, while self-efficacy builds confidence in individuals to improve safety behaviours when handling pesticides (Bay and Heshmati, 2016). Farmers who are familiar with the short-term risk of poisoning during pesticide application adopt safety measures (Elmore and Arcury, 2001; Strong et al., 2008). Reoccurrence of symptoms such as headache and itching may act as internal stimuli to encourage the farmers to practice safe behaviours. External stimuli such as the provision of information via social media and trainings to facilitate the adoption of healthy behaviour (Kien, 2015) also act as triggers to encourage good pesticide practices. Safety hazards, safety culture, and production pressure can influence self-efficacy of individuals which in turn causes them to practice safe or unsafe behaviour (Brown et al., 2000; Rezaei et al., 2018). Providing proper safety equipment and work clothing would build a more positive work experience and increase job satisfaction thereby increasing the self-confidence of individuals (Wagner et al., 2013). Safety education positively determines farmers' self-efficacy and enhances their skills to perform work more safely (Pettinger, 2000). Accordingly, our final hypothesis is that increased cues to action and self-efficacy have a positive effect on safety behaviour.

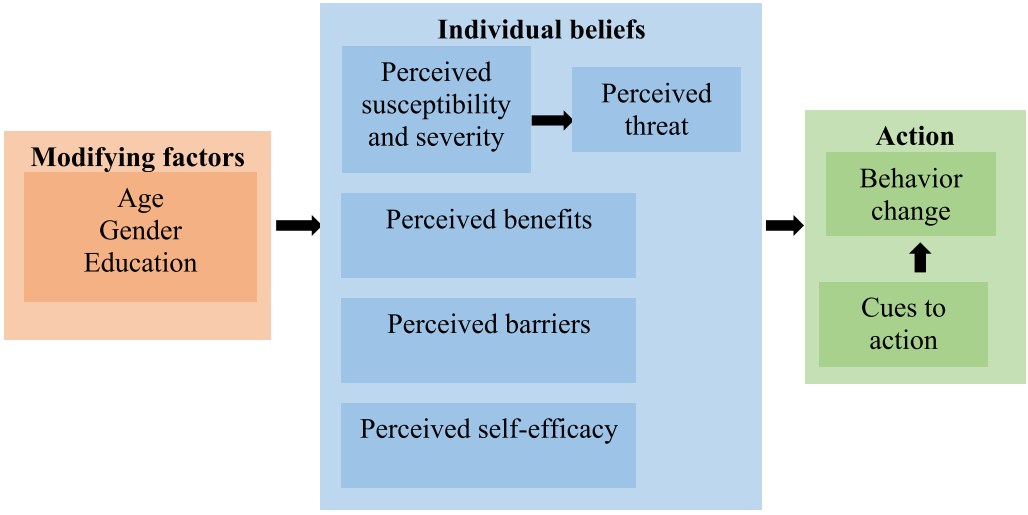

Fig. 1. The Health Belief Model (Champion and Skinner, 2008).