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Gender differences in pesticide use knowledge, risk awareness and practices in Chinese farmers

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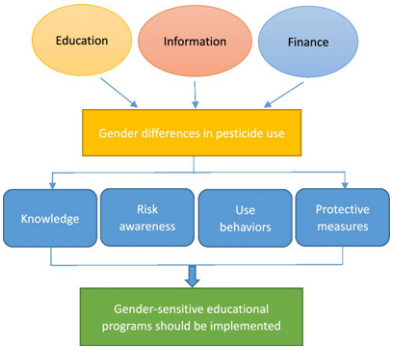
HIGHLIGHTS

- Male farmers had a better knowledge of pesticide use.
- Men had a greater awareness of associated health risk.
- More men used pesticides and disposed of the pesticide containers correctly.
- Fewer men applied protective measures or behaviors when using pesticides.
- Gender-sensitive educational programs should be implemented.

GRAPHICAL ABSTRACT



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ABSTRACT

This study investigates gender differences in the pesticide use knowledge, risk awareness and practices of farmers in Anqiu County, China. A total of 452 male and 178 female farmers from seven towns were interviewed in 2016. The results show that there are gender differences regarding knowledge of pesticide impacts, pesticide use practices and protective behaviors. Male farmers had a better knowledge of pesticide use and greater awareness of associated health risks. More men than women used pesticides and disposed of the pesticide containers correctly, but fewer men applied protective measures or behaviors when using pesticides. Canonical correspondence analysis indicated that participation in farmer professional cooperatives differed by gender and contributed greatly to the protective behaviors of farmers ($p < 0.05$). These results suggest that gender-sensitive educational programs should be implemented to increase the awareness of safety amongst farmers, and protective measures should be encouraged to reduce exposure to pesticide risks in China.

1. Introduction

Pesticides play an important role in pest management in agriculture (Beddington, 2010; Rahman, 2013). However, the widespread use of pesticides has had adverse effects on human health and the environment (Carvalho, 2006; Rasmussen et al., 2015). The unsafe handling of pesticides in developing countries has been widely documented (Atreya et al., 2012; Barraza et al., 2011; Bin et al., 2001; Florax, 2005;

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Garming and Waibel, 2009; Khan and Damalas, 2015; Lopes and Firpo, 2009; Snelder et al., 2008), making it an important policy concern in public health and environmental protection (Damalas et al., 2008; Hvistendahl, 2013; Verger and Boobis, 2013).

China has a long history of cultivation, and pesticide use has been increasing (Zhang et al., 2015). Farmers have the highest health risks related to pesticides (Palis et al., 2006; Yang et al., 2014). In order to protect farmers' health and the environment, local policy makers have endeavored to increase farmers' knowledge of how to use pesticides correctly and regulate pesticide usage. In China, both female and male farmers use pesticides. Due to the fact that many male farmers choose to seek jobs in urban areas for higher income instead of living on farms, more and more women are involved in farming activities, including pesticide use (Li et al., 2015). Studies done in other countries showed that females experience significantly increased pesticide risks (Garcia, 2003; Chetna et al., 2012).

Usually, women and men are treated fairly in the formulation of agricultural policies (Newhoff et al., 2014). However, relative to their male counterparts, women experience gender gaps with less access to finance, inputs, education and associated agricultural extension services (Akter et al., 2016). In recent decades, the importance of accounting for gender differences has been highlighted in the implementation and evaluation of programs across a variety of social and economic sectors. The FAO (2011) warns that failure to recognize differences and inequities between men and women poses a serious threat to the effectiveness of the agricultural development agenda.

A better understanding of farmers' knowledge, awareness and practices of pesticide use is essential for formulating effective public policies and public health and environmental protection (Fan et al., 2015; Jin et al., 2017). It is important to understand gender differences in knowledge, attitudes and practices regarding pesticide use to identify pesticide risks by gender and to recommend more gender-sensitive programs. Limited studies have been conducted to investigate gender differences in knowledge and practices of pesticide application amongst farmers (Atreya, 2007; Chetna et al., 2012). To address this gap, here 452 men and 178 women were interviewed to assess gender differences in pesticide use knowledge, risk awareness and practices in Anqiu, China. The findings of this study will not only help the Chinese government formulate more rational and effective pesticide policies but also contribute to the literature on understanding gender differences in knowledge, risk awareness and practices of pesticide use in developing countries.

2. Materials and methods

2.1. Description of the study area

The study was carried out in Anqiu County, Shandong province in eastern China (118°44′-119°27′E and 36°05′-36°38′N) (Fig. 1). Anqiu has an area of approximately 1760 km^2 and a population of 950,000. The county has >866.7 km^2 of arable land. The area has a continental monsoon climate where 10 different crops are grown. Winter wheat, scallions and garlic are the principal crops, occupying 69% of the total arable land, followed by peanuts, which occupies 13% of the total land area. As the central section of the North China Plain, agricultural production in Anqiu plays an important role in ensuring food security across China. To achieve high agricultural productivity, the county has adopted high-input farming practices, including pesticide use.

2.2. Survey instrument and data collection

A structured questionnaire was designed to explore our research objectives. The questionnaire was developed and revised based on several focus-group discussions and a series of pre-test surveys.

The final questionnaire used in the field contained three sections addressing the main topics: (1) farmers' knowledge, attitudes and risk awareness of pesticide use; (2) farmers' pesticide use practices and personal protective behaviors; (3) farmers' socioeconomic and

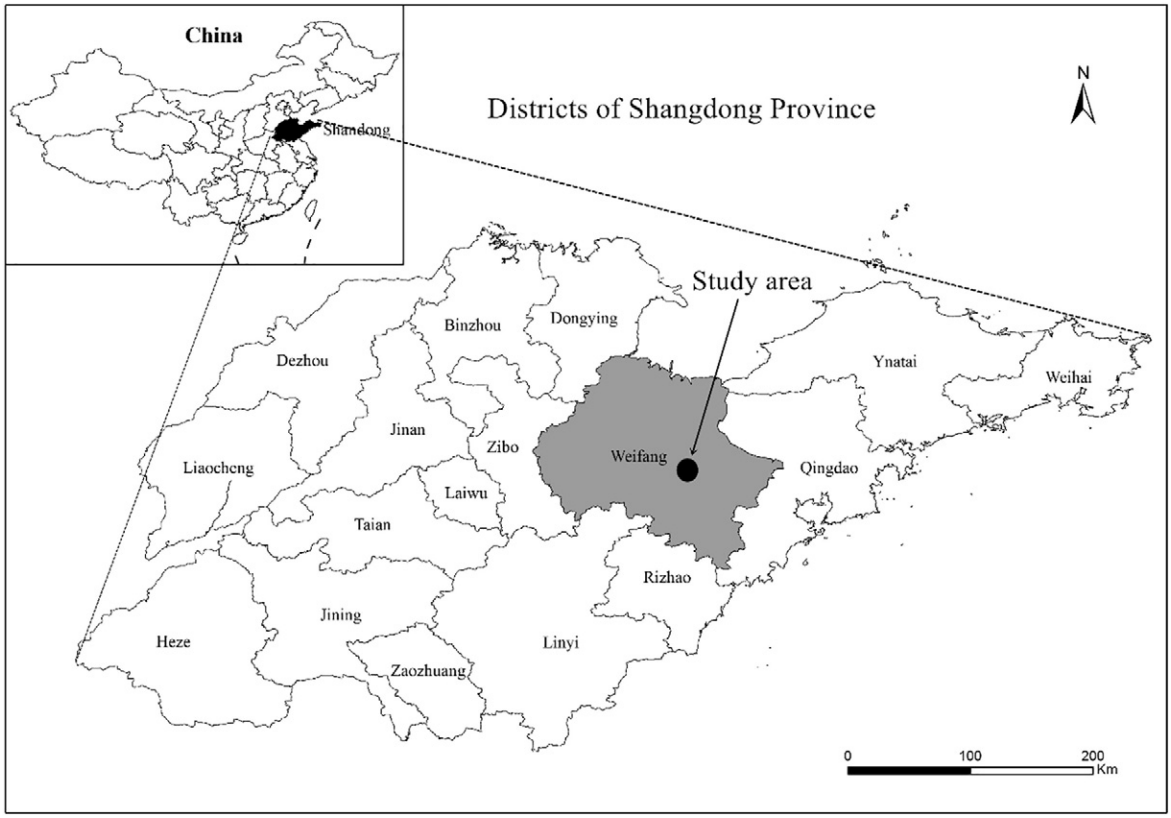

Fig. 1. Location of the study area.