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Stakeholders' knowledge, attitude, and practices (KAP) towards aflatoxins contamination in peanut-based products

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ABSTRACT

The aims of this study were to identify the differences in terms of knowledge, attitude and practices (KAP) of aflatoxins contamination amongst stakeholders of peanut-based products and to determine factors that mostly influence stakeholders' hygienic practices in peanut-based products. Using stratified random sampling responses were obtained from a total of 109 stakeholders of peanut-based products companies consisting of importers, small and large-scale manufacturers, and retailers located in Peninsular Malaysia. Statistical analyses including descriptive analysis, mean ranking analysis, one-way ANOVA and logistic regression analysis were used to analyze the data. The results revealed that the stakeholders have adequate knowledge, favorable attitude, and high hygiene practices towards aflatoxins contamination in peanut-based products with mean scores of 2.54, 4.27, and 2.61, respectively. Based on the one-way ANOVA results, there was a significant difference ($p < 0.05$) in knowledge and practices among the four different stakeholder groups. However, the result for attitude level towards minimizing aflatoxins contamination was found to be not significantly difference amongst stakeholder groups. Results of the logistic regression analysis showed that four significant variables namely hygiene and training programs, storage, knowledge about aflatoxins, and quality assurance certification were the most influential factors influencing hygiene practices towards minimizing aflatoxins contamination in peanut-based products. The results strongly emphasized the need for continuous hygiene improvement and training programs by the stakeholders of peanut-based products. Relevant strategies such as promotion and motivational models on health education and food safety campaigns will increase awareness and knowledge on food contaminants.

1. Introduction

Peanut (*Arachis hypogaea* L.) is an important source of proteins and fats in developing countries such as Malaysia. Peanut in Malaysia is usually consumed as a snack, side dish or in large portions per individual. Azrandeh, Selamat, and Lioe (2010) reported that the average Malaysian consumes 56.90 g of peanut per day. The same study also noted that demand and consumption for peanuts is increasing progressively over the years. Thus, Malaysians to a large extent are susceptible to the risks effects from aflatoxins due to ready availability of peanuts and peanut-based products throughout the country's retail markets and supermarkets. Peanuts have also been used in a variety of popular Malaysian dishes such as satay (beef or chicken with peanut sauce) and rempeyek (traditional cracker) (Sulaiman, Chye, Hamid, & Yatim, 2007).

Aflatoxins are toxic metabolites produced by certain fungi, such as *Aspergillus* spp. and particularly *Aspergillus flavus* and *A. paraciticus*. Besides, aflatoxins B_1 (AFB_1) remain the most toxic compared to other types of aflatoxins (Moss, 1998; Squire, 1981). Based on several epidemiological studies, AFB_1 is classified by the International Agency for Research on Cancer (IARC) as category Group 1 carcinogens (IARC, 1993; JECFA, 1998) related to Hepatocellular carcinoma (HCC) known as liver cancer (Goeger, Hsie, & Anderson, 1999) and acute hepatitis (Li, Yoshizawa, Kawamura,

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Luo, & Li, 2001; Park, Kim, & Kim, 2004). Incidence of aflatoxins has continued to increase significantly in Africa and Asian countries such as China and Philippines. In reference to Chao, Maxwell, and Wong (1991) and Lye, Ghazali, Mohan, Alwin, and Nair (1995) certain cases of food poisoning in the northwestern state of Perak in Peninsular Malaysia were attributable to aflatoxins and boric acid, among which fatal cases were reported for 13 Chinese children who died of acute hepatic encephalopathy and renal failure; due to ingestion of the noodles, "*loh see fun*", some hours before death. Hence, aflatoxins may increase level of stress susceptibility and as well affect kids growth efficiency.

Toxins are commonly found in human foods and even animal feeds (such as corn, peanuts, wheat, barley, sorghum, and other legumes and oilseeds) and are suspected to threaten both human and animal health. Aflatoxins formation is fostered by hot and humid conditions in that favor fungi growth (Azrandeh et al., 2010; Leong, Rosma, Latiff, & Ahmad, 2011; Liu & Wu, 2010). Since the relative humidity in Malaysia falls in the range of 70%–80% during wet season and 50%–60% during dry season, the hot and humid weather conditions may provide ideal growth conditions for *Aspergillus flavus* and easy production of aflatoxins (Bhat & Vasanthi, 2003). Studies by Abdullah, Nawawi, and Othman (1998) and Ali, Hashim, and Yoshizawa (1999) reported incidences of aflatoxin contamination of foods products in Malaysia. Starch-based food, commercial peanut-based products, and corn-based products, were among those reported. Moreover, activities from pre- and post-harvest practices such as improper storage, mishandling peanuts during transporting and marketing can contribute to fungi infestation, thereby increasing the risk of aflatoxins contamination (Azrandeh et al., 2010; Bhat & Vasanthi, 2003). Risk factors of aflatoxin contamination are due to lack of awareness on proper food hygiene, poor implementation and low level of training amongst workers (Audit Commission, 1990). Ali et al. (1999) further reported that 65% of peanut products from Malaysia were identified as being contaminated with aflatoxins at a mean level of 50 μg/kg, even though the worldwide permitted limit for aflatoxin B_1 (AFB_1) was from 0 to 30 μg/kg and total aflatoxins was from 0 to 50 μg/kg (Creppy, 2002; FAO, 2004). Also, the European Commission Regulations in 2010 established the current limits for AFB_1 and total aflatoxins in groundnuts, dried fruit, nuts, and cereals, as not more than 2 μg/kg and 4 μg/kg, respectively (Commission Regulation, 2010). According to the section 34 of the *Food Act, 1983 Food (Amendment) (No.3) Regulations 2014* and Health Science Authority (HSA), the maximum permitted level of total aflatoxins in peanut-based products in Malaysia is established as 15 μg/kg.

Globally, there has been increasing incidences relating to food-borne diseases including aflatoxins in both developed and developing countries (Scott, 2003). Thus, significant public health crisis can result from aflatoxins contamination if proper hygiene practices and personal sanitation are not applied for food products. Literature demonstrates that low level of awareness and knowledge regarding occurrence of aflatoxins contamination in food products especially peanut-based products is as a result of poor education level among food handlers and workers. Risks of aflatoxins contamination can be reduced through awareness campaigns to increase the level of public knowledge, including food handlers (James et al., 2007). Trainings, food safety education, and the developments of food safety certifications are important factors to ensure that food handlers are proficient and knowledgeable on the principles of food safety and personal sanitation (Jacob, 1989). Studies relating to aflatoxins exposure remain significant aspects of food safety that needs urgent attention. Therefore, this study aimed to identify the differences in terms of knowledge, attitude and practices (KAP) of aflatoxins contamination amongst stakeholders of peanut-based products and to determine factors that mostly influence stakeholders' hygienic practices in peanut-based products.

2. Materials and methods

A total of 109 stakeholders from companies of peanut-based products including importers, large and small-scale manufacturers, and retailers located in Peninsular Malaysia were the respondents in this study. Peanut-based manufacturers were divided into two (2) categories namely: large-scale manufacturers and small-scale manufacturers. The two (2) categories were defined based on two (2) criteria: annual sales turnover and number of full-time employees of the business. According to Hashim (2005), Ministry of International Trade and Industry (MITI) Malaysia redefined the Small and Medium-Sized and Enterprises (SMEs) in the Malaysian manufacturing sector to involve companies with larger operating capacity. Small-scale firms is referred to a company with less than 50 full time employees and an annual turnover of not more than RM10 million (US$2.6 million), whereas a company with between 51 and 150 employees and an annual turnover between RM10 million and RM25 million (US$2.6 million and US$6.4 million) is considered as medium-scale.

The peanut-based company details and data were obtained from the Ministry of Health (MOH) database. By using the data given, the companies were stratified and randomly selected according to the different types of peanut-based stakeholders entities located in Peninsular Malaysia. Face-to-face interviews using a structured questionnaire were carried out with the companies to get in-depth responses of their perspective. The established questionnaire consisted of two parts wherein the first part was established to obtain information about company's profiles. The second part consisted of statements related to the knowledge, attitude, and hygiene practices towards aflatoxins contamination in peanut-based products. The completed questionnaires were analyzed using descriptive analysis, mean ranking analysis, one-way analysis of variance (One-way ANOVA), and logistic regression analysis by using SPSS version 22.0.

Descriptive analysis was carried out to summarize the socio-demographic profiles of the respondents based on frequency distributions and percentages; thereby making it simpler to understand the profiles of peanut-based companies. Meanwhile, the mean ranking analysis on 3-point Likert scales statements was used to understand the stakeholders' KAP level towards aflatoxins contamination in peanut-based products. One-way ANOVA was performed to identify differences in knowledge, attitude, and practices of aflatoxins contamination amongst stakeholders groups of peanut-based products comprising importers, large-scale manufacturers, small-scale manufacturers, and retailers. Jevšnik, Hlebec, & Raspor, (2008) and Sanlier (2009) also used KAP variables to measure the significant difference of KAP against different groups or entities. Significant findings were further analyzed to determine which specific groups differed from each other using Tukey post hoc tests. Findings with a p-value <0.05 were used to determine statistical significance. The following hypothesis was developed and tested for this study: -

H_0: There is no significant difference between knowledge, attitude, and practices (KAP) of stakeholders towards aflatoxins contamination in peanut-based products.

Logistic regression analysis was conducted to identify factors that mostly influenced hygiene practices in minimizing aflatoxins contamination in peanut-based products. The logistic regression equation predicts the outcome of the categorical dependent variable from the independent variables. Equation (1) below shows the prediction of outcome of dependent variable as follows: -