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Short communication



Feasibility and Acceptibility of EatSAFE-StopWASTE© Mobile App

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Abstract

Food poisoning affects one in six people around the world every year and food wastage due to expired or spoiled food continues to become global problem. It is a hope through the advancement of technology, these issues can be reduced with the help of smartphone apps. The EatSAFE-StopWASTE© app was developed to be a user friendly, attractive, informative and flexible smartphone app that help users to reduce food poisoning risk through food safety knowledge and food poisoning risk estimator. This app which categorises food into shelf stable food and perishable food aims to reduce food wastage through reminders of the food purchased. The feasibility and acceptability of EatSAFE-StopWASTE© app were tested among 61 respondents, age ranged from 13 to 60 years old. Feasibility and acceptability of the app was found to be at 87.7% and 89.0%, respectively. Respondents agreed that the app is attractive (83.6%), user friendly (90.2%), easy to understand (95.1%), provides good features (82.0%), informative (86.1%), and useful (91.8%). It can be concluded that EatSAFE-StopWASTE© app is highly feasible and acceptable among users as an aid to help them in reducing food poisoning and food wastage.

Keywords: *EatSAFE-StopWASTE©; pathogens; feasibility; acceptability; mobile app*

1. Introduction

Annually, there are millions of people become sick and hospitalized as a result from contracting foodborne diseases. Pathogens contamination through the food chain has been recognised as a potential hazard in causing food poisoning. Food safety issues have always been challenged by increase in food trading internationally, changes in consumer's lifestyle, and consumer preferences over ready-to-eat food. Modern technologies and food safety programs such as animal husbandry, agronomic process, Good Manufacturing Practices (GMP), Hazard Analysis and Critical Control Point (HACCP) do increase the safety of food but do not totally prevent food poisoning cases from occurring [1]. Contaminations of food products may occur at different stages from farm which include the growth or production of raw materials up to the food prepared on the table ready to be consumed by consumers. In addition, pathogens are capable of attaching to living and inert surfaces and multiply to form microbial communities known as biofilms which are highly tolerant to various antimicrobial agents [2]. These factors had contributed to the pathogen prevalence in foods and food contact surfaces.

Food poisoning cases around the world remain as a serious issue in which about 600 million people fall ill and 420 000 people die due to consuming contaminated food [3]. WHO [3] reported African and Southeast Asia Region have the highest burden of foodborne illnesses. Southeast Asia Region recorded 150 million cases and 75 000 deaths per year. Among the foodborne illnesses, diarrhoeal diseases account the majority of the cases surpassing half of the global burden in which affected 550 million people and caused 230 000 deaths every year. Common causes of diarrhoea include eating raw or undercooked fish, meat, dairy products and fresh produce. Most of the pathogen detected include *Salmonella*, norovirus, *Campylobacter*, and pathogenic *E. coli*. Non-typhoidal *Salmonella* have been considered a public health concern for both high- and low-income countries.

Low- and middle-income countries are at a higher risk of foodborne diseases due to lack of safe water for food preparation; lower levels of literacy and education, poor hygiene awareness and practices in food production and storage; and poor implementation of food safety legislation [3, 4]. Complications from foodborne infection range from mild acute symptoms such as nausea, vomiting and diarrhoea to severe chronic illnesses such as organ failure, brain and neural damage and certain types of cancers. Immunocompromised individuals, children and pregnant women will develop more serious symptoms if contracted with the disease. Serious food poisoning in young children might result in delayed physical and mental development which eventually impact their later life [3].

Food poisoning cases continue to rise in Malaysia context due to the lack of awareness in the seriousness of this illness [4]. Most of the food poisoning outbreak reported in Malaysia occurred in schools, street markets and wedding receptions. The reasons behind higher incidence in such occasions are due to the food was undercooked when prepared in large amount, poor hygiene practices, prepared too early before the event or use of questionable raw materials. The number of cases showed a twofold increase within a 5-year span with an average of 8000 cases in year 2015 from 3822 cases in year 2010 [5]. The increasing number of outbreaks are unfortunate as food handlers have been trained of hygienic practices for food preparation [6].

Nowadays, mobile phone referred as "smartphone" offers advanced computing capability and connectivity just like tablet computer. These features reposition mobile phone as a new infor-

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mation medium [7] and there are about 2.32 billion smartphone users around the world [8]. In 2017, percentage of individuals in Malaysia aged 15 years and above using mobile phone were 97.7% compared to computer at 69.8% [9]. Smart phone comprised 75.9% from the total mobile phone sold in Malaysia as shown by Malaysian Communications and Multimedia Commission [10]. A variety of applications (apps) relating to Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Point (HACCP), Food Handling, and Calculating Food Wastage are available as separate applications from iOS and Android platform. To the best of our knowledge, app that could deliver food safety knowledge, estimates food poisoning risk and reduce food wastage through reminder, all as a single app is still not available in Google Playstore. The aim of this paper is therefore to describe the feasibility and acceptability of a new mobile app, EatSAFE-StopWASTE© to help users to improve their food safety knowledge, estimate food poisoning risk and reduce food wastage.

2. Methodology

2.1. Content Development

The app has two key functions: 1) to reduce food poisoning risk and 2) to reduce food wastage. These two main key functions were choose to be included in this app because most of the food poisoning cases are due to cross-contamination, poor hygiene awareness and poor food handling practices [3, 4]. Global food wastage was also estimated to be around 35 – 50% of all food produced globally and value of food wasted worth over $1 trillion [11]. To prevent food poisoning, improving food safety knowledge and constant reminding are necessary. Besides, risk estimator for different food commodities will help users to know the risk level of consuming certain food kept at certain conditions. The development of the framework and interface was initiated in October 2017 and completed in December 2017. The iterative development and testing process ware done in February 2018.

2.2. Application Development and Technical production

The software and interface were developed by Tri-Cyxlone Technology, Malaysia. The app was designed for Android platform due its popularity and most used smartphone platform in Malaysia [12]. Contents and technical issues were discussed and resolved through meetings and discussions. The contents were developed by experts in the field of food safety, food microbiology and public health. The finalized mobile app of EatSAFE-StopWASTE© was filed for copyright bearing number (LY20180001115). EatSAFE StopWASTE© is based on hybrid application which allow faster processing than native application. All the application was built in HTML code and uploaded in a server. The app was subsequently tested for its feasibility among smartphone users.

2.3. Feasibility and acceptability testing

2.3.1. Sampling and sample size

A sample of 61 users were chosen from lecturers, teachers and students from university and secondary schools in Besut, Terengganu. Inclusion criteria for survey participation were those who are able to use gadget and comprehend basic English. The platform was developed using English as this app targets not only locals but also global users after the app's inclusion in Google Playstore. Exclusion criteria for this study are those who do not own a smartphone.

2.3.2 Instruments (a): Respondent Information Form

This form consists of respondents demographic characteristics which include gender, age, race, occupation, and highest education level.

2.3.3. Instruments (b): Feasibility and Acceptability Questionnaire

The questionnaire consists of 11-item scale that measures the feasibility and acceptability of an app which was adapted from Salihah *et al.* [13]. It was constructed in English with 5-point Likert-scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher score corresponds to better feasibility and acceptability levels. Questions 1 to 4 were constructed to assess feasibility of the app and question 5 to 11 were aimed to evaluate acceptability which include suitability of language used, ease of operation, knowledge enhancement, usefulness and potential recommendation. Cronbach's alpha was used to measure the internal consistency and showed very good result (total = 0.851; feasibility = 0.645; acceptability = 0.821).

2.3.4. Data collection method

Respondents were selected randomly from university and schools located in Besut, Terengganu. They were briefed about EatSAFE-StopWASTE© app on its development, innovative features and functionality specifications. They were then allowed to explore the app from the smartphone provided in this study for five to ten minutes. Then, the respondents proceeded to fill in the *Personal Information Form* and *Feasibility and Acceptability Questionnaire*. All information and responses were confidential and personal information would not be revealed.

2.3.5. Data analysis

Data were analyzed using the IBM SPSS for Windows version 23.0. All socio-demographic as well as feasibility and acceptability data were analysed descriptively and presented as frequencies and percentages. This was carried out by determining the number of respondents (n) who answered in each Likert-scale and the corresponding percentage. Respondent who chose *Strongly Agree* or *Agree* were collectively calculated and considered as agree with the question or statement. The opposite was applied for *Strongly Disagree* or *Disagree* response.

3. Results and Discussion

3.1. Functionality overview

Screenshot of EatSAFE-StopWASTE© app was presented in Fig. 1. The two main functionality components of EatSAFE-StopWASTE© app consist of i) reduce food poisoning risk and ii) reduce food wastage. Food poisoning risk can be reduced through food safety knowledge section which covers, i) common causes of food poisoning, ii) factors affecting microbial growth such as food, acidity, time, temperature, oxygen and moisture abbreviated as "FAT TOM", iii) food utilisation or consumption order using First-In-First-Out (FIFO) or First-Expiry-First-Out (FEFO) principle and iv) 3 rules of Good Food Hygiene Practices. In addition, food poisoning risk estimator section covers four main food categories, namely cereals and grains, fish and meat, fruit and vegetables which will provide users three levels of food poisoning risk (high, medium or low) based on the freshness of food, temperature danger zone and duration of food left at temperature danger zone.
Food wastage can be reduced through StopWASTE section which covers, i) shelf stable food and ii) perishable food. The StopWASTE section reminds users of the foods they buy and thus

prevent multiple purchases of the same or similar items. If the foods are shelf stable, the expiry dates will be recorded while the impending spoilage date (three to seven days) for perishable foods such as fresh produce will be suggested. Table 1 summarized the details of each component found in the app.

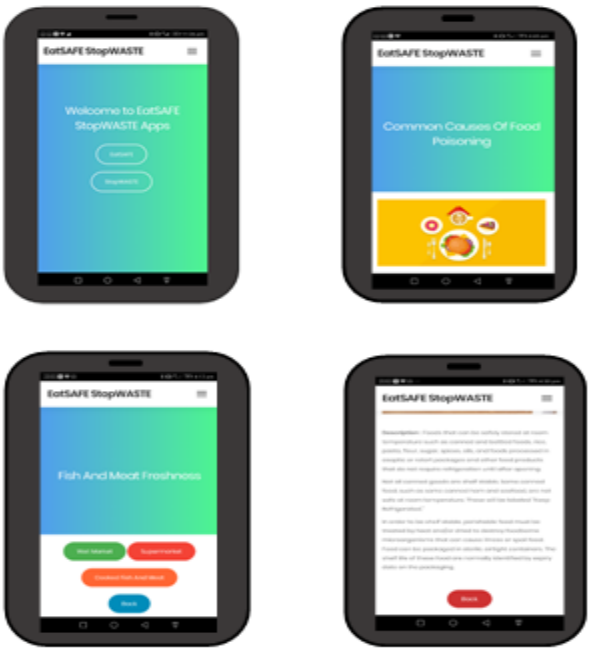


Fig. 1: Screenshot of EatSAFE-StopWASTE© app on a smartphone

3.2. Feasibility and acceptability

A total of 61 respondents were recruited from university and schools – 5 university staff, 10 university students, 5 teachers, and 41 school students. Convenience sampling was applied in selecting the respondents. About 82.0% of the respondents were female and 18.0% were male.

Table 2 shows the responses on the feasibility and acceptability of EatSAFE-StopWASTE© app. Majority of the respondents agreed that the app is attractive (83.6%), easy to use (90.2%), easy to understand in term of language (95.1%), and features offered (82.0%). About 86.9% of the respondents believed that the app can help them to reduce food wastage while 85.2% opined it can help in reducing food poisoning risk. Most of the respondents felt the app is useful and beneficial to them (90.2%) and think that it is a good app (93.4%). As such, 90.2% of them would like to own the app and 93.4% would recommend it to their family and friends.

Apps have become a convenient means to access information and perform specific functions using various operating systems. EatSAFE-StopWASTE© represents a novel mobile app designed to provide specific educational advice with regards to food safety knowledge, food poisoning risk and stop food wastage by knowing the characteristics of shelf stable food and perishable food. To the best our knowledge, this is the first mobile app based study that covers both food safety and food wastage. The app aims to increase food safety knowledge through simple and effective steps to prevent food poisoning as foods that because illness is not necessarily spoiled or taste bad. In addition, the app estimates the risk of food poisoning when the users enter the food purchased or consumed and follow the step-by-step instruction on the EatSAFE-StopWASTE© app. The risk level will be prompted after the information is entered in the "Are you at risk?" section. As such, the users will know the possible risk of the food that they are going to consume. This app could also fill the gap in food safety education not only for Malaysia but also globally. It serves as the quick note for food handlers and interactive food safety education for schoolchildren. In order to reduce food wastage, users could record their purchases in the StopWASTE section under shelf stable food or perishable food. Users are required to fill in the product name and the expiry date. StopWASTE also helps users to prevent multiple purchases of the same or similar items. The app attractive features and user friendliness could benefit majority of users who want to reduce food poisoning risk and food wastage.

As shown in the current feasibility study, EatSAFE-StopWASTE© app exhibits excellent feasibility in its attractiveness, easy to use and interactive features. The use of English language in the app was highly agreeable. This main reason could be due to the increase of ICT usage worldwide for browsing websites, checking emails, updating social media and sharing information such as video and photo prior to the smartphone apps being popularized [14]. As such, those who are exposed to the ICT are familiar with Basic English language as the main language of communication. In terms of acceptance, users believed their risk of food poisoning will be reduced through the information and risk estimator provided in the app. Majority of the users were interested in reducing food wastage through StopWASTE section as food wastage will cause unnecessary financial burden. Such responses indicated the needs of such apps which are easily available and affordable to users to which are offered by EatSAFE-StopWASTE© app. These feedbacks were similar to that reported by Salihah *et al.* [13] in their study on mobile app acceptance on nutrition educa-

Table 1: The key functionality components in EatSAFE-StopWASTE© app.

Component	Description
EatSAFE (Reduce food poisoning risk)	Two sub-components were included: Food safety knowledge covers the following aspects: Common causes of food poisoning Factors affecting microbial growth such as Food, Acidity, Time, Temperature, Oxygen and Moisture abbreviated as "FAT TOM" Food utilisation or consumption order using First-In-First-Out (FIFO) or First-Expiry-First-Out (FEFO) principle Three (3) rules of Good Food Hygiene Practices Food poisoning risk estimator with three (3) levels of risks (high, medium and low) covers the following food categories: Cereals and grains Fish and meat Fruits Vegetables
StopWASTE (Reduce food wastage)	Two sub-components were included: Shelf stable food Foods that can be safely stored at room temperature such as canned and bottled foods, rice, pasta, flour, sugar, spices, oils, and foods processed in aseptic or retort packages and other food products that do not require refrigeration until they are opened. Not all canned goods are shelf stable. Some canned foods, such as some canned ham and seafood, are not safe at room temperature. These will be labelled as "Keep Refrigerated." In order to be shelf stable, perishable food must be treated by heat and/or dried to destroy foodborne microorganisms that can cause illness or spoil food. Food can be packaged in sterile, airtight containers. The shelf life of these food are normally identified by expiry date on the packaging. Perishable food Perishable foods include meat, poultry, fish, milk, eggs and many raw fruits and vegetables. It also includes all cooked foods that have to be stored at refrigerator or freezer temperatures. The length of storage time for perishable food in freezer and refrigerator depending on the types of foods ranging from 3 to 7 days in refrigerator and from 2 to 3 months or as per stated on the food packaging in freezer.

tion for cancer patients in Malaysia. Therefore, at this juncture it can be justified that the use of the app was highly feasible and widely acceptable.

Table 2: Feasibility and acceptability of EatSAFE-StopWASTE© app (n=61).

	Statement	Response, n (%)				
		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
1.	EatSAFE-StopWASTE© app is easy to operate.	31 (50.9)	24 (39.3)	6 (9.8)	0	0
2.	The language used in EatSAFE-StopWASTE© app is simple and easy to understand.	37 (60.7)	21 (34.4)	3 (4.9)	0	0
3.	The colour scheme of EatSAFE-StopWASTE© app is good and attractive.	25 (41.0)	26 (42.6)	8 (13.1)	2 (3.3)	0
4.	The features in EatSAFE-StopWASTE© app are catchy.	23 (37.7)	27 (44.3)	11 (18.0)	0	0
5.	EatSAFE-StopWASTE© app will help to reduce my risk of food poisoning.	26 (42.6)	26 (42.6)	7 (11.5)	2 (3.3)	0
6.	EatSAFE-StopWASTE© app will help to reduce food wastage.	29 (47.6)	24 (39.3)	8 (13.1)	0	0
7.	EatSAFE-StopWASTE© app is beneficial to me.	35 (57.4)	20 (32.8)	6 (9.8)	0	0
8.	EatSAFE-StopWASTE© app attracts my attention.	23 (37.7)	28 (45.9)	8 (13.1)	2 (3.3)	0
9.	I would like to own EatSAFE-StopWASTE© app in the future.	35 (57.4)	20 (32.8)	6 (9.8)	0	0
10.	I think EatSAFE-StopWASTE© app is a good application.	41 (67.2)	16 (26.2)	4 (6.6)	0	0
11.	I would recommend EatSAFE-StopWASTE© app to others.	40 (65.6)	17 (27.8)	4 (6.6)	0	0

Though numerous advantages of EatSAFE-StopWASTE© app, it is not without limitations. This app can be further improved to add in more features such as storage of food photos and more information related to food safety. At this point of time, this app will only be released in Android operating system since it is the most popular operating system in Malaysia [10]. Android operating system was chosen due to its popularity and covers majority of smartphone users. As such, it is inaccessible to users with other operating system. The demographic of users which this newly developed app tested for feasibility and acceptability are the younger and middle-aged population group with good literacy level. Therefore, the feasibility and acceptability of this mobile app could not be possibly generalized to other population group.

4. Conclusion

Mobile apps play a significant role in information dissemination in the world today. EatSAFE StopWASTE© app was found to be highly feasible and acceptable to improve knowledge on food safety, reduce risk of food poisoning risk and reduce food wastage through reminder found in the app.

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