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Usability evaluation of food portion measurement using a mobile device

Submission date
13/03/2018

Recruitment status
No longer recruiting

Registration date
23/03/2018

Overall study status
Completed

Last Edited
30/04/2020

Condition category
Nutritional, Metabolic, Endocrine

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
There is a great need for innovative dietary assessment methods that not only provide valid intake data, but also suit for the lifestyles of different types of users. In mHealth app development, the usability of these design features are rarely subjected to systematic evaluation, and lack comparative evidence from user interaction. This research conducts a rigorous evaluation to explicate the differences of the three design features. The consolidated statistical results provide a better understanding of design suitability in the target group.

Who can participate?
University students of Chang Gung University and Chang Gung University of Science and Technology, Taoyuan, Taiwan. Eligible participants were (1) university students aged between 19 and 25 years, (2) capable of reading and operating the application of the smartphone, (3) without visual impairment, (4) without diabetes, high cholesterol, or high blood pressure, (5) not in pregnancy, (6) not a vegetarian, (7) neither participated a weight-loss program nor took any medications.

What does the study involve?
Each subject was randomized into three groups to evaluate and compare the effectiveness, efficiency and user's perception upon each measurement feature in an app. The subject in each group was asked to use the Android smartphone to record breakfast, lunch, and dinner in a day. Key-in Based Group (KBG)Subjects in this group used the feature in an app that has a standard food portion size (gram) as reference. to enter the times of the food standard quantity or food weights (gram) directly to prescribe the portion size of their dietary intake.
Photo Based Group (PBG)Subjects in this group used the feature in an app that has one-to-multiple photo selection design that allowed to flick left or right to select the photo which was demonstrated different food quantity including a plate, chopsticks and spoon for size reference.
Comparative aid Based Group (CBG)Subject used credit card as a comparator to measure food size in use of hand gesture to prescribe their food portion. The food portion size was described with the top view and side view on the food or utensils.
Each subject also required to determine his or her desired food courses before the experiment using online questionnaire. The questionnaire included twenty-five food items allocating into three meals, i.e., breakfast, lunch, and dinner. Each subject was required to select the three set

meals that include one hash browns, ham, and hot dog and a drink in the breakfast. For lunch, a staple food, main course, two kinds of vegetables, and two dishes with mixed food ingredients were arranged, and one main course and one drink were set for the dinner.
Four types of outcomes were assessed to evaluate the usability of mobile devices for dietary measurements, including absolute weight differences and accuracy to exam the effectiveness, and the response time to determine the efficiency of each subject in completing the food portion measurement procedure, subjects' perception and subjective preference.
The first outcome (absolute weight difference) was defined as was the absolute weight difference in grams compared with the real food. The second outcome measure (accuracy) was defined as the number of subjects that had within 10% of absolute weight difference or the number of correct counts. Subjects' perceptions on using each specific app were measured in use of questionnaire. Subjects are asked to score the typical 10 items with one of five response format that ranges from Strongly Agree (5) to Strongly Disagree (1). One open question was applied to collect their written statements for further design improvements.

What are the possible benefits and risks of participating?
Possible benefits include the enhanced effectiveness and acceptance of dietary intake recording using mobile devices. There are no risks of taking part in the study.

Where is the study run from?
Chang Gung University, Taoyuan City 33302, Taiwan.

When is the study starting and how long is it expected to run for?
From 01/04/2017 to 30/11/2017, 7 months.

How long will the trial be recruiting participants for?
This work was supported by the Research Fund of Chang Gung Memorial Hospital and Chang Gung University (BMRPD67), and the Ministry of Science and Technology, Taiwan (MOST- 105-2221-E-182-044).

Who is the main contact?
Dr. Ying-Chieh Liu (ycl30@mail.cgu.edu.tw).

Contact information

Type(s)
Public

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333

Additional identifiers

EudraCT/CTIS number

IRAS number

ClinicalTrials.gov number

Secondary identifying numbers
201601817B0

Study information

Scientific Title
User interface design and usability study of mobile food portion measurement on mobile device using a randomised trial

Study objectives
A mobile device can be used to quickly and accurately measure portion sizes for each food within a meal

Our primary outcomes were both based on the accuracy and time consumed in seconds of reporting food items. The two types of user interfaces usability of dietary record application was assessed. One was in terms of accuracy of weight/portion size estimation in the aspect of the effectiveness. The other was the time required to complete the task of weight/portion size estimation for each food. Three consecutive meals (i.e., breakfast, lunch, dinner) in a day with totally 13 food items among the 25 food items.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Ethics Committee and Institutional Review Board of Chang Gung Memorial Hospital, 23/01/2017, 201601817B0.

Study design
Single-site assessor-blinded three-armed parallel-group randomised controlled trial

Primary study design
Interventional

Secondary study design
Randomised parallel trial

Study setting(s)
Other

Study type(s)
Other

Participant information sheet
Not available in web format, please use the contact details below to request a patient information sheet.

Health condition(s) or problem(s) studied
Use of mobile device to measure food portions

Interventions
This intervention involved three types of user interfaces to record food portion size. Each subject was randomized into three groups to evaluate and compare the effectiveness, efficiency and satisfaction. This experiment was performed by two research assistants.
Key-in Based Group (KBG): Diet recording app using knowledge-based interface (KBI). KBI provided a standard food portion size (g) as reference, subject could enter the multiple of the food standard quantity or food weight (g) directly to record their diet.
Photo Based Group (PBG)Diet recording app using photo-based interface (PBI). Participants in this group used one-to-multiple photo selection design that allowed them to swipe left or right to select the picture that demonstrated the food quantity including a plate, chopsticks and spoon for size reference to record their diet.
Comparative Aid Based Group (CBG)Diet recording app using gesture-based interface (GBI). Subject used credit card as a comparator to measure food volume, then used smartphone gesture to record their diet by depicting food portion size of top view and side view on the touchscreen.

Intervention Type
Other

Primary outcome measure
1. Accuracy of weight/portion size estimation assessed by the absolute weight difference in grams compared with the real food and the number of participants that had within 10% of absolute weight difference or the number of correct counts.
2. Time required to complete the task of weight/portion size estimation for each food using the time from the user entering the food attribute to clicking the 'finished' button measured in milliseconds.
Three consecutive meals (i.e., breakfast, lunch, dinner) were measured in a day with 13 food items in total chosen from 25 food items.

Secondary outcome measures
User satisfaction assessed by system usability scale score including usable scale and learnable scale
open-ended questionnaire opinion for subjective evaluation to collect individual comment or suggestion for recording food portion size through these three types of user interfaces.
Following use, perceptions on using the apps were measured in use of the System Usability Scale (SUS). When a SUS is used, participants are asked to score the following 10 items with one of five responses that range from Strongly Agree to Strongly Disagree.

Overall study start date
23/01/2017

Completion date
23/01/2019

Eligibility

Key inclusion criteria
1. Student of Chang Gung University or Chang Gung University of Science and Technology, Taoyuan, Taiwan
2. Aged between 19 and 24 years
3. Capable of reading and operating smartphone apps

Participant type(s)
Healthy volunteer

Age group
Adult

Sex
Both

Target number of participants
120

Total final enrolment
124

Key exclusion criteria
1. Visual impairment
2. Diabetes, high cholesterol, or high blood pressure
3. Pregnant
4. Vegetarian
5. Participating in a weight-loss program
6. Taking medication

Date of first enrolment
01/04/2017

Date of final enrolment
30/11/2017

Locations

Countries of recruitment
Taiwan

Study participating centre
Chang Gung University, Taiwan
No.259, Wenhua 1st Rd., Guishan Dist.,
Taoyuan City
Taiwan
33302

Sponsor information

Organisation
Ministry of Science and Technology

Sponsor details
106, Sec. 2, Heping E. Rd., Taipei , Taiwan, R.O.C.
Taipei
Taiwan
10622

Sponsor type
Government

Website
https://www.most.gov.tw

ROR
https://ror.org/02kv4zf79

Funder(s)

Funder type
Not defined

Funder Name
Ministry of Science and Technology

Results and Publications

Publication and dissemination plan

Intention to publish date
31/05/2018

Individual participant data (IPD) sharing plan
The current data with anonymization can be requested based on ethical committee review and approval. The data sharing plans for the current study are unknown and will be made available at a later date.

IPD sharing plan summary

Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article	results	29/04/2020	30/04/2020	Yes	No