Dietary mobile apps: Acceptance among young adults

A qualitative study

Anna Rohde, Stefan Lorkowski, Christine Dawczynski, Christine Brombach

Abstract

The growing market in smartphone apps has also spawned a number of food tracking apps which have the potential to positively influence diet and eating behavior. The objective of this study was to examine, from the user's perspective, which factors turn a food app into an accepted tool. To this end, three food apps were tested by a total of 17 young adults over a period of one week. Their experiences and opinions were subsequently gathered and recorded in three focus groups. The transcribed material was analyzed by means of a content analysis, from which a number of acceptance factors were derived; these included easy and intuitive usability, a wide range of functions, reliability and the free availability of the app. The results underline the importance of targeted preliminary studies to guarantee acceptance of diet intervention by means of a food and nutrition app.

Keywords: food app, tracking app, acceptance, young adults, qualitative study

Introduction

The rapid development in the performance of smartphones has led to a widespread growth in software applications, or apps for short [2, 3]. These also include food and nutrition apps (hereinafter referred to as food apps), such as e.g. food tracking apps. These apps are similar to weight logs; they record eating behavior and generate visual feedback (actual vs. target) about e.g. energy and nutrients [4]. However, most of the available food apps are not scientifically evaluated [2, 4, 5–9]; functions and data quality may vary significantly [4]. In view of the population's affinity to technology-based tools, food apps could represent an appropriate intervention strategy to trigger changes in lifestyle and eating behavior [5, 10–13]. The competence cluster nutriCARD aims to develop a food app for adolescents and young adults which will positively influence eating behavior. This qualitative study was carried out in order to determine reasons for (non-) use of food apps [14] early on in the development process, focusing on the following area of interest: From the perspective of young adults, which factors must a food app incorporate in order to be used in the long-term?

Methodology
Study participants

This study aimed to recruit 18 participants aged 18 and above with a very good knowledge of German and in possession of a smartphone. In order to obtain a young study collec-
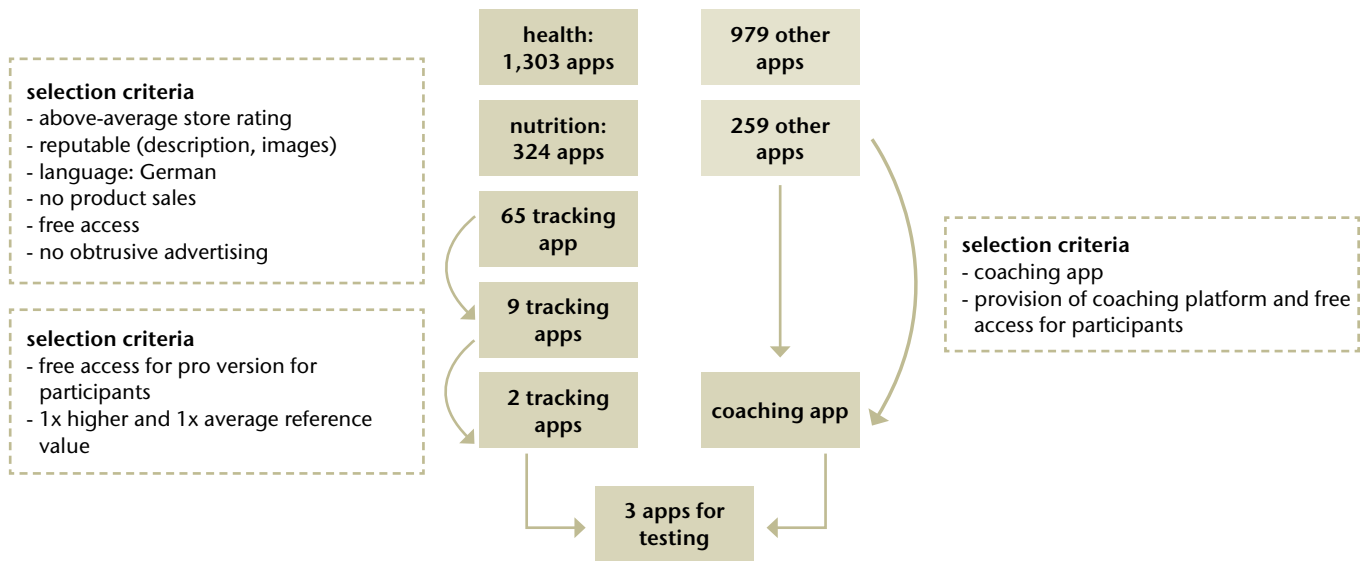
Fig. 1: **Selection process for food and nutrition apps** [own description]
Of the 65 tracking apps, 9 apps were more closely examined based on 6 user-related and behavior-related criteria: data quality, motivators, access, user-friendliness, target group and functions. These criteria were rated with points and a reference value was produced for each tracking app [4]. The coaching app was selected as the only one of its kind from 259 other food apps.

	App 1: *Was Ich Esse* [What I eat]	App 2: YAZIO *Kalorienzähler* [calorie counter]	App 3: Oviva Coach
tracking via...	hand measure	weight by gram	meal pictures
analysis of tracking via ...	representation in food pyramid	bar chart of energy and nutrients	feedback by diet coach
weight tracking	no	yes	yes
activity tracking	no	yes	yes
individual tips	no	no	yes

Tab. 1: **Description of test apps**

tive corresponding to the app's target group, participants were recruited at the Friedrich-Schiller-University (FSU) in Jena by means of notices, a press release and lectures. One expense payment (voucher for Amazon online store) was raffled among all the participants. Pregnant and breast-feeding women and people with chronic diseases were excluded from the study.

Selection and description of food apps

The apps were selected based on a systematic analysis of available apps in the field of health and nutrition. To this end, 1,303 health apps available on Google Play Store and Apple App Store in July 2015 were sifted and categorized into areas of application

[4]. Of these, 324 apps were available in the field of diet and nutrition. Three of these apps were selected for the study. All three apps aimed to record and analyze eating behavior, yet differed in their functions. Selection criteria were determined for this purpose (♦ Figure 1). The three selected apps are presented in ♦ Table 1.

Study design and data analysis

The 18 study participants were randomly and equally divided into three groups according to availability for a preliminary discussion. Each group was assigned one test app at random. In the preliminary discussion, the participants received access to their test app and filled out a questionnaire about their perso-

nal data. Each individual then tested their assigned app for seven successive days. Guided focus groups were subsequently held and audio-recorded. The discussion guideline followed a sequence of discussion stages in its question structure as per LAMNEK [15]: round of introductions and naming of the app most used before the study, time and situation of use of the food app, experiences with the food app, suggestions for improvement, how much participants would be willing to pay for a food app, motivators for using a food app, recommendation of the app. All the focus groups took place in November 2015 on the premises of the FSU.
The recorded focus group material was transcribed, anonymized using fictional names and analyzed based
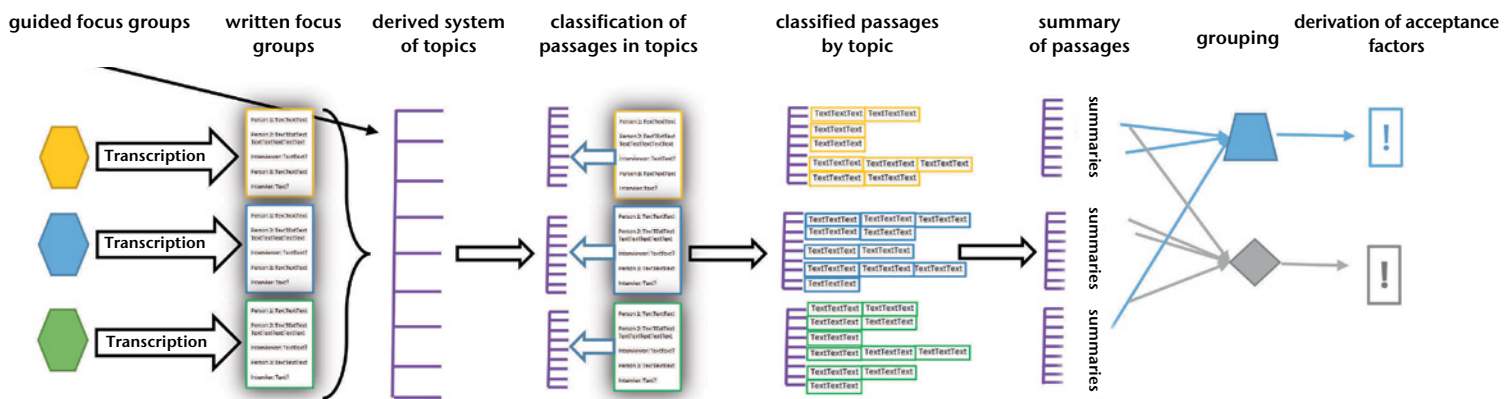
Fig. 2: **Analysis process**
Twelve topics relating to the research question were determined based on the discussion guideline and text material, to which the corresponding passages from each focus group were allocated. These categorized passages were then condensed and summarized. Acceptance factors were derived from the grouped passages across all focus groups.

on a content-structuring qualitative content analysis as per KUCKARTZ [16] using the MAXQDA 12 software. The analysis process is illustrated in ◆ Figure 2.

Results and discussion

Description of participants

Of the 17 participants (1 drop out in app group 1), 12 were female and 5 male. They consisted of 16 students (11x nutritional sciences, 5 others) and one employed person. The average age was 24 years old (20–31 years). The focus groups lasted between 47 and 72 minutes.

Topics addressed

The twelve prepared topics (see ◆ Figure 2) are illustrated in ◆ Table 2. In all groups, the participants mentioned both the advantages and disadvantages of the apps and made suggestions for improvement. We can therefore indirectly assume that an app is an accepted tool, insofar as certain prerequisites are fulfilled. Acceptance factors for app use derived from individual results are detailed below (see ◆ Figure 2). These results are further illustrated by example quotations from the participants in their original words.
◆ Figure 3 illustrates the derived

app-related and user-related acceptance factors for long-term app use. The process of derivation is described in ◆ Figure 4 by way of example. To begin with, the app-related acceptance factors are illustrated and interpreted below.

App-related acceptance factors (= micro-qualities)

Reliability & transparency

The results show that the functions and contents of the app must be

reliable and transparent for young adults. This example quotation reveals that an app must function reliably: *"I found the software problems negative, as everything kept disappearing. (…) And then you had to keep starting again; that took time, it stalled in-between and that was really annoying."* [Original citation: *"Und negativ fand ich die Software Probleme, weil ich eigentlich das ständig hatte, dass alles weg war. (…) Und dann musste man immer neu starten, das hat gedauert, es hing zwischendrin und das war einfach total lästig."*] (Nathalie, 43-1).

user-related topics	app-related topics
motivators for app use	advantageous features
	disadvantageous features
effects of app use on eating behavior	suggestions for improvement
	recommendation
use behavior	willingness to pay
	comparison with other apps
assessment of own eating behavior	uncertainty about app features
	contrasting views on disadvantages

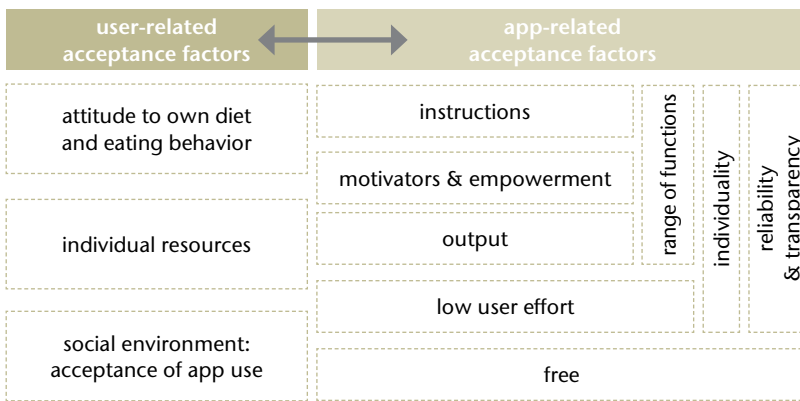Tab. 2: **System of topics (12 topics derived from discussion guideline and text material)** [own description]

Fig. 3: Acceptance factors for long-term app use
left: Which framework conditions are required from the potential user?
right: Which features should an app incorporate?

The structure and dashed depiction of acceptance factors indicate fluid boundaries between individual acceptance factors. For example, the 'individuality' factor applies to range of functions, instructions, motivators & empowerment, output and low user effort.

The importance of content reliability and transparency was apparent in the lack of trust felt by some participants in the contents and data, such as e.g. the calculated individual calorie requirement. The results show that trust in the app could be increased by means of an explanation by the app provider about the app's objective, the target group and the available functions.

Furthermore, details about data sources and information on foods in the stored food database were important to participants. E.g. they wanted information on whether the nutrients applied to the food when cooked or raw. In contrast to other studies [5, 17], data protection and privacy were not topics of discussion among the participants of this study. Nevertheless, these aspects must be taken into account during app development.

Individuality

The focus group discussions revealed that the individual users had very different requirements of the apps. Different needs must be satisfied by one and the same app. A food app must therefore be customizable. The need for individuality has been justified by DENNISON et al. as the need for control [17]. According to these results, there are many different ways in which to personalize an app, including filtered information and functions, profile creation, independent target setting, personalized tips for behavioral changes (through e.g. a coach) or bundled individual knowledge transfer and different forms of feedback in either graph, data or text format.

Range of functions

The results show that users need a wide range of functions: *"I think there wasn't a lot going on in the app."* [Original citation: *"finde so, war da nicht viel los sonst so in der App."*] (Fiona, 125-3).

However, the quality of the functions must not be forgotten:
"when I opened the app, there (...) were badges[1] (...). I thought huh? (...) Thank God it stopped after the first five minutes, otherwise I think I would have been really frustrated and said, well, I don't want to do it anymore, as I find that kind of thing incredibly annoying" [Original citation: *"als ich die App geöffnet habe, da (...) kam[en] gleich Badges[1] (...). Ich dachte mir so hä? (...) Gott sei Dank, hörte das nach den ersten fünf Minuten auf, sonst hätte*
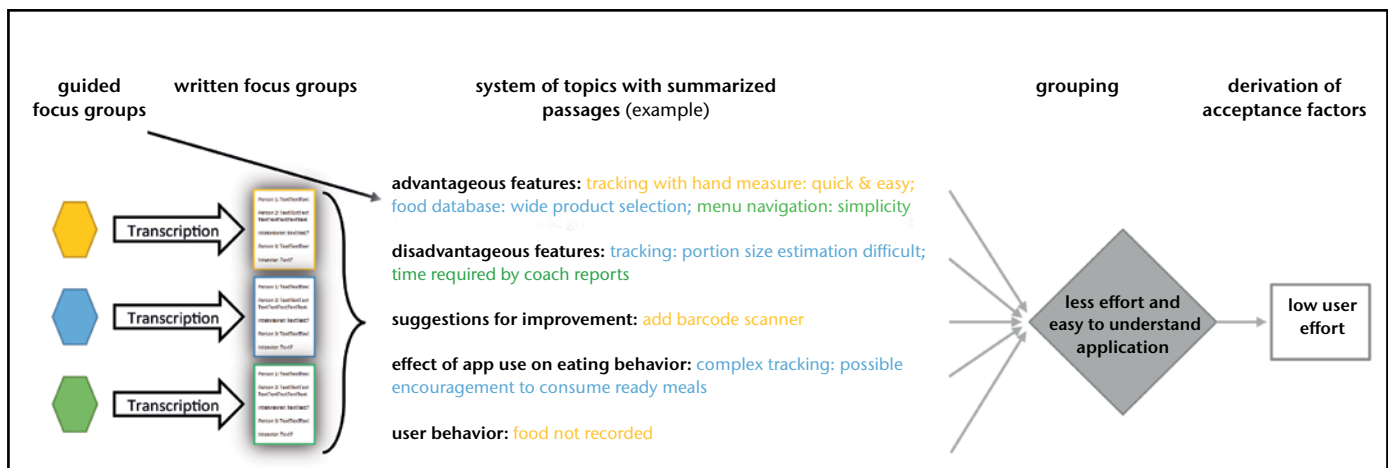

Fig. 4: Derivation of acceptance factors for 'low user effort' by way of example
The colors of the summarized passages show affiliation to the respective app. The summarized passages are an extract of all the grouped passages.

tracking	evaluation	other functions
different ways to enter portion: g, hand measure, average portion	visualization → e.g. food pyramid or actual vs. target graphic	target setting and personalized tips on reaching target
different nutrient values	calorie evaluation	profile creation
setting foods as favorites (faster tracking)	individual feedback	motivators
saving meals (faster tracking)		memory functions
adding food to food database		knowledge transfer
different tracking (activities, drinks, amount)		instructions/tutorial

Tab. 3: **Examples of positively perceived app functions**

motivators	demotivators
functions which ease tracking and user-friendliness	obstructive, impractical or not workable functions and/or functions whose purpose is not understood
personal coach	software problems
memories	advertising
recipes	high user effort
selection of diets	negative feedback on eating behavior
reward systems (e.g. collection of points)	
chronological traceability of evaluations	
personalized positive feedback/evaluation	

Tab. 4: **Selection of motivating and demotivating app features**

ich glaube ich auch frustriert gesagt, nä, keine Lust mehr, weil so was finde ich unglaublich nervig"] (Martha, 181-1).

A selection of results on functions perceived positively by participants is illustrated in ◆ Table 3. A food app with a high-quality range of functions could increase the probability of long-term use, as the use of lots of different apps for different functions increases the risk of short-term use [5].

Instructions

The results show that uncertainties – such as e.g. "how do I track?" or "what functions are there?" – could

be avoided by means of user instructions: *"there was no explanation of the app. I sat there and thought, ok what do I do now? How does it work? And as I said I still didn't discover many functions"* [Original citation: *"das Erklären der App hat gefehlt. Ich habe da gesessen und erstmal so gedacht, okay was mache ich damit jetzt? Wie geht das? Und ich habe viele Funktionen, wie gesagt, noch nicht entdeckt."*] (Sarah, 135-2).

Casperson et al. also note that an app must take the user by the hand to ensure efficient application [10]. They suggest a memory function for certain tasks. Such a function

was also rated positively in this and other studies, so long as it can be individually controlled [5, 10, 17].

Motivators & empowerment

The results show that personalized tips, in particular, could motivate users, in contrast to simple actual vs. target feedback, and empower users to change behavior, so long as clear operating instructions or tips for implementation are provided. *"Because then you simply see, ok, I need to eat more fruit. Now I'm standing there, right, what do I do now?"* [Original citation: *"Weil so sieht man halt, ok, ich muss jetzt irgendwie mehr Obst essen. Jetzt stehe ich da, mhm naja gut, was mache ich jetzt?"*] (Martha, 104-1).

In their study, Juarascio et al. found that a sense of obligation towards app use was increased by motivating features such as personalized tips [5]. This sense of obligation was also apparent in this study; the tips from the coach led to a sense of duty to implement them, and the dices[2] in the food pyramid encouraged participants to fill it out by consuming the corresponding foods.

In their results, Juarascio et al. cited levels[3], badges and various privileges as further motivating functions and established that visual traceability of tracked behavior was an important motivating point [5]. Other potential motivators and demotivators are listed in ◆ Table 4 based on the above results. Demotivating functions and features can also be defined as barriers [18] or deterrent functions [17] to app use, as in the following quotation about negative feedback on eating behavior: *"even when I say I want to change something, (...) [and*

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[1] Badges are digital stickers in apps which are collected during use of the app.

[2] 1 dice = 1 portion

[3] Different levels can be reached by fulfilling certain tasks.

the app] tells me that I'm eating badly, that's frustrating, demotivating and I think: well it's worked well until now." [Original citation: "selbst wenn ich sage, ich möchte was ändern, (…) [und die App] zeigt mir dann eben an, dass ich mich schlecht ernähre, dass das dann frustrierend ist, demotivierend und ich denk dann so: naja hat ja bis jetzt gut geklappt."] (Nathalie, 230-1).

These results show that food apps must contain certain functions, such as e.g. those listed in ◆ Table 4, to ensure that the use of the app is motivating and fun. Such incentives [19, 20] to use the app could be an important factor for long-term use.

Output

The effort required to use an app should lead to an achievable output for the user, in order to establish a consequential incentive in addition to an operational incentive [19, 20]. This is shown for example in the next quotation: "Ah, I entered water on the first day and no calories appeared. (…) it's simply not taken into account. And then I thought, then just leave it, if it doesn't interest you." [Original citation: "Ah, ich habe Wasser am ersten Tag eingegeben und da kommen einfach null Kalorien. (…) es ist, es ist einfach nicht berücksichtigt. Und dann habe ich mir gedacht, ja dann lässt du es halt weg, wenn es dich nicht interessiert."] (Sarah, 191-194-2).

The results reveal that target tracking and personalized tips, in addition to tracking visualization, were attractive and achievable outputs of app use for participants.

Diehl explains that many people's attempts to lose weight fail as high input is too little rewarded (output) [21]. A high level of effort can be a reason for short-term use [5, 17, 22]. It therefore appears even more important to find a balance between low user effort and a high range of functions with great output.

Low user effort

An app must be quick to operate and easy to understand, to ensure that users require little time or intellectual effort: "And you don't have the effort. She [the coach] just does it for you (…). So she gives you the information, (…) but you don't have to make the effort to get it." [Original citation: "Und du hast den Aufwand nicht. Sie [der Coach] übernimmt das halt auch für dich dann (…). Also sie übergibt dir die Information, (…) aber du musst keinen Aufwand betreiben, um sie zu bekommen"] (Christine, 211-3).

Participants stated that lower levels of effort are also achieved through intuitive menu navigation, clear layouts, easy to understand contents and functions, comprehensible vocabulary and fast tracking, above all of assembled meals.

The importance of fast tracking to ensure full and long-lasting use of an app is apparent in the following statement: "I wanted to enter onions. There weren't any. But I'm not running to the supermarket to take a picture of an onion. And [I] had no other onions that week. So I said, well, then I'll ignore it now and leave it out. The onion won't be a part of it." [Original citation: "Ich wollte Zwiebel eingeben. Das gab es nicht. Naja, aber ich renne ja nicht in den Supermarkt und fotografiere eine Zwiebel. Und [ich] habe die Woche jetzt auch keine weitere Zwiebel mehr gehabt. So dass ich gesagt habe, naja gut, dann ignoriere ich das jetzt und lasse sie weg. Die Zwiebel wird es nicht ausmachen."] (Martha, 145-1).

One participant also spoke in favor of an open food database, to reduce the effort of tracking. This would mean that food entries added into the food database by users are accessible to all other users of the app. The extent to which data and evaluation quality is influenced by potential errors in entry needs to be checked, as a complete food database on tracking apps could be an important factor for user acceptance.

Free

Participants tend to be willing to pay nothing or little for a food app. Participants' willingness to pay was dependent on individual need, on the scope of the app's functions and on individual financial resources. Dennison et al. also found that the free availability of a health app was an important point [17].

User-related acceptance factors (= macro-qualities)

A study on the mobile weight loss program "weight balance" by Haapala et al. revealed that macro-qualities should also be taken into account alongside smartphone and app features (= micro-qualities), such as e.g. users' living situations or social environments [13]. The results of this study also describe user-related acceptance factors alongside app-related factors.

Attitude to own eating behavior

The study participants were largely convinced that their own eating behavior was good, giving them increased self-confidence in the fact that they did not need to use a food app. This was expressed e.g. in the fact that portion sizes recommended by the app were ignored by participants if they did not correspond to current behavior, with the justification that they already ate healthily. This could be explained by the fact that health is taken for granted and only becomes a value when an illness occurs [23]. Beforehand, one's own eating behavior and its consequences are not perceived as a risk and priority (incl. financial and time) is not given to a food app. Thus, participants only saw the necessity of using a food app for existing health problems.

Individual resources

Individual resources are a pre-requisite to the use of a food app. According to participants' statements, these include having the time to engage with the subject of the app. In addition, technical knowledge, the availability of a smartphone and internet access and, where applicable, financial means were also important factors for users' willingness to use an app.

Social environment: acceptance of app use

An app needs to be accepted by the social environment. Tracking in the presence of others had to be justified and was felt to be impolite, as evident in the following quotation: *"I found it almost unpleasant, when I was sitting in the restaurant, to have to take a picture first. And when I met new people, I always first explained (…) that I was trying out an app, because I simply thought, how does that come across? (…) I found that really annoying."* [Original citation: *"mir war das schon fast unangenehm, wenn ich dann im Restaurant saß, erstmal ein Foto machen zu müssen. Und immer wenn ich dann so auf neue Leute getroffen bin, habe ich erstmal erklärt, (…) dass ich gerade eine App ausprobiere, weil ich halt dachte, wie kommt das denn jetzt rüber. (…) das habe ich wirklich als störend empfunden"*] (Christine, 101-3). This result reflects the social dimensions of diet and eating behavior; people want to be part of a community and not excluded [24], so other people's opinions on app use are significant.

Limitations

This study reveals some limitations. The participants were 'artificial users' and largely students with a nutritional scientific background, who were motivated to use the app by the study rather than by their own determination. The 'working conditions' of the study also limited the use of the app to a period of one week. Furthermore, participants did not discover or use all the functions of the apps; these were therefore unable to be considered in the analysis. These results cannot claim to be universal or validated success factors for an app. However, they underline the relevance of targeted strategies in order to consider acceptance factors of potential users during app development.

Summary

The results show that, from the perspective of the young adults in this study, a food app must be reliable and transparent, customizable, intuitive and easy to operate. Furthermore, it must guide, empower, motivate, offer achievable outputs, be free of charge and incorporate a wide variety of functions. The user must require as little effort as necessary (intellectual effort and time) to use the app. However, it is not only the design of the app that is important; the users themselves must demonstrate certain pre-requisites. These relate to users' attitudes to their own eating behavior, individual resources and social environment. These factors underline the relevance of targeted strategies in order to consider the opinions of potential users with different needs during app development.

Conflict of Interest
The authors declare no conflict of interest.

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