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Do Arabic weight-loss apps adhere to evidence-informed practices?

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Cite this as: *TBM* 2016;6:396–402 doi: 10.1007/s13142-015-0347-7 Abstract Mobile technology has been used successfully for promoting health and weight loss and for treating obesity. There is a high prevalence of smartphone and tablet users among the Saudi population. This study aimed to identify whether current Arabic weight-loss apps had features that adhered to evidence-informed practices. The six most relevant app stores were systematically searched using the Arabic words for weight and diet (n=298). All apps that met the inclusion criteria (n=65) were downloaded and examined for adherence to 13 evidence-informed practices. Latent class analysis identified two subgroups of apps: self-monitoring (15 % of apps) and advice-giving apps (85 %). The median number of evidence-informed practices was 1 (1, 2), with no apps having more than six and only nine apps including four to six. Meal planning was the most common feature (38 % of apps). These findings identify serious weaknesses in the currently available Arabic weight-loss apps. Thus, existing and future apps should include more features based on the best available evidence in the context of Arab culture.

Keywords

Smartphones, Tablets, Weight loss, Arabic, Apps, Weight reduction programs

INTRODUCTION

Currently, the prevalence of obesity in Saudi Arabia exceeds that in the USA [1]. The World Health Organization reports that 29 % of men and 42 % of women in Saudi Arabia are obese [2]. It has also been reported that noncommunicable diseases have become the main cause of death in the Eastern Mediterranean region [3]. These diseases have consistently been associated with overweight and obesity in the Middle East [3]. Although a positive correlation has been found between obesity and technology owing to increased sedentary behaviors, such as high rates of television watching among the Saudi population [4, 5], smartphone and tablet technologies may prove to be useful tools in the treatment of obesity.

The personal use of smartphones and tablets has increased markedly in the Middle East, especially in Saudi Arabia, where the average number of smartphones per person is 1.8 [6]. The development of

Implications

Practice: Weight-loss apps are widely available to the Arab population; however, these weight-loss apps lack localized content and adherence to evidence-informed practices.

Policy: Industry standards are needed for the development of Arabic weight-loss apps which present content that adheres to the evidence-informed practices, while effectively assisting the public with an approach that is tailored to the Arab population.

Research: Future Arabic weight-loss apps should be evaluated based on weight-loss outcomes and/ or changes in behaviors related to weight loss.

Electronic supplementary material

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smartphone and tablet applications (apps) has turned these devices into multifunctional tools. They can be used to amalgamate data collected from sensors, the Internet, and, most importantly, online social networks and can therefore function as interventional tools to treat and prevent obesity [7]. Smartphones and tablets have been used to raise awareness in different health-related areas, such as smoking and sexual health [8]. However, not much is known about the availability of health-related and, specifically, weight loss-related Arabic apps.

English-language weight-loss apps have been investigated by various researchers, who offer differing opinions on the criteria used to gauge the efficiency of such apps. Breton et al. [9] reviewed 204 apps for weight management available from the iTunes App Store, using the key words "weight loss" and "diet." Each app was compared with 13 evidence-informed practices that have been adopted since by health authorities in the USA. Pagoto et al. [10] identified 20 evidence-based strategies that were more comprehensive as criteria for weight-loss apps, especially regarding aspects of behavioral change. These 20 strategies included all but two evidence-informed practices from Breton et al. [9] (i.e., increasing fruit and vegetables and increasing water intake). In their research, Breton et al. found that only 15 % of weight-loss apps included five or more of the evidence-informed practices. Similarly, Pagoto et al. [10] found that only 19 % of the 20 strategies were included in weight-loss apps. It seems that an English-language weight-loss app that adheres to all 13 of the evidence-informed practices above is not yet available. While Pagoto et al. [10] raised an interesting point, namely that two evidence-informed practices from Breton et al. were not listed in the dietary guidelines of other countries; the consistent primary recommendation of these countries' guidelines is to consume an energy-reduced diet consisting of fewer animal products and sugar-sweetened beverages and to consume more fruit, vegetables, and water [11-13].

There is a paucity of data regarding weight-loss apps in Arabic language. The aim of this study was to identify the currently available Arabic weight-loss apps and to systematically review them by determining the level of adherence to the 13 evidence-informed practices used by Breton et al. [9].

METHODS

Selecting apps for review

We systematically searched the six most relevant app stores (Apple iTunes App Store, Blackberry Mobile Market, Google Play, Nokia Ovi, Samsung, and Microsoft Windows Marketplace) in March 2013, using Arabic translations of the words "weight" and "diet" or "regimen." Differences between the English and Arabic languages required changes to the original search terms used by Breton et al. [9]. Breton et al. used "weight loss" and "diet" to search the iTunes App Store, whereas in this study, we searched only for the Arabic translation of "weight" so as to obtain the broadest possible search results. The direct translation of "weight loss" is not a common term in the Arabic language. Additionally, the direct translation of "diet" is not commonly used in everyday language. Therefore, the search was done using both "diet" and the more common Arabic term "regimen". Prior to downloading, we reviewed the description pages of all apps, which provided an overall description of the app, the features included in each app, screenshots of what the app looks like when downloaded, user ratings, and customer reviews. The description page was used as an initial screening tool to determine whether weight loss was the stated purpose of the app. We downloaded all apps in the Arabic language that had weight control content to include in the study, and we systematically explored their functionalities over one period of use (Supplementary Table 1).

There were no distinctions made between the 65 apps that were included in our analysis with respect to age or gender of the end-user target population. In accordance with Breton et al. who only included apps in the "health and fitness" category [9], we excluded all

search results for the "books and references" categories in the six app stores searched, as well as results that had nothing to do with weight loss or diet (e.g., weight conversion apps). When an app had the same name or was developed by the same company as another app that was already included in the study, it was considered to be a duplicate content and excluded. Additionally, we excluded apps that were duplicated in the search results of the various search terms used. Following a review of both free and paid versions of apps, we found that the free version (where a paid version was also available, n=18) only provided a portion of the functionality or advice available in the paid version. For this reason, apps that included both free and paid versions were counted as one app, and only the paid version was downloaded.

Assessing evidence-informed practices

We extracted data to identify whether each app had features that adhered to 13 evidence-informed practices, following the methodology and criteria used by Breton et al. [9]. The Arabic apps were tested against the same criteria. If the app was capable of performing any of the following tasks, they were allocated one point per task, up to a maximum of 13 points: (1) determining and explaining BMI, (2) recommending and tracking daily servings of fruit and vegetables, (3) recommending daily physical activity, (4) advising the user to drink water instead of soda or juice and tracking their daily intake of water, (5) allowing for the recording of daily food intake, (6) providing a calorie tracker to maintain calorie balance, (7) providing weight-loss goals of 1-2 lb/week, (8) providing information about portion control, (9) recommending that the user read and understand nutrition labels, (10) providing a way to track weight, (11) providing a way to keep a physical activity journal, (12) offering suggestions for meal planning, and (13) offering a private social network or the capability of being linked to popular social media such as Facebook, Twitter, or Instagram for social support.

The lead author downloaded and tested the apps under the supervision of a research team consisting of the other authors, so as to standardize the inclusion criteria. Any uncertainties were discussed by the research team throughout the testing process. Additionally, an independent rater reviewed a random selection of 21.5 % (14/65) of the apps for adherence to the 13 evidence-informed practices, thereby achieving good interrater reliability of 93 %.

Statistical analysis

Descriptive statistics were used to summarize the total number and percentages of evidence-informed practices included in the Arabic apps. The median and interquartile range (IQR) were calculated for non-normally distributed data, such as stars representing user opinions (ranging from 0.5 to 5 stars), and number of user ratings (number of users who gave a star rating on the app description page). Latent class analysis

Apps identified from apps stores with search terms N=298:



Fig. 1 | Flow diagram of app selection for review

(LCA) is a statistical method for finding subtypes of related cases (latent classes) from multivariate categorical data. Latent class analysis is a particularly useful method because it uses a finite mixture modeling approach, providing a means of investigating all possible constellations of characteristics within the apps and providing a meaningful label for each subgroup or class of evidence-informed practice. We used latent class analysis to identify whether there were distinct classes or subgroups within the apps included in the study. No prior prediction of the outcome was made. The number of classes was determined by fit indices [14, 15], such as Bayesian information criteria (BIC), adjusted Bayesian information criteria (ABIC), Akaike's information criteria (AIC), and entropy and interpretability or model usefulness. The number of classes that minimized AIC and BIC was chosen from the modeling. The profile or description of these classes was based on the response pattern of evidenceinformed practice features for that class. Based on the posterior probability of class membership, each app was categorized into one of the classes. The app price was categorized into "paid" and "free". Fisher's exact test was used to investigate associations between pricing and class, based on the posterior probability. Support for the latent class analysis method in Stata is available through the PROC LCA (ver. 1.3.1) add-on routine created and distributed by The Methodology Center at The Pennsylvania State University (Penn State) [16, 17]. Apps that did not have any stars or ratings were excluded from the comparison, and the median stars and ratings of the two classes were compared using the Mann–Whitney test. A p value of less than 0.05 was considered significant.

RESULTS

A total of 298 apps were identified from the six app stores. Of these, 212 apps were excluded because they did not comply with the inclusion criteria, and 21 were excluded because they were duplicates (see Fig. 1). Sixty-five Arabic weight-loss apps complied with the inclusion criteria. All of these apps were from either the Google play store (58 %, n=38) or the iTunes App Store (42 %, n=27).

Evidence-informed practice scores

Of the 65 apps, 18.5 % (n=12) did not include any of the 13 evidence-informed practices, and none of the apps included all 13 practices. Almost half of the apps (42 %, n=27) contained only one, and 18 % (n=12)contained two evidence-informed practices. The median number of evidence-informed practices was 1 (1, 2), with no apps having more than six and only nine apps having between four and six evidence-informed practices. Table 1 shows the number of Arabic apps adhering to the 13 practices. Meal planning (38 %), assessing weight (26 %), and regular physical activity (20 %) were the most common features. Few apps helped the user to track their weight or keep a physical activity journal, and none supported portion control. Overall, no apps offered any form of social support.

Latent class analysis

The fit indices for the five latent class models are presented in Table 2. These indicate a two-class solution as the best-fitting model; AIC and BIC are minimized in the two-class model, although the three-class

Table 1 Number and percentage of Arabic	apps adhering to the 13	3 evidence-informed practices	
Evidence-informed practices	No. (%) of apps	Evidence-informed practices	No. (%) of apps
Meal planning	25 (38)	Tracking your weight	6 (9)
Assessing your weight	17 (26)	Keeping a physical activity journal	6 (9)
Regular physical activity	13 (20)	Weigh-loss goal of 1–2 lb/week	5 (8)
Maintaining calorie balance	10 (15)	Social support	2 (3)
Keeping a food diary	9 (14)	Reading nutrition facts labels	2 (3)
Eating a diet rich in fruits and vegetables	7 (11)	Portion control	0 (0)
Drinking water instead of soda or juice	7 (11)		

model provides a lower entropy (\mathbb{R}^2) and adjusted BIC. Overall, there were two types of apps, 15 % in class 1 (categorized as self-monitoring apps) and 85 % in class 2 (categorized as advice-giving apps). The selfmonitoring apps had a higher probability of including evidence-informed practice features such as maintaining calorie balance (0.85), keeping a food diary (0.76), assessing weight (0.49), weight-loss goals of 1-2 lb/ week (0.47), keeping a physical activity journal (0.39), drinking water (0.38), and tracking weight (0.38). The remaining evidence-informed practice features had a probability of less than 0.21. The advicegiving class had a higher probability of having evidence-informed practice features such as meal planning (0.44), physical activity (0.20), assessing weight (0.22), and eating a diet rich in fruit and vegetables (0.10). The remaining evidence-informed practice features had a probability of less than 0.10. The probability of having each of the evidence-informed practice features across the two classes is depicted in Fig. 2. The evidence-informed practice features that did not help us to understand the latent class or that were not able to be placed in clusters were portion control, social support, and reading nutrition facts labels. These features appeared in very few apps.

User ratings and price

Twenty-four of the apps included in this study had no user ratings. Among the rated apps, the number of user ratings varied from 1 to 1080, with a median rating (IQR) of 29 (14, 156) for class 1 (self-monitoring apps) and 39 (13, 135) for class 2 (advice-giving apps) (p=0.853). The median number of stars (IQR) was 4.5 (4, 4.5) and was not significantly different between selfmonitoring and advice-giving apps (p=0.428). Most apps were free, and the price of paid apps ranged from £0.69 to £2.99. There was no significant association between whether or not an app was free and the type (class) of app (p=0.565) (Supplementary Table 2).

DISCUSSION

The use of weight-loss apps on smartphones and tablets appears to be ubiquitous in Saudi Arabia. The leading smartphone platforms have a variety of weight-loss apps and most are offered for free. The large number of commercially available Arabic weight-loss apps highlights the need for research and development of evidence-based apps [18] that will promote health among Arab users. As was found in English apps [9, 10, 19], it is clear that current Arabic weight-loss apps have low levels of adherence to the 13 evidenceinformed practices for weight control. Most weight management guidelines [11–13] take a multicomponent approach that includes diet, exercise, and behavior modification. While the first two components are selfevident, behavior modification (altering behavioral patterns through learned techniques) is largely overlooked in both English and Arabic weight-loss apps.

The features of Arabic apps most commonly addressed meal planning practices or diet but placed little emphasis on modifying behavior and daily physical activity. This could be because the majority of the Arabic weight-loss apps that we reviewed were labeled through latent class analysis as being advice-giving apps. These apps concentrated on providing users with dietary and lifestyle recommendations and did not focus on self-regulation or tracking tools. Only a few of the apps included in our study focused on selfmonitoring and provided the tools necessary for users to track their weight loss goals. Although diet and exercise are important for weight loss, it seems that insufficient attention is paid to self-monitoring, which is also important in weight management guidelines.

Furthermore, it was noted from the latent class analvsis that a large proportion of Arabic apps did not include social support or suggestions about reading nutrition facts labels or portion control in either class. This finding is important because social support is a crucial part of achieving and maintaining weight loss from the perspective of social cognitive theory [20]. Breton et al. [9] found that only a limited number of apps provided social support, whereas conversely, Pagoto et al. [10] found that 47 % of the apps they investigated included access to an online social network. This discrepancy suggests that English apps have begun to provide a social networking feature in recent years, as social networking becomes increasingly popular. In our sample, only two of the 65 Arabic apps we reviewed had a social networking feature, which was surprising given the cultural background of the users. A page 399 of 402

Table 2 Fit indices	for a one-class model through to a	five-class model (number of a	ipps used=65 for each mod	iel)
Model	Entropy R^2	Adj. BIC	BIC	AIC
1 class	1	224.00	264.92	236.65
2 class	0.975	158.52	243.51	184.79
3 class	0.778	148.53	277.60	188.45
4 class	0.800	150.21	323.33	203.74
5 class	0.82	157.22	374.41	224.38
Best-fitting model is set	in italics			

recent qualitative research study, conducted to explore features for Arabic weight-loss apps from the perspective of overweight Saudi women, demonstrated the importance of social networking features to address their weight-loss needs [21]. Social networking features would be highly beneficial owing to cultural gender norms in Arab countries, where exercise and weightloss activities are not performed outdoors or in public facilities by women. These users need an environment in which they feel comfortable sharing their experiences with others and supporting each other to achieve weight-loss goals. Future developers of Arabic weightloss apps must consider these aspects if any success is to be had promoting these apps in Arab countries.

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Another notable limitation of the Arabic apps in this study was the fact that the majority did not include advice about reading nutrition facts labels, nor did they include suggestions for portion sizes, both of which can help users to choose healthier foods and prepare more appropriately portioned meals. This might be because of the lack of nutritional data and portion size information for traditional Arabic dishes prepared at home or in restaurants [22]. However, importation of food is on the rise and much of the foods present in Saudi supermarkets have nutrition labels from their country of origin. Users of Arabic weight-loss apps should have the opportunity to learn how to read these labels, identify what is healthy for them, understand the appropriate amounts to consume, and then apply this information to their daily shopping and cooking practices.

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Portion control is a key element in weight management [23], but this may be complicated by the cultural eating habits of the Arabic community [24]. Portion size is not a common concept among the Arab population, which makes managing food intake more difficult. Using the hands rather than cutlery when eating may also influence portion control because the amount of food that is consumed by using the hands has been found to be greater than by using cutlery [25]. Therefore, it may be helpful to establish a measurement that incorporates some part of the hand (e.g., the thumb or the palm) to estimate appropriate portion sizes [23] and to add this to the app features. The absence of portion control and education about nutrition facts labels in Arabic apps could prove to be detrimental to users meeting their weight-loss objectives. These factors have been shown to be crucial to achieving weight-loss goals and should therefore be taken into account in future app development.

The app that was unrated by users but that met the most evidence-informed practice criteria (six) was Myzan Alrshaqt, and it was found to be the most comprehensive Arabic weight-loss app available [26]. Although some of the apps had not been rated, it was found that the highly rated apps (five stars) did not have high scores in terms of total included evidenceinformed practices. This could be owing to unreliability of the app ratings because developers may attempt



Fig. 2 | Latent class profile plot of the probability of having each of the 13 evidence-informed practices across the two classes

to manipulate app ratings to influence sales [27]. A high number of apps were unrated, which could indicate that raising awareness about such health-related apps is required.

As in any study, there are limitations to this work that should be taken into account. First, this study was conducted by one research team consisting of three members and one independent rater who rated 14 of the 65 apps included in the study, achieving a 93 %compliance rate. Thus, it is possible that the apps could have had higher or lower ratings if an independent rater were to have replicated the entire study. Another potential limitation of this study is that some apps may have been upgraded since the data collection period; therefore, some Arabic weight-loss apps that are currently available may include a higher number of evidence-informed practices and may have higher ratings. Because we considered only the paid version of an app when a free one was available, another limitation is that we have not made any comparison with respect to differences between the free and paid versions of the same app, to demonstrate if there is a higher rate of evidence-informed practices present in the paid versions. Additionally, it is possible that not all features of an app were evident or included in this study because all apps were reviewed over only one period of use. It is possible that some app features become available to users after a longer period of time interacting with the app, such that these were unavailable to our reviewers during screening.

This study focuses heavily on the lack of information about and omission of crucial evidence-informed practices in Arabic weight-loss apps that were available at the time of the study. However, the increasing use of technology and social media by Arab users suggests that there will also be increasing interest in weight-loss apps. The strength of this study is that it is the first to investigate weight-loss apps in an Arab country and to reveal the need for their improvement. One of the main concerns with weight-loss apps currently available in the Arab market is the lack of content that takes into account the social norms in the Arab culture. All apps that were included in this study were developed by Arabic developers or companies (based on the apps' information pages), but most of the content appeared to have been taken from existing English apps, with very few instances of localized Arabic content. Of all the apps included in our study, there was only one (Ryjym-Rmdan) that provided specific dietary advice for Ramadan, which requires Muslims to spend 1 month fasting from dawn until sunset each day. However, further investigation revealed that the dietary recommendations in that app consisted mainly of western foods that are not a part of the traditional Arab diet and that are specifically not consumed during a time of religious practice. This study poses new questions about global marketing and cultural specificity of weight-loss management within the context of the Arab community, emphasizing the need for sensitivity regarding cultural differences and limitations. Overall, these findings identify serious weaknesses in the Arabic weight-loss apps that are currently available. It is recommended that the development of future apps should be based on evidence-informed practices. However, developing an Arabic app does not mean merely translating foreign content into Arabic language [28] but rather modifying relevant knowledge to meet the specific requirements of Arab culture.

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Compliance with ethical standards

Conflict of interest: The authors declare that they have no competing interests.

Adherence to ethical principles: This article does not contain any studies with human or animal participants performed by any of the authors.

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