An mHealth intervention for the dietary management of hemodialysis patients

CHAPTER 7

SUMMARY

In most chronic diseases, dietary and lifestyle changes are integral components of disease management. In Chronic Kidney Disease (CKD), treatment requires nutrition interventions that aim at controlling and minimizing adverse outcomes. Dietary interventions necessitate a high level of involvement by patients, because changing eating habits is a challenging task. This also influences the interactions between dietitians and patients. Patients may feel a loss of autonomy due to the restrictions imposed by the diet and dietitians providing positive and sensitive information may encourage autonomy.

The use of mobile devices in healthcare has increased exponentially over the past decade. Mobile apps set off new possibilities across many practice areas, including dietetics. Mobile health (mHealth) has the potential to deliver nutritional care to individuals and to support practitioners by providing tools that may contribute to dietetic care in health and disease.

This dissertation aims to provide insight into the available evidence on the effectiveness of dietary applications in chronic disease and to explore the feasibility of developing and pilot testing an mHealth intervention using an Arabic dietary app for hemodialysis patients (KELA.AE).

In Chapter 2, we conducted a systematic review of the available literature along with a random-effect meta-analysis of interventions using dietary applications. Data were extracted and clustered by studies using mobile apps as a sole intervention, comprehensive interventions comparing mobile apps to other tools, and counseling interventions supported by a mobile app. Most of the articles identified targeted obesity and diabetes.

The systematic review and meta-analysis that we performed confirmed that dietary mobile apps may have positive effects on nutritional outcomes. Most of these were self-monitoring apps used in the short-term, and outcomes were particularly related to weight management. Pooled estimates resulted from the random-effect meta-analysis showed significant improvements in weight, waist circumference, and energy intake of participants using dietary apps. Mobile apps that were used a sole intervention were found to be effective self-monitoring tools. Nevertheless, when compared to other tools (paper-based diaries, calorie reference books, or a self-monitoring website), we were unable to identify a clear superiority for mobile apps. Theory-based dietary apps used in a counseling intervention were found to be effective and thus may provide additional benefits. While educational dietary apps seem promising, not enough research is available in this field; only two studies identified apps that were used as educational tools.

In Chapter 3, we describe the development of the application. Kidney Education for Lifestyle Application (KELA.AE app) is a self-monitoring and educational app for Arabic speaking hemodialysis patients. The name KELA in Arabic signifies Kidney and.AE was selected as the suffix in the app name to relate the app to the Internet domain name of the United Arab Emirates (UAE). KELA.AE app was developed based on the Integrate, Design, Assess, and Share (IDEAS) Framework [1].

Qualitative, semi-structured interviews with hemodialysis patients, dietitians, and nephrologists were performed. The patients interviewed during the development reported using the Internet usage as a source for nutrition information. Patients also expressed frustration with the diet experience in general, which they considered challenging. The results of the interviews with patients stressed a need for education rather than self-monitoring.

Dietitians and nephrologists considered the app a useful tool for patients. However, some expressed concern regarding app misuse and replacement of healthcare practitioners. They expressed fear that patients would exclusively rely on the app instead of the dietitian or physician.

KELA.AE was developed in a stepwise formative person-centered approach. Existing evidence and theories were incorporated, and the content was culturally adapted. Overall, KELA.AE app was designed to contain a total of 24 podcasts, three animated videos, and 161 notifications. All educational materials were developed based on previously validated print Arabic dietary educational materials[2] amended to accommodate for the needs of the participants' culture (Emirate dialect, local traditional recipes…) and the educational modalities included in the app (podcasts, videos, and notifications). All educational materials developed are based on the Transtheoretical Model for behavior change[3]; however, the narration incorporates additional constructs from the Reasoned Action Approach[4].

In Chapters 4 and 5, we conducted a pilot study to assess the feasibility of an mHealth intervention using the KELA.AE app along with a face-to-face intervention. We also investigated the potential efficacy that KELA.AE usage may have on nutritional outcomes. We presented the data in two manuscripts, one describing the results of the feasibility of an mHealth intervention on dietary intakes and diet quality, the other describing phosphorus management in hemodialysis exploring the role of the educational features of the app.

In Chapter 4, we report the findings of the pilot on the feasibility and pilot testing the effects of the KELA.AE app on dietary intakes, anthropometric measurements, laboratory parameters, and adherence to current dietary guidelines. Our findings show that KELA.AE app is feasible to be used during mHealth interventions as an educational and self-monitoring tool. The short-

term usage may have a potential impact on improving energy and protein intakes among hemodialysis patients. However, no changes were observed in intakes of minerals; fat intakes were elevated at baseline and remained above recommendations after the intervention. No changes were observed in the anthropometric parameters and serum laboratory parameters for potassium and phosphorus. Serum Fe increased, which may be explained by the increase in the dietary protein of high biological value. Overall, we found the use KELA.AE to be a feasible tool used with a face-to-face intervention to address dietary intakes of hemodialysis patients. A larger randomized controlled trail is necessary to provide information on the efficacy of the app.

In Chapter 5, we reported the feasibility of using the KELA.AE in-app education on the phosphorus management of hemodialysis patients. We measured outcomes on patient knowledge, self-reported non-adherence, phosphorus intakes, and blood parameters.

The main findings of this pilot study show that in-app nutrition education is feasible as a supportive tool for dietitians and patients. Our study found that short-term app usage may improve patient knowledge; nevertheless, we found no improvement in dietary adherence. Surprisingly non-adherence to the phosphorus content of the diet increased after the intervention. This may be explained by the self-perception of adherence influenced by patient knowledge. Patients might have become more aware of the phosphorus content of food, and therefore, their self-perception of non-adherence changed accordingly.

Phosphorus intakes did not change after the pilot intervention. An increase in dietary protein, however, was observed, as reported in chapter 4. Guidelines on protein and phosphorus intakes in hemodialysis are somewhat contradictory, and thus achieving both is challenging, and patients often do not consume enough proteins to restrict phosphorus. Nevertheless, the increase in protein intakes did not negatively impact phosphorus intakes in this pilot study. Furthermore, the phosphorus to protein ratio post-intervention was nearer to the recommended ratio of 10-12mg/g protein [5], possibly meaning that patients increased their protein intakes while choosing foods that were lower in phosphorus.

The findings of this thesis present several implications for the practice setting and research. First, it provides evidence on the effectiveness of dietary apps in chronic diseases. Second, it provides insights for developers and dietetic practitioners on the formative development steps to be followed based on an in-person, evidence, and theory-based approach. We also provide the feasibility and potential efficacy based on the results of a pilot study evaluating an mHealth intervention using the KELA.AE app. Finally, this thesis generates directions for future research in the area of mHealth applied to dietetic practice in the context of chronic disease.

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