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Culturally sensitive lifestyle intervention to prevent type 2 diabetes among Somalis in Finland: a pilot study using JA CHRODIS Recommendations and Criteria

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Abstract

Introduction. Somalis, particularly women, have high risk for type 2 diabetes (T2D). We designed and piloted a culturally tailored lifestyle intervention model to prevent T2D among Somalis.

Methods. The pilot was designed using the JA CHRODIS Recommendations and Criteria, with special emphasis on target group empowerment. Intervention consisting of risk identification and group and digital lifestyle counselling was created based on the existing Stop Diabetes-model. The 12-week intervention was conducted in the mosque.

Results. Of those at T2D risk, 24 participants (73%) agreed to participate in the lifestyle counselling. Mean participation rate in the group sessions was 50% and 76% of the participants used the mobile application. A statistically significant increase in vegetable intake was seen after the intervention. A non-significant increasing tendency was seen in all parameters of physical activity. All respondents considered counselling meetings very useful or useful.

Discussion. The piloted model proved to be feasible in providing prevention interventions to an underserved population group. Key success factor was active involvement of the target community.

Key words

- type 2 diabetes
- prevention
- lifestyle intervention
- immigrants

INTRODUCTION

The number of people with diabetes has increased steadily during the last decades all over the world. Lifestyle factors, such as obesity, an unbalanced diet, and low physical activity, are known to predispose to type 2 diabetes [1]. In addition, other broader environmental, socio-economic and cultural factors can impact people's risk of getting diseases, their ability to prevent them, or their access to effective lifestyle interventions and treatments [2, 3].

Due to climate change and international crises, the size and composition of most European populations are nowadays to a large extent determined by international immigration [4]. Also in Finland, the share of people with foreign backgrounds has grown rapidly during recent years, the Somali population being one of the largest ethnic minority groups [5]. These changes in the population structure have an impact on the population health and need to be taken into account in health promotion and disease prevention.

Available data suggest that migrants tend to be more vulnerable to certain communicable diseases, injuries, poor mental health, and maternal and child health problems compared with the general populations in European countries [6]. It is well-documented that certain ethnic minorities have a higher prevalence of diabetes than non-minorities [7]. The study of Laatikainen et al. indicated that the prevalence of chronic diseases differs between ethnic groups also in Finland, and Somali population had significantly higher levels of diabetes

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compared to any of the other migrant groups and native Finns [8]. These observed differences in the prevalence of chronic diseases between ethnic groups can be partly explained by differences in lifestyle-related risk factors. Previous studies have confirmed that obesity, physical activity, and unhealthy diet are more common among Somalis, and especially among women, compared with other ethnic groups and native populations [8-13].

Lifestyle interventions targeting people at risk have been shown to effectively prevent or at least postpone type 2 diabetes in various ethnic groups in several countries [14-17]. However, the applied interventions have usually been tailored to suit the needs of the majority, and hence their methods and results cannot be directly generalized to minorities. Moreover, the effectiveness of interventions in different immigrant groups is not well known, as people with immigrant background have been underrepresented in prevention interventions. Cultural factors may have a significant effect on whether an intervention done in other groups will be feasible for ethnic minorities [18]. Furthermore, people with immigrant backgrounds are a hard-to-reach population segment and may face a language barrier effectively preventing their participation in the interventions [18, 19]. In fact, people coming from other cultural backgrounds may not even perceive chronic disease prevention to be a part of health care and they may be less likely to seek preventive health services [20].

The review by Lirussi [18] concluded that many health-care systems are inadequately equipped to improve diabetes prevention and disease outcomes in ethnic minority groups. Better outcomes in diabetes prevention and care were shown to be achieved when the intervention programmes took place in the community settings, were culturally adapted and group-based, were delivered by a multidisciplinary group of health professionals, and aimed at improving self-management skills, self-efficacy, or self-empowerment [18]. However, most of the interventions in the review focused on improving glycaemic control among people with diabetes [18], and interventions focusing on the prevention of type 2 diabetes by lifestyle changes were scarce [19, 21].

In Finland, there are no existing public health interventions targeting specifically the needs of immigrant population groups. To address this gap, we created and piloted, in close collaboration with the local Somali community, a culturally acceptable prevention intervention, with the aim to improve risk identification among and participation of the Somali population. The existing StopDiabetes (StopDia) prevention intervention model was used as the basis and JA CHRODIS Recommendations and Criteria (QCR) as the framework to guide the development and implementation of the pilot action plan [22, 23]. This paper reports the experiences and results of the pilot action to improve lifestyle and prevent type 2 diabetes among Somalis in Finland.

METHODS

The use of QCR [22] in the pilot action planning has been described in detail in the guide for the implementation of JA CHRODIS Recommendations and criteria [23]. QCR consists of a set of nine Recommendations and Criteria to improve prevention and high-quality care for people with chronic diseases: Design the practice, Promote the empowerment of the target population, Define an evaluation and monitoring plan, Comprehensiveness of the practice, Include education and training, Ethical considerations, Governance approach, Interaction with regular and relevant systems, and Sustainability and scalability [22, 23].

In this study, QCR was used as the framework to direct and monitor the implementation of the planned activities. The specifically addressed criteria were Practice design, Target population empowerment, Education and training, and Ethical considerations. The pilot was based on StopDia model, which is a Finnish type 2 diabetes risk identification and prevention model, created as part of the national StopDia project [24].

Cultural adjustment of an available intervention model

To ensure the suitability of the intervention model and tools, we set up a local implementation working group, including representatives from the participating research institutes and the Somali community in the capital region of Finland. Several workshops and group discussions were conducted, in order to map out the experiences and wishes of the Somali community in terms of the intervention and its execution. For the pilot, all questionnaires, forms, and materials including consents, study information letter, the diabetes risk test FINDRISC [25], group session materials, and the BitHabit application were translated to Somali language by the researcher with Somali background (IH) with help from volunteers from the Somali community. Group session materials and the BitHabit application contents were also culturally adjusted to be suitable for Somali population. For example, the traditional Somali diet was taken into account, and some prohibited foods, such as pork and alcohol, were excluded from the content of the intervention materials. For cultural acceptability, the interventions were organized in the mosque facilities, separately for men and women, and held in Somali language.

Recruitments of participants

The recruitment of participants was done in autumn 2018. The researcher with a Somali background (IH) organized several recruitment sessions in the mosque personally to give information on the pilot, thus increasing awareness and creating trust in the intervention. Personal contacts (word-of-mouth) and a written notification on public display aided the recruitment process, as well as the support and endorsement of the leader of the mosque, Imam. The participants recruited were Somali individuals living in the capital region in Finland, who had an increased risk to acquire type 2 diabetes. The risk was determined prior to recruitment by filling out the diabetes risk test FINDRISC. The FINDRISC is a validated method to identify, with 8 questions, an individual's likelihood to develop T2D within 10 years [25]. Additionally, women with children were enquired whether they had been diagnosed with gestational diabetes during pregnancy. The individuals who had in-

creased diabetes risk (12 points or more on the FINDRISC or previous gestational diabetes) were asked to join the study and received an informational handout regarding the pilot study. Three participants who got points lower than the predefined threshold (10 or 11) but were enthusiastic towards the intervention were also accepted. All participants filled out a consent form after the study procedure was explained to them verbally. Two groups were formed, one for males and the other for females. Originally, the aim was to have also a group with mobile application intervention only for those not willing or able to take part in the group sessions, but during the recruitment, it became apparent that all potential participants opted for group intervention combined with the use of the application. Participation was voluntary and the withdrawal was possible at any time during the intervention. The pilot action was conducted in accordance with the Declaration of Helsinki and the protocol was approved by the ethical committee of the Helsinki University Hospital.

Lifestyle counselling

The StopDia lifestyle counselling [24] comprised of group meetings (six meetings in 12 weeks) and the BitHabit healthy lifestyle support mobile application. The group meetings were organized in the mosque facilities, and the timing of the sessions was agreed within the groups, in order to maximise the possibilities of participation. The sessions were delivered in participants' own language, by the researcher with Somali background and Somali volunteer health care students. The group counselling was based on self-determination and self-regulation theories. Each group meeting lasted for approximately 1.5 hours, and each meeting had a similar structure and specific theme. The themes of the meetings were "Introduction to program and group", "Building daily rhythm", "Eating well and healthy", "Enjoying physical activity", "Bringing more activity into daily life", and "Being capable and successful" *(Table 1)*. The meetings consisted mostly of group and pair discussions with the instructor more as a coach rather than a lecturer. Between the group meetings, the participants could, if they wanted, do homework and exercises using the participant's workbook, such as keeping a diary of their physical activities or fruit and vegetable consumption. The aim of the homework was to enhance the adoption of behaviours that were discussed during the face-to-face meetings.

The BitHabit healthy lifestyle support application was implemented as a mobile-optimized web application. The main functionalities of the BitHabit application were 1) browsing behavioural suggestions and selecting those that the users want to perform, 2) daily self-monitoring of the selected behaviours, and 3) getting summary feedback for habit formation in each of the 13 lifestyle categories. The application also provided information on other users' selections in an anonymous format through pop-up messages. Automated reminders were sent by emails and SMS messages if the user did not select any habits, add any performance, start using the application within two days after the first uptake message, or use the application for seven days. The application also had an additional self-learning section that provided reliable information on the prevention of type 2 diabetes [26]. The participants were instructed on how to use the application at the first group visit and could use the BitHabit throughout the 12-weeks counselling period.

Evaluation data collection

The impact of the intervention was assessed with clinical and lifestyle measures taken before and after the lifestyle counselling period, measuring participation and the use of the mobile application, as well as participants' experiences and opinions of the pilot intervention. Health measurement data included height (without shoes), weight (in light indoor clothing), waist circumference (on top of undergarments), and

Table 1
Lifestyle counselling among Somali population in Finland: content of group sessions

	Theme	Aim
Session 1	Introduction to program and group	Get familiar with other participants and the program Information on type 2 diabetes and lifestyle factors in its prevention
Session 2	Building daily rhythm	Observation of the daily rhythms of eating habits, physical activity, sedentary behavior, stress, sleeping, and rest Tools for management of daily life Goal setting and planning: Actionable behavioral goals to improve rhythm of daily life
Session 3	Eating well and healthy	Self-monitoring and reflection of dietary habits Principles of a healthy diet Goal setting and planning: Actionable behavioral goals for diet
Session 4	Enjoying physical activity	Self-monitoring and reflection of physical activity Principles of sufficient physical activity Goal setting and planning: Actionable behavioral goals for physical activity
Session 5	Bringing more activity into daily life	How can I nudge myself to healthy lifestyle? Goal setting and planning: Actionable behavioral goals for re-designing home environment to support healthy choices
Session 6	Being capable and successful	Self-evaluating program outcomes Learning and insights for future Planning for maintenance of behavior changes

Lifestyle interventions was based on StopDia prevention intervention model [24].

blood pressure. Weight was measured with electronic scale (SECA 877), height with a portable stadiometer (SECA 213), waist circumference (WC) with a measuring tape (Hoechst mass easy-check 53106) and blood pressure with an electronic monitor (OMRON M6 AC). BMI was calculated as measured body weight (kg) divided by square of measured height (m^2) for all participants. Health questionnaire data included background information and questions about participants' nutrition (a short and culturally adjusted version of a validated food frequency questionnaire [27]), exercise habits, and self-evaluation of the capability of making healthy lifestyle changes. In addition, participants were given the possibility to use an accelerometer to record their steps for a six-day period before starting the group meetings and after them. The evaluation measurements were completed by the trained volunteer health care or medical students who were also members of the Somali community. If requested, the measurements were completed by a measurer of the same sex as the participant. The web application collected a log of application usage, consisting of time stamped log of page visits as well as habit selections and performances.

Classification of variables

Education was categorized into three levels: higher education (college, academic degree), lower education (elementary school, vocational school, high school), and being illiterate. Perceived capability to make changes in diet or in physical activity was assessed with a four category questions. The information on capability was dichotomized by dividing people into "capable" and "not capable". Those who chose options "I am capable" or "I am very capable" were defined as capable of making lifestyle changes and all other categories were "not capable".

Vegetable consumption was inquired with a six category question and the variable was dichotomized as "eat vegetables daily" or "eat vegetables less than daily". Same categories were used for fruit and berries consumption. Eating breakfast, lunch or dinner was assessed with four category questions, and analysis was done using two categories: "3 times per week or more" and "2 times per week or less".

Statistical analysis

The data was analysed using SPSS (version 25). Usage log data were analysed using Matlab 2017b. For continuous variables (health measurements, steps), the values are presented as means and standard deviation at baseline and at follow-up, and further analysed with t-test. The categorical diet and physical activity outcomes are reported as number and percentage of participants belonging to each category and compared between baseline and follow-up to detect the possible effect of the intervention. BitHabit selections and performances are reported as medians and interquartile range.

RESULTS

About 90 persons of those who visited the mosque during the recruitment sessions (estimate based on FINDRISC form consumption) filled in the FINDRISC form. Altogether 33 persons (approximately 37%) were found at increased risk of type 2 diabetes. Of them, 24 participants (18 women and 6 men, 73% of those at increased risk) signed the informed consent and had their baseline measurements taken, 22 took part in at least one group session and 21 were measured at the follow-up. The mean age of women and men was 47.1 ± 10.1 and 43.6 ± 9.2 years, respectively *(Table 2)*. The mean number of years the participants

Table 2
Baseline characteristics of the study population

	All n = 24	Women n = 18 (75%)	Men n = 6 (25%)
Age (years) (mean ± SD)	46.2 ± 9.8	47.1 ± 10.1	43.6 ± 9 .2
Years in Finland (mean ± SD)	22.3 ± 6.6	23.3 ± 4.8	19.5 ± 10.2
Household size (mean ± SD)	6 ± 3	6 ± 3	7 ± 3
Marital status, n (%)			
Married	17 (71)	12 (67)	5 (83)
Single	3 (13)	2 (11)	1 (17)
Divorced or widowed	4 (16.7)	4 (22)	-
Education, n (%)			
Higher education	7 (30)	4 (22)	3 (60)
Lower education	14 (61)	12 (67)	2 (40)
Illiterate	2 (9)	2 (11)	-
Employment, n (%)			
Full- or part-time	8 (33)	4 (22)	4 (67)
Unemployed	3 (12)	2 (11)	1 (17)
Student	8 (33)	7 (39)	1 (17)
Stay-at-home mother	4 (17)	4 (22)	-
Other	1 (4)	1 (6)	-
FINDRISC (mean ± SD)	14 ± 2	14 ± 2	12 ± 2

Lower education: elementary, vocational or high school or lower; higher education: college or academic degree.

Table 3
Lifestyle counselling among Somali population in Finland: Participation in group sessions

	All (total n = 22)		Women (total n = 16)		Men (total n = 6)	
	n	%	n	%	n	%
Session 1	17	77	13	81	4	67
Session 2	11	50	8	50	3	50
Session 3	7	32	4	25	3	50
Session 4	4	18	4	25	0	0
Session 5	10	46	8	50	2	33
Session 6	18	82	12	75	6	100

had spent in Finland was 22.3 ± 6.6 years. Of the participants, 30% had high educational attainment (college or academic); on the other hand, 2 of the participants identified as illiterate. The mean household size was 6 ± 3 persons.

The mean participation rate in the group sessions was 50% *(Table 3)*. The first and last sessions were the most popular, and the session 4 ("Enjoying physical activity") had the lowest attendance. After the 12-week lifestyle counselling period *(Table 4)*, 80% of all the participants reported eating vegetables at least once a day. The same number for baseline was 50%. This change was statistically significant ($p < 0.05$). A non-significant increasing tendency was seen in all parameters of physical activity. No statistically significant changes were evident in clinical parameters; however, non-significant tendency for reduction in waist circumference and systolic blood pressure was observed among all participants. At the follow-up, 91% of all participants reported feeling confident about their capacity to increase their physical activity, while at the baseline, the proportion was 61%. On the other hand, a reduction from 76% to 57% was observed in the perceived capacity to make dietary changes among all participants, but also this change did not reach statistical significance.

All participants who took part in group session were registered as BitHabit web app users. User activity varied greatly, but all users were actively viewing the habit selection window, even it did not lead to any selection of actions. Based on the application data, 19 (76%) users chose at least one habit and 17 (68%) marked at least one habit performance. The median and interquartile range for selected and performed actions were 12 (3.50-72.0) and 44.0 (17.8-431), respectively. The top 5 selections were physical activity, vegetables, grains, fat and oils, and sleep among women and men.

After the counselling period, we asked the participants to fill in a self-evaluation form concerning group meetings and their experiences of the pilot. Totally 20 participants filled in the evaluation form and all of them considered counselling meetings very useful or useful. All 20 participants would also recommend the intervention to others. Of the respondents, 16 (80%) evaluated that the topics of group meetings were interesting and relevant to them, and presented in a way that was easily understandable. They also considered that the home assignments were useful and that they received a proper amount of material to support them.

Table 4
Baseline (BL) and follow-up (FU) values in clinical and lifestyle-related factors

	All		Women		Men	
	BL (n = 24)	FU (n = 21)	BL (n = 18)	FU (n = 15)	BL (n = 6)	FU (n = 6)
Anthropometrics (mean ± SD)						
Weight, (kg)	91.1 ± 12.8	91.2 ± 13.3	89.6 ± 13.9	89.5 ± 14.8	95.6 ± 7.4	95.6 ± 7.9
BMI, (kg/m^2)	32.8 ± 4.3	32.9 ± 4.4	33.9 ± 41	34.1±4.3	30.0 ± 1.4	29.9 ± 3.5
WC, (cm)	106.2 ± 94	105.5 ± 11.3	104.6 ± 9.2	103.7 ± 11.9	111.1 ±91	109.9 ± 9.3
SBP, (mmHg)	119 ± 18	117 ± 15	116 ± 18	110 ± 10	129 ± 11	134 ± 13
DBP, (mmHg)	78 ± 9	79 ± 8	77 ± 9	75 ± 6	81 ± 8	86 ± 9
Diet (%)						
Capable to make changes in diet	76	57	69	53	100	67
Vegetables daily	50	80*	50	73	50	100
Fruit and berries daily	52	52	53	47	50	67
Breakfast three times or more per week	91	95	88	100	100	83
Physical activity (%)						
Capable to increase physical activity	77	91	75	93	83	83
Incidental exercise three or more times per week	48	86	51	80	40	-
Planned exercise three or more times per week	23	48	13	40	60	67
Steps per day (mean ± SD)	3771 ± 2866	4568 ± 2080	2278 ± 1692	3962 ± 1471	6757 ± 2360	5377 ± 2616

WC: waist circumference; SBP: systolic blood pressure; DBP: diastolic blood pressure.
* p=0.016

In the self-evaluation form, more than half of those who filled it in reported having made some changes in their daily lifestyle habits. Out of 20 respondents, 70% (n = 14) reported having increased their vegetable consumption, 50% (n = 10) reported eating less sugary snacks and sweets, 45% (n = 9) increased amounts of whole grains in their diet, and 55% (n = 11) reported more frequent meal patterns and increased amount of exercise. Other reported activities were: taking stairs instead of an elevator and paying more attention to sleep rhythm. Also, BitHabit app was found to be either "very useful" or "useful". Altogether 12 (60%) respondents evaluated that they were "very likely" to continue making healthy life style changes in the future, and all the rest (40%) evaluated that they were "likely" to do the same. Data on participants' perspectives on the intervention suggest that they were very satisfied with the concept and content of the intervention model.

DISCUSSION

Given the higher prevalence of diabetes in certain ethnic minorities, there is an urgent need to develop culturally specific practices to prevent type 2 diabetes. In this paper, we describe the process of cultural adjustment and implementation of an available intervention model and report the experiences and results of the pilot action to prevent type 2 diabetes among Somalis in Finland. In general, the co-created intervention model consisting of risk identification and lifestyle counselling was feasible and well-received by the target community, and suggestion towards modest improvement in lifestyle was observed during the 12-week counselling period. Furthermore, out of 22 respondents, a total of 20 evaluated that they were likely to continue with the lifestyle changes after the counselling period.

Migrants have their own knowledge and attitudes about health issues which influence their health-seeking behaviours, approaches to disease prevention, and decision-making in regard to acting on the guidelines of health care providers [28]. Previously, it has been shown that the use of group counselling and making cultural adaptations to the interventions together with the target community members could result in better outcomes in the prevention and care of type 2 diabetes among immigrant populations [18]. Also, in our pilot, taking the culturally and linguistically adjusted group-based intervention close to the participants, and having it delivered by experts who themselves belong to the target community, proved to be a feasible concept of providing preventive intervention to this under-served population segment.

Regular physical activity and diet are key components of lifestyle intervention in people with high risk for type 2 diabetes [15, 16]. However, studies addressing these issues in ethnic minorities, especially within Somali population, are scarce. In Europe, culturally adapted lifestyle interventions have mainly been carried out in South Asian immigrants with high risk for diabetes [19, 21, 29, 30]. These preventive intervention trials have suggested more modest effects in South Asian adults than in European-origin adults. However, in a recent meta-analysis lifestyle interventions in South Asian populations resulted in a clinically important 35% relative reduction in diabetes incidence, despite the modest changes in lifestyle related factors [31]. In the present pilot, the observed changes in behaviours and known risk factors of type 2 diabetes were moderate in African immigrants, but these small changes in important behaviours (e.g. increase in consumption of vegetables) could have a large impact in diabetes risk reduction in long-term and on population level, like previously was shown among Asian immigrants [31].

Interestingly, participants' self-efficacy in making lifestyle changes seemed to shift in a somewhat unexpected way. After the counselling period, the participants reported increased perceived capability to make changes in their physical activity behaviours, while their perceived capability to improve their diet seemed to decrease. The reason for this might be that "healthy diet" as a concept is multi-dimensional and therefore probably more difficult to grasp during a relatively short time than the rather simpler message to increase all physical activity by, for example, walking more. The "recommended diet" might also be in conflict with one's own perception of a proper, traditional diet and therefore more difficult to adopt.

The qualitative study of Gele *et al*. explored the experiences of Somali immigrant women in the reception of preventive health services in relation to type 2 diabetes in Norway [32]. Somali women were found to have a good knowledge of diabetes and its risk factors. However, participants reported unhealthy lifestyle habits, such as sedentary lifestyle and unhealthy diet, and this was partly explained by poor access to tailored health information and tailored physical activity services [32]. Further, the numerous U.S. studies have documented the disparities in the usage of preventive health services between immigrant populations [33, 34], and the disparities have found to be greater for Somali patients compared with non-Somali patients [34]. In our pilot, we showcased how providing the risk screening and lifestyle counselling services in facilities that people know and where they feel secure, by trustworthy people from their own community, abolishes the barriers against preventive interventions identified in the research literature.

In general, participants were very satisfied with the conduct and content of the intervention and they expressed interest to continue the lifestyle changes also after the pilot period. However, some challenges were faced during the implementation which offered us several important learnings to be considered for future prevention activities in Somalis and other immigrant groups. The recruitment of men was more difficult than anticipated. The most important reason was that the men's risk factor levels, especially BMI, tended to be lower as compared to women, which is confirmed also by literature [35]. In the future chronic disease prevention activities, the inclusion criteria should be extended to cover other risk factors, such as smoking, that are more prevalent among men [36].

Furthermore, some participants had difficulties in attending the scheduled counselling sessions due to lack of time or conflicting timetables even though the group

sessions' timetable was agreed together. One reason for this was that the participants had larger families than the general Finnish population [37], thus arranging child care during the group sessions could be pivotal for enabling participation of especially the mothers. This, in turn, might actually increase the impact of the whole intervention, as the mothers are usually in charge of the dietary choices within the family.

Originally, we aimed to offer a digital-only intervention for those individuals with increased risk, but with no time or interest to take part in the group meetings. However, during recruitment it became evident that the digital-only intervention was not appealing to this target group and all participants wanted to sign up for the group intervention. It has been suggested that lack of digital skills might be a barrier against participation of some population groups in state-of-the-art interventions that are (partly or solely) conducted digitally [38]. This, however, proved to be no issue in this pilot group, as all participants did register as BitHabit users and 76% chose at least one healthy habit to pursue. Nevertheless, there may be other cultural factors at stake. Previously, the use of culturally competent facilitator has been shown to be one of the explaining factors for successful health promotion approaches among immigrant women [39]. Also, in the study of Gele et al, most Somali-origin respondents preferred preventive health information in their own language and through oral communication combined with visual materials [32]. These findings emphasise the importance of using an instructor with adequate cultural competence, not only digital tools, when implementing preventive interventions among immigrant groups.

The used strategies of the empowerment-based intervention, such as providing culturally adapted intervention materials and open communication with target group, were the main strenghts of our intervention. Also, the evidence- and theory-based intervention model, activities which took place in a facility that was familiar and convenient for the participants, culturally competent facilitator, inclusion of the target group members into planning and implementation of the intervention, and holistic approach to healthy lifestyles were other strength of this pilot. Moreover, the QCR provided a feasible and practical framework for the designing and implementing this pilot [22, 23]. It steered focus on the whole picture at the beginning of the project and forced to ponder the practical details in advance. However, there was a weakness in terms of scientific evaluation, because due to low sample size in this "feasibility pilot" the observed quantitative results could be evident but not statistically significant, and there was no control group for comparison. However, due to the nature of the study, just by their participation, valuable knowledge on this population was gained.

In conclusion, the piloted model proved to be feasible in providing prevention interventions to an underserved population group. The co-created T2D prevention intervention model could be transferred to other Somali communities in Finland and other countries, but would require close collaboration with the target population as well as training of the local implementers. Same intervention could be feasible, after adjustment and translation, for other immigrant groups and would benefit people with other risk factors also, not just those who are at high T2D risk. In the future, it would be important to establish collaboration between health care services and preventive intervention providers. If the model will be implemented on a large scale, it could have an important effect also as regards to health disparities between population groups.

Author's contribution

JL, KW, IH and EV planned the study design. EV carried out the statistical analyses. KW drafted the manuscript. IH, JL, EM and ML contributed to a critical revision of the work. All the authors read and approved the final version of manuscript. KW takes authors responsibility for the contents of the article.

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Conflict of interest statements

None

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