

The Effect of Health Coaching and Education on the Control of Type 2 Diabetes: A Randomized Controlled Trial

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Abstract **Aims/hypothesis:** This study aims to test the effect of health coaching and education on the control of Type 2 diabetes in terms of HbA1c. **Methods:** We enrolled 123 participants; (61 control and 62 intervention). This randomized controlled trial compared usual care with an intervention that entailed health-coaching skills. The inclusion criteria as follows: age 18 years, HbA1c 6.5 or more and diagnosed with Type 2 diabetes. The data were collected from the outcome measures at baseline and after three months of follow up. The primary outcome was HbA1c; secondary outcome was BMI (Body Mass Index). The data were analyzed using linear regression. **Results:** The participants in the intervention group had significant improvements in HbA1c (Diabetes Empowerment Scale, with a mean difference of 1.78 % compared to that of the control group ($p=0.032$)) and a decrease in BMI (with a mean difference of 0.9 kg/m² compared to that of the control group, $p < 0.001$). **Conclusions:** Diabetes health coaching has an Major role in healthcare that facilitates self-care, behavior change and offers frequent follow up and support. Health coaching for those with diabetes is an effective intervention for improving glycemic control.

Keywords: *diabetes mellitus, world health organization, glycosylated hemoglobin, king abdullah medical city, body mass index, health coaching*

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1. Introduction

Diabetes mellitus (DM) is a chronic disease that occurs because of incapability of the human body to generate adequate amounts of insulin hormone or to utilize insulin effectively [1]. Over time, damage and potentially fatal complications may occur if blood glucose levels remain above the normal threshold [2]. Examples of these complications include myocardial infarction, kidney disease, stroke, diabetic foot, and several others of micro- and macro-vascular problems [3]. In a report by the WHO (World Health Organization), in 2016, DM caused death of 1.6 million people and in 2012 high blood glucose was accountable for the death of 2.2 million globally [4].

The increase in income per capita and the accompanying shift in lifestyle to more sedentary activity with high fat diets and resultant obesity apparently underlie much of the increased prevalence of diabetes mellitus [5]. The Management of diabetes is dependent largely on the patient's own abilities to carry out self-care

in his daily life, and patient education is considered an essential component of achieving this objective. There is evidence that people affected with the disease often have inadequate knowledge about the nature of diabetes, its risk factors and associated complications and this lack of awareness may be the underlying factor affecting attitudes and practices towards its care [6]. Health education on diabetes, with consequent improvement in knowledge, attitudes, and skills leads to better control of the disease, and is widely accepted to be an integral part of comprehensive diabetes care. Glycosylated hemoglobin (HbA1c) levels have been used in planning and assessing the management of diabetic patients the past couple of decades [7]. The growth of chronic diseases particularly diabetes mellitus, increases the needs for health educators to raise the awareness of patients and involve them in their plan to help hand by hand with health care providers and thus, prevent and advance the health of our community.

In Canada, the health coach for the diabetic has an effective role in improving the HbA1c, the patient's lifestyle and behavior. The health coaching helped to speed up the improvement of diabetic patient health as a result of

the patient participation in the treatment plan and knowledge of the main problem [8,9].

1.1. Aim of Study

This study aims to evaluate the effect of health coaching and education on the control of patients with Type 2 diabetes. This will help us to achieve an optimum design of health educational programs to control patients with Type 2 diabetes and assesses the effectiveness of health education on the patient compliance to the plan of care.

1.2. Subject and Methodology

1.2.1. Study Design and Participants:

This study is a randomized controlled trial, which was carried out at King Abdullah Medical City (KAMC) in Makkah, Saudi Arabia. Between 05 Jan 2020 and 05 Jan 2021, all adult diabetic patients with HbA1c > 6.5% who visited KAMC outpatient building were invited to participate in this study. Any patients with a history of drugs or alcohol abuse, mental illness or HIV were excluded from the study, along with patients who refused to participate.

1.2.2. Sample Size:

Sample size was calculated by Randomization was performed in 1:1 ratio using permuted blocks of variable sizes. A randomization list was prepared before starting the study and it guided the preparation of serially numbered sealed envelopes, one for each consecutive patient. The envelopes contained the patient's serial study code and the treatment assignment. Consecutive envelopes were opened only after the patient signed the informed consent to software with population size 1000, expected frequency 50%, acceptable margin of error 5%, design effect=1.0, and cluster=1. The required sample was 123 participants.

1.2.3. Tools of Data Collection

Data were collected through a self-administered questionnaire. It includes five sections as follows:

Section I: It includes Inclusion criteria such as adult type 2 diabetes patients with HbA1c >6.5 %, patients who are interested to participate in this study and exclude criteria such as drug and alcohol abuse patients, patients who have mental illness ,patient refusal

Section II: personal data of the patients as age, gender, nationality, area of residence and date of diagnosis.

Section III: co-morbidities and complication if patients diabetic. Hypertension, cardiac, obesity, kidney and smoker for complication if have kidney failure, nerve damage and psychosocial impaired

Section IV: medication current as tablets or insulin just follow medication intake such as name of medication, dose, form, rout, date of start and end date

Section V: laboratory investigation such as HbA1c, glucose fasting, kidney function

Beside foot and eye examination

1.3. Ethical Part & Confidentiality

Confidentiality of patients was maintained, additionally, a written informed consent was acquired from the patients

before performing any study-related activity. The patients could withdraw from the study at any time, with no consequence or impact on their treatment. The study protocol and consent forms seeker approved from KAMC IRB, date: 05-Jan-2020.

1.4. Data Collection

123 participants included in this study were randomly allocated into one of two groups: a control group (61 participants), in which patients received traditional health education about DM, and an intervention group (62 participants), in which patients received interactive coaching sessions about DM. In both groups, participants were followed up for about 10 months.

Perform the best possible concealment of allocation. The following baseline characteristics were recorded before randomization: weight, height, body mass index, baseline HbA1c.

Following randomization, each of the following educational methods was delivered at the level of patients:

- A) For the control group a Traditional Health Education (THE) about DM was delivered which contained: traditional education as per what is routinely performed in the hospital, focusing on the patient's problems and educational needs [10].
- B) For the intervention group a Health coaching and education (HCE) was delivered, coaching included the following: brochure distribution, videos display for diabetic patients, and role-playing, interactive sessions with the patient. We measured the patient understanding and asked the patient to repeat the instructions and to demonstrate what was learned.
 - According to the patient's status, the health educator formed an educational plan that focused on the patient's problems and educational needs.
 - After we educated the patients and gave them the needed information, we started the health coaching method to modify behaviors associated with the development of the disease (DM), build motivation, and promote self-determination and self-efficacy, also to increase confidence and readiness to change.
 - The coaching sessions proceeded to fulfill SMART goals that should be Specific, Measurable, Achievable, Realistic, and within a particular Time period.
 - Coaching session description:
 - o First session: identification; the coach welcomes patient and obtains his/her agreement on the SMART goals.
 - o Second session: After 2 weeks the patient is followed up by revising diet, exercise and any problems facing patient, as well as by laboratory parameters.
 - o Third session: After 1 month the patient is followed up by sending educational material by video and by assessing the extent of achievement of the set goals.
 - o Fourth session: After 2 month the patient is followed up and their need are assessed.

- Fifth session: After 3 month the patient is followed up by repeating lab investigation especially HbA1c.

The following was done for patients in both groups:

- Measurement of the FBS (Fasting Blood Sugar) 2 times through the study.
- Patients were warned about signs of hypoglycemia or hyperglycemia and were instructed on how to deal with complications.
- Revising the daily events by reading the diary of diabetes.

Primary outcome: HbA1c measured at the start of the coaching and after 3 months for patients in both study groups.

Secondary outcome: BMI

1.5. Statistical Analysis

SPSS software, version 21.0 was used for all statistical analyses. Comparison between groups was made by Student’s t-test or Mann Whitney test according to data distribution, Chi squared test for categorical values. Tests comparing the two groups were two-sided. Linear regression models were built with the HbA1c and the BMI as dependent variables and the study group as the main predictor. Adjustment was done for baseline HbA1c and for the final HbA1c for the model of the BMI. Statistical significance was decided based on p values < 0.05.

2. Results

The study sample consisted of 123 participants distributed as 61 control and 62 intervention

Table 1 shows characteristics of study participants in the two study groups at baseline. The mean age in both groups was around 57 years, male: female ratio was around 1:1 and there are no important differences at baseline. However, we can note that the intervention group had a lower HbA1c level as compared to the control group.

Table 1.

Baseline	Control (n=61)	Intervention (n = 62)
Age (in years)		
Mean ± SD	57.4 ± 11.9	57.4 ± 9.8
Gender (n, %)		
Male	33 (54.1)	33 (53.2)
Female	28 (45)	29 (46.8)
Weight (kg)		
Mean ± SD	87.4 ± 21.1	85.7± 18.1
Height (Cm)		
Mean ± SD	161.4 ±10.5	161.5 ± 8.8
BMI (kg/m2)		
Mean ± SD	33.4± 6.8	32.721± 6
Smoker (n, %)	3 (4.9)	2 (4.3)
HbA1c (%)		
Mean ± SD	9.92± 1.6	7.6 ± 1.3

Table 2 shows the results of regression analysis, taking the final HbA1c as the dependent variable and the study group (intervention versus control) as the main predictor,

while adjusting for the baseline HbA1c. Analysis shows that coaching of patients with Type 2 diabetes can be responsible for an average reduction of 1.78 % of HbA1c (p=0.032). This is after adjustment for the baseline HbA1c, which was noted in the baseline values table to be lower in the intervention group. Baseline HbA1c is also an independent predictor of the final HbA1c a patient with 1% higher HbA1c at baseline is expected to have an average of 0.73% higher reading at the end (beta = 0.729, p<0.001).

Table 2. Factors affecting HBA1c level at follow up

Factor	Beta	Sig	P value
Group	(-1.78)	<0.001	(-2.1) -(-1.6)
HbA1c	0.729	< 0.001	(0.63) -(0.83)

Table 3 shows the results of regression analysis, taking the final BMI as the dependent variable and the study group (intervention versus control) as the main predictor. Analysis shows that coaching of patients with Type 2 diabetes can be responsible for an average reduction of 1.0 kg/m² of BMI (p=0.032). HbA1c significantly affects the BMI so that for every 1.0% rise in HbA1C the BMI is likely to increase by 0.3 kg/m² (beta = 0.3, p<0.001). These results come after adjustment for the baseline BMI which remains to be a significant independent predictor of the final BMI (beta = 0.9, p <0.001)

Table 3. Factors affecting BMI (Body Mass Index) level at follow up

Factor	Beta	Sig	P value
Group	(-1.0)	0.032	(-1.9) -(-0.1)
BMI	0.9	< 0.001	0.9 -1.0
HbA1c	0.3	< 0.001	0.12 -0.6

Table 4 shows some examples of problems encountered during the coaching sessions, the goals set during those sessions and the solutions suggested. We can see that problems varied between patients, while as expected a good proportion of patients had problems with eating carbohydrates other patients had problems with physical activities where they wanted to increase their physical activities, and some patients had psychological problems like problems with sleeping. Solutions suggested during coaching sessions were tailored to each patient’s problem and they greatly helped each patient to address their own difficulties and to reach their goals in terms of glycemic and diabetic control.

Table 4. Factors affecting Health coaching

Number	The problem	The goal	The solution
Patient1	Eating a lot of sugar	Reduce your sugar intake within 3 months	Replace sugar with healthy extracts
Patient2	Sitting for a long time at desk work	Commitment to sports within 3 months	buy a bike
Patient 3	Eating more carbohydrates, especially rice	Reduce your carbohydrate intake	Eat rice every two days
Patient4	Going through a bad psyche	Psychotherapy within 3 months	Treat depression and improve blood sugar
Patient5	sleep after eating	Not sleeping after eating	Reducing eating too much

3. Discussion

Health coaching is a new intervention to improve diabetic control of patients with Type 2 diabetes. Health coaching includes a set of strategies such as goal setting, knowledge acquisition about diabetes, individual care and frequent follow-up. The present study aimed to explore the effect of health coaching on the intermediate term control of Type 2 diabetes via assessment of an objective measure, namely the HbA1c. The results show that health coaching helped to improve the levels of HbA1c significantly as compared to the group that received the standard care.

We start the health coaching method to modify behaviors associated with the development of the disease (DM), build motivation, and promote self-determination and self-efficacy, also to increase the confidence and readiness to change. The coaching session contained questions determined by a SMART goal. The coaching skill of the health educator helped to speed up the improvement of the health of the diabetic patient because of the patient participation in the treatment plan and knowledge of the main problem. This study used coaching skills in health education sessions; the health educators received a course about diabetes for six months. The course is certified by The Makkah Healthcare Cluster and Derhum Weqaya Charity Coaches also received a two-months course about applying health coaching by a trainer (Dr. Hani Bahwirth) certified from the Accredited Coach Training Program [11].

Our results come in consistency with those of some previous studies, in a study by Diana Sherifali, Evaluating the effect of a diabetes health coach in individuals with type 2 diabetes (2016) in Canada, fifty-six patients with Type 2 diabetes were randomized to either 6 months of IH (Integrative Health) coaching or usual care (control group). Coaching was conducted by telephone for fourteen, 30-minute sessions. Patients were guided in creating an individualized vision of health, and goals were self-chosen to align with personal values. The coaching agenda, discussion topics, and goals were those of the patient, not the provider. Pre-intervention and post-intervention assessments measured medication adherence, exercise frequency, patient engagement, psychosocial variables, and HbA1c. Perceived barriers to medication adherence decreased, while patient activation, perceived social support, and benefit finding all increased in the IH coaching group compared with those in the control group. Improvements in the coaching group alone were also observed for self-reported adherence, exercise frequency, stress, and perceived health status.

Coaching participants with elevated baseline HbA1c ($\geq 7\%$) significantly reduced their HbA1c [8].

In another study by Sherifal 724, adult participants with diabetes were included: 353 participants were randomized to a diabetes health coaching intervention, and 371 were randomized to usual care. The pooled effect of diabetes health coaching overall was a statistically significant reduction of HbA1 levels by 0.32 (95% CI, -0.50 to -0.15). Longer diabetes health coaching exposure (>6 months) resulted in a 0.57% reduction in HbA1c levels (95% CI, -0.76 to -0.38), compared to shorter diabetes health coaching exposure (≤ 6 months) (-0.23% ; 95% CI, -0.37 to -0.09).

Across all studies, diabetes health coaching consisted of goal setting, knowledge acquisition, individualized care and frequent follow up.

It was also shown in the current study that the group with health coaching could achieve significantly lower levels of BMI as compared to their baseline values and to the standard care group. Such results were shown after adjustment for baseline BMI and HbA1c. Continuous follow-up of a diabetic in their entire lifestyle, leads to an improvement in HbA1c and then an improvement in BMI. In Scotland, a study has found that reinforcement and maintenance of exercise and physical activity improved HbA1c with very little change in BMI study no formal coaching was used (Kirk, A., 2004) [12]. This can point out that the benefits of coaching go further beyond those of simple encouragement to increase physical activity and those benefits are not limited to diabetic control.

We can see from the details of coaching sessions that coaching can adjust solutions to each patient's problem, and we know that these problems are different among patients and some rare problems can be encountered and would never be solved except with high index of suspicion because they are not common problems like having psychological conditions that require expert advice. These Types of problems can only be discovered in coaching sessions.

The current study highlights the importance of the presence of the health educator in modern health care, which leads to improving the quality of healthy life and improving the patient's health. For the continuation of improvement, the educator's skill must be developed with the necessary skills, including the health coach. The improvement in HbA1c can be translated to a reduction in the incidence of diabetic complications a decrease in the death rate and chances of infection. Extrapolating these effects to numbers and knowing for example that the yearly global incidence of infection is estimated to be 463 million resulting from unhealthy lifestyle and lack of attention to health care [13]. We can imagine the huge impact that the health educator could have. This would ultimately enhance the quality of life, reduce global health burdens, and budget.

4. Conclusion

This study shows diabetes health coaching has an emerging role in healthcare that facilitates self-care, behavior change and offers frequent follow up and support. This randomized controlled trial finds that health coaching for those with diabetes is an effective intervention for improving glycemic control. Therefore, we recommend more implementation of health education development and working on empowering health educators and improving their skills to offer their best and to improve the health status of diabetic patients.

5. Recommendation

Online courses for awareness of patients as patients club should be encouraged. Future studies should be conducted to provide more evidence about coaching cessation.

All patient participate in health coach program to improve life style, Hba1c and avoid complication of diabetes.

Improve BMI and encourage important of physical examination to enhance health.

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