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# The Influence of Health Coaching in Controlling Blood Sugar in Type 2 Diabetes Mellitus Patients: A Systematic Review

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**Abstract**

**Background**: Physiologically, DM patients' blood sugar control is affected by stress, but it can also interfere with their ability to regulate themselves in carrying out daily care. **Objective**: This study aims to identify and analyze available scientific evidence about the effect of Health Coaching (HC) in controlling blood sugar in type 2 DM patients. **Method:** This systematic review is based on the PRISMA checklist. Literature search via PubMed, Science Direct, google scholar, Cochrane, and Wiley. Structured research questions used the PICO electronic method (patient, intervention, comparison, and outcome). **Results:** The number of respondents who suffered from type 2 DM was 6,169, with the longest treatment time of 3 years. Four interventions are found in controlling blood sugar in type 2 DM patients: HC using web-based coaching techniques, HC using a telephone, face-to-face HC utilizing a smartphone, and HC using an application. Cell phone called MDMA (diabetes management mobile app). **Conclusion:** Interventions found as HC techniques to control blood sugar in type 2 DM patients were Health coaching with web-based coaching techniques, HC conducted using the telephone, HC conducted face-to-face utilizing a smartphone, and HC using a cellular mobile application called MDMA (application cellular diabetes management). **Recommendation**: Therefore, further research is needed regarding the standard of HC intervention in controlling blood sugar in diabetes mellitus patients.

**Keywords:** Health coaching, Type 2 diabetes mellitus, Glycaemic control, HbA1c

## INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia due to defects in insulin secretion, insulin action, or both. Chronic hyperglycemia in DM will be accompanied by damage and impaired function of several organs, especially the eyes, kidneys, nerves, heart, and blood vessels (1). DM is also called a silent killer (2). The impact of DM is to cause microvascular complications (retinopathy, nephropathy, neuropathy) and macrovascular (coronary heart disease, lower limb ischemic disease, stroke) (3)

The global prevalence of diabetes in adults has increased over the last decades. Around 382 million people worldwide, or 8.3% of adults, are estimated to suffer from DM, and 80% live in low and middle-income countries. If current trends continue, by 2035, around 592 million people, or 1 adult in 10 will suffer from DM. This means three new cases every 10 seconds or nearly 10 million per year, and the most significant increase occurs in developing economic areas (4). It is projected that up to one in three adults in the United States will suffer from DM by 2050. Elderly adults aged 45 years and over are the largest population with DM (5)

Then the overall incidence of DM among adults in China is estimated to be around 11.6%, with a population of 12.1% among men and 11.0% among women (6). At the same time, Indonesia is the seventh largest home in the world, with 7.6 million DM patients (4).

Physiologically, blood sugar control in DM patients is affected by stress. It can also interfere with self-regulation in daily care, such as: monitoring blood sugar regularly, following a dietary plan, and taking medication at the right time (7). Seeing this is very much needed for behavioral interventions that can provide control on blood sugar (8), such as Health professional guidance on how to motivate patients to adapt to real-life settings and patients' daily lives and Speak for the transformation of health knowledge by education into patient health behavior to adjust their health behavior.

Health Coaching (HC) is a new behavioral approach that facilitates individuals in transforming their cognitive and emotional functioning to adopt positive health behaviors, using personal goal setting and specific action plans. HC is one of the most effective behavioral techniques that are directly related to a positive lifestyle, such as smoking cessation, managing obesity, and diabetes management, which in turn has an impact on hemoglobin glycation resulting in control of blood sugar as evidenced by a decrease in HbA1c levels in DM patients (9).

At present, it is known that HC is a health coaching intervention that costs relatively cheaply and can be done using a telephone and a smartphone application (10-12).

Even so, HC does not have consistent time effectiveness in each intervention in controlling blood sugar (13). Although the health coaching industry has developed rapidly in recent years, there has not been a synthesis of scientific evidence to determine precisely how coaches apply the duration of interventions that effectively control blood sugar in diabetes mellitus patients. In this scenario, it is essential to identify what was done under the "health training" rubric and whether this duration was adequate compared to the other durations (14)

This is undoubtedly a challenge for nurses as health professionals who directly provide services to influence the community to solve their health problems. For this reason, this study aims to identify and analyze available scientific evidence about the effect of HC in controlling blood sugar in DM patients. This study was based on a study design that included the type of HC, the duration of the HC, and the effects of the HC. It is important to emphasize that information from the literature regarding HC interventions in controlling blood sugar takes different forms and effects. For this reason, we used review articles that included study interventions (randomized and non-randomized), cohort studies, and cross-sectional studies.

## OBJECTIVE

This study aimed to identify and analyze available scientific evidence on the effect of HC in controlling blood sugar in DM patients.

## METHODS

### Design

The rules for this systematic review are based on the 2009 PRISMA (15).

**Databases**

Literature search via PubMed, ScienceDirect, Google Scholar, Cochrane, and Wiley. Structured research questions using the electronic PICO (patient, intervention, comparison, and outcome) method (16). The PICO in this article is P: patients with diabetes mellitus, I: health coaching, C: no comparison, O: blood sugar control. Meanwhile, search keywords based on the database in the abstract title (Figure 1).

Search Strategy

| PICO Components | |
|---|---|
| P | Diabetes mellitus OR Diabetic OR, Diabetes mellitus OR DM, Diabetes mellitus OR Diabetes type 1, Diabetes OR Diabetes treatment, Diabetes OR Diabetes review, Diabetes OR Gestational diabetes mellitus |
| I | Health Coaching OR Coaching, Health Coaching OR Diabetes Coach Program, Health coaching OR coaching smartphone application |
| C | There is no comparison in this review article. |
| O | Glycemic control OR Control blood sugar OR HbA1c |

Figure 1: Description of the keywords used in the literature search using the PICO (population, intervention, comparison, and outcome) method

The research questions formulated through the PICO strategy are as follows: "What kind of HC intervention effectively controls blood sugar in DM patients?

Identified 647 articles from the five published literature search data from 2012-2021; All studies are in humans only and relate to the research question). The authors assessed all independently identified articles for inclusion in the systemic review.

Of the 647 potential articles, 60 were excluded due to double publication, 198 were excluded because they were not full text, and 301 were excluded because they needed to match the research questions.

**Eligibility of criteria**

Studies included in this literature review should 1) focus on interventions to control blood sugar, 2) be written in English as the manuscript's language, and 3) be published from 2012-2021. Of the 88 articles retrieved, eighty-one did not meet the requirements because they needed to match the research results. Thus only seven articles met the inclusion criteria consisting of 4 RCT articles, one cross-sectional, and 2 study cohorts. Figure 2 depicts the study inclusion process.

**Quality appraisal**

The included articles were criticized using the Critical Appraisal Skill Program (CASP) Checklist (17)

Studies were selected according to the level of evidence, recommendation, and quality. The story of recommendation is a quality measure linked to the level of research evidence and aids in the interpretation of recommendations. For the analysis of the quality of clinical studies, the Oxford Center for Evidence-Based Medicine (CEBM) was used to classify research into five levels of evidence according to research design (1,2,3,4 and 5).

Studies were grouped into four levels of recommendation (A, B, C, and D). Class A, i.e., level 1 studies (1a, 1b, and 1c), were used for systematic reviews of randomized clinical trials and represented the higher level of evidence. Class B (2a,2b,2c,3a, and 3b) were used for systematic reviews of cohort studies, research results, case-control studies, and case-control studies. Class B represents a moderate level of evidence. Grades C (4) and D (5) describe the

lowest level of evidence. Class C is used for case studies, and Class D is for expert opinion (17).

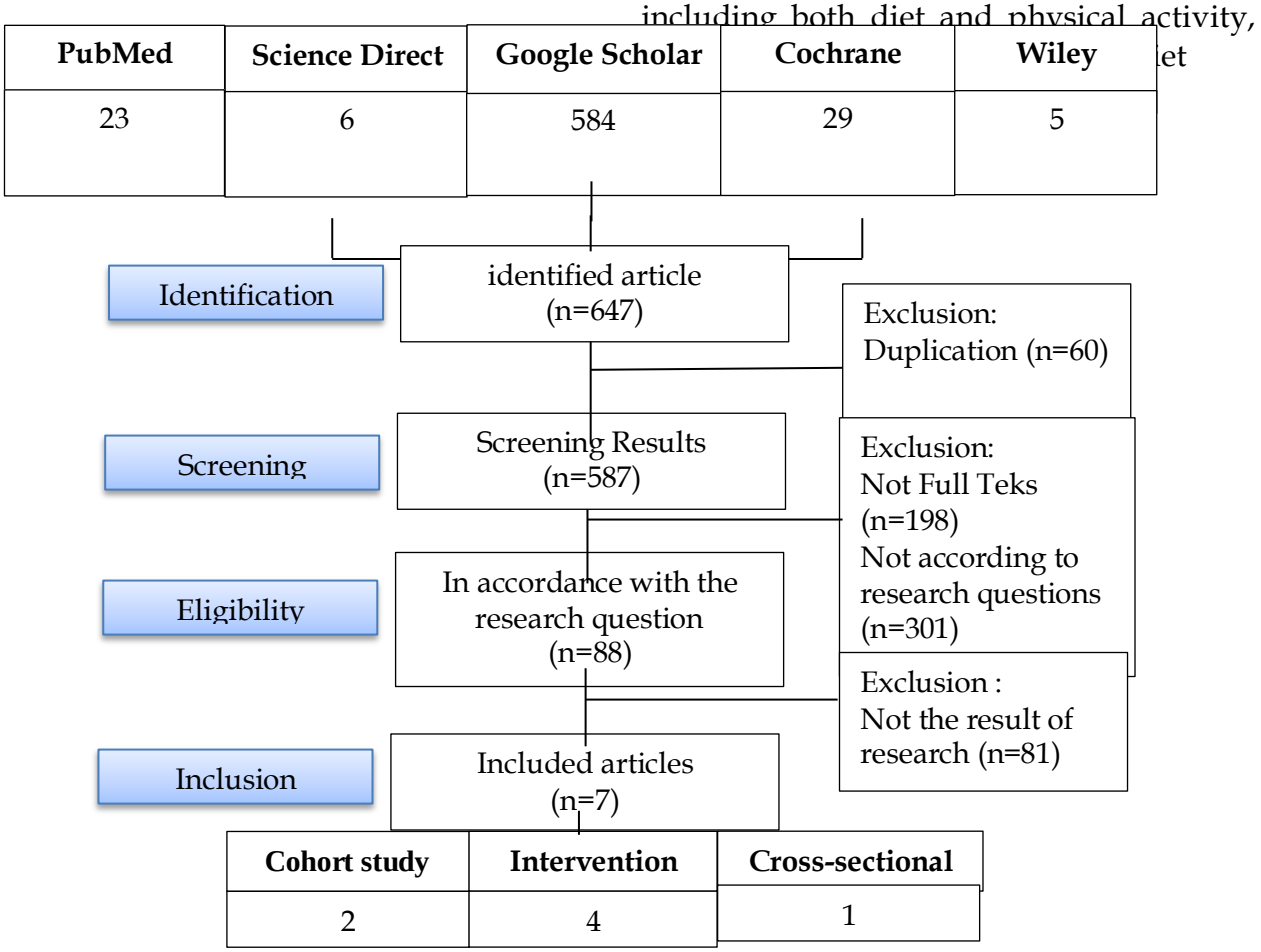


Figure 2: Flow diagram for study inclusion and exclusion

## RESULTS

### Research design

In this systematic review, seven clinical studies were identified that met the research criteria on the effect of HC in controlling blood sugar in DM patients. There are four intervention studies, which consist of an RCT study 8,13,17,18 and 1 cross-sectional study (20), and there are 2 cohort studies (9,21).

### Type of Health Coaching

HC is an intervention often carried out to control blood sugar in various ways in each study. A study (22) used a web-based HC technique, namely the ANODE e-coaching program, a nutrition program based on web support tools developed and provided by the MXS company. ANODE is designed to improve lifestyle habits, including both diet and physical activity, Module and self-monitoring of physical activity, 2) nutritional assessment, 3) generator of balanced diet menus, 4) physical education activities and recipe program. While (23) used the HC technique, carried out using the telephone. At the same time, (22) HC was conducted face-to-face utilizing a smartphone for intervention compared to HC without a smartphone for the control group by each participant in a randomized controlled manner. The research conducted (24) showed HC using a cellular mobile application called MDMA (diabetes management mobile application) which allows patients to enter diabetes self-care

data (blood glucose values, carbohydrate intake, medications, and other diabetes).

For a cross-sectional study, conducted HC by comparing primary care units with HC and primary care units without HC followed up for three years (20). Meanwhile, a study showed a cohort study using the face-to-face HC technique in collaboration with the HC utilizing the telephone (9). Furthermore, the cohort study (21) with the HC technique used the diabetes mobile app with an in-app coaching program. The app has several features, including an in-app training component. Users can log actively and passively (through the Health kit) and track their self-care behaviors (e.g., medications taken, carbohydrates consumed, activity minutes, and blood glucose readings) and patient health data (e.g., weight and A1C test results). This application also facilitates user access to fellow DM sufferer communities to share data and learn from each other by supporting one another.

**Duration of Health Coaching**

The duration of HC found in controlling blood sugar varied in each study. A study conducted a study with web-based HC (e-coaching ANODE) with an intervention time of 16 weeks (18). Meanwhile, another study (8) using the telephone for six months. Whereas a study (13), showed that the duration of HC was carried out for three months, which was then continued for up to 6 months. The duration of HC using a mobile application is 12 months. For a cross-sectional study (19-20). The period of HC was carried out for three years and for the cohort study also showed the duration of HC was carried out for ten months (9). Another study confirmed that the duration of HC was carried out for 12 weeks (21).

**Effect of Health Coaching**

Various HC effects using web-based HC technique, namely the ANODE e-coaching program as a nutrition program based on a web support tool developed and provided by the MXS company (18) . ANODE shows significant changes in weight loss, waist circumference, and HbA1c. Furthermore, another study using a telephone with substantial results in the intervention and control groups, was marked by improved HbA1C levels, fasting glucose, and increased adherence in the intervention group (8). In addition, a previous study was carried out directly or face to face using a smartphone, namely an intervention compared to HC without a smartphone for the control group by each participant (13). The results shows a very rapid decrease in HbA1c levels for the intervention group was monitored for three months which was followed by a significant reduction in body weight and waist circumference.

An HC conducted by a study (19) using a mobile application called MDMA (diabetes management mobile application) which allows patients to enter diabetes self-care data (blood glucose values, carbohydrate intake, medications, and diabetes others), showed standard mean HbA1c levels at 0, 3, 6, 9, and 12 months in the four subgroups (i.e., younger patients in the control group, older patients in the control group, younger patients in the intervention group). , and older patients in the intervention group). Across all four subgroups, the average HbA1c level decreased over the 12-month study period. Then for the HC performed by comparing the primary care unit with HC and the primary care unit without HC followed up for three years, a significant coaching × time interaction was observed, indicating that the difference in glucose between primary care units with and without coaching increased over time (20). HC showed control of blood sugar in the intervention group with control on HbA1c levels.

Furthermore, a research (9) conducted face-to-face HC techniques in collaboration with HC using the telephone by comparing HC (intervention group) and education (control group) which showed post-intervention results that there was a reduction in HbA1c and a much more significant increase in tooth brushing self-efficacy. It was consistent with previous study confirmed that the HC technique using the diabetes mobile app with an in-app coaching program showed a significant decrease in HbA1C with a tremendous increase in psychosocial self-efficacy after the intervention was carried out for 12 weeks (21).

Table 1: Synthesis of evidence regarding blood sugar control type 2 diabetes mellitus patients

| Intervention | Quotes in studies | Level of Evidence | Recommendation Value |
|---|---|---|---|
| *Health coaching with web-based coaching techniques, namely the ANODE e-coaching program* | 1 | 2b | B |
| *Health coaching conducted by telephone* | 1 | 2b | B |
| *Health coaching is carried out face-to-face using a smartphone.* | 1 | 2b | C |
| *Coaching by using a mobile application called MDMA (diabetes management mobile application)* | 1 | 2c | B |

## DISCUSSION

Overall, four intervention products were found as types of HC to control blood sugar in type 2 DM patients: Web-based HC, namely the ANODE e-coaching program, a nutrition program based on a web support tool developed and provided by the MXS company. ANODE is designed to improve lifestyle habits, including both diet and physical activity, with a coaching duration of 16 weeks (18), HC conducted by telephone with a duration of 6 months (18), HC carried out directly face to face using a smartphone for the intervention group compared to HC without a smartphone for the control group by each participant who was carried out in a randomized controlled manner with a duration of HC for 3 and 6 months (22), HC using a mobile application called MDMA (diabetes management mobile application) that allows patients to enter diabetes self-care data (blood glucose values, carbohydrate intake, medications, and other diabetes) (19).

This is associated with the level of evidence as Class 2b recommendation B, the level of proof as Class 2b recommendation C, and the status of evidence as Class 2c recommendation B. In this study, the duration of HC for each intervention was different, based on research by (18). The shortest HC is 16 weeks; analysis by (20) lasts three years.

Of the seven articles reviewed systematically, HC has a controlling effect on blood sugar in type 2 DM patients, namely HC with a web-based coaching technique, namely the ANODE e-coaching program cited from studies with a level of evidence 2b and grade of recommendation B proven to reduce HbA1C levels in DM patients followed by weight loss and reduction in waist circumference in DM patients. This HC technique is the HC model of the hospital-to-home model. Patients who leave the hospital feel confused by the new drugs they get and the changes in circumstances they experience, where they have to learn to handle these conditions.

This HC model is widely used by teaching patients and families skills and confidence as they move from hospital to home. This is focused on four pillars, namely: Having a reliable drug management strategy, overcoming barriers to follow-up, knowing how to recognize and respond to worsening signs and symptoms, and using personal health records to record goals or goals expected within 30 days, health information and questions to ask your doctor or healthcare worker at your next appointment. (25), but research related to

HC interventions with this technique is intended for patients who are not technologically illiterate (18)

Furthermore, HC carried out using the telephone was quoted from research with a level of evidence 2b and grade of recommendation B showing an improvement in HbA1C levels followed by improvements in fasting glucose and increased adherence. This HC technique is a coaching model. The team model is a doctor, medical assistant, or health worker assigned to visit patients. Health coaches conduct pre-visits to review patient medications and arrange treatment plans, assist during doctor visits and post-visits, assess whether patients understand and agree to recommended treatment plans, and involve patients in action plans for behavior change. Follow-up by phone was then carried out between visits to check the action plan and treatment adherence. This is done because regular follow-up can improve health outcomes in chronic diseases (25), and HC with this technique is easier to do (8).

Then HC was carried out directly face to face using a smartphone for intervention compared to HC smartphone for the control group with a level of evidence 2b and grade of recommendation C, which resulted in a rapid decrease in HbA1C levels and changes in body weight and waist circumference. HC with this technique is a coaching role which is called serving in continuity (sustainably), meaning that the Coach connects with patients not only during visits but also between visits, creating familiarity and continuity (25) and HC by using mobile applications the so-called MDMA (mobile diabetes management application) with the level of evidence 2c and grade of recommendation B shows significant results in reducing HbA1C levels in all age groups from young to old. The research of (22) confirms this HC technique. The increased use of mobile technology has a healthcare role that can maintain communication consistency and monitor patients remotely so that trainers can detect patient non-compliance and resolve it quickly without knowing the good time of day or night. Therefore the use of HC with this technique is also a recommendation to do.

In HC, by comparing primary care units with HC and primary care units without HC, which were followed up for three years showing control of blood sugar with control of HbA1C levels, this HC technique is the same as the HC technique carried out by (13) but have different effects and duration of time. For the 2 cohort studies conducted by (9), the HC technique used was the same as that carried out by (13). Still, there was a difference in the duration of the HC, namely for ten months, and the HC technique by (21) is the same as the HC carried out by (19), namely using HC with a mobile application but has a difference in coaching duration.

The goal of identifying this evidence in controlling blood sugar in type 2 DM patients has been achieved. However, several things that became the main limitations of this study review were the need for a standard in determining the duration of HC interventions. Hence, the duration of HC in each study varied with the shortest HC duration of 16 weeks. (18), and the longest duration is up to 3 years (20). Therefore, further research is needed regarding the standard of HC intervention in controlling blood sugar in diabetes mellitus patients.

## CONCLUSION

In this literature search, seven clinical studies have been identified on the effect of HC in controlling blood sugar in type 2 DM patients. There are 4 HC interventions found with different techniques. HC with web-based coaching techniques, namely the ANODE e-coaching program, HC, which is carried out using the telephone, HC is carried out face-to-face utilizing a smartphone, and HC using a cellular mobile application called MDMA (diabetes management mobile application). The level of evidence is 2b and a class of recommendation B.

The aim to identify evidence of the influence of HC in controlling blood sugar

in type 2 DM patients has been achieved. However, several things that became the main limitations of this study review were the absence of a standard in determining the duration of HC interventions, so the period of HC in each study was different, and the most extended term was up to 3 years.

## IMPLICATIONS FOR CLINICAL PRACTICE

The HC technique found in this review can be used to provide blood sugar control in type 2 DM patients.

**Acknowledgment**
Not Applicable

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