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Retrospective meta-analysis study ■

Correlation Between Hemoglobin A1C Level and Fasting Blood Glucose Level: a Summary on the Reports in the Setting with High Prevalence of Hemoglobin Disorder

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SUMMARY

The investigation of hemoglobin A1C is presently accepted as a tool for the evaluation of the glycemic control in the diabetic patients. However, due to the high cost, it is limitedly used in many developing countries. The old classical approach, fasting blood glucose determination, is still the standard method in those countries. There are many reports showing the correlation between hemoglobin A1C level and fasting blood glucose level. An interesting point is that there is a limited assessment on those reports, especially in the setting with possible problems of using hemoglobin A1C due to the interference from hemoglobin disorder.

In this work, the author performed a meta-analysis by fixed effect model to summarize the reports on the correlation between hemoglobin A1C level and fasting blood glucose level in the setting with high prevalence of hemoglobin disorder, Thailand. The databases PUBMED (from 1910 to February 2012), Cochrane Library (from 1993 to February 2012) and Thai Index Medicus (from 1918 to February 2012) were used for searching the time span.

Only four specific reports on the correlation between hemoglobin A1C level and fasting blood glucose have been found. All reports are homogeneous presenting a poor correlation between the two parameters. Of overall 1,207 diabetic cases, a pooled correlation coefficient is equal to 0.48.

The result shows that the poor correlation might be due to the high prevalence of hemoglobin disorder in this setting. This might imply that fasting blood glucose might not be used to imply hemoglobin A1C in the areas with the background of endemic hemoglobin disorder.

Key words: diabetes mellitus, investigation, hemoglobinopathy, glucose

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INTRODUCTION

Diabetes mellitus is a common endocrine disorder. The important pathology is the defect of normal glucose metabolism resulting in hyperglycemic stage. For the management of diabetic patients, the main focus is on normalizing the blood glucose (1). Basically, the pathology in diabetes mellitus is usually due to the fluctuation of the blood glucose level (2). An important group of laboratory investigation for monitoring the glucose control is determination of glycated end product (3). In medicine, the two main tests are hemoglobin A1C and fructosamine (3). Due to the ability for telling a longer period of glycemic control, the investigation of hemoglobin A1C is presently widely used as a diagnostic tool for the evaluation of the glycemic control in the diabetic patients. However, due to the high cost, it is limitedly used in many developing countries (4). The old classical approach, fasting blood glucose determination, is still the standard method in those countries. There are many reports showing the acceptable correlation between hemoglobin A1C level and fasting blood glucose level (5-7). However, the problem of hemoglobin A1C measurement can be expected in cases with hemoglobin disorder (8). An interesting point is that there is limited assessment of those reports, especially in the settings with possible problems of using hemoglobin A1C due to the interference from hemoglobin disorder. In this work, the author performed a meta-analysis to summarize the reports on the correlation between hemoglobin A1C level and fasting blood glucose level in the setting with high prevalence of hemoglobin disorder, Thailand.

MATERIALS AND METHODS

First, the author performed the literature searching using three main databases, PUBMED (from 1910 to February 2012), Cochrane Library (from 1993 to February 2012 and Thai Index Medicus (a national reference of medical publication in Thailand; from 1918 to February 2012) to find the papers reporting the study on hemoglobin A1 in Thailand. The key words for searching are "diabetes" and "hemoglobin A1C". All derived papers were collected for further selection. Only specific papers reporting on correlation between hemoglobin A1C level and fasting blood glucose level were recruited for further summative analysis. The author used the fixed-effect model of meta-analysis. Focusing on analysis, the correlation meta-analysis was performed to find a pooled correlation coefficient (9) (more details on this meta-analysis calculation technique can be seen and appreciated via

<http://www.ndsu.nodak.edu/ndsu/horsley/corr.pdf>).

The SPSS 12.0 for Windows program was used for statistical analysis. The flow diagram showing a step by step procedure of this study is given in Figure 1.

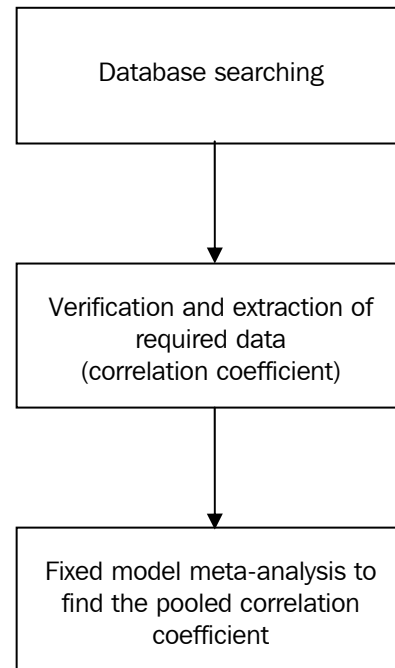


Figure 1. Step by step procedure in this study

RESULTS

Based on searching, there were 84 primary derived publications (55 publications from PUBMED, 0 publication from Cochrane Library and 29 publications from Thai Index Medicus). However, only four specific reports (all from Thai Index Medicus) on the correlation between hemoglobin A1C level and fasting blood glucose level were derived (10-13). All reports were homogeneous presenting a poor correlation between the two parameters (Table 1). Of overall 1.207 diabetic cases, the pooled correlation coefficient is equal to 0.48 (CI=0.41-0.51).

Table 1. Characteristics of included studies

Studies	Correlation coefficient	Significance
Tossapornpong [10]	0.52	< 0.01
Kittiperachol [11]	0.46	< 0.01
Sripanithan [12]	0.54	< 0.01
Suphapasith [13]	0.43	< 0.01

DISCUSSION

A big problem in laboratory investigation is the cost of the test. The use of hemoglobin A1C is also affected by the cost (14). Based on this fact, there are several attempts to study the correlation between hemoglobin A1C level and fasting blood glucose level. As already noted, satisfactory correlations are reported in some papers (5, 6). However, despite the observed satisfactory correlation, some authors have concluded that measurement of hemoglobin A1C is superior (7). A recent report by Landgraf et al. has shown that the important factor is the period of blood collection relating to meal (15). Nevertheless, from a meta-analysis on using hemoglobin A1C in diabetes management compared to standard glucose measurement technique, it is concluded that "measurement of HbA1c levels may represent a reasonable approach to identifying treatment-requiring diabetes (16)."

In this work, the author especially focused his interest on the observed correlations in the setting with the problem of endemic hemoglobin disorder, which has been proved to affect the hemoglobin A1C analysis [8]. Based on meta-analysis, the result shows that the poor correlation can be derived, which might be due to the high prevalence of hemoglobin disorder in this setting. This might imply that fasting blood glucose might not be used to imply hemoglobin A1C in areas with background of endemic hemoglobin disorder. Indeed, the limitation of resource should not be the barrier to provide the good medical care to the local population. It should be noted that the test might be cheaper, but if it provides incorrect result it is useless for investigation.

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KORELACIJA IZMEĐU NIVOA HEMOGLOBINA A1C I NIVOA JUTARNJEG NIVOA ŠEĆERA U KRVI: REZIME IZVEŠTAJA U USLOVIMA SA VISOKOM PREVALENCOM POREMEĆAJA HEMOGLOBINA

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Sažetak

Trenutno ispitivanje nivoa hemoglobina A1C se smatra sredstvom u proceni kontrole nivoa šećera u krvi kod dijabetičara. Međutim, zbog visoke cene ovakva ispitivanja su u manjoj meri zastupljena u zemljama u razvoju. Stari, klasičan pristup - određivanje nivoa šećera u krvi je još uvek standardna metoda u ovim zemljama. Postoje mnogi izveštaji koji pokazuju korelaciju između nivoa hemoglobina A1C i jutarnjeg nivoa šećera u krvi. Ono što je interesantno je da je procena tih izveštaja krajnje ograničena, naročito u sredinama sa mogućim problemima korišćenja hemoglobina A1C usled javljanja poremećaja hemoglobina.

U radu je autor predstavio meta anлізу kako bi rezimirao izveštaje o korelaciji između nivoa hemoglobina A1C i jutarnjeg nivoa šećera u krvi u uslovima prevalencije poremećaja hemoglobina, Tajland. Za proučavanje vremenskog perioda korišćene su baze podataka PUBMED (u periodu od 1910 do 2012) i Kohran biblioteka (od 1993 do februara 2012) i Thai Index Medicus (od 1918 do februara 2012).

Pronađena su samo četiri specifična izveštaja o korelaciji između nivoa hemoglobina A1C i jutarnjeg nivoa šećera u krvi. Svi izveštaji su ujednačeni i prikazuju slabu korelaciju između ova dva parametra. Od ukupno 1.207 slučajeva, koeficijent korelacije je iznosio 0.48.

Rezultati ukazuju da je slaba korelacija možda uslovljena velikom prevalencom poremećaja hemoglobina u ovom okruženju. To bi dalje moglo da implicira da se nivo jutarnjeg šećera u krvi možda ne može koristiti za određivanje nivoa hemoglobina A1C u oblastima sa endemskim poremećajima hemoglobina.

Ključne reči: dijabetes melitus, ispitivanje, hemoglobinopatija, glukoza