Original Article

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Glucose Control and Its associated Factors among Patients with Type 2 Diabetes at a Northern Community Health Center in Thailand

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Abstract

A community health center the primary setting for caring patients with type 2 diabetes is responsible for enabling them to control their glucose level adequately. The objective was to determine the proportion of patients with adequate glucose control and the factors which could associate with glucose control. The population were all patients with type 2 diabetes registered as patients of a community health center in Chiang Mai, Thailand (n=149). The sample was patients who had literacy and regular records of glucose levels. Patients' information about demographics, intention, self-care behaviors and glucose levels during the last 6-month period was considered. Data were collected from a patient profile and a questionnaire in 2009. Adequate glucose control was defined as fasting glucose level ≤ 130 mg/dl. Results showed that 25.9% of respondents (n=135) were considered as adequate glucose control. Factors presenting negative association with glucose level were age, physical activity and intention to control diabetes but the positive one was eating habit. In conclusion, there are only one fourth of patients with adequate glucose control indicating that serious attempt and proper care are needed for the majority of patients with inadequate glucose control. Strengthening patients to keep strong intention to control diabetes and to engage in self-care behaviors of healthy eating and performing physical activity simultaneously and consistently is very necessary for succeeding in adequate glucose control. In particular, careful attention should be paid to the younger patients because of their tendency of inadequate control.

Key words: Thailand, glucose control, patients with type 2 diabetes

INTRODUCTION

The prevalence of diabetes continues to increase according to the estimates of 2.8% in 2000 and 4.4% in 2030[1] and also the expenditure on it rises consistently[2]. Diabetes is a burden of health system because it is a chronic disease characterized by a high blood glucose level which could lead to other serious morbidity and take a high cost of health care. To reduce such high glucose level is one necessary means to prevent risk of diabetes complications, especially micro- and macro-vascular diseases[3]. Thus, the important target of health care for diabetes patients is to enable them to control their glucose levels to the optimum value adequately. However, there are a number of patients with poor glucose control which are still a difficulty in health system[4,5]. Several factors are demonstrated to involve glucose control or self-care of

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diabetes patients. Younger patients are less likely to care themselves about diet, taking medication and exercise[6,7]. Psychological theory could be applied to make patients eat healthily[8]. The relation between belief and intention about taking medicine is shown[9]. It is evident that the diabetes patients' views on beliefs about and attitudes toward the disease and self-care are necessary for their success in glucose control[10-13]. Healthy diet is considered as one of the basic recommendations for diabetes patients[14,15] and the lack of it may aggravate the disease[16]. Another important behavior is to perform physical activity. This activity can improve health and reduce risk of patients with type 2 diabetes[17,18]. Physical activity can be beneficial to glucose control[19], glucose tolerance[20] and insulin sensitivity[21]. The benefit from physical activity depends on not only its intensity but also the time spent for it[22]. Some patients have indicated that the most burden self-care activity is to take medicines[23]. There are reports demonstrating that uncontrolled patients take medication at a poor adherence rate[24,25].

Previous reports on patients with type 2 diabetes usually examine factors involving their demographics, psychological or behavioral dimension. Thus, this study has addressed these dimensions simultaneously whether they associate with glucose levels of patients in order to provide a better understanding and care of them. Besides demographics, attitude and intention of patients are also necessary to focus since they can further affect the action to control glucose[26,27]. Self-care behaviors suggested for diabetes patients include eating, performing physical activity and taking medicines prescribed[28-31]. Each behavior will be advantageous to patients because healthy eating could prevent a rise in blood glucose level and maintain it in a normal range, physical activity would promote the glucose use by body tissues especially skeletal muscle, and medication could enhance insulin activity. Moreover, proper diet and physical activity are evident to reduce risk of cardiovascular complications among diabetes patients[32]. As a result, these self-care behaviors were included in the investigation.

Thailand has also faced a rise in number of patients with type 2 diabetes especially those with inadequate glucose control. According to Thai Good Clinical Practice of diabetes, the optimum value of 130 mg/dl or lower is considered as the target for adequate glucose control. It seems that most diabetes patients could not reach this optimum value. Thus, the objective was to determine the proportion of patients with adequate glucose control and the factors affecting their glucose control. This investigation hypothesized that demographics, intention to control diabetes, eating habit, physical activity and medication compliance of diabetes patients would associate with their glucose levels.

METHODS

Setting

In the country, a community hospital located at every district is main setting and a community health center affiliated to each sub-districts is primary place responsible for caring people in the areas. In Chiang Mai, a community health center where there were about 9,700 citizens living in its area and its community hospital had 30 beds participated in this study. For mutual responsibility for glucose control, the hospital would send manageable diabetes patients who had glucose levels ≤180 mg/dl to the center for facilitating them to achieve an optimum level. Such patients were suggested to visit the center regularly according to the appointment for checking their glucose levels. On the other hand, the center would refer back unmanageable patients who demonstrated glucose levels higher than 180 mg/dl for three consecutive visits to the hospital for adjusting the medicines or the treatment.

Participants

The study population were all patients who were registered as type 2 diabetes patients of this community health center (n=149). These patients usually visited the center for checking their fasting glucose

levels every 2-month appointment. Weight and height of patients were also measured to determine their body mass index (BMI). The sample was these patients who had literacy and the average records of fasting glucose level and BMI during the last 6-month period. Patients who presented their glucose levels of 130 mg/dl or lower during this period were considered as adequate glucose control.

Data collection

A structured questionnaire was developed from interviewing a number of patients (n=20) about their attitude, intention and medication, and from modifying the two tools which are reliable and valid. Pre-test of this questionnaire was carried out in patients with type 2 diabetes (n=32) affiliated to another near-by community health center. The study patients, at their houses, were asked to complete the questionnaire which consisted of demographic data and the following measures.

Measures

Attitude toward an object is described to influence intention to perform a behavior which respects to that object, and intention is mentioned to further determine such behavior[26,27]. In this study, attitude toward diabetes and intention to control diabetes of patients were examined.

Attitude toward diabetes was measured by subject evaluative responses to these four negative items: 1) Diabetes was chronic, 2) Diabetes was dangerous to other organs, 3) Diabetes was harmful to foot ulcer, and 4) Diabetes could result in blindness; and four positive items: 5) Diabetes could be controlled, 6) The danger of diabetes could be reduced by regular exercise, 7) The danger of diabetes could be reduced by food restriction and 8) The danger of diabetes could be reduced by medication compliance. Responses were on a five-place scale ranging from the most (5) to the least (1) satisfactory. Higher scores reflected stronger attitude.

Intention to control diabetes was examined by subject responses to these 10 items: I intend to avoid 1) snack, 2) dessert, 3) sweet drinking, 4) starch and sugar; I intend to regularly 5) exercise, 6) participate in community activity, 7) move the body often; I intend to take 8) all medicines prescribed, 9) medicines at right doses, and 10) medicines at right times. Responses were on a five-place scale ranging from the highest (5) to the least (1) degree of intention. Higher scores presented stronger intention to control diabetes.

Eating behavior is considered to consist of three different domains: uncontrolled eating (trend to overeat due to the internal and external stimuli and a lack of control), emotional eating (tendency to eat more than usual due to a response to emotional cue), and restrained eating or cognitive restraint (conscious restriction on eating in order to control body weight)[33-35]. The Three-Factor Eating Questionnaire-R18[36] which contains these domains of eating was modified to investigate the eating habit of subjects.

Eating habit was determined by subject responses to these10 items: 1) I usually eat fully, 2) I often want to eat, 3) I can eat every time, 4) I am induced to eat by the smell and texture of food, 5) When I feel lonely, I usually console myself by eating, 6) When I feel blue, I usually overeat, 7) When I feel anxious, I often find myself eating, 8) I will eat only at meals, 9) I warn myself that I will eat just enough, 10) I try to avoid snack. These items were referred to as uncontrolled eating (items 1-4), emotional eating (items 5-7) and restrained eating (items 8-10). These items were on a four-place scale ranging from mostly true (4) to rarely true (1). For restrained eating items, the scores were reversed before calculating the score of this part and adding to the total score of eating habit. Higher scores implied greater tendency to eat.

Physical activity can be defined as the body movement resulted from the contraction of skeletal muscle that spends energy more than the basal level. Metabolic Equivalent of Task (MET), a physiological concept used to indicate the energy expenditure on physical activities, is a ratio of a metabolic rate (rate of energy consumption) during a particular physical

activity to a metabolic rate at rest[37-39]. The values of MET can vary from 1 (quiet sitting) to 18 (running at 17 km/h). The Short Questionnaire to Assess Health-enhancing physical activity[40] which contained daily actions was adapted to measure physical activity of subjects.

Physical activity was evaluated by subject responses to the questionnaire which covered household activities, activities at workplace and leisure-time activities. Subjects were asked to indicate the activities they performed and the time spending for such activities (days per week or hours per day). The activities were classified as either light or heavy according to the degree of physical effort to perform. Then, an intensity score of 2 or 5 (MET values) was given to a light or a heavy activity, respectively. For example, cooking, washing dishes, and ironing were light activities while scrubbing the floor, gardening and bicycling were heavy ones. The score of each activity was calculated by multiplying its intensity score and its number of minutes per week. The total scores of physical activity were summated from each activity score. Higher scores indicated greater energy or calories exploited for physical activity.

Medication compliance was determined by subject responses to a questionnaire concerning about medicines prescribed for diabetes. Subjects were asked for self scoring about these items with the scores ranging from 1 to 10: 1) I take all kinds of medicines, 2) I take the medicines at the right doses, 3) I take the medicines at the right times. Higher scores suggested better medication compliance.

Data analysis

Validity and reliability of questionnaire were based on factor loadings on a single factor, and on coefficient alpha (Cronbach's alpha) with the value over 0.7, respectively (Table 1). Descriptive analysis was used to determine the characteristics and measures of respondents. Differences in group number and mean were based on chi-square test and t-test. Relationship between variables was observed by Pearson's correlation coefficients. Attitude would relate to intention and then, intention would associate with glucose level. The significant variables related to glucose level were further determined the association by multiple regression. All analyses used SPSS (version 16.0 for windows) at the significance level of 0.05.

RESULTS

A total of 135 respondents were eligible for this study. The number of females was significantly greater than males (91 vs 44, $p<0.001$). The occupations of respondents were employees (40.1%), traders (25.9%), agriculturists (9.6%), and others (24.4%). The other characteristics and measures of respondents were demonstrated (Table 2). The number of respondents with adequate glucose control was significantly lower their counter parts (35 vs 100, $p<0.001$). There were significant relationships between glucose level and age, intention to control diabetes, eating habit and physical activity (Table3). Attitude toward diabetes was also related to intention to control diabetes indicating its importance for intention. Regression coefficients demonstrated that glucose level had the positive association with eating habit (beta=0.228), and the negative ones with age (beta=-0.280), physical activity (beta =-0.200) and intention to control diabetes (beta=-0.184) (Table 4). These factors accounted for 28.5% of variance in glucose levels. This finding has supported the hypothesis that age, intention and behaviors (eating habit and physical activity) of patients could associate with their glucose control but the other demographics and medication compliance could not.

Table 1. Validity and reliability of questionnaire

	Items	Factor loadings				Alpha
Attitude toward diabetes	8					
Attitude, negative	4	0.90	0.94	0.92	0.92	0.94
Attitude, positive	4	0.82	0.80	0.80	0.78	0.80
Intention to control diabetes	10					0.83
by food restriction	4	0.80	0.91	0.80	0.82	0.87
by body movement	3	0.88	0.80	0.76		0.74
by medication	3	0.95	0.92	0.83		0.88
Eating habit	10					0.81
Uncontrolled eating	4	0.76	0.83	0.89	0.81	0.84
Emotional eating	3	0.86	0.84	0.85		0.81
Restrained eating	3	0.85	0.92	0.87		0.85
Medication compliance	3	0.94	0.91	0.92		0.91

DISCUSSION

This investigation has demonstrated that there are only about one fourth of patients with type 2 diabetes who have achieved adequate glucose control. The proportion of patients with inadequate glucose control is quite high and similar to that in other countries[41]. However, patients who have older age, lesser tendency to eat, greater performing physical activity, and stronger intention to control diabetes would have lower glucose levels than their peers and could achieve adequate glucose control. Therefore it is necessary to foster patients to build positive attitude toward diabetes and strong intention to control diabetes and to recognize the benefit of self-care behaviors enhancing their adequate glucose control, especially younger patients.

The finding that younger patients are likely to present inadequate glucose control has confirmed the previous reports. Perhaps, diabetes usually shows no sign of serious symptoms and takes times to elicit the complications, so younger patients may overlook and neglect its danger. This disease which slowly damages some body organs could make patients careless of the necessity to control glucose adequately. Proper information about diabetes is very necessary for this group of patients, in particular, people firstly diagnosed as diabetes patients. The earlier the patients are informed about diabetes, the better their glucose levels are controlled. In addition, early screening test for diabetes among younger adults may be advantageous to them to prevent from diabetes danger.

Table 2. Characteristics and measures of respondents (n=135)

	Mean	**SD**
Age (years)	58.7	9.4
Body mass index (kg/m^2)	25.0	7.4
Duration of being diabetes (years)	5.6	4.0
Glucose level (mg/dl)	152.9	40.7
Attitude toward diabetes		
Attitude, negative	8.2	4.8
Attitude, positive	17.5	3.4
Intention to control diabetes	40.5	6.0
by food restriction	15.7	3.6
by body movement	10.9	2.6
by medication	13.9	1.8
Eating habit	17.9	4.8
Uncontrolled eating	8.4	2.8
Emotional eating	4.1	1.7
Restrained eating	5.1	2.3
Physical activity	4087.6	2927.2
Household activities	1258.1	1555.4
Activities at work place	2216.3	2380.1
Leisure-time activities	613.5	708.7
Medication compliance	27.6	3.4

Patients with lesser tendency to eat are more likely to have lower glucose levels which would be advantageous to their disease. They should aim at healthy eating and keep discipline to eat carefully. This investigation has suggested a reminder for patients before eating. This reminder consists of 1) why to eat, 2) when to eat, and 3) how to eat. The patients should remember and recognize the answers for such questions which are to eat for stopping hungry, to eat at meal times, and to eat just enough only. The advantageous information provided by this study is that diabetes patients who feel lonely, blue or anxious are prone to find something to eat. Therefore these patients should be aware of these emotional stages and should try to avoid them.

Table 3. Pearson correlation coefficients of variables

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Age											
2. Gender	-0.11										
3. Body mass index	-0.08	0.05									
4. Duration of being diabetes	0.31*	-0.05	-0.09								
5. Attitude, negative	0.05	-0.04	0.16	0.04							
6. Attitude, positive	0.01	0.16	0.04	-0.02	-0.11						
7. Intention to control diabetes	0.08	0.10	-0.18*	0.00	-0.29*	0.28*					
8. Eating habit	-0.35*	-0.06	0.24*	-0.02	0.30*	-0.30*	-0.43*				
9. Physical activity	-0.23*	-0.15	-0.05	-0.24*	-0.14	0.11	0.15	-0.07			
10. Medication compliance	0.09	0.17*	-0.13	0.04	0.05	0.12	0.26*	-0.15	0.02		
11. Glucose level	-0.33*	0.02	0.02	-0.02	0.13	-0.15	-0.34*	0.42*	-0.18*	-0.16	

* correlation is significant at the 0.05 level

Table 4. Regression of glucose level on its associated factors

	Factors	Beta	p-value	R	R^2
Glucose level, mg/dl				0.534	0.285
	Eating habit	0.228	0.011		
	Age	0.280	0.001		
	Physical activity	0.200	0.011		
	Intention to control diabetes	0.184	0.028		

Physical activity is an essential factor associated with glucose control. Regular exercise is a common suggestion of good health for anyone including diabetes patients. However, some patients may be unable or inconvenient to exercise regularly. The findings demonstrate that a combination of three kinds of physical activities, i.e., household activities, activities at workplace, and leisure-time activities could reduce glucose level. This is beneficial to patients because they have more options to perform these activities. In this case, it is observed that percentage of score from leisure-time activities which could include exercise is lower than the others (Table 2). This observation implies that this patient group is less likely to exercise or spend energy. Patients who may lack leisure-time activity could spend more physical effort on household activities and activities at work place to control their glucose levels.

The finding has demonstrated that to control diabetes depends on not only

behaviors of patients but also their intention. In comparison, patients have shown higher score of intention to control diabetes by medication than by food restriction [92.7% (13.9/15) vs 78.5% (15.7/20), $p<0.05$] and by body movement [92.7% (13.9/15) vs 72.6% (10.9/15), $p<0.05$] (Table 2). Patients should recognize the importance of intention to control diabetes by food restriction and by body movement as well because it could enhance the overall intention which would further result in actual behaviors of eating and performing physical activity. Intention is related to both negative and positive attitude in different directions. Increasing positive attitude and decreasing negative attitude toward diabetes are necessary to build a strong and consistent intention. This necessity could be effective by providing appropriate information about diabetes to patients.

The finding that there is no relationship between glucose control and medication compliance is not correspondent with other studies which indicate that poor glucose control is associated with poor medication compliance or vice versa [42, 43]. Despite the fact that patients have demonstrated good medication compliance, the proportion of inadequate glucose control is still high. This suggests that medication compliance is not enough to reach the adequate glucose control.

CONCLUSION

This study has revealed that there are only one fourth of patients who can achieve adequate glucose control. The majority of patients with inadequate glucose control are called for serious attempts and proper actions to care them. However, age, eating habit, physical activity and intention to control diabetes of patients are associated with their glucose control. Strengthening patients to keep strong intention to control diabetes and strictly follow the supportive self-care behaviors simultaneously and consistently is very necessary for succeeding in adequate glucose control. In particular, careful attention should be paid to the younger patients because of their higher tendency of inadequate control.

REFERENCES

1. Wild S, Roglic G, Green A, et al. Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004; 27:1047–1053.
2. Zhang P, Zhang X, Brown J, et al. Global healthcare expenditure on diabetes for 2010 and 2030. *Diabetes Res Clin Pr* 2010; 87:293-301.
3. Kahn SE, Cefalu WT. Glucose control, macro- and microvascular disease, and the Food and Drug Administration: Let's keep our eye in the ball. *J Clin Endocr Metab* 2008; 93(10):3727-3729.
4. Khattab M, Khader YS, Al-Khawaldeh A, et al. Factors associated with poor glucose control among patients with type 2 diabetes. *J Diabetes Complicat* 2010; 24 (2):84-89.
5. Neville SE, Boye KS, Montgomery WS, et al**.** Diabetes in Japan: a review of disease burden and approaches to treatment. *Diabetes Metab Res Rev* 2009; 25(8): 705-716.
6. Chang HY, Chiou CJ, Lin MC, et al. A population study of the self-care behaviors and their associated factors of diabetes in Taiwan: results from the 2001 National Health Interview Survey in Taiwan. *Prev Med* 2005; 40:344-348.
7. Jordan DN, Jordan JL. Self-care behaviors of Filipino-American adults with type 2 diabetes mellitus. *J Diabetes Complicat* 2010; 24 (4):250-258.
8. Jones H, Edwards L, Vallis TM, et al. Changes in diabetes self-care behaviors make a difference in glucose control The Diabetes Stages of Change (DiSC) study. *Diabetes Care* 2003; 26(3):732-737.
9. Farmer A, Kinmonth AL, Sutton S. Measuring beliefs about taking hypoglycaemic medication among people with Type 2 diabetes. *Diabetic Med* 2006; 23:265–270.
10. Cooper H, Booth K, Gill G. A trial of empowerment-based education in type 2 diabetes-Global rather than glycaemic benefits. *Diabetes Res Clin Pr* 2008; 82: 165-171.
11. Mosnier-Pudar H, Hochberg G, Eschwege E, et al. How do patients with type 2 diabetes perceive their disease? Insights from the French DIABASIS survey. *Diabetes Metab* 2009; 35(3):220-227.
12. Sloan FA, Padrón NA, Platt AC. Preferences, beliefs, and self-management of diabetes. *Health Serv Res* 2009; 44(3): 1068-1087.

13. Sircar AR, Sircar S, Sircar J, et al. Patients' concepts and attitudes about diabetes. *J Diabetes Complicat* 2009. (in press).
14. Ben-Avraham S, Harman-Boehm I, Schwarzfuchs D, et al. Dietary strategies for patients with type 2 diabetes in the era or multi-approaches; review and results from the Dietary Intervention Randomized Controlled Trial (DIRECT). *Diabetes Res Clin Pr* 2009; 86:S41-S48.
15. Magkos F, Yannakoulia M, Chan JL, et al. Management of the metabolic syndrome and type 2 diabetes through lifestyle modification. *Ann Rev Nutr* 2009; 29: 223-256.
16. Hamnvik OPR, McMahon GT. Glucose targets for patients with type 2 diabetes mellitus**.** *Mt Sinai J Med* 2009; 76:227–233.
17. Hu D, Sun L, Fu P, et al. Prevalence and risk factors for type 2 diabetes mellitus in the Chinese adult population: The InterASIA Study. *Diabetes Res Clin Pr* 2009; 84:288-295.
18. Melzer K, Kayser B, Pichard C. Physical activity: The health benefits outweigh the risks. *Curr Opin Clin Nutr Metab Care* 2004; 7(6):641-647.
19. Hordern M, Foot W, Prins J, et al. The effect of a three-year exercise intervention on glycaemic control in patients with type 2 diabetes. *J Sci Med Sport* 2010; 12 (supplement 2): e211.
20. Sigal RJ, Kenny GP, Wasserman DH, et al. Physical activity/exercise and type 2 diabetes. *Diabetic Care* 2004; 27:2518–2539.
21. Duncan GE, Perri MG, Theriaque DW, et al. Exercise training, without weight loss, increases insulin sensitivity and postheparin plasma lipase activity in previously sedentary adults. *Diabetic Care* 2003; 26:557–562.
22. Kuduzovic E, Nuhbegovic S, Ljuca F, et al. Importance of physical activity in the patients with Diabetes Mellitus type 2. *Health Med* 2009; 3(3):296-302.
23. Gorter KJ, Tuytel GH, De Leeuw JRJ, et al. Preferences and opinions of patients with Type 2 diabetes on education and self-care: a cross-sectional survey. *Diabetic Med* 2010; 27(1):85–91.
24. Bezie Y, Molina M, Hernandez N, et al. Therapeutic compliance: a prospective analysis of various factors involved in the adherence rate in type 2 diabetes. *Diabetes Metab* 2006; 32:611-616.
25. Hanko B, Kazmer M, Kumli P, et al. Self-reported medication and lifestyle adherence in Hungarian patients with Type 2 diabetes. *Pharm World Sci* 2007; 29:58–66.
26. Fishbein M, Ajzen I. Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. London: Addison-Wesley Publishing Company. 1975.
27. Ajzen I, Fishbein M. Understanding Attitudes and Predicting Social Behaviors. Englewood Cliffs: Prentice-Hall, Inc. 1980.
28. Thai Diabetes Association. Clinical Practice Guideline for Diabetes 2008. Bangkok: Rungsilp Publishing. 2008. p12-16.
29. Cramer JA. A systematic review of adherence with medications for diabetes. *Diabetes Care* 2004; 27(5):1218−1224.
30. Heisler M, Smith DM, Hayward RA, et al. How well do patient's assessments of their diabetes self management correlate with actual glycemic control and receipt of recommended diabetes services. *Diabetes Care* 2003; 26(3), 738−743
31. Nielsen PJ, Hafdahl AR, Conn VS, et al. Meta-analysis of the effect of exercise interventions on fitness outcomes among adults with type 1 and type 2 diabetes. *Diabetes Res Clin Pr* 2006; 74:111−120.
32. Trichopoulou A, Psaltopoulou T, Orfanos P, et al. Diet and physical activity in relation to overall mortality amongst adult diabetics in a general population cohort. *J Intern Med* 2006; 259:583−591.
33. Eldredge KL, Agras WS. Weight and shape concern and emotional eating in binge eating disorder. *Int J Eat Disorder* 1996; 19 (1):73-82.
34. Ahern AL, Field M, Yokum S, et al. Relation of dietary restraint scores to cognitive biases and reward sensitivity. *Appetite* 2010; 55 (1):61-68.
35. Martins C, Robertson MD, Morgan LM. Impact of restraint and disinhibition on PYY plasma levels and subjective feelings of appetite. *Appetite* 2010; 55 (2):208-213.
36. De Lauzon B, Romon M, Deschamps V, et al. The Three-Factor Eating Questionnaire-R18 Is Able to Distinguish among Different Eating Patterns in a General Population. *J Nutr* 2004; 134:2372-2380.
37. Ainsworth BE, Haskell WL, Leon AS, et al. Compendium of physical activities: classification of energy costs of human physical activities. *Med Sci Sports Exerc* 1993; 25 (1):71-80.
38. Ainsworth BE, Haskell WL, Whitt MC, et al. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc* 2000; 32 (9 Suppl): S498-504.
39. Byrne NM, Hills AP, Hunter GR, et al. Metabolic equivalent: one size does not fit all. *J Appl Physiol* 2005; 99 (3):1112-1119.

40. Wendel-Vosa GCW, Schuita AJ, Sarisc WHM, et al. Reproducibility and relative validity of the Short Questionnaire to Assess Health-enhancing physical activity. *J Clin Epidemiol* 2003; 56: 1163–1169.
41. Moreira Jr ED, Neves RCS, Nunes ZO, et al. Glucose control and its correlates in patients with diabetes in Venezuela: Results from a nationwide survey. *Diabetes Res Clin Pr* 2010; 87:407-414.
42. Rhee MK**,** Slocum W, Ziemer DC, et al. Patient adherence improves glycemic control. *Diabetes Educator* 2005; 31: 240-250.
43. Rozenfeld Y, Hunt JS, Plauschinat C, et al. Oral antidiabetic medical adherence and glycemic control in managed care. *Am J Managed Care* 2008; 14 (2): 71-75.