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## Health literacy in Korean immigrants at risk for type2 diabetes

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### Abstract

Rising incidence of type 2 diabetes (DM) in Korean immigrants has highlighted the need for better prevention efforts. Health literacy is an important predictor in the utilization of preventative health measures, however little is known about health literacy in Korean immigrants. This study examined DM risk factors in a sample of 145 at-risk Korean immigrants, their level of health literacy, and associations between health literacy and DM risk factors. Findings indicated a high prevalence of DM risk factors and a low level of health literacy in the sample. Health literacy was correlated with English proficiency, acculturation, and lower waist to hip ratios among all participants, and with lower blood glucose levels among highly acculturated participants. Korean immigrants who are less acculturated may have lower health literacy than those who are more acculturated. Thus, linguistically and culturally sensitive health education should be incorporated into diabetes prevention efforts.

### Keywords

Health Literacy; Korean Americans; Type 2 diabetes risk prevention; Health behaviors

### Introduction

Health literacy, defined as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services to make appropriate health decisions” [1], has been shown to be associated with health behaviors and outcomes in diabetes management and prevention [2]. Studies suggest that people with high level of health literacy are more likely to engage in health-promoting behaviors (i.e., adopting a healthy lifestyle, treatment adherence) and thereby have better health outcomes [3]. Unfortunately, studies also indicate that people of low socioeconomic status, ethnic minorities, and immigrants, groups that have been shown to be at high risk for type 2 diabetes (DM), tend to have low health literacy levels, putting them at even higher risk for DM and poor health outcomes [1, 4–7].

Korean immigrants, the 5<sup>th</sup> largest Asian subgroup in the United States [8], have significantly higher prevalence of DM than Caucasians, and the risk-adjusted odds of DM incidence in this group were among the highest in five Asian subgroups (Chinese, Vietnamese, Japanese, Korean, and Filipino) surveyed in California [9]. Of concern is that Korean immigrants are also at risk for low health literacy. Studies indicate that health

literacy rates may be especially poor among non-English speaking recent immigrants to the U.S. [10], which characterizes the majority of Korean Americans; over 90% of the adult Korean population is foreign born, and more than 70% of Korean immigrants have limited English language proficiency [11, 12]. Indeed, a recent study found low health literacy among Korean adults and suggested that the added linguistic barrier faced by Korean immigrants may reduce the facility with which they appraise health information even further [13].

Further adding to the risk of low health literacy in this population is the fact that Koreans have an extremely high rate of uninsurance [14]. In fact, in California, Korean immigrants have the lowest rate of health insurance coverage of any ethnic group, with only 33% of Korean individuals covered by health insurance [15]. Health insurance provides access to both preventive care (e.g., DM screening, risk assessment) and health information necessary to maintain and improve health and prevent illness (e.g., learning about risk factors for DM and how to reduce risk). Uninsured Korean immigrants may not have access to vital health information and services, thereby placing them at even higher risk of low health literacy.

Type 2 diabetes usually develops over many years as a result of obesity, often caused by unhealthy lifestyle behaviors such as poor dietary habits. Studies demonstrate that the onset of DM can be delayed or prevented by engaging in healthy lifestyle habits, particularly healthy dietary practices [16, 17]. However, diet management is widely considered the most difficult part of weight management for individuals [18, 19]. Low health literacy regarding diet may present as a serious barrier to healthy dietary practices for Korean and other Asian immigrants at risk for DM. At present, however, little is known about the level of dietary health literacy in Korean immigrants at risk for DM and the extent to which dietary health literacy is related to DM risk among those who have not yet developed the condition. The purpose of the present study is to describe DM risk factors in a sample of Korean immigrants at risk for DM, to determine the level of their dietary health literacy, and to examine the extent to which health literacy is associated with specific health promotion behaviors and biological DM risk outcomes.

## Theoretical Framework

The conceptual framework for the current study is based on chronic disease prevention model developed by WHO [20], which focuses on identification and intervention of lifestyle risk factors (e.g., diet and exercise) for prevention of chronic diseases such as heart disease and diabetes. Evidence suggests that low health literacy may be a risk factor for poor preventive health outcomes [21]. In light of the rising incidence of DM in Korean immigrants and the importance of prevention through risk factor identification and management, information on dietary health literacy among high-risk individuals in Korean immigrants is vital.

## Methods

### Participants

Participants were recruited from the local Korean community using flyers and newspaper advertisements in both English and Korean. Eligible participants were Korean men and women between the ages of 21 and 79 who were at risk for developing DM, as defined by having at least one of the following risk factors [22]: 1) a first-degree relative with DM, 2) a body mass index (BMI) > 23 [23], and/or 3) a history of gestational diabetes (women).

## Data Collection

Interested participants contacted research assistants via telephone, at which time individuals were screened for eligibility. Respondents found eligible for the study were then provided with additional information about the study and directed to the community site for data collection. At the center, participants completed self-report questionnaires in their preferred language (English or Korean) and a trained research assistant took participants' blood pressure, measured their height, weight, and waist and hip circumferences, and assessed their blood glucose level using a finger-stick blood test. Participants were given a \$10 gift certificate to a local Korean market as compensation for their time. All measures and procedures were approved by the university Institutional Review Board.

## Measures

Socio-demographic data included age, gender, education, income, marital status, and health history. English proficiency was assessed by a four-item scale which asks respondents to report, on a 5-point Likert-type scale, the extent to which they speak, understand, read, and write in English. Higher scores on the scale indicate better English language proficiency. The scale, based on the Interagency Language Roundtable Scale [24], has demonstrated excellent validity and reliability [25]. Acculturation was measured by the Short Acculturation Scale for Koreans (SAS-K), a 12-item tool made up of three subscales; Language Use/Ethnic Loyalty, Media, and Ethnic Social Relations. Originally developed as the Short Acculturation Scale for Hispanics (SAS-H) [26], this tool was validated in Korean population [25]. The SAS-K demonstrated excellent reliability with an overall Cronbach's alpha level of .93. In this study, the Cronbach's alpha was .92.

Health behaviors were measured by a brief survey of dietary and exercise behaviors from the California Health Interview Survey [27]. Each participant was asked to indicate how many times per day in the last month they consumed fruit, vegetables, and soda/energy drinks. Participants were also asked about their physical activity levels in the past week. Respondents were asked to indicate if and how often they had engaged in moderate physical activity, such as bicycling or gardening, and if and how often they had engaged in vigorous physical activity, such as running or aerobics.

Dietary health literacy was assessed by the Newest Vital Sign scale (NVS) [28]. The NVS is a tool that presents a nutrition label for a container of ice cream to participants and asks them 6 questions about the information they can derive from reading the label. Respondents who get fewer than 4 questions correct are considered to have low dietary health literacy. The task requires that participants have facility with both reading and numeracy in order to answer the questions correctly. Sample items include "If you eat the entire container, how many calories will you eat?" and "Pretend that you are allergic to peanuts. Is it safe for you to eat this ice cream?" The NVS scale has demonstrated acceptable reliability and validity, and may be more sensitive to limited health literacy than the Test of Functional Health Literacy in Adults (TOFHLA) [29, 30]. The scale demonstrated acceptable reliability. Cronbach's alpha in this sample was .69, which is consistent with that found for other non-English versions of this instrument (e.g. Spanish form) [28].

Biological risk for DM was assessed by standardized procedures. Blood glucose was measured using a finger-stick sample of whole blood and analyzed using an Accu-Chek® blood glucose meter that was validated as having accuracy comparable to venipuncture [31]. Normal, pre-diabetes, and diabetes levels for fasting and random glucose samples were determined according to American Diabetes Association practice guidelines [32]. Random glucose sample followed the guidelines for 2 hour oral glucose tolerance test. Blood pressure was assessed twice (2 minutes apart) after the participant had been seated for at

least 5 minutes in a quiet room using an electronic blood pressure monitor (A&D Medical, LifeSource UA-767PV). The two readings of blood pressure were averaged to create a mean resting blood pressure value for each participant. Height and weight were measured in centimeters (cm) and in kilograms (kg) respectively. BMI was computed using the following formula:  $BMI = kg/m^2$ . Waist circumference was measured in centimeters by placing a non-stretching measuring tape in a horizontal plane around a participant's abdomen at the top of the iliac crest. The reading was taken after expiration, making sure that the tape was secure but not too tight. Hip measurement was measured at the point of maximum circumference over the buttocks, with the measuring tape held in a horizontal plane touching the surface of light clothing. The waist to hip ratio (WHR) was calculated by dividing waist measurement by hip measurement.

## Analysis

All statistical analyses were completed using the SPSS 18 (SPSS; Chicago, IL) statistical package. Frequencies and descriptive statistics were used to examine sample characteristics, and bivariate correlations were used to examine associations between dietary health literacy, demographics, DM risk factors, and health behaviors. Sample sizes ( $N$ s) vary slightly across analyses due to some participants missing data on certain variables.

## Results

Participants included 145 ( $M$  age = 49.17,  $SD$  = 12.29; 50% Female) Korean immigrant adults. All completed questionnaires in Korean. Ninety-two participants (63.4%) indicated that they had a family history of DM. More than three quarters (76.6%) of participants had BMI values greater than 23, a cutoff for normal suggested for Asians [23]. Only one woman in the sample had experienced gestational diabetes. Characteristics of the sample are presented in Table 1.

### Biological Risk Factors and Health Behaviors

Both biological and health behavior measures confirmed that participants were at high risk for DM. According to practice guidelines [32, 33], 89% exhibited an abnormally large waist to hip ratio, defined as greater than 0.9 for men and greater than 0.8 for women, 62% had high systolic blood pressure (>120 mmHg), 63% had high diastolic blood pressure (>80 mmHg), and 30% had glucose levels in the pre-diabetes (fasting glucose 100–125 mg/dL; random glucose 140–199 mg/dL) or diabetes range (fasting glucose  $\geq$  126 mg/dL; random glucose  $\geq$  200 mg/dL). In terms of health behaviors, 59% reported eating one serving or less of fruit and 57% reported eating one serving or less of vegetables per day over the past week. However, 74% reported engaging in moderate physical activity and 50% reported engaging in vigorous physical activity at least one day in the past week. Participants' biological and behavioral risk profile is illustrated in Table 2.

### Dietary Health Literacy

Participants' dietary health literacy was rather low overall, with an average NVS score of 2.37 (Range: 0–6), or 39.6% correct. Correlations between demographic variables and dietary health literacy were examined (Table 3). Dietary health literacy was significantly positively correlated with income ( $r = .23, p < .01$ ), years of education, ( $r = .28, p < .01$ ), English proficiency ( $r = .41, p < .001$ ) and acculturation ( $r = .41, p < .001$ ), and negatively correlated with age ( $r = -.46, p < .001$ ).

We next assessed correlations between dietary health literacy, health behaviors, and DM physiological risk outcomes (Table 3). Few significant associations emerged. However, higher scores on the NVS scale were significantly associated with lower waist to hip ratios ( $r$

=  $-.19$ ,  $p < .05$ ). No significant associations emerged between dietary health literacy scores and health behaviors examined. Next, because the NVS dietary health literacy scale was developed in the United States and asks participants to respond to a nutrition label for ice cream (which is not a common food in the traditional Korean diet), we reasoned that this measure may be more predictive of health behaviors and/or DM risk outcomes for individuals who are more acculturated. Thus, we re-ran the correlation analyses for only those participants who scored above the mean on the SAS-K ( $N = 53$ ). For these participants, dietary health literacy was significantly negatively correlated with blood glucose levels ( $r = -.39$ ,  $p < .001$ ).

## Discussion

This study examined the level of dietary health literacy and the extent to which this diet-focused health literacy is associated with diet and exercise behaviors and biological DM risk outcomes in a sample of Korean immigrants at risk for DM. The dietary health literacy level in this Korean immigrant sample was low, despite the relatively young age and high education level. However, the finding is consistent with the majority of the health literacy literature that showed that ethnic immigrants who have language barriers and low acculturation tend to have low health literacy [34–37]. In the present study, both acculturation and English proficiency were low. Unfortunately, our sample's dietary health literacy level could not be compared with those of other ethnic groups because no studies used the NVS in an at-risk DM population.

The present study used a diet-specific health literacy measure. While health literacy studies with diabetic populations have often used general health literacy measures such as S-TOFHLA or REALM, these measures are not disease/condition-specific and information obtained by these measures may not be appropriately translated for the specific use with targeted DM prevention. Aside from being a non-specific health literacy measure, we did not use REALM or S-TOFHLA because these measures, when translated into the Korean language, did not lead to a valid assessment of health literacy in Korean immigrant women [3]. Further, health literacy measures developed specifically for the diabetic population address content that is most pertinent to disease management (as opposed to disease prevention). These measures may not be appropriate for people who are at risk for DM but have not yet developed the condition since they would not be expected to be familiar with certain terms and concepts relevant to diabetes management. Health literacy in the diet domain, particularly the ability to understand and interpret nutrition labels, is crucial to the management of obesity, which is the strongest risk factor for DM [38, 39]. By using a health literacy measure that is specific to diet, findings from this study provide diet-specific health literacy information that can be used in developing prevention strategies for Korean and potentially other Asian immigrants at risk for DM.

Dietary health literacy was correlated with several socio-demographic factors. Participants with higher income, more years of education, more English proficiency, higher acculturation, and younger age had higher dietary health literacy. These findings are consistent with previous studies that examined health literacy and demographic factors [6, 40]. Among biobehavioral factors, only waist to hip ratio was correlated with dietary health literacy, such that higher dietary health literacy was associated with lower WHR. While no similar study of this nature is available for comparison, this is an important finding to note because of growing evidence that body fat distribution is important in developing DM among Asians [41, 42] and because of the possibility that dietary health literacy may play a role in reducing WHR. Interestingly, higher dietary health literacy was associated with lower blood glucose level only among those participants who were above the mean score on the acculturation scale, suggesting that diet health literacy may have different implications

for highly acculturated Korean immigrants than for less acculturated individuals. For example, if less-aculturated individuals are unfamiliar with standard food labeling practices in the United States or if they do not tend to utilize labeling information when making food decisions, then objective measures of risk such as blood glucose may not be directly affected by their level of health literacy, at least not as it was assessed in this study. Further investigation is needed to explain this finding and to guide the development of a tailored intervention for health literacy for Korean immigrants at risk for DM.

The study has a few limitations. First, it is a descriptive, correlational study, thus causation cannot be inferred. Second, we used a convenience sample, thus generalization may not be made beyond the target study population. In particular, Korean immigrants in this study were mostly middle aged with an overall high level of education and a higher insurance rate than what has been reported for Korean immigrants in general. Future studies should include a wider age range and more diverse educational backgrounds for a better representation of the population to provide validation of these findings. Third, we used the original version of the NVS with ice cream as an example. However, some participants indicated that they did not eat ice cream and others asked what “serving” meant, suggesting the content of the NVS may not have been easily understood by all participants. Song et al. [43] also found in their study of nutrition education program that certain elements of diet recommendations – such as the concept of a “serving” of a specific food – were not well understood by their sample of Korean American diabetic patients. Future studies using the NVS with Korean populations should consider cultural and conceptual modification of the measure based on these observations.

## Conclusions/New Contribution to the Literature

To the best of our knowledge, the present study is the first to examine diet-specific health literacy in Korean immigrants at risk for DM, an understudied at-risk subgroup. The study showed that Korean immigrants at risk for DM have low dietary health literacy levels, adding to the concern for this population known to have high prevalence of DM. This study also revealed that older age, low education and income, low English proficiency, and low acculturation, as well as higher WHR are correlated with low dietary health literacy among Korean immigrants, suggesting areas of further investigation to better understand dietary health literacy for DM prevention. Future studies using the NVS with Korean and other ethnic immigrants should also consider tailoring the format and content of the dietary health literacy measure to the culture of the study population.

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**Table 1**

## Characteristics of the sample

Variable	Mean (SD) or %	N
Age	49.17 (12.29)	142
Male	50	143
Age at arrival in US	29.7 (11.07)	127
Married	77.2	142
Education		143
High School or lower	16.1	
2-Year College	13.3	
4-Year College	48.3	
Graduate/Professional	22.4	
Annual Income		140
< \$20,000	10.7	
\$20,000–\$39,999	30	
\$40,000–\$59,999	25.7	
\$60,000–\$79,999	11.4	
\$80,000 +	22.1	
Has Health Insurance	57.6	144
Has Had Physical Exam	54.5	145
Family History		145
Diabetes	63.4	
Hypertension	45.5	
Heart Disease	18.6	
Stroke	12.4	
Taking Medication		131
Blood Pressure	13.7	
Cholesterol	6.9	
Both	5.3	
Neither	74	
Years lived in the US	18.71 (10.04)	143
SASK scores (0–4, higher = more acculturated)	0.66 (0.65)	132
English Proficiency (0–4, higher = more proficient)	1.88 (0.93)	142
NVS Score (0–6)	2.38 (1.68)	145

SASK: Short Acculturation Scale for Koreans

NVS: Newest Vital Sign scale

Ns vary slightly due to missing data

**Table 2**

## Biological and behavioral risk profile

Variable	%	N
BMI		141
Normal (< 23 kg/m <sup>2</sup> ) <sup>a</sup>	23.4	
Overweight (≥ 23 kg/m <sup>2</sup> ) <sup>a</sup>	21.3	
Obese (≥ 27.5 kg/m <sup>2</sup> ) <sup>a</sup>	55.3	
WHR (> 0.9 men; > 0.8 women) <sup>b</sup>	88.7	141
SBP (> 120 mmHg) <sup>c</sup>	62.1	145
DBP (> 80 mmHg) <sup>c</sup>	63.4	145
Blood Glucose		143
Normal <sup>c</sup>	70.6	
Pre-diabetes <sup>c</sup>	24.5	
Diabetes <sup>c</sup>	4.9	
Behavioral Risk Factors		
1 or Fewer Servings of Fruit per Day	58.6	145
1 or Fewer Servings of Vegetables per Day	56.6	145
1 or More Soft Drinks per Day	39.4	145
No Moderate Exercise in Past Week	26.2	145
No Vigorous Exercise in Past Week	50.0	145

BMI: Body mass index

WHR: Waist-to-hip ratio

SBP: Systolic blood pressure

DBP: diastolic blood pressure

<sup>a</sup>World Health Organization recommendation for Asians, 2002

<sup>b</sup>The Obesity in Asia Collaboration, 2008

<sup>c</sup>American Diabetes Association, Clinical Practice Recommendations, 2012

**Table 3**

Correlations of NVS total score with demographic, DM risk factors, and health behaviors

Variable	All Participants		Acculturated Participants	
	Correlation	<i>N</i>	Correlation	<i>N</i>
Demographics				
Age	-.46 ***	142	-.46 **	53
Gender	-.07	143	-.11	53
Income	.23 **	140	.30 *	50
Education	.28 **	143	.24 †	53
English Proficiency	.41 ***	142	.24	53
Acculturation	.41 ***	132	--	--
DM Risk Factors				
Body Mass Index	.04	141	-.08	52
Waist-Hip Ratio	-.19 *	143	-.22	53
Systolic Blood Pressure	-.08	145	-.18	53
Diastolic Blood Pressure	-.05	145	-.07	53
Glucose Level	-.04	143	-.39 **	52
Health Behaviors				
Fruit Intake	.02	145	-.07	53
Vegetable Intake	-.02	145	-.22	53
Soda Intake	.15 †	145	.21	53
Moderate Activity (past 7 days)	-.01	143	-.04	53
Vigorous Activity (past 7 days)	.09	142	-.01	51

†  $p < .10$ ;\*  $p < .05$ ;\*\*  $p < .01$ ;\*\*\*  $p < .001$