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Acculturation and body mass index among marriage-based immigrant Vietnamese women in Korea

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Objective
This study aimed to analyze the association of socioeconomic factors, acculturation, and body mass index (BMI) as the first large prospective cohort study to determine the state of health of Vietnamese-born migrant women residing in Korea.

Methods
Participants were Vietnamese marriage-based immigrant women living in Korea. Data (n=1,066) was collected during both periods of baseline (2006–2011) and follow-up (2012–2014) in 34 cities in Korea.

Results
The results show that acculturation stress is relatively low among participants. Current BMI showed a significant difference according to the current age, monthly family income, and psychophysical stress. Depending on age, education level, monthly family income, we identified a significant difference in the annual BMI change. In correlation analysis, current BMI was significantly associated with age at arrival, reading and writing in Korean language adaptation, and psychophysical stress. Annual BMI change was significantly associated with age at arrival and years since immigration.

Conclusion
Our analysis revealed that acculturation measured by Acculturative Stress Scale for International Students had no association with current BMI or annual BMI change, but had an association with several socioeconomic statuses. This study had the advantage that subjects had a homogenous background of marriage-based immigrant women, so we could see the association of BMI and acculturation, without considering cofounding factors.

Keywords: Immigrants; Women's health; Acculturation; Body mass index

Introduction

Overweight and obesity are currently critical global public health issues. According to the World Health Organization, approximately 1.6 billion of the world's population is estimated to be overweight, and 400 million are estimated to be obese [1]. In recent years, obesity has been considered as one of the key diseases because it has caused cardiovascular diseases, diabetes, cancer, inflammatory disease, and chronic metabolic diseases. In Korea, rapid economic growth and globalization have increased the number of obese people due to changes in dietary habits and a lack of physical activity. The health problems related to obesity become one of the most

important social issues. The prevalence of obesity has steadily increased in parallel with socioeconomic growth in Korea [2]. According to the Korea National Health and Nutrition Examination Survey, the percentage of adults that are obese (body mass index [BMI] of 25 or higher) has increased from 25.1% in 1998 to 28% in 2013 [3].

In Korea, there is an increase in international marriages as a result of economic growth and globalization. According to the National Statistical Office of the Republic of Korea, international marriage comprised 23.3% of marriages in 2014, and marriage between Korean men and Vietnamese women accounted for 29.4%, which is the second largest international marriage rate with its rapid increase after the marriage between Korean men and Chinese women [4]. As international marriages have increased, health problems of married immigrant women have emerged as a new issue.

Acculturation means a change taking place in one or both groups when 2 cultures have relatively long contact. The effect of acculturation appears across different cultural levels of interaction [5]. The cultures in the host country, such as the ecological environment, cultural heritage, dietary habit, or education, influence immigrants to physically and psychologically resemble people in residence. Acculturation affects not only behavior pattern but also their psychophysical wellbeing. To explain the mental problems in the process of acculturation, Berry and Annis [6] suggested the term 'acculturation stress' that was immigrants' suffering and adverse effects in the process of acculturation. Using acculturation scales might help to measure acculturation stress accurately and objectively and understand the relationship between migration and obesity.

Overweight and obesity can be considered as one of the most important health-related factors occurring from a morbid lifestyle. The migrants, through the acculturation process, will undergo a change in lifestyle that can cause changes in their health status accordingly. Many studies have examined the relationship between obesity and acculturation. Studies on Asian Americans identified a positive association between acculturation and body weight [7,8]. Other studies have confirmed an increase of unhealthy weight gain among immigrants that have moved from a low-income country to a high-income country [9]. However, acculturation varies depending on ethnicity, sex, age, time of migration, and duration of residence.

By using a prospective cohort study, this study aims to 1) measure acculturative stress by using the Acculturative Stress Scale for International Students (ASSIS), 2) analyze the association between acculturation, current BMI, and annual change of BMI, and 3) investigate the impact of socioeconomic factors of marriage-based immigrants on current BMI and annual change in BMI.

Materials and methods

This study is based upon the Cohort of Intermarried Women in Korea that is a part of the Korean Genome and Epidemiology Study (KoGES) immigrant study, established in November 2006. The baseline data was gathered in between 2006 and 2011, and the follow-up data were collected in between 2012 and 2014. The participants were Vietnamese marriage-based immigrant women who voluntarily joined in the cohort study. This study was approved by the Institutional Review Board of Ewha University Mokdong Hospital (IRB No. EUMC 132-2, EUMC 200-18:09.4.15, EUMC200-19:09.4.15, EUMC221-2-24:2010.03.10).

A total of 1,074 women participated in both baseline and follow-up studies, conducted in 34 cities where many Vietnamese immigrant women lived. Participants were recruited through advertisement by the Marriage Immigrant Family Support Center and the Korean Language School for Marriage Immigrants. After completing the survey and measuring BMI, finally, 1,066 women were selected as participants of the study. The survey included basic questions, such as age, age at arrival, life habits (food adaptation, dietary change, Vietnamese dietary times, and language preference), and socioeconomic factors (monthly family income and education).

In addition, in order to measure the acculturation stress of Vietnamese immigrant women, the study used the ASSIS [10] adapted in Korean [11] and translated into Vietnamese. It consists of 34 questionnaires with a 5 Likert scale ranging from 1 as strongly disagree to 5 as strongly agree. The scores ranged from 36 to 180 on this scale and higher scores on each item meant a higher acculturative stress. We calculated BMI by weight in kilograms divided by the square of the height in meters (kg/m^2). Research staff measured each participant's height and weight at the study site using a height measuring rod and a standard scale. Annual change of BMI was calculated by BMI in the baseline study subtracted from BMI in a follow-up study, divided by the follow-up period.

1. Statistical analysis

We conducted descriptive analysis in order to identify the distribution of sociodemographic features and variables of acculturation. By using analysis of variance and *t*-test, the mean BMI was compared with consideration of sociodemographic characteristics and various acculturation statuses. We also conducted bivariate linear regression and multiple linear regressions to estimate the unadjusted, age-adjusted and multivariate-adjusted association between each acculturation variable and BMI individually. In order to assess the confounding effects, each of the covariates, which include age, family monthly income, and education, were added into the model. We used the SPSS ver. 21.0 (IBM Corp., Armonk, NY, USA) for the analysis. Continuous variables were described as a mean±standard deviation for the statistical analysis, and the result was considered to be statistically significant when the *P*-value was less than 0.05 for all items.

Results

The sample of this study was a total of 1,066 Vietnamese marriage-based immigrant women. The average age of the participants was 28.51±4.25, mean age at arrival was 21.63±3.69, mean BMI was 21.53±2.71(kg/m^2), and mean annual BMI change was 0.135±0.431 (kg/m^2/year). The average Acculturative Stress Scale was 2.23±0.74, which was lower than 3 meaning that acculturation stress was relatively low. The largest percentage, 39.4% (420 participants), were educated from the age of 13–15, and 49% (511 participants), got monthly family income from 1,500 to 3,000 dollars. Sixty point four percent of participants felt that they had no economic problems. Among the participants, 78.2% were 1st generation immigrants who married and migrated to Korea before the age 24. The largest percentage (41.5%) had lived from 6 to 8 years in Korea. In terms of language, 62% answered that they were good/excellent at speaking Korean, 64% were good/excellent in reading and writing Korean. Sixty-one point seven percent of participants had dietary changes after immigration, and 62.6% had difficulty in adjusting to Korean food (Table 1).

Current BMI significantly differed in terms of current age, monthly family income, and psychophysical stress, but had no difference in age at arrival, years since immigration, ASSIS quantile level, education level, language adaptation, emo-tional stress, economic problems, Korean food adaptation, or dietary change after immigration. Annual BMI change significantly differed with age, education level, and monthly family income, but had no difference in regards to age at arrival, years since immigration, ASSIS quantile level, language adaptation, psychophysical stress, emotional stress, economic problems, Korean food adaptation, or dietary change after immigration (Table 1).

Table 2 indicates unadjusted, age-adjusted and multivariate-adjusted (adjusted for age, education level, household income) parameter estimates for all acculturation variables. AS-SIS, and current BMI and annual BMI change were β=−0.134; standard error [SE]=0.132 and β=−0.007; SE=0.023 respectively, and had no significant associations. In unadjusted models, current BMI was positively correlated with age at arrival (β=0.077; SE=0.023), but there was no correlation between them in the age-adjusted and multivariate-adjusted models. Annual change of BMI was not correlated with age at arrival in unadjusted models and multivariate-adjusted model but had a positive correlation in age-adjusted model (β=0.015; SE=0.07). Less than 6 years since immigration showed significant association with the annual change of BMI (β=0.088; SE=0.042) in the multivariate-adjusted model. Regarding the Korean language, when the adaptation level of reading and writing was good, it was significantly correlated with current BMI in unadjusted (β=−0.470; SE=0.210), age-adjusted (β=−0.480; SE=0.207), and multivariate-adjusted model (β=−0.574; SE=0.210), but there was no significant correlation between current BMI and the adaptation to Korean language speaking. Annual change of BMI was not significantly associated with the adaptation to Korean language reading, writing or speaking adaptation. The absence of psychophysical stress was significantly correlated with current BMI in unadjusted (β=0.491; SE=0.171), age-adjusted (β=0.515; SE=0.169), and multivariate-adjusted models (β=0.560; SE=0.172), but was not correlated with annual change of BMI. Other acculturation variables, including economic problems, Korean food adaptation, dietary change after immigration, and Vietnamese dietary times were not significantly correlated with either current BMI or annual change of BMI.

Discussion

This study examined the association between acculturation

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Table 1. Mean body mass index by sociodemographic characteristics and acculturation variables

Characteristics	Current BMI			Annual change of BMI		
	No. (%)	Mean±SD	*P*-value	No. (%)	Mean±SD	*P*-value
Age (yr; mean=24.01; SD=4.34)			<0.001			0.016
Less than 25	130 (12.2)	21.17±2.89		99 (10.8)	0.240±0.634	
25–29	598 (55.9)	21.31±2.62		508 (55.6)	0.102±0.401	
30–34	240 (22.5)	21.86±2.78		212 (23.2)	0.142±0.408	
35 and above	101 (9.4)	21.52±2.59		94 (10.3)	0.185±0.343	
Since year immigration (yr)			0.735			0.234
Less than 6	322 (32.4)	21.35±2.74		254 (30.1)	0.165±0.542	
6–8	413 (41.5)	21.46±2.66		361 (42.7)	0.119±0.401	
More than 8	260 (26.1)	21.51±2.45		230 (27.2)	0.100±0.332	
Education (yr)			0.154			0.010
Less than 7	133 (12.5)	22.05±2.98		108 (11.9)	0.228±0.483	
8–12	181 (17.0)	22.53±2.53		151 (16.6)	0.075±0.386	
13–15	420 (39.4)	21.45±2.53		361 (39.7)	0.123±0.436	
15–18	268 (25.1)	21.35±2.87		237 (26.0)	0.115±0.414	
19 and above	64 (6.0)	21.66±3.06		53 (5.8)	0.259±0.429	
Monthly family income (won [₩])			0.005			0.032
Less than 1,000,000	140 (13.6)	22.03±2.87		115 (13.0)	0.196±0.395	
1,000,000–1,500,000	247 (23.9)	21.75±3.04		211 (23.9)	0.101±0.405	
1,500,000–3,000,000	511 (49.5)	21.40±2.54		435 (49.2)	0.159±0.448	
More than 3,000,000	135 (13.1)	21.01±2.40		123 (13.9)	0.058±0.444	
ASSIS quantile (%)			0.361			0.916
0–25	227 (24.6)	21.76±2.71		197 (25.0)	0.148±0.456	
26–50	234 (25.4)	21.66±2.70		204 (25.9)	0.136±0.418	
51–75	230 (24.9)	21.32±2.49		183 (23.3)	0.121±0.450	
76–100	232 (25.1)	21.56±3.07		203 (25.8)	0.150±0.432	
Age at arrival (yr)			0.090			0.382
Less than 20	339 (31.7)	21.36±2.71		284 (31.1)	0.123±0.444	
20–24	497 (46.5)	21.46±2.84		419 (45.9)	0.122±0.441	
25–29	146 (13.7)	21.91±2.22		133 (14.6)	0.160±0.363	
30 and above	87 (8.1)	21.93±2.70		77 (8.4)	0.204±0.427	
Korean language adaptation - speaking			0.951			0.055
Poor/fair	402 (38.3)	21.53±2.80		348 (38.8)	0.168±0.435	
Good/excellent	647 (61.7)	21.54±2.64		549 (61.2)	0.111±0.428	

Table 1. Continued

Characteristics	Current BMI			Annual change of BMI		
	No. (%)	Mean±SD	*P*-value	No. (%)	Mean±SD	*P*-value
Korean language adaptation - reading and writing			0.079			0.887
Poor/fair	384 (36.7)	21.50±2.64		334 (37.3)	0.140±0.457	
Good	358 (34.2)	21.33±2.71		296 (33.0)	0.123±0.398	
Excellent	305 (29.1)	21.80±2.73		266 (29.7)	0.131±0.436	
Psychophysical stress			0.002			0.277
Absence	403 (41.6)	21.83±2.63		349 (42.1)	0.153±0.439	
Presence	566 (58.4)	21.30±2.66		479 (57.9)	0.120±0.430	
Emotional stress			0.951			0.469
No stress	403 (38.2)	21.83±2.63		349 (38.8)	0.153±0.439	
Sometimes	566 (53.7)	21.30±2.66		479 (53.2)	0.120±0.430	
Frequent	85 (8.1)	21.63±3.31		72 (8.0)	0.104±0.382	
Economic problems			0.765			0.895
Absence	634 (60.4)	21.52±2.61		550 (61.3)	0.133±0.435	
Presence	415 (39.6)	21.57±2.88		347 (38.7)	0.129±0.422	
Korean food adaptation			0.286			0.711
Difficult	657 (62.6)	21.61±2.71		566 (63.0)	0.130±0.428	
Average	299 (28.5)	21.33±2.67		250 (27.8)	0.128±0.450	
Easy	94 (9.0)	21.67±2.90		82 (9.1)	0.171±0.414	
Dietary change after immigration			0.611			0.923
No change	402 (37.9)	21.59±2.71		344 (37.8)	0.133±0.433	
Change	660 (62.1)	21.50±2.71		566 (62.2)	0.135±0.430	
Vietnamese dietary times			0.725			0.412
1–3 times per day	53 (5.0)	21.22±2.74		50 (5.5)	0.224±0.390	
1–6 times per weeks	267 (25.2)	21.44±2.66		218 (24.0)	0.111±0.429	
1–3 times per month	431 (40.7)	21.57±2.73		374 (41.2)	0.130±0.450	
Not usual	308 (29.1)	21.60±2.74		265 (29.2)	0.142±0.413	

BMI, body mass index; SD, standard deviation.

and BMI of Vietnamese marriage-based immigrant women residing in Korea through a prospective cohort study. Current BMI significantly differed in terms of current age, monthly family income, and psychophysical stress and annual BMI change significantly differed with age, education level, and monthly family income. Acculturation, measured by ASSIS, showed no significant difference with current BMI and annual BMI change. In the correlation analysis, current BMI was associated with age at arrival, reading and writing in the Korean language

adaptation, psychophysical stress, and annual BMI change was significantly correlated with age at arrival, and years since immigration. The participants were the 1st generation marriage-based immigrants whose mean age at arrival was 21.63±3.69 years. Participants were in general well acculturated.

Delavari et al. [12] have argued that previous studies on migration and acculturation used inconsistent methods to measure the acculturation by using surrogate measures, which

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Table 2. Parameter estimates for linear regression models of acculturation variables and BMI

Variables	Parameter estimates[a]					
	Current BMI			Annual change of BMI		
	Unadjusted	Age-adjusted	Multivariate-adjusted	Unadjusted	Age-adjusted	Multivariate-adjusted
ASSIS	−0.134 (0.132)	−0.146 (0.130)	−0.193 (0.133)	−0.007 (0.023)	−0.006 (0.023)	−0.006 (0.023)
Age at arrival (yr)	0.077 (0.023)[b]	−0.038 (0.043)	−0.046 (0.043)	0.006 (0.080)	0.015 (0.070)[c]	0.014 (0.070)
Since year immigration (yr)						
Less than 6	−0.166 (0.220)	0.101 (0.227)	0.158 (0.231)	0.064 (0.039)	0.077 (0.041)	0.088 (0.042)[c]
6–8	−0.057 (0.209)	0.065 (0.209)	0.081 (0.212)	0.018 (0.036)	0.024 (0.037)	0.025 (0.038)
More than 8	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Korean language adaptation - speaking						
Poor/fair	−0.011 (0.172)	−0.027 (0.170)	−0.089 (0.175)	0.057 (0.030)	0.056 (0.030)	0.052 (0.030)
Good/excellent	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Korean language adaptation - reading and writing						
Poor/fair	−0.302 (0.206)	−0.323 (0.204)	−0.462 (0.211)[c]	0.009 (0.035)	0.008 (0.036)	0.006 (0.037)
Good	−0.470 (0.210)[c]	−0.480 (0.207)[c]	−0.574 (0.210)[c]	−0.008 (0.036)	−0.008 (0.037)	−0.013 (0.037)
Excellent	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Psychophysical stress						
Absence	0.491 (0.171)[b]	0.515 (0.169)[b]	0.560 (0.172)b)	0.035 (0.020)	0.037 (0.030)	0.034 (0.030)
Presence	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Economic problems						
Absence	−0.051 (0.172)	0.018 (0.170)	0.148 (0.177)	0.004 (0.030)	0.006 (0.030)	0.012 (0.030)
Presence	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Korean food adaptation						
Easy	−0.058 (0.300)	−0.064 (0.296)	−0.040 (0.302)	−0.041 (0.051)	−0.041 (0.051)	−0.040 (0.052)
Average	−0.343 (0.321)	−0.354 (0.318)	−0.366 (0.324)	−0.042 (0.055)	−0.042 (0.055)	−0.046 (0.057)
Difficult	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Dietary change after immigration						
No change	0.087 (0.171)	0.093 (0.170)	0.011 (0.170)	−0.003 (0.030)	−0.003 (0.030)	−0.009 (0.030)
Change	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Vietnamese dietary times						
1–3 times per day	−0.385 (0.404)	−0.314 (0.399)	−0.322 (0.400)	0.082 (0.067)	0.084 (0.067)	0.089 (0.067)
1–6 times per weeks	−0.160 (0.227)	−0.043 (0.226)	−0.002 (0.231)	−0.030 (0.039)	−0.028 (0.040)	−0.018 (0.041)
1–3 times per month	−0.028 (0.202)	0.037 (0.201)	0.041 (0.205)	−0.012 (0.035)	−0.010 (0.035)	−0.001 (0.036)
Not usual	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

Values are presented as β estimate (standard error).
BMI, body mass index; ASSIS, Acculturative Stress Scale for International Students.
[a]Parameter estimates adjusted for age (as continuous), education, household income; [b]P-value <0.01; [c]P-value <0.05.

make it difficult to conduct comparative or meta-analysis. They suggested using standardized acculturation scales in order to get accurate results. Our study conducted 2 kinds of surveys, ASSIS and Suinn-Lew Asian Self-Identity Acculturation Scale (SL-ASIA), among standardized acculturation scales that were used in many other studies, directed at 300 marriages based immigrant women. Out of the 2 surveys, we chose to use ASSIS because it showed a higher Cronbach's α coefficient score (0.966) than SL-ASIA. This study complemented the surrogate marker of acculturation by investigating years since immigration, language adaptation, and food adaption.

The study on immigrant Hispanics in the US found weak relationships between acculturation and obesity with controlling for socioeconomic status [13]. For Mexican Americans, socioeconomic status and assimilation differently affected obesity depending on sex [14]. A systematic review found 9 papers that studied the association between acculturation and overweight/obesity of the immigrant population who moved to high-income countries from low or medium-income countries using a standardized acculturation scale. Out of these 9 studies, 6 studies showed that a higher acculturation was positively associated with BMI, and 3 studies showed associations between higher acculturation and lower BMI, mainly among women [12]. A study on low-income Puerto Rican women in the US found that participants who were less acculturated had a lower risk of obesity [15]. However, our study showed no significant difference between acculturation stress and BMI. Since various studies on acculturation and obesity found no consistent results, it is necessary to conduct more follow-up studies.

A previous study analyzed data from the US New Immigrant Survey (NIS) and found that immigrants who arrived in the US before the age of 20 and had a higher chance to be overweight/obese than those who arrived at older ages as their duration of residence increased [16]. This showed that age at arrival might affect overweight/obesity prevalence. However, our study found that there was no correlation between age at arrival and BMI because there was low age difference (21.63±3.69).

Among immigrants living in the US, there were significant and positive associations between weight status and duration of residence [17]. A study on Asian Americans found that foreign-born Asian Americans were more likely to be obese with increasing duration of residence [18]. A study in Canada also confirmed that obesity prevalence was positively associ-

ated with years since immigration [19]. Another study found that although immigrants were less obese than the general population at their arrival in Canada, their BMI increased with a longer period of residence [20]. Research using the US NIS reported that the level of obese/overweight risk was increased among the immigrants that had migrated between the ages of 21 to 30 and had resided for more than 1 year [16]. Among Mexican-born women who had resided more than 10 years, they identified a significant difference in BMI [16]. Similarly, a longitudinal study of Asian Americans' acculturation and BMI, reported that, among foreign-born Asians, a short period of residence in the US showed association with larger increases in 5-year BMI compared to those who had lived in Korea for more than 25 years [21]. Our study did not find a difference between current BMI or annual change of BMI in terms of duration of residence or age at arrival, in Korea. There was no significant change in BMI because the participants were all women and 79.3% of them had resided in Korea for a relatively short period (less than 8 years) since immigration.

In our study, current BMI significantly differed by monthly family income. One of the previous studies on the association of economic status and body weight researched 4,647 participants and found that BMI was inversely associated with socioeconomic status, which might be derived from divergent health behaviors [22]. A study of Finnish women and men using income data in a taxation register found out that there was a linkage between obesity and income disadvantage, particularly for women from a better socioeconomic background [23]. Other studies also confirmed the association between economic status and body weight among the general population in the US [24-26]. Based on these studies, we infer that the difference of current BMI by monthly family income might be derived from economic status rather than acculturation.

Past studies have shown that there was a weak association between language and BMI [8]. Our study found the association of Korean language adaptation (reading and writing) and current BMI. We need to understand the unique situation of participants that they were marriage-based immigrants who lived with Korean men and had to use the Korean language more than other immigrants who came to Korea with their whole family or resided alone.

As the duration of residence increases, immigrants are more likely to change their dietary habits that become similar to that of the host country. Such a dietary change may affect their body weight [27-29], and cause obesity. A study on the im-

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migrants living in the US found that immigrants who reported high dietary change had a higher possibility of becoming overweight or obese than those who reported a low dietary change [16]. However, our results showed that there was no difference in BMI in terms of whether a person experienced a dietary change. One possible explanation for this result is that our survey did not ask the level of dietary change, but whether there was a dietary change or not. It can also be explained by the fact that Korean food is not hugely different from Vietnamese food.

In this study, our analysis found a significant correlation between psychophysical stress and BMI among Vietnamese immigrant women. This result remained the same when we adjusted the parameters by age, education level, and monthly family income and, thus, we could confirm the importance of psychophysical stress of Vietnamese marriage-based immigrant women. We could also infer the relationship between acculturation and BMI, which is a strong point of this study. Furthermore, our study is reliable because we included height and weights measured using the same measurement tool, and measured BMI accurately by continuous values.

The participants in this study were young Vietnamese women who were the first generation of marriage-based immigrants. Because the participants had the homogenous background, we did not have to consider the various factors affecting acculturation. However, since the participants had a shorter period of residence in Korea, they might be less acculturated. Accordingly, there would be no group with various levels of acculturation and few participants would be fully acculturated. Compared to other immigrants who moved to Korea with their whole family or resided alone, the participants in this study have a unique circumstance in that they immigrated to Korea based on marriage and had to use the Korean language, eat Korean food, and encounter Korean culture.

It would be ideal for a longitudinal study to diagnose migrants before their migration up to 5 years post-migration [30] by conducting a baseline study on demographics, weight and lifestyle and a follow-up study, which collected annual data on weight, lifestyle, and acculturation. By doing this, we would understand when individual behaviors change and how these changes explain weight changes. If behavior changes can be forecast, we can provide interventions to prevent immigrants from adopting detrimental changes [30]. Thus, our cohort study would provide policy implications in regards to health programs for Vietnamese immigrant women in Korea. It can also be used as the basis for a future study on marriage-based immigrant women.

In conclusion, this study was the first large prospective cohort study that examined the health condition of Vietnamese marriage-based immigrant women living in Korea. The results show that acculturation measured by ASSIS had no association with current BMI or annual BMI change, but had an association with monthly family income. Furthermore, the psychosocial stress of the participants was significantly correlated with BMI even after adjusting for age, education, and monthly family income. It explains the importance of managing their psychosocial stress to improve their health conditions.

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Conflict of interest

No potential conflict of interest relevant to this article was reported.

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