

## Vietnamese may develop type 2 diabetes with smaller increases in body mass index and waist circumference than Taiwanese

Review Article

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### Abstract

**Background:** Obesity is associated with development of diabetes. However, it seems that the level of obesity in association with diabetes may differ from country to country.

**Aim:** To compare BMI and waist circumference in diabetic patients between Vietnamese and Taiwanese.

**Methods:** Subjects were found to be diabetes mellitus by the health examination and had not treatment before. They were 163 Vietnamese and 298 Taiwanese. Body weight, height and waist circumference were measured

**Results:** Compared with Taiwanese, the Vietnamese diabetes had significantly lower in BMI ( $23.1 \pm 4.1$  vs.  $25.9 \pm 3.4$  kg/m<sup>2</sup>,  $p < 0.001$ ), and waist circumference ( $82.2 \pm 10.2$  vs.  $86.8 \pm 9.4$  cm,  $p < 0.001$ ; respectively).

**Conclusion:** Vietnamese people may develop diabetes at smaller increase of BMI and waist circumference than the increase in these indices to induce diabetes in Taiwanese, thus indicating that the factors of Type 2 DM in Vietnam such as BMI, genetic, dietary and life-style which have inter-correlate complexly. It requires further in-vestigations.

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### Introduction

The incidence and prevalence of type 2 diabetes have been increasing and becoming one of the priority health problems in not only industrialized countries but also developing and newly industrialized countries. According to International Federation of Diabetes (IDF), in 2011 there were 366 million people with diabetes, and this is expected to rise to 552 million by 2030 [1]. In the last three decades, Vietnam and Taiwan have experienced rapid improvements in socio-economy. As a result, living condition, quality of life and lifestyle have also changed thus affecting on disease's patterns. The chronic diseases due to the lack of adaptation with these changes have increased [2,3]. The increase in prevalence of diabetes by the time has also observed in both

countries [4,5]. Generally, the increase is primarily the result of lifestyle changes known as the "Nutrition Transition," characterized by over-consumption of food, increased consumption of total fat (lipids), protein, and lack of physical activity [6]. The association of overweight (defined by body mass index, BMI) and type 2 diabetes has been well-documented [7,8,6]. In addition, accumulation of body fat (BF) measured by bioimpedance analyzer (BIA) or CT scan, DEXA scan) and abdominal fat (measured by waist circumference, waist-to-hip ratio (WHR), MRI, CT scan) are also considered as risk factors for insulin resistance, [9], pathophysiological factors for chronic lifestyle related diseases [10]. According to previous studies, with the same BMI level, the Asians have higher BF% compared to age and gender matched Caucasians [11].

It strongly corroborates the need for specific cutoffs of BMI and abdominal fat for Asian population. The lower cut point values for BMI to define overweight and obesity and lower waist circumference value to define abdominal obesity have been proposed for Asian population [12]. Studies in Indians suggested that BMI of 23 (for both genders) and waist circumference of 87cm (for men) and 82cm (for women) were optimal cut point for identifying cardiometabolic risks (including diabetes, pre-diabetes) [13]. Wildman RP et al. also suggested that BMI value of 24 and a waist circumference value of 80 in both genders were appropriate for use in the identification of high-risk Chinese patients [14]. In addition, the BMI cut-off of 22-24 and waist circumference cutoff near 75-80cm for women and 80-85cm for men were suggested for overweight and central adiposity in Asian population [15,16,17]. In Vietnam, the BMI of both undiagnosed and diagnosed diabetes were  $23 \text{ kg/m}^2$  or lower [18]. Both the genetic and dietary factors which affect on these values of diabetes, are differ-

ent in the world, even among the Asians.

Taken together, whether it is appropriate to apply the same BMI and waist circumference cutoffs to all Asian populations needs to be addressed further. The purpose of this study was to compare the BMI and other anthropometric parameters of untreated diabetic patients (including both diagnosed and undiagnosed) between Taiwanese and Vietnamese.

## Materials and Methods

### Subjects

In both countries, subjects were found to be diabetes mellitus by the health examination and had not treatment before. Totally, 163 Vietnamese and 298 Taiwanese were invited to participate in this study.

This study was approved by the Research and Ethical Review Board of the Health Service of Ho Chi Minh City and also by the MJ Research Foundation Review Committee in Taiwan. A written informed consent was obtained from all participants. The diabetic patients will be referred to family physicians or endocrinologists for receiving appropriate treatment after being enrolled into this study

### Anthropometric measurements

Body weight, height, waist and hip circumferences, and percent body fat were measured with the participant in the standing position wearing light clothing and no shoes. Body weight was deter-

mined using a digital scale Tanita 1609 (Tanita, Tokyo, Japan) to the nearest 0.1 kg. Height was measured with a portable Seca stadiometer 208 (Vogel & Halke, Hamburg, Germany) to the nearest 0.1 cm. Body mass index (BMI) was computed as the ratio of weight (kg) per height squared (m<sup>2</sup>). Waist circumference was measured at the minimum circumference between the umbilicus and iliac crest.

The classification of diabetes and was carried out according to WHO criteria [19]

### Statistical analysis

Data were presented as mean and standard deviation. The independent sample unpaired t-test was used to compare means and test for significant differences in anthropometric. General linear model adjusted for family age and gender was used to compare the difference in anthropometric parameters in diabetic subjects between the Vietnamese and Taiwanese. A p-value < 0.05 was considered as statistical significance. Statistical analyses were performed using SPSS for windows 10.0 (SPSS, Chicago, IL).

## Results

The anthropometric parameters are shown in Table 1. As compared with Taiwanese, the Vietnamese diabetics are shorter (159.8 ± 7.8 vs. 152.6 ± 6.5 cm, p < 0.001), lower in BMI (23.1 ± 4.1 vs. 25.9 ± 3.4 kg/m<sup>2</sup>, p < 0.001), and waist circumference (82.2 ± 10.2 vs. 86.8 ± 9.4 cm, p < 0.001; respectively). These differences are still significant after adjustment for age and gender (Table 1).

## Discussion

**Table 1: The anthropometric parameters of study population**

Variables	Vietnamese						Taiwanese						p1	p2	p3	p4
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD				
AGE (yrs)	62.1	0.1	63.1	9.7	61.7	8.9	53.8	7.1	58.1	7.9	58.5	6.2	< 0.01	< 0.001	< 0.001	-
HEIGHT (cm)	152.6	6.5	160.1	5.3	150.9	5.4	159.8	7.8	165.5	5.6	154.1	4.8	< 0.001	< 0.001	< 0.001	< 0.001
WEIGHT (kg)	53.9	10.7	57.9	9.6	53.1	10.7	66.2	10.4	70.4	9.6	62.1	9.6	< 0.001	< 0.001	< 0.001	< 0.001
BMI	23.1	4.1	22.5	3.5	23.2	4.1	25.9	3.4	25.6	3.2	26.1	3.6	< 0.001	< 0.001	< 0.001	< 0.001
WAIST (cm)	82.2	10.2	82.8	10.8	82.1	10.1	86.8	9.4	89.8	8.8	83.8	9.1	< 0.001	NS	< 0.001	< 0.001

P1: comparison performed between male subjects only P2: comparison performed between female subjects only

p3: comparison performed on total population between 2 nations without any adjustment

p4: comparison performed on total population between 2 nations after adjustment for age, gender

The prevalence of diabetes has been increasing rapidly and constitutes a significant public health problem and priority. Understanding the characteristics of diabetes is essential for developing programs to prevent and control this disease. In the current study, we found that although in the same Asian population, the BMI of Taiwanese with diabetes has significantly higher in BMI and waist circumference compared to those in Vietnamese.

In Vietnam, the BMI level of general population has slowly increased from 1980s to present; the average BMI of healthy Vietnamese was constant from 1985 to 1997 at low level [20,21] then has increased to 21.6 kg/m<sup>2</sup> for males and to 21.4 kg/m<sup>2</sup> for females [22]. In addition, the waist circumference has also increased by 5cm, but is still in normal range (73.6cm for women and 76.6cm for men). In the present study, the BMI and waist circumference of Vietnamese with type 2 diabetes were 23 kg/

m<sup>2</sup> and 82cm; they are greater approximately 1.5 (for BMI) and 5cm (for waist circumference) than those of healthy Vietnamese.

In Taiwan, according to Tu YK et al., the BMI and waist circumference of healthy subjects have been constant for ten years (1996 – 2006) and the average BMI and waist circumference are 24kg/m<sup>2</sup> for male and 22kg/m<sup>2</sup> for female. While, the waist circumference in female subject has been constant (70.2 vs. 70.4cm), this index has increased by 2cm (from 80 to 82cm) in male subjects [23]. The results of this study show that the BMI and waist circumference of Taiwanese with type 2 diabetes were greater approximately 1.5kg/m<sup>2</sup> (25.6 vs. 24.1 kg/m<sup>2</sup>) in male and 4.5 kg/m<sup>2</sup> (26.1 vs. 21.5 kg/m<sup>2</sup>) in female subjects (for BMI); and 7cm (89.8 vs. 82.4cm) in male and 14cm (83.8 vs. 70.4cm) female subjects (for waist circumference) than those of healthy subjects.

Taking together, it is suggested that the Vietnamese people may

develop diabetes at small increase of BMI and waist circumference, while it requires more increase in these indices to induce diabetes in Taiwanese. Since the prevalence of diabetes in Vietnamese has rapidly increased in the last three decades, this finding is important point that needs to be paid more attention in the screening program for diabetes in Vietnam.

In order to early detection of diabetic patients, the screening program should include subjects with small increase in BMI and waist circumference even though their indices are in normal range. It suggests that there are other important factors other than BMI (obesity) and further investigation should conduct in the future.

The difference in genetic features between Taiwanese and Vietnamese may be contributed factors for development of diabetes with small increase of BMI and waist circumference in Vietnamese. Furthermore the lack of adaptation of dietary and lifestyle changes may be another explanation. During previous decades, the Vietnamese had spent a long period of time in lack of food, their body had to adjust with the difficult condition (especially from 1975-1985). As mentioned above, with the increasing development and industrialization in Vietnam from 1990's, the socio-economy had ameliorated. As consequence, a shift of traditional lifestyle (high levels of occupational and leisure time, lower fat meals) to a more Westernized one is taking place. The consumptions of energy, animal protein and lipid have significantly increased [24]. In addition, the change in consumption of brown-rice to well-polished rice has also been observed. The relationship between consumption of well-polished rice (high glycemic index) and increase postprandial blood glucose in general Vietnamese was observed [25]

As mentioned previously, cut point values of BMI to define overweight ( $>23$  kg/m<sup>2</sup>) and obesity ( $>25$  kg/m<sup>2</sup>) and waist circumference (WC) to define abdominal obesity ( $>90$  cm in men and  $>80$  cm in women) have been proposed for Asians population [12] However, the cutoffs for obesity indices for T2DM risk factors may differ between different Asian ethnicities. A study in Thailand suggested that the optimal cutoffs for diabetes, hypertension and dyslipidemia for men and women, respectively, are 22–23 and 24–25 kg/m<sup>2</sup> for body mass index (BMI); 80–85 and 81–85cm for waist circumference (WC); 0.89–0.91 and 0.85–0.88 for waist-hip ratio (WHR); [26]. For Hong Kong Chinese, optimal cutoffs are 23.4 kg/m<sup>2</sup> for BMI, and 78.2cm for WC, in men; and 23.4 kg/m<sup>2</sup> for BMI, and 74.7cm for WC in women [27] Li et al. recommended a BMI cutoff at 24 kg/m<sup>2</sup> for both sexes and WC at 85cm for men and 80cm for women in a study of 13,817 adults living in Shanghai. Meta analysis of data from 13 population-based studies in China and Taiwan showed that a BMI of 24kg/m<sup>2</sup> had a sensitivity and specificity for identification of cardiovascular risk factors, and if this target is achieved it would prevent approximately 50% clustering of cardiovascular risk factor [28]. The pre-sent study has also enriched the literature to illustrate the potential limitations of applying uniform BMI and WC cut points to assess the health risk of individuals globally. The cut points for BMI and WC are likely to be population specific as there are clear differences across ethnic populations in the relationship among overall adiposity, abdominal obesity, and visceral fat accumulation and dietary and lifestyle habits.

## Conclusions

The present study indicates that in the same Asian population, the influence of dietary intake, lifestyle may differ from one to

another country in development of diabetes. For Vietnamese, the cut off values of BMI and waist circumference should be re-considered (to be lower) in establishment an appropriate screening and control program for the disease including education on their dietary patterns such as healthy food; gradually replacing well-polished white rice to brown rice; and active lifestyle.

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