

## Short Communication

# Secular trends in growth and nutritional status of Vietnamese adults in rural Red river delta after 30 years (1976-2006)

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In order to assess secular trends in growth of the Vietnamese population following a period of rapid economic growth, a follow-up study on physical growth and nutritional status of adults was carried out in a rural section of the Red River delta, Vietnam 30 years after the original study. The initial study in 1976 found that average height and weight of Vietnamese adults was similar to data collected by French experts Huard and Bigot in 1938. Hence, no noticeable secular trends were observed in almost 40 years. However, the 2006 follow-up study revealed a positive secular trend in growth of adults, aged 16-60 years. The average increased rate in height of males was up to 1.1 cm/decade in the age group 26-40 years and up to 2.7 cm/decade in the age group 16-25 years. Nutritional status, as indicated by body mass index, increased in both sexes and in all age groups between 1976 and 2006. In 2006, average dietary intake of fat and animal protein was higher than that found in 1976. The percentage of energy from fat in the diet increased from 6% in 1976 to 16% in 2006. This study shows that Vietnam is entering the nutrition transition period.

**Key Words:** BMI, growth, dietary intakes, adults, Vietnam

## INTRODUCTION

From the end of the 19<sup>th</sup> century onwards, a positive secular trend towards a taller adult stature can be found in almost every country in Europe, North America and in Japan. Human adult height represents the end point of a continuous interaction between genetic and environmental determinants. The most important, direct environmental factors influencing secular trends are nutrition and health. Indirect factors are factors that affect nutrition (both qualitatively and quantitatively) and health. Examples of indirect factors are alterations in socio-economic living conditions (e.g., minimum income), social and health care, and quality of food preparation.<sup>1,2</sup> Growth outcome of a population can therefore be used as mirror of conditions in society and predictor of the human resource.<sup>3</sup> While secular increase in stature has significantly slowed down during the last two decades in Scandinavian countries, there are reports that the process is continuing in many developed countries.<sup>4</sup> In Portugal during 20<sup>th</sup> century (1904–2000), the average increase of adult height was 8.93 cm, which yield a rate 0.99 cm per decade.<sup>5</sup> A positive secular change is assumed to reflect improvements in the nutritional, hygienic and health status of a population.

Information on adult height in the past comes mainly from slave and conscript data, the latter available for several European countries since the 19<sup>th</sup> century and or even before. Many reports on secular trends in growth are based on cross-sectional representative surveys or longi-

tudinal studies follow-up on defined populations with a preferable interval of 10 years or more.<sup>1,3,6</sup>

As a result of successful economic reforms and nutrition policies from 1985 onwards, Vietnam has improved dramatically in economic, health and nutrition status, with food and nutrition situation improving during the last two decades.

In Vietnam, an improvement in nutrition status has been attributed to the successful implementation of the national nutrition policies in Vietnam. The first policy on nutrition (The National Plan of Action for Nutrition 1995–2000) focused on food insecurity, child and mother malnutrition; the follow-up policy (The National Nutrition Strategy 2001–2010) added additional strategies to deal with nutrition related health problems.<sup>7,8</sup> During this period, the prevalence of underweight (low weight for age) was reduced from 51.5 to 30.1% and the prevalence of stunting (low height for age) was reduced from 59.7 to 33.0% (using, the National Center for Health Statistics (NCHS) growth reference data). The prevalence of

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women, aged 20-49 years, with a body mass index (BMI) less than 18.5 was reduced from 33.1% in 1990 to 26.3% in 2000.<sup>8</sup>

Recently, more data have become available regarding secular trends in growth in developing countries that are experiencing a period of economic transition.<sup>9</sup> However, no recent data are available for Vietnam. Therefore, this study was undertaken 30 years after an initial study in 1976 to assess changes in physical growth and nutritional status of adult Vietnamese that took place over this period of rapid economic growth.

## MATERIALS AND METHODS

### Study area and population

The two Vietnamese Nutritional Surveys were carried out in a rural area located 20 km from Hanoi that focused primarily on physical growth and nutritional status of adults.<sup>10</sup> The survey in 1976 was conducted by Hanoi Medical University with financial support from the Vietnamese Government, and the key findings have been published before.<sup>8</sup> The study in 2006 was carried out by the National Institute of Nutrition of Vietnam with financial support from Ministry of Health Vietnam. Two of the investigators of the present study in 2006 were involved in the initial study in 1976. Participants were randomly chosen by cluster from a list of subjects which was provided by local health centres. A total of 1886 and 1640 subjects, aged 16 to 60 years, were recruited in 1976 and in 2006, respectively. Ethical approval for the study pro-

ocols were obtained from the Ethical Committees of Hanoi Medical University and the National Institute of Nutrition. Before conducting the studies, written informed consent was obtained from every participant.

### Data collection

Body weight and height were measured using standardized procedures and recorded as the midpoint of duplicate measurements. Body fat was measured using the Omron HBF-302 (Omron Corp., Tokyo, Japan), which provides absolute and percentage body fat. Nutritional status was assessed by BMI according to WHO classification. Dietary data were collected by a single 24h recall.<sup>11</sup>

### Data analysis

Statistical analyses were carried out using Epi info 6.04, and the SPSS software for windows, version 11.0 statistical packages (SPSS, Inc., Chicago, Illinois, USA). The results are presented as mean  $\pm$  standard deviation. Comparison between anthropometrical indices in 1976 and 2006 were done with Student's *t*-test. Statistically significant differences are indicated by  $p < 0.05$ .

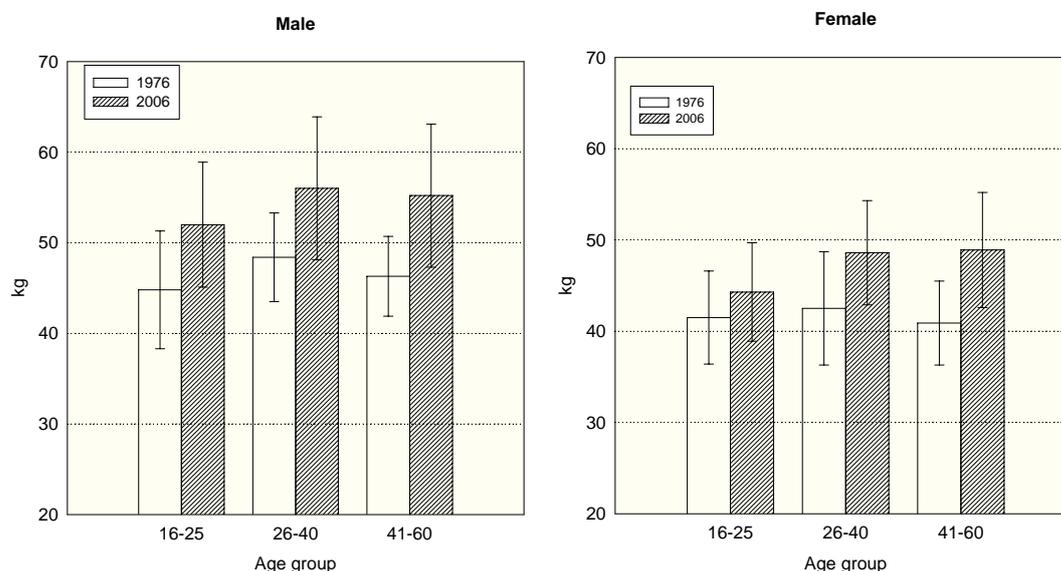
## RESULTS

All mean values of the main anthropometric measurements of the study population increased significantly between 1976 and 2006 (Table 1 and Figure 1).

In comparing the data between 1976 and 2006, there was a remarkable increase in height in all age groups and

**Table 1.** Secular change in height (cm) of subjects

Gender	Group age	1976 study	2006 study	<i>p</i> ( <i>t</i> test)
		Mean $\pm$ SD (n)	Mean $\pm$ SD (n)	
Male	16-25	155.8 $\pm$ 8.6 (229)	163.9 $\pm$ 5.6 (280)	<0.005
	26-40	159.5 $\pm$ 6.0 (230)	163.0 $\pm$ 5.1 (188)	<0.005
	41-60	158.0 $\pm$ 6.2 (264)	161.3 $\pm$ 6.4 (240)	<0.005
Female	16-25	148.4 $\pm$ 5.2 (464)	152.7 $\pm$ 4.9 (270)	<0.005
	26-40	149.2 $\pm$ 5.2 (377)	153.4 $\pm$ 4.8 (267)	<0.005
	41-60	146.4 $\pm$ 5.7 (322)	151.5 $\pm$ 5.3 (395)	<0.005



**Figure 1.** Secular change in weight (mean; SD) of subjects

in both sexes ( $p < 0.05$ ). The difference was most impressive in the males in the youngest age group of 16-25 years. In 1976, men with greatest height was seen in the age group of 26-40 years while after 30 years, the greatest height was observed in the younger group from 16-25 (Table 1). In 1976, the average weight in all groups was below 50 kg and it decreased after 40 years of age. In 2006, average weight was not only higher than in 1976 ( $p < 0.05$ ), but the average weight of females subjects also increased as they got older (Figure 1).

Concerning nutritional status, a dynamic shift of body mass index value (BMI) was observed. In all age groups and in both sexes, the average value of BMI was higher in 2006 than in 1976 ( $p < 0.05$ ). Moreover, in 1976 the average value of BMI was highest in the age group of 26-40 yrs, and then decreases, but in 2006, it continues to increase as the subjects got older.

The average daily energy intake was higher in 2006 ( $2160 \pm 679$  kcal) compared to 1976 ( $1904 \pm 524$  kcal), especially with regard to intake of animal protein and fat. Energy contribution of fat to total energy increased sharply; from 6% in 1976 to 16% in 2006 (data not shown).

## DISCUSSION

In 1938, French experts Huard and Bigot measured the height and weight of 4,545 adult Vietnamese living in the rural area of the Red river delta, North Vietnam.<sup>12</sup> The results indicated that the mean height of adult men reached 160 cm and women reached 150 cm. The mean weight of male adults was 47.3 kg. Up to 40 years later (1938–1976) there was no noticeable change in height of both sexes and this situation may be related to the hard condition of living during the long war.<sup>13</sup> Since the mid 1990's decade data reported positive secular trends in growth in children and adult Vietnamese.<sup>6,14-17</sup> Results of this study have confirmed the positive secular trends in growth of Vietnamese adults in the last 30 years. Based on population surveys, rates of up to 10 mm/decade are typical for Western European countries in recent years while Eastern Europe and Japan have achieved 30 mm/decade.<sup>1</sup> In our study, the rate of up to 27 mm/decade was found in the youngest group of male (16-25 years) and 11 mm in the group of 26-40 years.

The close association between increase in height, per capita income, food intake and urbanization levels have been found in Europe in the last century.<sup>18-20</sup> With regard to nutritional intake, the present study revealed an impressive increase of animal origin protein and fat intake during the past recent decades as reported elsewhere.<sup>21-22</sup> Although genetic factors strongly influence height, adult body height also reflect conditions during childhood as nutritional and health status during growth periods in childhood determine how much of a person genetic potential can be reached.<sup>20</sup> Therefore, reduction in childhood malnutrition, especially stunting observed in Vietnam in the recent decades might have contributed substantially to the positive secular trends in growth reported here.<sup>19</sup>

The dynamic change of body mass index demonstrates the improvement of nutritional status. In 1976, child malnutrition and Chronic Energy Deficiency (CED) was widespread in Vietnam but recently, the percentage of

overweight and obesity has increased rapidly in our country.<sup>21,23</sup> Therefore, these figures predict a picture of double burden of malnutrition in the nutrition transition period.

In summary, the finding of this study has firmly show positive secular trends in growth of Vietnamese adults living in lowland area in the late 30 years (1976–2006). A dynamic change of BMI was also observed. Among possible influencing factors, we have identified nutritional intake of subjects as a major potential factor, as nutritional intake has increased substantially during this period, in particular animal protein and fat intake. Whether these trends have also implications for improvement in human capital should be followed scientifically.

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## AUTHOR DISCLOSURES

Nguyen Cong Khan, Ha Huy Tue, Le Bach Mai, Le Gia Vinh and Ha Huy Khoi, no conflicts of interest.

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## 越南紅河三角洲農村人民成長及營養狀態的 30 年長期趨勢 (1976-2006)

為了評估在經濟快速成長期之後，越南人的長期生長趨勢，在紅河三角洲附近農村進行一個體格成長及營養狀況的 30 年追蹤研究。在 1976 年研究開始時發現，越南成人的身高、體重與 1938 年法國專家 Huard 及 Bigot 蒐集的資料相似。因此在之前將近 40 年間，看不到明顯的生長趨勢。然而於 2006 年的追蹤研究，卻顯示了越南成人(16-60 歲)有正成長的長期趨勢。在 26-40 歲年齡層的男性，平均身高的增加速率，每 10 年為 1.1 公分；16-25 歲男性則每 10 年增高 2.7 公分。在營養狀態的部份，以身體質量指數當指標，發現從 1976 年到 2006 年，在兩性及各年齡層的身體質量指數皆增加。在 2006 年，平均飲食脂肪及動物性蛋白質的攝取量皆高於 1976 年。由飲食脂肪得到的能量攝取比率，從 1976 年的 6% 增加到 2006 年的 16%。這個研究顯示了越南正進入一個營養過渡期。

**關鍵字：**身體質量指數、成長、飲食攝取、成人、越南