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ORIGINAL ARTICLE

Age at menarche and its association with the metabolic syndrome in Taiwan

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KEYWORDS
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Summary
Background: The average age at menarche in the Taiwanese population is falling. Contrarily, the prevalence of metabolic syndrome (MetS) showed a worldwide increase in the past two decades. The aim of this study was to examine the association between age at menarche and MetS.
Materials and methods: A total of 3292 women aged 19—91 years old were enrolled in two databases from 2004 to 2008. MetS was defined according to American Heart Association's criteria. Age at menarche was obtained from self-reported questionnaires. Multiple logistic regression analyses were used to estimate the association between age at menarche and MetS with adjustment for potential confounding variables.
Results: The prevalence of MetS increased with age. After adjusting age, lifestyle status, and reproductive factors as variables, subjects who had menarche at a younger age showed significantly higher risk of MetS. The adjusted odds ratio of having MetS in <12 and 12—14 years old menarche age groups were 1.71 (1.07—2.71) and 1.22 (1.00—1.50), respectively. The significant increase in odds ratio for MetS in early age menarche also reveals a dose—response effect.

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Conclusions: Early onset of menarche is an important risk factor of MetS and may help identify women at risk of MetS.

Introduction

A rapid fall in the age of women at menarche has been reported in Taiwan and other developed countries [1]. According to a public investigation in 2005, girls in north Taiwan start menstruation from an average age of 12.1 years old. A downward shift of 0.37 year in the mean menarche age during the past decade was also reported [2]. A growing body of evidence in Europe, America, mainland China, Japan, and Korea also reported that the mean age at menarche is falling [3—6].

By contrast, the prevalence of metabolic syndrome (MetS) showed a worldwide increase in the past two decades [7,8]. MetS is a clustering of metabolic abnormalities that places patients at higher risk of developing diabetes mellitus (DM), cardiovascular disease (CVD), stroke, and overall mortality. Efforts to identify possible risk factors early in life are important in order to benefit from preventive interventions.

Few studies were reported to clarify whether age at menarche affects the development of MetS [9—11]. Therefore, we examined the effect of different age groups at menarche on the prevalence of MetS and the relationship of such effect to MetS components.

Materials and methods

Study population and sampling method

Study subjects were enrolled from two databases. One was obtained from a health screening centre in a tertiary hospital in Taiwan from 1 January 2006 to 31 December 2008. As previously reported, subjects underwent a health check-up, completed a structured questionnaire, and signed an informed consent to participate in the study [12]. The study was restricted to 2702 female participants. We excluded subjects without complete information for age at menarche ($n = 622$). A total of 2080 female subjects were finally included. The second database is a population-based study composed of residents aged 40 and above in 2004 in Taichung, Taiwan [8]. A total of 363,543 residents in this area were identified during the time of study, which represented about 4.09% of the national population of the same age. A total of 2359 subjects were recruited. Among these, 1212 female individuals who completed the laboratory measurements and questionnaires were selected. A total of 3292 female subjects were selected for further analyses. Ethics approval for patient recruitment and data analysis was obtained from the Institutional Review Board of China Medical University Hospital in Taiwan.

Anthropometric indices and biochemical determinations

Trained staff measured height, waist circumference (WC), hip circumference (HC), weight, and blood pressure (BP) of the study subjects [8]. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Blood samples were drawn in the morning after a 12 h overnight fast and were sent for analysis within 4 h of collection. Biochemical markers were analysed with a biochemical autoanalyzer (Beckman Cou, Fullerton, CA, USA) at the Clinical Laboratory Department (China Medical University Hospital, Taichung, Taiwan).

Reproductive factors, personal history and life style behaviours

Several factors, such as DM, hypertension, dyslipidemia, history of gestational diabetes (GDM), alcohol consumption, smoking history, number of pregnancies, educational level, and marital status, were self-reported. Personal history of using hormone replacement therapy (HRT), use of oral contraceptive pills (OCP), occurrence of menopause, and history of abdominal total hysterectomy (ATH)/bilateral salpingo-oophorectomy (BSO) were also reported. History of smoking and alcohol consumption was divided into three classes