ความชุกของภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารและโรคเบาหวานชนิดที่สองในประชากรวัยรุ่นและวัยผู้ใหญ่ตอนต้นที่อาศัยอยู่ในเขตชนบทของประเทศไทย

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Prevalence of Impaired Fasting Glucose and Type 2 Diabetes in Adolescence and Young Adults in Rural Thailand

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วัตถุประสงค์: เพื่อหาความชุกของภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหาร (impaired fasting glucose) และเบาหวาน ในประชากรอายุน้อย ที่อาศัยอยู่ในเขตชนบทของประเทศไทย

วิธีการศึกษา: เป็นการศึกษาแบบตัดขวางโดยทำการศึกษาในประชากรไทยอายุระหว่าง 14 ถึง 35 ปี ทั้งเพศชายและหญิง ที่อาศัยอยู่ในเขตชนบทจำนวน 474 ราย ผู้เข้าร่วมงานวิจัยจะถูกเจาะเลือดเพื่อวัดระดับน้ำตาลในเลือดภายหลังอดอาหาร หากมีค่ามากกว่าหรือเท่ากับ 126 มิลลิกรัมต่อเดซิลิตร จะถูกเจาะเลือดซ้ำ โดยการวินิจฉัยภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารและเบาหวานจะใช้เกณฑ์ของสมาคมโรคเบาหวานแห่งประเทศสหรัฐอเมริกา (American Diabetes Association, ADA)

ผลการศึกษา: การศึกษานี้พบความชุกของภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารและเบาหวานร้อยละ 4 (19/474 ราย) และ 1.3 (6/474 ราย) ตามลำดับ พบความชุกในเพศชายสูงกว่าเพศหญิงแต่ไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ และไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติของความชุกของภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารและเบาหวานระหว่างผู้ที่มีภาวะอ้วนกับ

Objective: To determine the prevalence of impaired fasting glucose (IFG) and diabetes (DM) in young rural Thai adults.

Material and Method: The study was designed as a cross-sectional investigation of 474 rural Thai adults aged between 14 and 35 years in both sexes. Fasting plasma glucose was measured and repeated if the first measurement was greater than 126 mg/dl. IFG and DM were diagnosed according to the American Diabetes Association's (ADA) criteria.

Results: The respective overall prevalence of IFG and DM was 4.0% (19/474) and 1.3% (6/474); higher among men than women although the difference was not statistically significant. There was also no statistically significant difference in the prevalence of IFG and DM between obese and non-obese subjects. Advancing age was significantly associated with IFG for both sexes: each 1-year increase in age was associated with a respective 1.29-fold (95% CI: 1.05 to 1.60), 1.20-fold (95% CI: 0.91 to 1.58) and 1.39-fold (95% CI: 1.02 to 1.91), increase in the risk of IFG for all subjects, men and women. The diabetic risk was not, however, associated with age. We found no association

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ไม่อ้วน การศึกษานี้พบว่าอายุที่เพิ่มขึ้นมีความสัมพันธ์กับการเกิดภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารอย่างมีนัยสำคัญทางสถิติในทั้งเพศชายและเพศหญิง โดยทุก 1 ปีที่เพิ่มขึ้น มีความสัมพันธ์กับการเพิ่มขึ้นของภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารทั้งในผู้เข้าร่วมการศึกษาทั้งหมด ในผู้ชายและผู้หญิง โดยพบความเสี่ยงเพิ่มขึ้น 1.29 เท่า (ช่วงความเชื่อมั่นร้อยละ 95 เท่ากับ 1.05-1.60), 1.20 เท่า (ช่วงความเชื่อมั่นร้อยละ 95 เท่ากับ 0.91-1.58) และ 1.39 เท่า (ช่วงความเชื่อมั่นร้อยละ 95 เท่ากับ 1.02-1.91) ตามลำดับ อย่างไรก็ตามไม่พบความสัมพันธ์ระหว่างอายุกับความเสี่ยงของการเป็นโรคเบาหวาน นอกจากนี้ยังไม่พบความสัมพันธ์ระหว่างเพศและภาวะอ้วนกับการเกิดภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารและเบาหวาน

สรุป: ภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารและเบาหวานในประชากรไทยอายุน้อยที่อาศัยอยู่ในเขตชนบทพบได้สูงขึ้น ผลการศึกษานี้มีความสำคัญต่อระบบสุขภาพในระดับประชากรทั้งนี้เนื่องจากภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารสามารถพัฒนาไปเป็นเบาหวานชนิดที่ 2 ในผู้ใหญ่ได้ในอนาคต ในขณะที่ประเทศไทยกำลังก้าวเข้าสู่สังคมเมืองเพิ่มขึ้นและต่อเนื่องจึงอาจส่งผลให้ความชุกของภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหารและเบาหวานมีแนวโน้มเพิ่มสูงมากในอนาคต

คำสำคัญ: ภาวะบกพร่องของน้ำตาลในเลือดหลังอดอาหาร, เบาหวาน, ประเทศไทย

between sex and BMI (body mass index) for developing IFG and DM.

Conclusion: The prevalence of IFG and DM among rural Thai adults is trending upward. These estimates have important implications for public health because of the high rate of conversion from IFG level to type 2 DM among adults. As the pace of urbanization continues or accelerates, the prevalence of IFG and DM will likely escalate.

Keywords: Impaired fasting glucose, diabetes, Thailand

Introduction

Type 2 diabetes and impaired fasting glucose (IFG) are recognized as global health problems. New data indicate that the estimated prevalence reached 366 million in 2011 and is expected to top 512 million by 2030[1]. The InterASIA study confirmed that diabetes and IFG are common among Thai adults; the estimated overall prevalence of diabetes and IFG in Thai adults ≥35 years of age was 9.6 and 5.4%, respectively [2]. In a more recent survey (2009), the prevalence of diabetes and IFG in Thailand was trending upward[3]. Notwithstanding these two surveys, there is a dearth of data vis-à-vis the prevalence of IFG and diabetes among young rural Thais.

The prevalence of obesity among Thai children and adolescents has been trending upward over the past decade[4, 5]. It is well recognized that when these demographics are afflicted with obesity there is a significantly increased risk of metabolic abnormalities, i.e., diabetes, hypertension and dyslipidemia[6]. The place of urbanization in developing countries including Thailand is more pronounced than in developed countries[9]. In an effort to contribute to the international literature on diabetes and IFG, we designed a study to determine the prevalence of diabetes and IFG among young rural Thais.

Materials and methods

Setting and Subjects

This study was a cross-sectional investigation in Khon Kaen, a rural province in northeastern Thailand, with a population of 1.8 million. The setting was a health check-up clinic at Srinagarind Hospital, a teaching hospital at Khon Kaen University. The majority of clients who visit the clinic live around the capital city of the province.

The study was reviewed and approved by the Ethics Committee of Khon Kaen University and written informed consent was obtained from each participant. Between 2003 and 2004, all men and women who came to the clinic for health check-ups were invited to provide basic clinical information for the study. A total of 4,247 participants (1,664 men and 2,583 women) were recruited but only 474 subjects whose age between 14-35 years old who considered to be adolescences and young adults were included for the analyses. Those taking medications for diabetes were excluded. All of the participants were of Thai ethnicity.

Measurements

The participants were invited to meet with a research nurse who helped complete the questionnaire and informed consent form. Body weight (including light indoor clothing) was measured using an electronic balance (accuracy to 0.1 kg) and standing height (without shoes) using a stadiometer (accuracy to 0.1 cm). Body mass index (BMI) was the ratio of weight (kg) divided by height squared (m^2).

Serum samples were collected in the morning after the participant had fasted for 12 hours prior to the clinic visit. Blood samples were immediately centrifuged. Measurements included fasting plasma glucose (FPG) using the glucose oxidase method. The diagnosis of diabetes was based on the American Diabetes Association's (ADA) criteria using FPG ≥126 mg/dl and repeated within 1 week. IFG was defined when FPG was between 100 and 125 mg/dl.

Statistical analysis

Statistical analyses were performed using SPSS, version 15, (SPSS Inc, Chicago). Descriptive statistics were calculated for each sex. Results were expressed as the mean and standard deviation (SD). Descriptive statistics were computed for each sex separately. The prevalence was expressed as percentage. The difference in baseline characteristics between men and women, obese (BMI ≥ 25 kg/m2) and non-obese (BMI < 25 kg/m2) were tested using the unpaired t-test. A logistic regression model was used to calculate the risk of IFG and DM. Statistical significance was at $p < 0.05$.

Results

A total of 474 Thai participants, between 14 and 35 years of age (mean: 30.4 and 32.1 years for men and women, respectively) were included in this study. Men were heavier, taller and had a higher BMI than women. The FPG was also significantly higher among the men (Table 1). Although the prevalence of IFG and DM was higher in men than women, this respective difference was not statistically significant.

In the current study, the respective prevalence of IFG and DM between obese and non-obese men and women were not significantly different. We found that both IFG and DM occurred in both men and women 30 and over. Only 1 person (F) had been diagnosed with IFG at the age of 24.

Advancing elderly age was significantly associated with IFG for both sexes. The magnitude of association was higher in women than in men. Each 1-year increase in age was associated with a respective 1.29-fold (95% CI: 1.05 to 1.60), 1.20-fold (95% CI: 0.91 to 1.58) and 1.39-fold (95% CI: 1.02 to 1.91), increase in the risk of IFG for all subjects, men and women (Table 3). The risk for diabetes was not, however, associated with advancing age (data not shown). There was also no association found between sex and BMI for developing IFG and/or DM.

Table 1 Characteristics of study subjects

	Men (N=146)			Women (N=328)		
	Min	Max	Mean ±SD	Min	Max	Mean ±SD
Age (yr)	14	35	30.4 ± 4.4	15	35	31.2 ± 3.8**
Weight (kg)	46	119	66.9 ± 12.7	36	90	52.7 ± 9.1*
Height (cm)	150	185	168.3 ± 5.9	143	180	156.3 ± 5.4*
Body mass index (kg/m^2)	16.4	41.2	23.6 ± 4.1	14.5	35.3	21.6 ± 3.6*
Fasting plasma glucose (mg/dl)	65	319	92.1 ± 34.8	59	146	84.0 ± 9.6*

*$p<0.001$**$p <0.05$

Table 2 Prevalence of impaired fasting glucose (IFG) and diabetes mellitus (DM)

	Normal N (%)	IFG N (%)	DM N (%)
Sex			
Men (n=146)	135 (92.5)	7 (4.8)	4 (2.7)
Women (n=328)	314 (95.7)	12 (3.7)	2 (0.6)
Body mass index			
<25 (n=383)	364 (95)	14 (3.7)	5 (1.3)
≥ 25 (n=91)	85 (93.4)	5 (5.5)	1 (1.1)
Age group (yr)			
≤ 20 (n=15)	15 (100)	-	-
21-25 (n=28)	27 (96.4)	1 (3.6)	-
26-30 (n=123)	119 (96.7)	1 (0.8)	3 (2.4)
31-35 (n=308)	288 (93.5)	17 (5.5)	3 (1.0)

Table 3 Association of sex, age and BMI with impaired fasting glucose (IFG)

Sex	Variables	Odds ratio (95% confidence interval)	p-value
Alls	Sex (male : female)	1.36 (0.52-3.52)	0.531
	Age (+1 yr)	1.29 (1.05-1.60)	0.016
	BMI (+1 kg/m^2)	1.01 (0.89-1.13)	0.959
Men	Age (+1 yr)	1.20 (0.91-1.58)	0.191
	BMI (+1 kg/m^2)	0.97 (0.79-1.19)	0.766
Women	Age (+1 yr)	1.39 (1.02-1.91)	0.035
	BMI (+1 kg/m^2)	1.01 (0.86-1.18)	0.900

Discussion

This study revealed the prevalence of IFG and diabetes in young people between 14-35 years of age in rural area of northeastern Thailand. These data are important for health service planning and education programming for young people.

Using the 2004 ADA definition of IFG (i.e. having a FPG between 100 and 125 mg/dl), we found that the prevalence of IFG in our study was 4%, which is comparable to a previous study from the Thai National Health Examination Surveys in 2003 and 2009 and other studies on the Asian population[2,3]. The prevalence of IFG in our study was, nevertheless, lower than a previous report on young urban Thai adults; for which the prevalence was high in both men and women[2,3,8]. In the current study, the prevalence of diabetes was 1.3% and the total prevalence of diabetes and IFG was 5.2%. This may be because urban families generally consume more animal fats, sugar and fewer vegetables than their rural counterparts, and also have sedentary lifestyles in which passive watching activities have replaced outdoor activities. These changes are contributing to a rising rate of metabolic syndromes and also insensitivity to insulin[9]. By contrast, in Thai rural areas people still have more traditional lifestyles and consume lower fat, less processed carbohydrates, and more vegetables and herbs.

IFG was more prevalent among men than women, although this difference was not statistically significant. The finding is, however, consistent with several studies of adult populations showing IFG to be more common among men and IGT more common among women[10-12]. Since we did not assess IGT in the current study, we cannot say whether the same sex-specific differences occur among young Thai adults.

The current study did not find that the prevalence of IFG and diabetes increased with obesity; in contrast to other reports. For instance, one US study reported that IFG was strongly associated with obesity in adolescents with 1 in 6 overweight adolescents having IFG[13]. A number of studies that have compared Asian and Europid adolescents and found that Asians have a higher body fat at a lower body weight[14,15], which might explain why IFG and diabetes increased even though body weight of our subjects was not in the obesity range. Accordingly, we should consider using other parameters to determine body fat (e.g. the body adiposity index) instead of BMI in any follow-on study[16,17].

Our study demonstrated the prevalence and upward trend of dysglycemia among young, Thai adults which needs further investigation through a multi-center study with a specifically Asian or Thai perspective. Although we included large numbers of subjects in our analysis, a number of limitations must be taken into account when considering whether our prevalence estimates represent the true burden of disease. Our study was conducted in a single center in northeastern Thailand; the data on diet control and physical activity of people were not specified; and our estimates are based on people who came to our hospital for a health check-up so our study population probably did not include persons who have never attended hospital or the persons who have their check-up done at a primary care unit.

In conclusion, the prevalence of dysglycemia in young Thai adults was trending upward. This may be due to globalization and industrialization which have brought with them a tendency for adolescents to be sedentary and unfit, and which have led to a global epidemic for the major risk factors for metabolic syndrome and type 2 diabetes. The trends should, therefore, be further investigated in a multi-center study from Thailand or Asian perspective.

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