Appropriated Waist Circumference Cutoff Level for Health Screening of Thai Young Adolescences

Lakkana Thaikruea[1], Siriboon Yavichai[2], Chadchadaporn Nuntakwang[2], Kulyapa Yoonut[2]

1 Community Medicine Department, Medicine Faculty, Chiang Mai University, Thailand
2 Health Promotion Center, Maharaj Nakorn Chiang Mai Hospital, Medicine Faculty, Thailand

Contact: Lakkana Thaikruea, Telephone: 66-53-945471 to 4
Fax: 66-53-945476, E-mail: lthaikru@mail.med.cmu.ac.th

Background

The Chiang Mai Medicine Faculty, provides health screening to detect health problem and risk group for high school students who past entrance examination in the academic year 2012. The cutoff level for screening and health education based on Thai Ministry of Public Health (MOPH) is defined as 90.0 cm in male and 80.0 cm in female. These values are based on a waist circumference (WC) measurement at midpoint between lower costal margin and superior iliac crest (WCM) but implemented based on the umbilical level (WCU) . In addition, different methods of WC measurement give different values of the WC. The Medicine Faculty currently measure WC at ileac crest level (WCI) due to its feasibility in mass screening. There is no official cutoff level of WCI for overweight and obesity in Thai young adolescence.

Objective

To determine correlation between WCI and WCM and to define appropriated WCI and body mass index (BMI) cutoff levels for admission students.

Methods

The admission students had physical examination, anthropometry measurement (height in centimeter-cm, body weight in kilogram-kg, WC in cm, and blood pressure measurement (systolic blood pressure – BPs, diastolic blood pressure – BPd). The WC was measured by two methods, which were WCI and WCM. Body mass index (BMI) was calculated as weight in kg divided by height in meter square (m^2). High blood pressure (BP) was define as any one of these following conditions: 1) BPs 140 to 159 millimeter lead (mmHg) and/or BPd 90-99mmHg; 2) BPs 160-179 mmHg and/ or BPd > 110 mmHg; or 3) BPs > 140 mmHg and BPd < 90 mmHg.

Results

There were 6344 admission students. 59.30% of them were female. The mean age was 18.82 ± 0.86 years. Among 6279 of students, 5.20% had high BP.

Anthropometry indicators

BMI

- BMI ranged from 12.99 to 61.30 kg/m^2
- There were 22.20% underweight, 10.30% overweight, and 14.80% obese.

Waist circumference

- Among 2525 students, the median WCM of males and females were 80.00 cm (range: 61.00-125.00) and 77.00 cm (range: 53.00-132.00), respectively.

Correlation

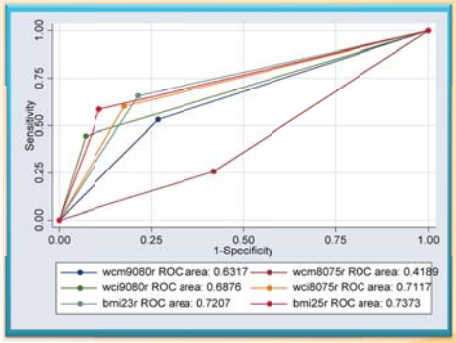
- Correlation between WCM and WCI was 0.86.

Waist circumference cutoff level and high blood pressure

- Medians of WC significantly varied by BP category in both genders.
- Median WC of male (87.00 cm) and female (97.00 cm) students with high BP were statistically significantly (Kruskal-Wallis p-value = 0.0001) higher than those of males (80.00 cm) and females (77.00 cm) with normal BP, respectively.

Receiver Operating Characteristic Curve

When comparing area under the ROC curve of high BP using WCM9080 (0.6317) as standard, WCI8075 (0.7117), WCI9080 (0.6876), BMI23 (0.7207), and BMI25 (0.7373) had significantly larger areas than those of WCM9080 (P value < 0.001).



ROC areas of high BP for each cutoff level of BMI and WC among students*

* **WCM9080r** = WCM ≥ 90 cm in males and ≥ 80 cm in females
WCI9080r = WCI ≥ 90 cm in males and ≥ 80 cm in females;
WCI8075r = WCI ≥ 80 cm in males and ≥ 75 cm in females
BMI23r = BMI ≥ 23.0 kg/m^2
BMI25r = BMI ≥ 25.0 kg/m^2

Sensitivity, specificity, and classification of each cutoff level

WCI9080 and BMI23 had the highest specificity and sensitivity, respectively. WCI9080 had the highest classification value.

Sensitivity, specificity, and classification of each cutoff level of BMI and WC

Anthropometry Indicators	Sensitivity	Specificity	Classified
WCM9080	53.13%	73.22%	72.20%
WCI9080	44.53%	92.99%	90.53%
WCI8075	60.16%	82.19%	81.07%
BMI23	65.63%	78.51%	77.86%
BMI25	58.59%	88.86%	87.33%

Discussions

World Health Organization (WHO) suggested that the Asian population had different associations between health risks and BMI and body fat percentage than the European population. The current cutoff levels underestimate health risks. According to BMI cutoff level of WHO, only half of the students had an appropriate BMI.

All anthropometry indicator cutoff levels were statistically significantly associated with high BP. For prevention and health promotion, the BMI cutoff level of 23 kg/m^2 should be used. According to Thai MOPH, we used WCM9080 as a standard when comparing areas under the ROC curve of high BP with other anthropometric indicators. WCM and WCI had very high correlation. Based on our findings, we determine WCI cutoff level for our population as 80 cm in males and 75 cm in females because a sensitivity of this kind of screening is more appropriate than specificity and its classification value was also high.

Recommendations

We recommend WCU rather than WCI because it is feasible, ease of understanding for health campaigns, and standard for national reference. For generalization and long term follow up, appropriate cutoff level of WCM and WCI should be determined in context of the Thai young adolescence.

Acknowledgements

We would like to express our thankfulness to the CMU Medicine Faculty for their support.