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Editorial

Surrogate Measures of Insulin Resistance in an Apparently Healthy Population: a Simpler and Easier, yet Reliable Index

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▸ See the article "The Cut-off Values of Surrogate Measures for Insulin Sensitivity in a Healthy Population in Korea according to the Korean National Health and Nutrition Examination Survey (KNHANES) 2007–2010" in volume 33, e197.

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Insulin resistance (IR) is a well-known risk factor for, and a precursor to, cardiovascular diseases and diabetes. Since IR precedes these diseases for a couple of years, it becomes crucial to evaluate insulin sensitivity in a simple yet reliable way. To select a suitable method for assessing IR among different types of IR assessing studies, researchers should first determine what the purpose of their study is. For example, the hyperinsulinemic euglycemic (HIEG) clamp technique, as well as the Belfiore, Cederholm, and McAuley indices are considered to be appropriate for research-based purposes, but these are not used in routine clinical settings. At present, the HIEG clamp technique and frequently sampled intravenous glucose tolerance test are the most reliable approaches,[1] but these are time-consuming and complicated. In practice, simpler and more convenient tests to measure IR have been used; for example, the homeostasis model assessment-insulin resistance (HOMA-IR), quantitative insulin sensitivity check index (QUICKI), Matsuda index, and triglyceride and glucose (TyG) index are considered to be useful for large-scale clinical practice and epidemiological investigations.[2,3]

Simply available IR surrogate indices can be classified into two categories. [2] The first is the fasting sample-derived, which is the most commonly used, simple, and cost-effective index. It helps assess IR in the liver more reliably than in the peripheral skeletal muscle, but it can be unreliable in the elderly population and in patients with uncontrolled or type 1 diabetes. The other index originates from the oral glucose tolerance test, which is relatively well correlated with the HIEG clamp technique and has been validated in different populations. However, it is potentially confounded by physiological factors such as the rates of glucose absorption or endogenous insulin secretion in response to glucose and incretins.

In this issue, Moon et al.[4] reported the cutoff values of HOMA-IR, McAuley index, and TyG index divided by sex and age before and after menopause in Korean adults based on the Korea National Health and Nutrition Examination Survey results. Moon et al.[4] suggested that the optimal cutoff value for HOMA-IR was 2.20 (sensitivity: 65%; specificity: 70%). These results show that the cutoff values for HOMA-IR in Korean populations are slightly lower than those in a US-based population, but are very similar to those previously reported in other studies of Korean populations.[5,6] Ryu et al.[5] suggested that the cutoff value of HOMA-IR was

2.43 (sensitivity: 73.7%; specificity: 73.7%), and Lee et al.[6] reported that the cutoff value of HOMA-IR was 2.34 (sensitivity: 62.8; specificity: 66.8%).

The TyG index has also emerged as another viable option for identifying IR in apparently healthy subjects. It has been reported to be a slightly better index than HOMA-IR, but it can be easily measured in most laboratories. Guerrero-Romero et al.[3] reported a correlation between the TyG index and the HIEG clamp technique, and suggested that the best value of the TyG index for diagnosis of IR was 4.68, which showed the highest sensitivity (96.5%) and specificity (85.0%). Moon et al.[4] also showed similar cutoff values and supported the findings of Guerrero-Romero et al.[3] with a population-based study. The best values of the TyG index for diagnosis of IR were 4.76 in men and 4.71 in pre- and postmenopausal women. These results will become more clear with the addition of the findings of triglyceride levels variability in the different ethnic populations.

Another consideration in measuring and evaluating IR in women is whether menopause is complete. In postmenopausal women, a decrease in estrogen levels, a relative increase in androgen activity, and a decrease in sex hormone–binding globulin levels increase IR. Moon et al.[4] suggested that the cutoff values for HOMA-IR in postmenopausal women were lower than those in premenopausal women (2.03 and 2.55, respectively). This pattern is also quite similar to that revealed in Gayoso-Diz et al.'s study[7] of Spanish adults in the general population. However, interestingly, the TyG index was not different between pre- and postmenopausal women in the study by Moon et al.[4] This remains to be further investigated, including studies in other ethnic populations.

Although there is no perfect method to precisely measure insulin sensitivity thus far, the HIEG clamp technique is the most optimal. However, the HIEG clamp technique is unrealistic in practical settings. Instead, HOMA-IR and TyG index may prove to be viable alternatives for screening for IR in large-scale general populations. These indices are highly sensitive and specific, as well as cost-effective. In particular, the TyG index is deemed to be simpler and inexpensive compared with HOMA-IR, which in turn has the disadvantage of showing some test differences in insulin assays. In the future, further investigation of the correlation between the TyG index and HIEG clamp technique in population-based samples should be encouraged to add more confidence to clinical availability.

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