

A slightly high-normal glucose level is associated with increased arterial stiffness in Japanese community-dwelling persons with pre-diabetes

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Abstract

Impaired fasting glucose (IFG) in diabetes is a risk factor for arterial stiffness and cardiovascular disease (CVD), but the impact of a slightly high-normal glucose level remains controversial. We investigated whether slightly high-normal fasting plasma glucose (FPG) was independently associated with arterial stiffness in non-diabetic community-dwelling persons. We recruited 114 men aged 69 ± 9 years (range 40–89) and 208 women aged 68 ± 7 years (range 36–84) during their annual health examination in a single community. Arterial stiffness was evaluated by the mean of the right and left brachial–ankle pulse wave velocity (ba-PWV). Age-adjusted ba-PWV increased significantly from the lowest to the highest FPG group ($p < 0.001$). Multiple linear regression analyses for ba-PWV revealed that FPG levels ($\beta=0.154$, $p < 0.001$) were independently and significantly associated with ba-PWV. The multivariate-adjusted ba-PWV value of the high-normal glucose group (Group 3: 95–100 mg/dL) was significantly higher than that of the lowest normal glucose group (Group 1: 52–89 mg/dL) ($p=0.021$), and the ba-PWV value in the IFG group (Group 4: 101–125 mg/dL) was significantly higher than those of the normal glucose groups (Group 1: <90 mg/dL; Group 2: 90–94 mg/dL) ($p < 0.001$ and $p=0.009$, respectively). Slightly high-normal glucose levels were associated with arterial stiffness in Japanese community-dwelling persons.

Keywords

arterial stiffness; fasting plasma glucose; pulse wave velocity; risk factor

Introduction

The progressive relationship between glucose level and cardiovascular risk extends below the diabetic threshold¹ and fasting plasma glucose (FPG) is an important predictor of cardiovascular disease (CVD) after adjusting for potential confounders. Hyperglycemia increases the production of reactive oxygen species in cells and stimulates the release of the potent proinflammatory cytokines such as IL-8 and TNF- α .² Several recent studies have shown that impaired fasting glucose (IFG) in diabetes is a risk factor for arterial stiffness^{3–8} and CVD,⁹ but the impact of a slightly high-normal glucose level remains controversial and there are few studies to investigate the relationship between high-normal FPG and increased arterial stiffness.⁸ The precise mechanisms by which the level causes CVD and mortality remain unelucidated.

Arterial stiffness can be easily and noninvasively assessed by measuring pulse wave velocity (PWV).¹⁰ Recently, brachial–ankle PWV (ba-PWV) has been proposed in Japan,^{11,12} and the technical simplicity and short sampling time of the method make it more feasible for screening a large population than previous methods. This method cannot isolate

changes in the muscular medium-sized arteries from those in the larger conduit arteries, but a ba-PWV of 1400 cm/s¹² is useful to discriminate middle-aged patients with CVD (e.g. coronary atherosclerosis and peripheral artery diseases).^{13,14} Thus, increased ba-PWV may be one important explanation linking the relationship between FPG and CVD.

We investigated whether increased FPG was associated with arterial stiffness by measuring ba-PWV, and whether this association is independent of sex, body mass index (BMI) and other confounders of CVD. For this, we used

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