Medical Practice Prognostic Utility
Handgrip Strength Measurements

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Reference ranges of handgrip strength from 125,462 healthy adults in 21 countries: a prospective urban rural epidemiologic (PURE) study.

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Abstract

BACKGROUND:

The measurement of handgrip strength (HGS) has prognostic value with respect to all-cause mortality, cardiovascular mortality and cardiovascular disease, and is an important part of the evaluation of frailty. Published reference ranges for HGS are mostly derived from Caucasian populations in high-income countries. There is a paucity of information on normative HGS values in non-Caucasian populations from low- or middle-income countries. The objective of this study was to develop reference HGS ranges for healthy adults from a broad range of ethnicities and socioeconomically diverse geographic regions.

METHODS:

HGS was measured using a Jamar dynamometer in 125,462 healthy adults aged 35-70 years from 21 countries in the Prospective Urban Rural Epidemiology (PURE) study.

RESULTS:

HGS values differed among individuals from different geographic regions. HGS values were highest among those from Europe/North America, lowest among those from South Asia, South East Asia and Africa, and intermediate among those from China, South America, and the Middle East. Reference ranges stratified by geographic region, age, and sex are presented. These ranges varied from a median (25^{th}-75^{th} percentile) 50 kg (43-56 kg) in men <40 years from Europe/North America to 18 kg (14-20 kg) in women >60 years from South East Asia. Reference ranges by ethnicity and body-mass index are also reported.

CONCLUSIONS:

Individual HGS measurements should be interpreted using region/ethnic-specific reference ranges.

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Prognostic value of grip strength: findings from the Prospective Urban Rural Epidemiology (PURE) study.

Leong DP1, Teo KK2, Rangarajan S3, Lopez-Jaramillo P4, Avezum A Jr5, Orlandini A6, Seron P7, Ahmed SH8, Rosengren A9, Kelishadi R10, Rahman O11, Swaminathan S12, Iqbal R13, Gupta R14, Lear SA15, Oguz A16, Yusoff K17, Zatonska K18, Chifamba J19, Igumbor E20, Mohan V21, Anjana RM21, Gu H22, Li W22, Yusuf S2; Prospective Urban Rural Epidemiology (PURE) Study investigators.

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Abstract

BACKGROUND:
Reduced muscular strength, as measured by grip strength, has been associated with an increased risk of all-cause and cardiovascular mortality. Grip strength is appealing as a simple, quick, and inexpensive means of stratifying an individual's risk of cardiovascular death. However, the prognostic value of grip strength with respect to the number and range of populations and confounders is unknown. The aim of this study was to assess the

independent prognostic importance of grip strength measurement in socioculturally and economically diverse countries.

METHODS:
The Prospective Urban-Rural Epidemiology (PURE) study is a large, longitudinal population study done in 17 countries of varying incomes and sociocultural settings. We enrolled an unbiased sample of households, which were eligible if at least one household member was aged 35-70 years and if household members intended to stay at that address for another 4 years. Participants were assessed for grip strength, measured using a Jamar dynamometer. During a median follow-up of 4.0 years (IQR 2.9-5.1), we assessed all-cause mortality, cardiovascular mortality, non-cardiovascular mortality, myocardial infarction, stroke, diabetes, cancer, pneumonia, hospital admission for pneumonia or chronic obstructive pulmonary disease (COPD), hospital admission for any respiratory disease (including COPD, asthma, tuberculosis, and pneumonia), injury due to fall, and fracture. Study outcomes were adjudicated using source documents by a local investigator, and a subset were adjudicated centrally.

FINDINGS:
Between January, 2003, and December, 2009, a total of 142,861 participants were enrolled in the PURE study, of whom 139,691 with known vital status were included in the analysis. During a median follow-up of 4.0 years (IQR 2.9-5.1), 3379 (2%) of 139,691 participants died. After adjustment, the association between grip strength and each outcome, with the exceptions of cancer and hospital admission due to respiratory illness, was similar across country-income strata. Grip strength was inversely associated with all-cause mortality (hazard ratio per 5 kg reduction in grip strength 1.16, 95% CI 1.13-1.20; p<0.0001), cardiovascular mortality (1.17, 1.11-1.24; p<0.0001), non-cardiovascular mortality (1.17, 1.12-1.21; p<0.0001), myocardial infarction (1.07, 1.02-1.11; p=0.002), and stroke (1.09, 1.05-1.15; p<0.0001). Grip strength was a stronger predictor of all-cause and cardiovascular mortality than systolic blood pressure. We found no significant association between grip strength and incident diabetes, risk of hospital admission for pneumonia or COPD, injury from fall, or fracture. In high-income countries, the risk of cancer and grip strength were positively associated (0.916, 0.880-0.953; p<0.0001), but this association was not found in middle-income and low-income countries.
INTERPRETATION:
This study suggests that measurement of grip strength is a simple, inexpensive risk-stratifying method for all-cause death, cardiovascular death, and cardiovascular disease. Further research is needed to identify determinants of muscular strength and to test whether improvement in strength reduces mortality and cardiovascular disease.

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Comment in
Risk factors: Hand grip strength predicts cardiovascular risk. [Nat Rev Cardiol. 2015]

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Grip strength and mortality. [Natl Med J India. 2015]
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Low Grip Strength and Prediabetes in Normal-Weight Adults.

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Abstract

INTRODUCTION:

Detection of prediabetes is an important step in diabetes prevention in primary care. Risk stratification of healthy-weight individuals for detection of prediabetes is necessary to avoid missed opportunities for diabetes prevention.

METHODS:

Using data from the 2011 to 2012 National Health and Nutrition Examination Survey, we studied the relationship between combined handgrip strength, a proxy for lean muscle mass, and prediabetes among adults aged ≥20 years without diagnosed or undiagnosed diabetes who had a healthy body mass index (18.5-24.9 kg/m(2); unweighted n = 1340, weighted n = 58,360,690). Prediabetes was defined as having a glycohemoglobin level between 5.7% and 6.4%.

RESULTS:

Of the healthy-weight adults, 20.5% had prediabetes. Combined mean grip strength was lower for individuals with prediabetes than those with normoglycemia in the full sample (63.8

vs 70.9 kg; P = .004). Similar results were seen among both men (87.9 vs 82.1 kg; P = .03) and women (51.8 vs 56.5 kg; P = .001) in subgroup analysis.

CONCLUSIONS:

Grip strength is associated with prediabetes among healthy-weight US adults. Grip strength may have utility as an indicator for screening healthy-weight individuals for prediabetes.

KEYWORDS:

Hand Strength; Prediabetes

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Grip Strength as a Marker of Hypertension and Diabetes in Healthy Weight Adults.

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Abstract

INTRODUCTION:

Muscle strength may play a role in cardiometabolic disease. We examined the relationship between hand grip strength and diabetes and hypertension in a sample of healthy weight adults.

METHODS:

In 2015, we analyzed the National Health and Nutrition Examination Survey 2011-2012 for adults aged ≥20 years with healthy BMIs (between 18.5 and <25) and no history of cardiovascular disease (unweighted n=1,467; weighted n=61,587,139). Hand grip strength was assessed with a dynamometer. Diabetes was based on hemoglobin A1c level and reported diabetes diagnosis. Hypertension was based on measured blood pressure and reported hypertension diagnosis.

RESULTS:

Individuals with undiagnosed diabetes compared with individuals without diabetes had lower grip strength (51.9 vs 69.8, p=0.0001), as did individuals with diagnosed diabetes compared with individuals without diabetes (61.7 vs 69.8, p=0.008). Mean grip strength was lower among individuals with undiagnosed hypertension compared with individuals without hypertension (63.5 vs 71.5, p=0.008) as well as among individuals with diagnosed hypertension compared with those without hypertension (60.8 vs 71.5, p<0.0001). In adjusted analyses controlling for age, sex, race, smoking status, and first-degree relative with disease, mean grip strength was lower for undiagnosed diabetes (β=-10.02, p<0.0001) and diagnosed diabetes (β=-8.21, p=0.03) compared with individuals without diabetes. In adjusted analyses, grip strength was lower among individuals with undiagnosed hypertension (β=-6.6, p=0.004) and diagnosed hypertension (β=-4.27, p=0.04) compared with individuals without hypertension.

CONCLUSIONS:

Among healthy weight adults, combined grip strength is lower in individuals with diagnosed and undiagnosed diabetes and hypertension.

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Muscle Weakness Thresholds for Prediction of Diabetes in Adults.

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Abstract

BACKGROUND:

Despite the known links between weakness and early mortality, what remains to be fully understood is the extent to which strength preservation is associated with protection from cardiometabolic diseases, such as diabetes.

PURPOSE:

The purposes of this study were to determine the association between muscle strength and diabetes among adults, and to identify age- and sex-specific thresholds of low strength for detection of risk.

METHODS:

A population-representative sample of 4066 individuals, aged 20-85 years, was included from the combined 2011-2012 National Health and Nutrition Examination Survey (NHANES) data sets. Strength was assessed using a handheld dynamometer, and the single highest reading from either hand was normalized to body mass. A logistic regression model was used to assess the association between normalized grip strength and risk of diabetes, as determined by haemoglobin A1c levels ≥6.5 % (≥48 mmol/mol), while controlling for sociodemographic characteristics, anthropometric measures and television viewing time.

RESULTS:

For every 0.05 decrement in normalized strength, there were 1.26 times increased adjusted odds for diabetes in men and women. Women were at lower odds of having diabetes (odds ratio 0.49; 95 % confidence interval 0.29-0.82). Age, waist circumference and lower income were also associated with diabetes. The optimal sex- and age-specific weakness thresholds to detect diabetes were 0.56, 0.50 and 0.45 for men at ages of 20-39, 40-59 and 60-80 years, respectively, and 0.42, 0.38 and 0.33 for women at ages of 20-39, 40-59 and 60-80 years, respectively.

CONCLUSIONS AND CLINICAL RELEVANCE:

We present thresholds of strength that can be incorporated into a clinical setting for identifying adults who are at risk of developing diabetes and might benefit from lifestyle interventions to reduce risk.

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Greater hand-grip strength predicts a lower risk of developing type 2 diabetes over 10 years in leaner Japanese Americans.

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Abstract

AIMS:

Much is known about body composition and type 2 diabetes risk but less about body function such as strength. We assessed whether hand-grip strength predicted incident diabetes.

METHODS:

We followed 394 nondiabetic Japanese-American subjects (mean age 51.9) for the development of diabetes. We fit a logistic regression model to examine the association between hand-grip strength at baseline and type 2 diabetes risk over 10 years, adjusted for age, sex, and family history.

RESULTS:

A statistically significant (p = 0.008) and negative (coefficient -0.208) association was observed between hand-grip strength and diabetes risk that diminished at higher BMI levels. Adjusted ORs for a 10-pound hand-grip strength increase with BMI set at the 25th, 50th or 75th percentiles were 0.68, 0.79, and 0.98, respectively.

CONCLUSIONS:

Among leaner individuals, greater hand-grip strength was associated with lower risk of type 2 diabetes, suggesting it may be a useful marker of risk in this population.

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