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Decreasing sedentary behavior by 30 minutes per day reduces cardiovascular disease risk factors in rural Americans

Zyad T. Saleh, PhD [a,*], Terry A. Lennie, PhD, FAAN [b], Gia Mudd-Martin, PhD [b], Alison L. Bailey, MD [c], Michael J. Novak, PhD [d], Martha Biddle, PhD [b], Amani A. Khalil, PhD [a], Muhammad Darawad, PhD [a], Debra K. Moser, PhD, RN, FAAN [b,e]

[a] Faculty of Nursing, The University of Jordan, Jordan
[b] College of Nursing, University of Kentucky, USA
[c] Division of Cardiovascular Medicine, The Gill Heart Institute, University of Kentucky, USA
[d] College of Dentistry, University of Kentucky, USA
[e] University of Ulster, Newtownabbey, United Kingdom

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ABSTRACT

Regular physical activity has been associated with reduced cardiovascular disease (CVD) risk factors; however, a decrease in the amount of time spent during the remainder of the day in sedentary behavior may be equally important. The aim of this study was to examine the effects of a decrease in sedentary behavior on CVD risk factors among 205 individuals living in rural Appalachia. All participants received a comprehensive CVD risk reduction life-style intervention and measurement of major CVD risk factors and physical activity levels. Participants were divided into: 1) Adopters: those who decreased their sedentary behavior by 30 min or more per day post-intervention and 2) Non-adopters: those who did not. Repeated measures analysis of variance showed a significant group by time interaction showing that Adopters had a greater reduction in body weight and BMI than Non-adopters. These findings demonstrate that decreasing sedentary behavior is important for achieving optimal body weight.

The prevalence of cardiovascular disease (CVD) among rural Americans is a public health burden that is, in part, attributed to sedentary lifestyle.[1,2] This lifestyle is considered among the top 5 risk factors for CVD.[2,3] Individuals who spend more than 3 h per day in sedentary behaviors such as sitting and lying down are at higher risk for CVD.[4,5] The more time spent in sedentary activity, the higher risk of CVD independent of other major CVD risk factors such as older age, smoking, and increased body mass index (BMI).[3–5] Sedentary lifestyle contributes to increased risk of other CVD factors, including elevated plasma triglyceride, low high density lipoprotein (HDL) cholesterol, hyperglycemia, hypertension, and increased abdominal adiposity.[6] People with a sedentary lifestyle frequently engage in other CVD risk behaviors such as smoking and increased caloric and fatty food intake.[7] Thus, sedentary behaviors can have negative impact on cardiovascular health.

Evidence shows that regular physical activity helps in preventing the development of CVD and reduces symptoms in people with established CVD.[8,9] However, a growing body of research has demonstrated that despite meeting the minimum physical activity level recommendation, cardiovascular health can be compromised when the remainder of the day is spent in prolonged periods of sedentary behaviors.[4,5,10] This suggests that individuals can be at increased CVD risk if they are physically active for a period of the day but otherwise sedentary. This may be common as researchers have shown that individuals may compensate for increased planned physical activity by increasing sedentary time and reducing incidental physical activity (e.g., climbing stairs).[11] Accordingly, successful CVD preventive interventions may need to target both an increase in planned physical activity and a reduction in sedentary behaviors. The majority of studies to date have not determined the necessary level sedentary behavior reduction needed to decrease CVD risk factors.

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* Corresponding author. Department of Clinical Nursing, Faculty of Nursing, The University of Jordan, Amman 11942, Jordan. Tel.: +962785358313; fax: +96265300244.
E-mail address: zyad.saleh2@ju.edu.jo (Z.T. Saleh).

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The American Heart Association and the American College of Sports Medicine jointly recommend engaging in at least 30 min of moderate-to-vigorous intensity activity daily to reduce risk of CVD.[12] However, recent research has suggested that cardiovascular health benefits can be achieved by repeated short bouts of activity, including all leisure, occupational, or household activities, when performed at moderate or vigorous intensity levels.[12,13] These bouts may make physical activity more convenient and reduce time spent in sedentary behaviors. However, this has not been demonstrated in adults with multiple CVD risk factors.

Therefore, the aim of this study was to determine whether a reduction in sedentary behavior by 30 min or more per day reduced CVD risk factors of increased body weight, BMI, waist circumference (WC), blood pressure (BP), blood glucose, triglycerides, and cholesterol and low HDL, following a CVD risk reduction intervention among individuals with multiple CVD risk factors living in rural Appalachia.

Methods

Design

This was a secondary analysis of a subsample of participants in HeartHealth intervention study conducted between 2009 and 2011. HeartHealth was a structured, 3-month educational and skill building intervention using a whole health approach to promote self-care of CVD risk factors in rural Appalachian Kentucky. The intervention focused on encouraging lifestyle modifications with regard to improving eating habits, adherence to prescribed medication, physical activity level, and psychological health based on the Theory of Planned Behavior. Individualized counseling was included to set goals and address individuals' attitudes that facilitate or impede lifestyle change. Data were collected at baseline and 3 months later at completion of the intervention.

Participants and setting

Participants were residents of 3 counties located in southeastern Kentucky that are among a cluster of counties with some of the highest rates of CVD risk factors and mortality in the United States.[14,15] Participants were recruited from primary care clinics, community centers, self-referral, participant referrals, and flyers posted at various community locations. Inclusion criteria were adults with CVD or having two or more of the following CVD risk factors: 1) age >44 years in men or >55 years in women, 2) family history of CVD, 3) history of hypertension, abnormal lipids, or diabetes, 3) current smoker, 4) overweight or obesity, 5) diet high in total fat or low in fruit and vegetable intake, or 6) sedentary lifestyle.

Exclusion criteria were: 1) cognitive impairment, 2) non-English speaking, 3) chronic drug abuse, 4) end-stage renal, liver, or pulmonary disease; 5) undergoing active treatment for cancer, 6) gastrointestinal or other disease that required special diet; or 7) condition that prohibited engagement in physical activity.

A subsample of 271 participants provided data on physical activity, 66 of these participants had missing activity data, either at baseline or 3 months, due to technical issues including errors in saving or uploading the data and the battery becoming dislodged. For the remaining 205 participants included in this study, baseline and 3-month follow up data were used to determine whether CVD risk factors were reduced by decreasing sedentary activity by 30 min or more daily following the intervention.

Measurement of variables

Demographic characteristics

Demographic characteristics including age, gender, marital status, level of education, employment status, and financial status were collected by self-report. Marital status was classified as either married/cohabitate or unmarried. Level of educational was categorized as having high school or less, or more than high school. Participants' employment status was categorized as employed or unemployed. Financial status was assessed using one item that asked participants to rate their income as either having less than enough money to meet basic living requirements, or having sufficient or more money to meet basic living requirements.

Sedentary lifestyle modification

Activity levels were categorized as total time per 24-h spent at sedentary, light, moderate, and vigorous intensity levels. Activity was measured using an Actiwatch accelerometer (Actical®, Respironics Inc. company, OR). The Actiwatch was worn on the non-dominant arm for 48 h. The Actiwatch contained an accelerometer that captured body movement (activity counts). Movements were summed over each minute epoch and converted into energy unit (metabolic equivalents [METs]). According to the manufacturer's default setting, METs that defined each activity level were: a) 0 METs for physical inactivity, b) 0 < to <3 METs for light activity, c) 3 to <6 METs for moderate activity, and d) ≥6 METs for vigorous activity.[16] The amount of time spent in each activity level was determined by totaling the minutes spend in the corresponding METs range. The Actiwatch has been shown to be a valid measurement of daily activity intensity.[17,18] Sedentary lifestyle modification after participation in the HeartHealth intervention program was defined as a decrease of 30 min or more per day being physically inactive (i.e., time spent in activities = 0 METs). The cut point of 30 min was based on the data that show a decrease in sedentary activity that increases physical activity by a minimum of 30 min per day has a significant positive impact on cardiovascular health.[12]

Dependent variables

Lipid profile

Non-fasting lipid profile was obtained from a fingerstick blood sample using portable lipid analyzer (Cholestech LDX, Inverness Medical, CA). The Cholestech can measure total cholesterol, triglyceride, and HDL levels in whole blood. The Cholestech can also calculate LDL from total cholesterol, triglyceride, and HDL. However, LDL was excluded from our analyses, as the Cholestech cannot determine LDL if total cholesterol, triglyceride, or HDL are outside the measurement range. The Cholestech has been shown to be accurate, precise, and provide reproducible measurements of total cholesterol, triglyceride, and HDL.[19]

Blood glucose

Blood glucose was defined as Hemoglobin A1c (HbA1c). HbA1c represents the average blood glucose level of individual over the previous 120 days.[20] HbA1c was measured from non-fasting fingerstick blood samples using portable HbA1c blood monitor (A1C Now, BayerContour, NJ). HbA1c blood monitor has been shown to be a valid measurement of HbA1c.[21]

Blood pressure

Blood pressure was measured in millimeters of mercury by aneroid sphygmomanometer after sitting for 5 min by trained nurses using the AHA standard procedure.[22]