Physical Activity
Can There Be Too Much of a Good Thing?

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It is widely acknowledged that physical activity in some way, shape, or form is beneficial to a person’s health, a concept that has been around for >2 millennia, having been first espoused by Hippocrates: “Eating alone will not keep a man well; he must also take exercise.” Therefore, it should come as no surprise that in this issue of Circulation, Armstrong and colleagues present findings from The Million Women’s Study that highlight the beneficial effects on the risk of coronary heart disease, cerebrovascular disease, and venous thromboembolism that regular moderate physical activity confers among active healthy, middle-aged women in the United Kingdom. Findings from the current study have brought among active healthy, middle-aged women in the United Kingdom. Findings from the current study have brought to light a clear U-shaped relationship between the frequency of physical activity and vascular risk; the greatest difference in vascular risk occurred between the least active women (<40 excess metabolic equivalent [MET] hours per week) versus all other groups.

The key findings from this article relate to the frequency, intensity, and total amount of physical activity that were associated with optimal vascular benefits among middle-aged women. Interestingly, the relationship between the frequency of activity (either strenuous or any) and vascular risk was not linear but rather U-shaped; in women who engaged in strenuous activity (defined as “enough to cause sweating or a fast heart rate”), the optimal frequency of activity in terms of vascular risk reduction was 2 to 3 times per week which was associated with significant relative risk reductions of 17% to 19% in comparison with the rarely/never group. Any further increase in the frequency of strenuous exercise beyond that point was associated with an increased vascular risk. For any activity, which mainly included walking, gardening, and housework, the optimal frequency was 4 to 6 times per week (in comparison with rarely/never), which was associated with a slightly greater 17% to 25% reduction in the risk of vascular outcomes in this population. And, as with the frequency of activity, there was also no evidence of a linear association between the total amount of physical activity and reductions in vascular risk; the greatest difference in vascular risk occurred between the least active women (<40 excess metabolic equivalent [MET] hours per week) versus all other groups.

Ascertaining a valid and reliable measure of physical activity and its relationship with health outcomes requires that numerous hurdles be overcome. Physical activity must be measured (preferably at >1 time point) in a large enough sample of people for a long enough period of time to accrue a sufficient number of events for estimates of the association between physical activity and vascular disease to be derived. Reliably estimating the volume of physical activity is notoriously challenging. This has in part been due to the inherent difficulties in accurately measuring not only the frequency of physical activity, but also its type, intensity, and duration, and variations in activity level over time, as well. Comparability between studies has also been impeded by a general lack of consistency as to which activities constitute physical activity. For example, The Million Women Study is one of the few large-cohort studies to measure housework and to include it as a form of moderate physical activity.

In many ways, the current study has been able to overcome these methodological challenges by sheer virtue of its size and length of follow-up. Between 1996 and 2001, >1.1 million healthy British women with a mean age of 56 years were recruited into the study. At baseline, the women were asked how often they did any exercise and how often they did strenuous exercise. At a resurvey 3 years later, 44% of participants reported how many hours they spent each week on a range of physical activities including housework, gardening, walking, or exercise that caused sweating or a fast heart rate. When relying on self-report data of this type, it is crucial to understand how valid the methods for assessing the exposure are. In a previous publication from the same group, the authors examined the level of agreement between activity measured at the 2 time points. For strenuous activity, absolute agreement for questionnaires 2 years apart was 52% (κweighted=0.51), and, for any physical activity, the absolute agreement for questionnaires 2 years apart was 47% (κweighted=0.58), suggesting that there was moderate agreement between the studies or, in other words, the level of physical activity that women reported doing was in reasonable agreement with what was actually done.

Over the course of 9 years of follow-up and after excluding women who may have been asymptomatic for serious disease at the commencement of the study, there were >49 000 cases of incident coronary heart disease, >17 000 strokes, and 14 500 venous thromboembolism events. In comparison with being inactive, doing any form of exercise at least once a week was associated with the greatest reductions in the risk of incurring any of these vascular events. Increments in the amount of physical activity beyond once a week were associated with smaller benefits up to a certain point beyond which there were no gains in terms of reduced risk of vascular outcomes. The point of inflection depended on the type of vascular event, and...
the intensity of activity, as well. But, in general, undertaking moderate exercise on 4 to 6 days of the week was associated with the greatest reductions in relative risk estimates in comparison with women who were inactive. For strenuous exercise, in comparison with never, restricting the activity to 2 to 3 days of the week was optimal. It is noteworthy that increases in the frequency of strenuous exercise to >3 times per week were associated with significantly increased vascular risk (in comparison with strenuous exercise 2–3 times per week).

The possibility of confounding is always a concern with observational data. In the current study, the women who reported doing strenuous exercise daily comprised only 3.2% of the population in comparison with 47% of women in the reference group who reported no strenuous exercise. And, rather counterintuitively, the prevalence of current smokers was similar in both groups at 25%, considerably higher than the prevalence estimates for women who did strenuous exercise between 1 and 6 times per week. Even though the results were adjusted for smoking (and other risk factors), the authors acknowledge that residual confounding may have persisted and, thus, may have explained some of the association between physical activity and vascular risk in the most active women.

Although the current findings are consistent with the literature, they are not directly comparable with those from other cohorts because the metric used to quantify the absolute volume of activity in The Million Women Study was the excess MET as opposed to the more commonly used MET.5–7 A MET is the ratio of the metabolic rate of an activity to the rate of energy expended while sitting quietly8; 1 MET is the rate of energy expenditure while at rest, so a 3 MET activity (such as housework) expends 3 times the energy used by the body at rest. Therefore, a 3 MET activity undertaken for 60 minutes is equivalent to 180 MET-minutes (or 3 MET-hours) of physical activity. Moderate-intensity exercise, such as walking, gardening, and housework, typically equates to 3 to 6 METs, whereas vigorous activity (such as cycling) is estimated to be ≥6 METs. In contrast, an excess MET is defined as the excess energy expenditure associated with any given activity above that of the basal metabolic rate obtained by subtracting 1 MET from each multiplier before calculations (i.e., the excess MET associated with walking for 60 minutes is 120 MET-minutes [or 2 excess MET-hours as opposed to 3 MET-hours]). Calculating excess MET-hours takes into account the differences in the proportion of energy expenditure attributable to resting metabolic rate during low versus high activities and thus is a better indicator for assessing the actual amount of energy expended as a result of physical activity. For example, in low-intensity activities such as housework (which accounts for more than half of all activity in the current study), the proportion of energy expenditure attributable to resting metabolic rate is higher than of high-intensity activities.3

The use of excess MET-hours versus MET-hours to estimate physical activity levels between studies is likely to explain some of the observed variation in reported activity levels between comparable populations. For example, in the current study, the amount of physical activity in women reporting any exercise varied from 58 excess MET-hours in the rarely/never active group to 79 excess MET-hours per week in the daily category. In comparison, among women (average age, 50 years) in the European Prospective Investigation into Cancer and Nutrition (EPIC) mean MET-hours per week were 50 in the inactive group and 145 MET-hours in the most active group.9 Finally, data from the Nurses’ Health Study (mean age, 64 years) show considerably lower levels of total physical activity with an average of 1.3 MET-hours per week in the least active group to 37.6 MET-hours in the most active group, these low activity levels in the latter study are likely to reflect in part the noninclusion of household activity.10 But, irrespective of how physical activity was calculated, women in The Million Women Study were all at the more active end of the spectrum, and, thus, the generalizability of the findings to women who are largely inactive remains unclear.

Current recommendations suggest that, for cardiovascular health, adults should be doing at least 30 minutes of moderate-intensity aerobic activity at least 5 days per week in bouts of ≥10 minutes, or 25 minutes of vigorous aerobic activity at least 5 days per week, or a combination thereof.11 In total, this amount of activity would equate to ≈8 to 12 MET-hours per week. In the current study, even women who reported doing no physical activity at study baseline still accrued >15 excess MET-hours per week (after excluding housework) predominantly through walking and gardening.3 In comparison, in England, nationally representative data indicate that only 28% of women aged 55 to 64 years12 (and a similar percentage in the United States13) meet the recommended guidelines for physical activity. Part of the disparity in prevalence estimates between the current study and national figures is likely to be a consequence of the healthy-volunteer effect. However, because women in the study had similar levels of other vascular risk factors (such as smoking and body mass index) comparable to that of the general population, it is unlikely that they differed that dramatically from the rest of the population in terms of physical activity levels. Rather, the aforementioned differences in how physical activity is defined and measured between studies are likely to explain some of the variation.

In conclusion, in healthy, active, middle-aged women, moderate and frequent physical activity was optimal for vascular risk reduction. These findings may offer some hope – and perhaps even a dash of inspiration – to the estimated 30% of adults worldwide who struggle to achieve the recommended levels of physical activity.14 To paraphrase Hippocrates, walking may well be woman’s best medicine.

Disclosures

None.

References


**Key Words:** Editorials ▪ cardiovascular diseases ▪ cohort studies ▪ exercise
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Circulation. 2015;131:692-694; originally published online February 16, 2015;
doi: 10.1161/CIRCULATIONAHA.115.014721

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2015 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the
World Wide Web at:
http://circ.ahajournals.org/content/131/8/692

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