Long-term Effects of Physical Activity Level on Changes in Healthy Body Mass Index Over 12 Years in Young Adult Women

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Abstract

Objectives: To examine the effects of overall level and timing of physical activity (PA) on changes from a healthy body mass index (BMI) category over 12 years in young adult women.

Patients and Methods: Participants in the Australian Longitudinal Study on Women's Health (younger cohort, born 1973-1978) completed surveys between 2000 (age 22-27 years) and 2012 (age 34-39 years). Physical activity was measured in 2000, 2003, 2006, and 2009 and was categorized as very low, low, active, or very active at each survey, and a cumulative PA score for this 9-year period was created. Logistic regression was used to examine relationships between PA accumulated across all surveys (cumulative PA model) and PA at each survey (critical periods PA model), with change in BMI category (from healthy to overweight or healthy to obese) from 2000 to 2012.

Results: In women with a healthy BMI in 2000, there were clear dose-response relationships between accumulated PA and transition to overweight (P=.03) and obesity (P<.01) between 2000 and 2012. The critical periods analysis indicated that very active levels of PA at the 2006 survey (when the women were 28-33 years old) and active or very active PA at the 2009 survey (age 31-36 years) were most protective against transitioning to overweight and obesity.

Conclusion: These findings confirm that maintenance of very high PA levels throughout young adulthood will significantly reduce the risk of becoming overweight or obese. There seems to be a critical period for maintaining high levels of activity at the life stage when many women face competing demands of caring for infants and young children.

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The most recent Global Burden of Disease report suggests that high body mass index (BMI) is the greatest contributor to the overall burden of disease in Australasia.[1] Numerous well-conducted observational studies have shown that high BMI is related to a range of cardiovascular, metabolic, reproductive, mental health, and musculoskeletal problems, as well as to the development of a variety of common cancers.[2]

Cross-sectional data from women in different age groups in the last Australian National Health Survey (2011-2012) suggest that young adulthood (18-35 years of age) may be a critical time for weight gain.[3] Prospective data from the Australian Longitudinal Study on Women's Health (ALSWH) confirm that there are marked increases in the prevalence of both overweight (BMI [calculated as weight in kilograms divided by height in meters squared] of 25 to <30) and obesity (BMI ≥30) as women move through their 20s and 30s. For example, at age 18 to 23 years, 68% of the ALSWH cohort of women born between 1973 and 1978 had a BMI in the healthy range when they were first surveyed in 1996; by 2012, this proportion had decreased to 49%, and 26% of the women then had a BMI in the overweight range, and 23% were obese.[4]

Fundamentally, an increase in BMI reflects an imbalance in energy intake and energy expenditure.[5] Despite the implicit relationship with energy balance, the role of physical activity (PA) in weight maintenance, and, therefore, BMI, is still debated in the literature. Some argue that PA contributes very little to weight management, with energy intake instead playing the key role.[6,7] Others argue that PA has an important role,[8,9] although the amount of

PA that is recommended for weight management varies.[10-13]

Many of the previous studies that have explored the association between PA and weight have been cross-sectional; few have assessed longitudinal changes or considered the pattern or timing of PA accumulation over time.[14] It is plausible that there may be an additive effect given that many studies suggest higher levels of PA for weight maintenance.[12] Alternatively, there may be life stages when PA is more important for weight maintenance, such as in early adulthood, when rates of weight gain are highest.[4]

The aim of this study was to examine relationships between the level and timing of PA and changes from healthy BMI over a 12-year period in young adult women aged 22 to 27 years in 2000. Two different models were used to compare the strength of associations between PA, overall and at different periods, and BMI transitions over 12 years.

METHODS

The ALSWH is a prospective study of factors shaping the health and well-being of 3 cohorts of Australian women (young, born in 1973-1978; middle aged, 1946-1951; and older, 1921-1926), who were randomly recruited from the national Medicare health insurance database. The focus of this article is on the young cohort, which was, at the time of recruitment, generally representative of women the same age in the Australian population.[15] An update of the profile of the continuing cohort was published in 2015.[16] The study was approved by The University of Newcastle and The University of Queensland research ethics committees, and all participating women provided informed consent. More details can be found at the ALSWH website (http://www.alswh.org.au).

Surveys

The women completed surveys with questions about a range of health issues, behaviors, health services, and social and demographic factors in 1996 and 2000 and then at 3-year intervals to 2012. Full details of each survey can be found at the ALSWH website (www.aslwh.org.au). Because the PA questions were different in the first survey (1996), data from the second survey (2000) were used as the baseline for the present study.

Analysis Sample

The focus was on transition from a healthy BMI in 2000 to a higher BMI category over time. For the analysis, only women reporting PA data in the 2000, 2003, 2006, and 2009 surveys and BMI data in the 2000 (healthy weight only) and 2012 (healthy weight, overweight, or obese) surveys were included (n=2735). Participants were omitted if they did not have a healthy BMI in 2000 (n=4210); BMI was missing in 2012 (n=1901); PA was not reported in 2000, 2003, 2006, or 2009 (n=800); or they were underweight (BMI <18.5) in 2012 (n=42). The women were aged 22 to 27 years in 2000; 25 to 30 years in 2003; 28 to 33 in 2006; and 31 to 36 in 2009.

Outcome Variables

The BMI, calculated using self-reported weight and height, was categorized as healthy (18.5 to <25), overweight (25 to <30), or obese (≥30) based on the World Health Organization classification.[17] Change in BMI category was identified as changing from a healthy BMI (2000) to either an overweight or obese BMI (2012). The BMI calculated from self-reported height and weight has substantial agreement with BMI obtained from measured height and weight for estimating BMI category.[18]

Main Explanatory Variable

Once each year in 2000, 2003, 2006, and 2009, PA was assessed using a modified version of the Active Australia survey.[19] Women were asked to report time (hours and minutes) spent walking briskly and in moderate- (eg, social tennis, recreational swimming, and dancing), and vigorous-intensity (eg, those that make you breathe harder or puff and pant, eg, aerobics, competitive sports, and vigorous cycling) leisure activities in the past week. Time spent walking and in moderate-intensity activities (minutes per week) was multiplied by a metabolic equivalent (MET) value of 3.33 (to reflect the average intensity of these activities), and time in vigorous-intensity activity was multiplied by 6.66 METs.[20,21] These 2 MET minute per week values were summed to create a single PA MET minute variable for each of the four 2000 to 2009 surveys. Scores were categorized as very low (<250 MET min/wk), low (250 to <500 MET min/wk), active (500 to <1000