Smoking Cessation and Weight Gain

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Cigarette smokers have a lower average body weight than nonsmokers, and the cessation of smoking is associated with weight gain. Although this weight gain does not offset the health benefits of smoking cessation, it is frequently a source of concern for smokers planning to quit. The objective of our review was to estimate the risk and duration of weight gain after cessation of smoking to help physicians in counseling concerned smokers.

We reviewed the literature by doing a MEDLINE search using key words for articles on the changes in body weight after smoking cessation. The retrieved data indicated that (1) the risk of weight gain is highest during the 2 years immediately following smoking cessation, and declines thereafter; (2) on average, sustained quitters gain about 5 to 6 kg in weight; (3) physical exercise, older age, higher baseline body mass index, and lower rates of smoking attenuate the degree of weight gained after smoking cessation; and (4) the evidence regarding the permanence of the expected weight gain is conflicting.

KEY WORDS. Smoking cessation; weight gain; preventive health services. *(J Fam Pract 1998; 46:460-464)*

Both smoking[1,2] and obesity[3-7] are associated with an increased risk of cardiovascular disease[2,5-7] and higher overall mortality.[1,3,4] Both of these are modifiable, and therefore are logical targets for health-promoting interventions. However, smoking cessation may lead to weight gain. Although some investigators have claimed that weight consciousness does not interfere with smoking cessation attempts,[8,9] most surveys have found that smoking behavior is related to a belief that smoking controls weight.[10-13] Weight consciousness predicts current smoking,[14] as well as attempts to quit smoking[15,16] and recidivism after smoking cessation.[17,18] As many as 75% of women and 35% of men reported that if they quit smoking, they would not tolerate more than 5 pounds (2.3 kg) of gain in weight.[19]

The decision to quit smoking appears, therefore, to be affected by competing concerns about the morbidity and mortality associated with continued smoking[20] and about weight gain and withdrawal symptoms associated with smoking cessation.[21] In addition to counseling and support, physicians can offer information on the magnitude of these competing risks. Most smokers who quit do so on their own,[22] and those who cite internal reasons for wanting to quit (eg, concerns about health and desire for self-control) are more successful than those who do so for external reasons (eg, persuasion, immediate reinforcement, and social influence).[23]

These findings are consistent with the premise that people accept more responsibility for behavior change when motivated internally rather than externally.[24] Internal motivation can be facilitated by care providers if they support self-determination rather than try to control behavior. Self-determination is supported if the patient is provided with information, if his own perspective is acknowledged and respected, and if he is permitted to choose among options.[24] We believe that a policy of convincing patients to stop smoking by brushing aside their concerns about the risk of weight gain is less likely to achieve its goal. Smokers are entitled to information about their concerns that can help them make an informed decision based on their values.

The objective of this paper was to review published evidence regarding predictors and duration of weight gain following smoking cessation. Insight into the possible modifiers of the weight gain may help physicians provide appropriate counseling for individual smokers planning to quit.

LITERATURE REVIEW

The relationship between smoking and body weight has been the subject of many cross-sectional and prospective studies. We made an effort to identify all published studies of weight gain after cessation of

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smoking. The comprehensive review by Klesges et al[25] was used as a source for articles published before 1987. We conducted a MEDLINE search for the years 1985 to 1997 using the key terms "smoking" and either "body weight" or "body mass index." We then used the reference sections of the identified articles to select additional studies.

BODY WEIGHT AND SMOKING

Cross-sectional studies have indicated that the mean age-adjusted body weight is highest among ex-smokers, lowest in current smokers, and intermediate in never-smokers.[26-31] A comparison of 1911 male monozygotic twins with their identical siblings revealed that smokers were an average of 2.4 to 4.0 kg lighter in weight than nonsmokers. As many as 26.5% of the ex-smokers, but only 19.9% of their currently smoking siblings, were obese (ie, had a body mass index exceeding 27.8 kg/m^2).[32]

These findings have been confirmed by 31 of the 41 prospective studies reviewed in 1989 by Klesges et al[25] and by more recently published surveys. Smokers who quit have been found to gain more weight than nonsmokers,[33] with increments in both central and peripheral adiposity.[34] A 10-year follow-up of 9004 adults disclosed that the risk of major weight gain in those who quit, relative to those who continued to smoke, was 8.1 in men and 5.8 in women.[35] Women were reported to gain an average of 4.5 kg over the first year after cessation.[36] Recent quitters gained an average of 4.0 kg, significantly more than continuing smokers, who gained an average of 1.2 kg.[37] An analysis of the data of the Nurses Health Study[38] revealed that the average weight gain over 2 years was 3.0 kg in the 1474 women who stopped smoking, and 0.6 kg among the 7832 women who continued smoking. Finally, the data of two surveys of the National Academy of Sciences-National Research Council Twin Registry indicated that during 16 years of follow-up, 2179 men quit smoking and averaged a weight gain of 3.5 kg in excess of those who continued smoking.[39]

There is undisputed evidence that smoking cessation leads to a net mean gain of 2.4 to 5 kg of weight. The variability among the numerous studies in the observed amount of weight gained could be attributed to a failure to discriminate between point prevalence of abstinence (ie, between smokers who reported at the time of the survey they had quit) and continuous abstinence (ie, those who reported they had not been smoking over a defined period). Continuously abstinent participants have been reported to gain 5.90 kg on average at 1 year after cessation of smoking, which is significantly more than point prevalent abstinent participants (3.0 kg) and those continuously smoking (1.1 kg).[40] Similar weight increments were reported by sustained quitters after a 1-year follow-up: women gained a mean of 8.4% (5.3 kg) of their baseline weight, and men gained 6.7% (5.5 kg). After 2 years women gained 9.8% of their baseline weight, compared with 6.9% for men.[41]

MODIFIERS OF WEIGHT GAIN AFTER SMOKING CESSATION

A genetic predisposition to thinness, physical activity, older age, higher initial body mass index (BMI), and lower smoking rates are reported to be associated with lower weight gain following smoking cessation (Table).

Lower weight gain because of genetic predisposition is strongly supported by the weight changes in 146 monozygotic and 111 dizygotic twin pairs in which both twins quit smoking. Concordance for weight gain was significantly greater in monozygotic than dizygotic pairs.[39] Physical activity has been identified as an attenuating factor by all but one study that considered this a variable. The Nurses Health Study revealed that smoking cessation was associated with a weight gain of approximately 2.4 kg. This gain was minimized if cessation was accompanied by a moderate increase in the level of physical activity.[38] Physical activity was negatively associated with the rate of increase in BMI following smoking cessation during a 2-year follow-up of 1209 occupationally active men (P. F. et al, unpublished data, 1998). A prospective cohort study of 1639 male and 1913 female employees participating in a worksite intervention study for smoking cessation and weight control similarly found that exercise attenuated the increase in body weight.[42] Finally, an intensive program that limits access to alcohol and high-fat foods and increases physical activity has been shown to attenuate weight gain after smoking cessation in 86 military recruits.[43] The only study we know of that reached different conclusions is that by Williamson et al,[35] who found that low physical activity increased the risk of weight gain in women but not in men. The

term "physical activity" has been variably defined as self-reported recreational sport activity (low, medium, or high),[35] three or more sport activities in a week (P. F. et al, unpublished data, 1998), or as the number of weekly sessions of vigorous or nonstrenuous job-related or recreational exercise.[42]

The rate of weight gain in general declines with age.[44] It also declines with older age in recent quitters.[35,36,44,45] The data from the National Academy of Sciences-National Research Council Twin Registry revealed that "super-gainers" in weight after smoking cessation were younger than those reporting no change in weight.[39] Some authors have reported that a higher baseline BMI predicted a lower weight gain after smoking cessation.[29,41,45] Others have found that weight gain after cessation of smoking was either unrelated[40,46-48] or directly related[49] to initial weight. Finally, the inverse relationship between initial BMI and subsequent weight gain after cessation of smoking has been reported in women, but not in men.[35]

Some longitudinal studies[29,35,45,46,49-51] have revealed a direct relationship between smoking rates before cessation and weight gain after it; others[40,43,47,48] have reported no relationship between these two variables; and still others have reported a U-shaped relationship between the amount smoked and weight gain, with moderate smokers (10 to 19 cigarettes per day) gaining the most weight after cessation.[52,53] Finally, occasional surveys have identified a higher socioeconomic status,[39] poorer self-rated health,[37] and increased alcohol consumption[41] as attenuating factors for the weight gain after smoking cessation.

IS WEIGHT GAIN AFTER CESSATION OF SMOKING TEMPORARY OR PERMANENT?

The determinants of the weight gain after smoking cessation remain poorly understood. This gain is believed to result mostly from changes in caloric intake and, to a lesser extent, from changes in energy expenditure.[18] Regression analyses have indicated that adjusting changes in nutrient intake for weight predicted posttreatment weight gain better than absolute changes in nutrient intake,[54] and it has been claimed that the increase in caloric intake peaks at 6 months after smoking cessation but returns to baseline levels after 1 year.[36] In addition, smoking has recently been shown to induce insulin resistance and dyslipidemia, while smoking cessation increases insulin sensitivity and improves the lipoprotein profile in spite of the accompanying increase in body weight.[55]

In a 2-year follow-up study conducted by the authors, the mean increase in BMI has been found to be 0.08 ± 1.53 in never-smokers, 0.11 ± 1.5 in smokers who had stopped smoking before study entry, 0.26 ± 1.5 in current smokers, and 1.07 ± 1.2 in those who stopped smoking after study entry (unpublished data, 1998). In other words, the rate of weight gain peaks within 2 years after smoking cessation, but returns afterward

TABLE

Modifiers of Weight Gain After Smoking Cessation, Based on a Review of the Literature

Modifier	Effect on Weight Gain
Genetic disposition	Greater concordance of weight among monozygotic than dizygotic twins[32,39]
Physical activity	Reduced weight gain in quitters engaged in physical activity[38,42,43]
Age	Rate of weight gain declines with age[35,36,39,44,45]
Initial body mass index	Lower weight gain in quitters with higher initial weight[29,41,45]
	Higher weight gain in quitters with higher initial weight[49]
	No effect[40,46-48]
Smoking rate	Higher weight gain in quitters with higher smoking rates[29,35,45,46,49-51]
	U-shaped, with moderate smokers gaining most weight after smoking cessation[52,53]
	No effect[40,43,47,48]
Alcohol consumption	Lower weight gain among social drinkers[41]
Self-rated health	Lower weight gain in quitters with lower self-rated health[37]
Socioeconomic status (SES)	Lower weight gain in quitters with higher SES[39]
	No effect[29]

to the baseline rates observed in never-smokers. The transient nature of the increased rate of weight gain after cessation of smoking is also supported by the observations reported by others.[28,29,35,50]

The main unresolved question is whether the weight gained during the first 2 years after smoking cessation is retained or lost with continuing abstinence. After a 13-year follow-up study, Williamson et al[35] concluded that "the mean body weight of those who had quit had increased only to that of those who had never smoked." Similarly, Blitzer et al[52] reported that the mean gain of 5.4 kg of weight in women after smoking cessation was permanent. However, this conclusion is at odds with two other studies that found the age-adjusted mean BMI higher among recent quitters than among never-smokers and those who quit smoking for more than 2 to10 years.[28,29] This latter finding seems to indicate an inverse relationship between body weight and years after smoking cessation, with the BMI stabilizing about 15 years after cessation of smoking.[28]

CONCLUSIONS

The relationship between smoking cessation and body weight has been extensively studied by both cross-sectional and longitudinal designs. Based on a review of this literature, some key points emerge: (1) The risk of weight gain is highest during the first year after smoking cessation and declines thereafter. (2) Sustained quitters gain, on average, approximately 5 kg more than continuing smokers. (3) Physical exercise, older age, a higher baseline BMI, and lower rates of smoking attenuate the degree of weight gained after smoking cessation. (4) There is conflicting evidence regarding the permanence of the weight gained after smoking cessation.

The modifiers of weight gain after smoking cessation (genetic disposition, physical activity, age, initial BMI, smoking rate, alcohol consumption, self-rated health, and socioeconomic status) may be used to estimate the risk of weight gain in individual smokers planning to quit. Our approach to weight control with smokers who are planning to quit would consist of advising patients about appropriate caloric intake and recommending physical exercise. A program that limits access to alcohol and high-fat foods and that increases physical activity has been shown to attenuate weight gain after smoking cessation.[43] In their extensive review, Klesges et al[25] concluded that "clinic-based programs designed to reduce postcessation weight gain have neither prevented weight gain nor increased cessation rates." Still, there is preliminary evidence that nicotine replacement by chewing gum,[56] transdermal nicotine patch,[57,58] or nicotine inhaler[59] may increase the rates of smoking cessation and that physical exercise three supervised sessions per week for 15 weeks may improve short-term quit rates in women.[60] Finally, there are indications that nicotine replacement[51] or serotoninergic medication[61] may reduce also the amount of weight gained after smoking cessation.

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