Why exercise is an important component of risk reduction in obesity management

Non-surgical intervention has many benefits

A recent article published in the Journal[1] was widely reported in the popular press,[2,3] with statements such as the following being quoted:

> public health messages encouraging people to eat healthy food and to exercise are unlikely to have long-term impact on their weight.

and

> In the absence of safe, effective pharmacological agents that can be used long-term, bariatric surgery is the most successful intervention for sustained weight loss.

The essence of the arguments presented was that once people are obese it is too late to reverse, that exercise and diet are ineffective in terms of impact on body mass index (BMI), that bariatric surgery is effective and that attention (including funding) should be focused on epigenetic origins of obesity and publicly funded access to bariatric surgery.

While we acknowledge that the author may have been reflecting on his experience with very obese individuals, it is unfortunate that his viewpoint and the ensuing media attention inferred that exercise is not a useful or efficacious intervention for obese people in general, for several reasons.

> "exercise is good for you, whether you lose weight or not"

1. BMI and body weight are not measures of fatness when used to assess changes in individuals over time

In population studies of adults, BMI is a useful surrogate for obesity because it scales weight according to height.[4] Although BMI provides no information regarding the composition of weight, or its distribution, this is not especially important in studies of thousands of participants because a high BMI can reasonably be assumed to be due to excess fat mass. However, caution must be applied to the simplistic assumption that a high BMI equates to obesity (ie, body fatness) when dealing with changes in individuals over time.[5] This is because, in adults, height does not change over time and change in BMI therefore reverts to a measure of change in body weight, which provides limited information pertaining to change in body composition. This is best illustrated in the case of change in BMI in response to exercise. Exercise increases skeletal muscle and lean body mass, particularly in individuals who are very inactive and deconditioned a priori. Indeed, many current exercise physiology prescriptions specifically target increases in skeletal muscle mass in at-risk individuals, because skeletal muscle possesses multiple glucose uptake pathways, including those which are insulin independent. Such exercise often results in no change in body weight or BMI, whereas sensitive imaging modalities reveal significant decreases in fatness, including abdominal fat mass.[6] Put another way, exercise has countervailing effects on fat and lean body mass.[7] In this context, it is conceivable that exercise training interventions which induce the least body mass or BMI change may be those which have the greatest benefit.

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2. Exercise decreases cardiovascular risk via mechanisms largely independent of change in BMI

Since the seminal study of London busmen in the 1950s, a compelling body of epidemiological literature has emerged indicating that exercise is associated with a decrease in cardiovascular events of approximately 30%.[8] Meta-analyses indicate that a similar benefit accrues from exercise-based cardiac rehabilitation programs.[9] A recent analysis of data from the Women's Health Study quantified the contribution of traditional and novel risk factors to this exercise-related risk reduction.[10] When pooled, modification of known cardiovascular risk factors accounted for 35.5% of exercise-mediated reduction in coronary events. The effect of exercise on BMI accounted for 6.8% of the benefit of exercise on coronary artery disease. Two things are germane. First, the benefits of exercise in terms of cardiovascular health are multifactorial and not fully explained by the effects of exercise on known risk factors. This "risk factor gap" may relate to direct antiatherogenic effects of exercise on artery walls.[11] Second, the contribution of changes in BMI to the overall effect of exercise is extremely modest. That is, exercise has major effects on cardiovascular disease risk which are independent of effects on BMI.

3. Fitness is a strong predictor of cardiovascular and all-cause mortality and predicts risk much better than fatness

Much of the epidemiological evidence relating exercise to cardiovascular risk has relied on physical activity self-reporting, which can be error-prone. One notable exception is the Aerobics Center Longitudinal Study (ACLS), which involved exercise tests of cardiorespiratory fitness in 25 341 men and 7080 women.[12] A low fitness level conferred a similar relative risk as smoking and a higher risk than high cholesterol and hypertension, and was a more powerful predictor of mortality than BMI.[13] Fitter participants had lower relative risk, even if they also possessed multiple cardiovascular risk factors, and individuals who increased their fitness levels significantly decreased their relative risk.[13]

In a subsequent analysis of the ACLS that directly addressed the effects of fitness and fatness, obese participants who had preserved fitness had similarly low relative risk as lean fit participants, whereas lean unfit participants had elevated risk which approximated that in obese unfit participants.[14] These findings, subsequently confirmed in women,[15] are sometimes summarised as indicating that fitness is a more important risk factor than fatness, although it has sensibly been pointed out that the solution to both problems is to prescribe exercise rather than weight loss.

4. Exercise-based interventions decrease progression to diabetes, largely independent of effects on body mass

To assess the role of exercise in preventing diabetes in individuals who are obese and at high risk, the Diabetes Prevention Program in the United States randomly assigned 3234 obese non-diabetic participants with elevated fasting blood glucose to receive placebo, metformin or an intensive

program of lifestyle modification (including 150 minutes of exercise per week).[16] After a mean follow-up period of 2.8 years, the incidence of diabetes, compared with the placebo group, was reduced by 31% in the metformin group and 58% in the lifestyle modification group. Lifestyle modification prevented one case of diabetes per seven persons treated for 3 years — in this sense, it was about twice as efficacious as metformin. These beneficial effects in terms of prevention or delay of diabetes persist for at least 10 years.[17] However, the difference in body mass between the lifestyle modification and metformin groups was relatively modest, indicating that exercise benefits may be mediated by mechanisms largely independent of weight loss. Indeed, participants who achieved their exercise goals but not their weight loss goals had a 44% reduction in diabetes risk compared with those in the placebo group.[18] Exercise-based lifestyle interventions are the "best buy" in terms of reversing and preventing diabetes in people with obesity.[19] If emerging data on epigenetic influences on adult health are borne out, it may be particularly relevant to establish good exercise habits early in life.

5. Exercise is an intervention which possesses "ecological validity" for the management of obesity

There are several cogent arguments to include exercise in obesity management which may be described as "ecologically valid". The success of modern medical science is based on the tenet of identifying a problem (eg, high societal cardiovascular disease risk), isolating the cause(s) (eg, cigarette smoking as a risk factor) and treating these (eg, preventive approaches to decrease smoking). In the case of obesity, energy storage as fat is ultimately related to imbalance between energy intake (food) and expenditure (physical activity). In this sense, we know the cause. It has been estimated that the average difference in energy expenditure between modern Westerners and hunter gatherers amounts to the equivalent of walking about 19–33 km per day.[20] As previously argued, we have Stone Age genes that were forged in an environment of high energy expenditure, but we now live in a food-abundant, sedentary society which is just decades old.[21] This fundamental imbalance between our genes and our environment can be seen as a cause of much contemporary Western lifestyle disease. Although it will be hard to reverse-engineer caloric density and inactivity, we have hardly begun our efforts in this regard and novel strategies will emerge. It took time to educate the community about the risks of smoking and to develop effective strategies and policies to combat it, but successful efforts in Australia are now lauded and emulated.

There is no evidence that atherosclerosis can be reversed by bariatric surgery, a pertinent issue given that the disease is likely to develop if people avoid (or do not have access to) programs to prevent it while on a surgery waiting list. The goal is to reduce the incidence of myocardial infarction, stroke and diabetes and to improve health and longevity, not just get a smaller number from the weighing scales or BMI calculation. The benefits of bariatric surgery in terms of survival are uncertain,[22] although some evidence exists for reduction of comorbidities and reduced mortality. Nonetheless, should we really give up on targeting the root causes of obesity in favour of "curative" surgical approaches?

Summary

Bariatric surgery has an important and evidence-based role in the treatment of severe and recalcitrant obesity. However, lack of investment in prevention, especially exercise, effectively condemns a large proportion of the approximately 20% of Australians who are already obese to disease progression and, ultimately, surgery. It is our view that the argument that exercise has no role to play in prevention is fundamentally flawed.[23] Medical professionals who deal with overweight and obesity should prescribe exercise because exercise is good for you, whether you lose weight or not.

In a recent consensus statement on obesity management, it was concluded that "Continuing population-based efforts are essential to prevent the onset of obesity and type 2 diabetes"[24] and experts in bariatric surgery research have commented that "comprehensive weight management programs should be available for obese patients with type 2 diabetes with nonsurgical options attempted first".[25] Balanced statements such as these should inform public health messages.

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