

## MOVING IT FOR WEIGHT LOSS

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**ABSTRACT**

**The rate of overweight and obesity is increasing worldwide, with significant health impacts. Obesity is a risk factor for morbidity and mortality, and weight loss should take a multipronged approach, including dietary control and physical activity. The lack of physical activity, sedentary behaviour, and poor cardiorespiratory fitness are all independent risk factors for morbidity and mortality. Thus, it is important to advise lifestyle changes to address these issues. Most individuals who have no contraindications can embark on light- to moderate-intensity physical activity without the need for medical clearance. Specific advice on physical activity should be given, targeting the individual, and this can be done using the FITT (frequency, intensity, time, type) principle. Physical activity should also be reviewed regularly and progressed gradually to target physical activity guidelines. Individuals should also be encouraged to replace sedentary behaviour with at least light-intensity physical activity whenever possible.**

**Keywords: Overweight, obesity, physical activity, sedentary behaviour**

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Overweight and obesity is a worldwide problem, including in Singapore. The 2016/7 National Population Health Survey carried out jointly by the Ministry of Health (MOH), Singapore and Health Promotion Board (HPB), Singapore, found that 8.7 percent of Singaporeans and permanent residents (PRs) aged 18-69 years of age are obese, while more than a third (36.2 percent) are at least overweight.<sup>1</sup> 13 percent of children aged 6-18 years of age in mainstream schools are overweight.<sup>2</sup> The impact of obesity on health is significant, with obesity being the fifth leading risk factor contributing to disability-adjusted life years (DALYs) in 2017, accounting for 6.4 percent of total risk-attributable DALYs, with an increase of 141 percent from its impact in 1990.<sup>3</sup>

Achieving weight loss in an overweight or obese person requires a multipronged approach, including diet control

and physical activity. Overweight and obese persons should aim for a weight loss of 5 to 10 percent of initial weight over six months.<sup>4</sup> Studies have shown that physical training on its own rarely achieves more than three percent initial weight loss. In contrast, a combined diet and physical activity intervention programme can result in 5 to 15 percent of weight loss.<sup>5,6</sup>

**Aerobic physical activity in weight loss**

General physical guidelines recommend that adults above 18 years old undergo at least 150 minutes of moderate-intensity aerobic physical activity per week, or 75 minutes of vigorous-intensity aerobic physical activity per week, or a mixture of both, where one minute of vigorous-intensity aerobic physical activity is equivalent to two minutes of moderate-intensity aerobic physical activity.<sup>7</sup> Exercise, defined as 'planned, structured, and repetitive'<sup>8</sup>, is a subset of physical activity defined as 'any bodily movement produced by skeletal muscles that result in energy expenditure'.<sup>8</sup> Other domains of physical activity include work, play, house chores, leisure time activities and active transportation. In addition, the latest guidelines have recommended that moderate- to vigorous-intensity physical activity of any duration can confer health benefits.<sup>9</sup>

For general health benefits, it is advisable for overweight or obese persons to reach this target. However, there appears to be a dose-response relationship between physical activity and the amount of weight lost. Studies have shown that 225 to 420 minutes per week of aerobic physical activity is required to result in a weight loss of 5kg to 7.5kg over 3 to 16 months, while 200 to 300 minutes per week of aerobic physical activity is required to prevent weight regain following weight loss.<sup>10</sup> Moderate- to vigorous-intensity aerobic physical activity carried out a minimum of three days a week resulted in approximately 2 to 3 percent weight loss at six months. Daily low-intensity walking and achieving daily 'step counts' of at least 10,000 steps resulted in 1 to 1.5 percent weight loss at three to six months.<sup>5</sup>

Studies have shown that cardiorespiratory fitness appears to be a more significant risk factor for all-cause mortality than BMI levels. When prescribing physical activity to obese and overweight individuals, improving their cardiorespiratory fitness should be a goal of therapy rather than just focusing on the amount of weight lost.<sup>11</sup>

**Resistance exercise in weight loss**

Resistance exercise alone does not appear to result in significant weight loss, with a maximum of one percent of initial weight loss expected.<sup>6</sup> In fact, resistance exercise without diet control may result in weight gain, though perhaps due to increased fat-free mass.<sup>5</sup> Resistance training may be useful in increasing the resting metabolic rate and

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has shown other benefits on health regardless of weight loss.<sup>5</sup> When coupled with an adequate diet, resistance training may increase strength and decrease body fat in older adults.<sup>12</sup>

Current physical activity guidelines recommend all adults above 18 years old should undergo strength training at least two days a week, involving major muscle groups.<sup>7</sup>

### **Sedentary behaviour in weight loss**

Sedentary behaviour is defined as 'any waking behaviours characterised by an energy expenditure of 1.5 metabolic equivalents (METs) or less, while in a sitting, reclining, or lying posture'.<sup>13</sup> Conversely, physical inactivity is defined as the inability to achieve physical activity guideline targets.<sup>13</sup> Thus, one can be physically active, yet also engaging in long periods of sedentary behaviour.

The deleterious effect of sedentary behaviour on health has been documented, with sedentary behaviour associated with a greater risk of mortality from all causes, mortality from cardiovascular causes or cancer, and the incidence of cardiovascular disease, cancer and type 2 diabetes.<sup>14</sup> The deleterious effect of sedentary behaviour appears to be mitigated only with high levels of moderate- to vigorous-intensity physical activity (a minimum of 30 to 40 minutes of moderate- to vigorous-intensity physical activity a day).<sup>15</sup> Even without moderate- to vigorous-intensity physical activity, it appears that replacing sedentary behaviour with at least light-intensity physical activity may help to reduce some of this risk.<sup>9</sup>

## **PRE-PARTICIPATION SCREENING**

Given that obesity is a risk factor for cardiovascular disease, obese individuals may be concerned about becoming physically active and the risk of exertion-related sudden cardiac events. Traditionally, it was recommended that individuals undergo a medical examination and symptom-limited exercise testing before initiating moderate or vigorous-intensity physical activity, depending on their risk profile.<sup>16</sup> This was aimed at picking up individuals who may have occult cardiovascular disease that may put them at higher risk of developing an acute cardiac complication during physical activity.<sup>17</sup> Following these recommendations, an individual diagnosed with diabetes mellitus and above 35 years of age would be advised to undergo a medical examination and symptom-limited exercise test before embarking on brisk walking.<sup>16</sup>

However, such an algorithm likely created unnecessary barriers to an individual embarking and maintaining a physical activity programme. The risk of sustaining a physical activity-related cardiac event is very low, even in asymptomatic individuals doing vigorous-intensity physical activity. This risk is further attenuated with regular physical activity and increasing fitness levels.<sup>18</sup> Considering these factors, preparticipation screening guidelines have evolved.

The current American College of Sports Medicine (ACSM)

preparticipation screening guidelines<sup>18</sup> focuses on the presence of any known cardiovascular disease (including cerebrovascular disease and peripheral artery disease), type 1 or 2 diabetes mellitus, or renal disease, as well as any signs or symptoms arising from these diseases:

- a. Asymptomatic individuals with none of the abovementioned diseases do not need to seek attention from a health care professional prior to doing physical activity, though those who have not been regularly physically active should start with light- to moderate-intensity physical activity.
- b. Individuals with the abovementioned comorbidities but are asymptomatic, and keen to start a physical activity programme, should seek medical clearance from a healthcare professional. If there are no contraindications for exercise, they can start light-to-moderate-intensity physical activity with gradual progression. Those who are already regularly active should seek medical clearance before embarking on vigorous-intensity physical activity but can continue with moderate-intensity physical activity without the need for medical clearance.
- c. Any individual with signs and/or symptoms suspected to be due to or arising from any of the abovementioned comorbidities should seek medical clearance prior to starting or resuming physical activity.

Exercise testing is no longer routinely recommended in any of the above groups but may be considered by the health care professional as part of medical clearance.

Individuals should also be encouraged to participate in self-administered pre-participation screening questionnaires regularly to assess if they have any symptoms or signs of medical conditions that may warrant medical advice prior to starting exercise.<sup>19</sup> Examples of such questionnaires include the Physical Activity Readiness Questionnaire for Everyone (PAR-Q+)(20) and the Get Active Questionnaire (GAQ) developed by the Canadian Society for Exercise Physiology.<sup>21</sup> Education on safety during sports and exercise also plays an important role in management. Individuals should be educated on the limitations of pre-participation screening and seek medical attention if they develop warning symptoms or signs during exercise, including chest pain, palpitations, giddiness, fainting spells, seizures, unexplained breathlessness, or extreme fatigue.<sup>19</sup> They should also not exercise in acute illness states, e.g., fever, generalised malaise, or myalgia.

## **MOVING WITH COMORBIDITIES**

Persons who are overweight or obese may also have other chronic medical problems such as diabetes mellitus and hypertension, or musculoskeletal issues such as knee osteoarthritis. Even in the presence of these comorbidities, general exercise prescription remains the same, i.e., at least

150 minutes of moderate-intensity aerobic physical activity per week for individuals 18 years and above of age, with strengthening exercises of major muscle groups of the body at least two times a week.<sup>7</sup> However, modifications to the actual exercise prescription should be made considering these comorbidities. The following paragraphs highlight some of the considerations in exercise prescription for obese or overweight individuals with comorbidities, though these are by no means exhaustive.

### **Diabetes mellitus**

Increased glucose uptake by muscles following a bout of prolonged aerobic physical activity may persist for 24 to 48 hours, depending on the intensity of physical activity.<sup>22</sup> To benefit from this effect, individuals with diabetes may want to consider moderate- or high-intensity physical activity daily or at least every other day.<sup>22</sup>

In addition, individuals with diabetes may need to time their physical activity with their medications. For example, individuals on insulin need to avoid prolonged physical activity during their medication's peak onset to avoid hypoglycaemic episodes. During the initiation of a physical activity programme, it is also helpful to gauge the individual's response to physical activity by means of self-blood glucose monitoring, to allow for optimal titration of medications.

Individuals with diabetes mellitus should also be assessed for any complications that may affect physical activity. For example, those with foot ulcers should avoid jogging or water activities.<sup>22</sup>

### **Hypertension**

Individuals with hypertension should consider exercising almost, if not daily, to take advantage of a phenomenon known as post-exercise hypotension, whereby blood pressure drops following an acute bout of physical activity, which is sustained for up to 24 hours.<sup>23</sup>

Anti-hypertensive medication may also affect the mode of monitoring the intensity of physical activity. Individuals who are hypertensive on beta-blockers may not reach the target heart rate with moderate- to vigorous-intensity physical activity. Thus, the rating of perceived exertion should be considered to monitor the intensity of physical activity in these individuals.<sup>24</sup>

### **Knee Osteoarthritis**

Evidence suggests that overweight and obese persons experience more forces in their knee joints while walking.<sup>25</sup> Weight loss is also associated with a decrease in knee joint forces that is at least equal to, or even up to four times, the absolute weight lost.<sup>26,27</sup> However, overweight, and obese persons may find it difficult to embark on physical activity for weight loss, as they experience pain in their knees on walking. Upon seeking medical attention, they may be prescribed analgesia and advised to avoid aggravating activities. Yet, the decrease in walking activity can result in

muscle atrophy and worsening joint stiffness, resulting in a vicious cycle of knee pain and inactivity.

For such individuals, it may be useful to modify physical activity in various ways. For example, walks can be carried out in short bouts (for example, 5- to 10-minute bouts) with rest breaks in between, given that any duration of moderate- to vigorous-intensity physical activity can be beneficial. Aquatic exercise, e.g. walking in the pool can also reduce joint forces while increasing muscle activation<sup>28</sup>, making it a suitable form of exercise for overweight or obese persons with knee osteoarthritis. Knowing the exact exercise or movement that triggers the person's pain is useful as well. For example, individuals with predominantly patellofemoral osteoarthritis may experience anterior knee pain on cycling but feel more comfortable walking on flat ground. The importance of timing physical activity to peak onset of any analgesia and proper footwear should be emphasised. A physiotherapy referral may be warranted to improve muscle and joint strength and flexibility, improving knee osteoarthritis pain.

## **PUTTING IT ALL TOGETHER: THE FITT EXERCISE PRESCRIPTION**

Along with dietary intervention, the importance of physical activity in health and the management of overweight and obesity is well-known. However, physicians may be stumped as to how to give specific advice on physical activity.<sup>29</sup> A systematic way to advise on physical activity will be to consider it as a 'prescription'. Much like how a medication is prescribed in terms of type, route, dose and frequency, physical activity can be prescribed using the FITT principle: Frequency, Intensity, Time (Duration) and Type. Individuals should also be advised to reduce their sedentary behaviour regardless of their physical activity levels.

It is important to know the individual's current physical activity level to prescribe physical activity. This can provide a glimpse of the individual's health status and has been advocated as a 'vital sign'.<sup>30</sup> By asking the average number of days per week of moderate- to vigorous-intensity physical activity that one engages in and the average time spent per day, one can estimate the individual's level of physical activity. Further specific questions can ascertain if the individual has issues with physical activity, and modifications are made as necessary.

Although hitting recommended levels of physical activity has shown to be optimal in terms of health benefits, it is important to start low and go slow, especially for individuals who have not been physically active beforehand. Trying to achieve recommended physical activity volumes too rapidly may result in musculoskeletal injuries or even cardiovascular issues. Some activity is always better than none, and the intensity or duration of each physical activity should be targeted at the individual's current health status, with regular review and gradual progression.

### Case study

You have just diagnosed Mr A, a 30-year-old male, with diabetes mellitus after doing a routine health screen, advising him on lifestyle measures, and starting him on metformin. Mr A is a non-smoker, non-drinker, and has no other medical problems of note. He has not been active since completing his National Service almost ten years ago. His height is 1.69m, and his weight 90kg, with his BMI at 31.5, putting him in the obese range. His weight has been steadily increasing over the years, and he has tried jogging to lose weight but experiences bilateral knee pain on jogging more than 20 minutes, which worsens if he tries to jog more frequently than twice a week.

From Mr A's history and physical examination, he does not appear to have overt neuropathy or retinopathy resulting from his diabetes mellitus. He also does not have any symptoms of chest pain, giddiness, or undue breathlessness on exertion.

Mr A is working in a deskbound job and works 9 am to 6 pm daily, with an hour of lunchtime. He commutes to work by MRT and takes a 10-minute walk between the MRT station and home. He thinks he will be able to fit in 10 minutes of physical activity in the weekdays and 20 minutes of physical activity on weekends at this point in time.

Considerations when prescribing physical activity to Mr. A include:

- a. Pre-participation screening  
Mr A has diabetes mellitus but is asymptomatic. He does not appear to have any symptoms or signs of cardiovascular disease. Light- to moderate-intensity physical activity can be prescribed with gradual progression.
- b. Comorbidities  
Mr A has newly diagnosed diabetes mellitus. Metformin is unlikely to cause hypoglycaemic episodes during exercise. He also has knee pain on jogging but has no issues when walking.

Taking the above into consideration, an initial exercise prescription for Mr. A may look like the following:

- i. Type: Aerobic physical activity – Brisk Walking  
Frequency: Daily  
Intensity: Moderate intensity using the Talk Test (can talk but not enough breath to sing)<sup>7</sup>  
Duration: 10 minutes on weekdays (can extend walk in the neighbourhood on the way home from the MRT station, ensuring proper supportive footwear); 20 minutes on weekends (can be in the neighbourhood, void deck, or any space available)

- ii. Type: Resistance training – bodyweight exercises for major muscle groups (including wall squats, hip abduction side-lying, calf raises, bridges, push-ups, forward lunges)

Frequency: Wednesdays and Saturdays

Intensity: 8-12 repetitions at light effort<sup>31</sup>

Duration: Two sets of all exercises<sup>31</sup>

- iii. Take frequent breaks from the desk. Walk around the office or do whole-body stretches every hour to reduce prolonged sitting.

As part of overall management, Mr A should also be referred to the dietitian for advice on caloric restriction for his obesity as well as a diabetic diet. He should be educated to seek medical attention if he develops any symptoms and signs such as chest pain, palpitations, giddiness or fainting spells, seizures, unexplained breathlessness, or extreme fatigue during exercise, and not to exercise if he is acutely ill with systemic symptoms such as fever, malaise, or myalgia. He should also be reviewed regularly, with the aim of assessing his weight, diabetic control, as well as to progress his physical activity. Physical activity should be progressed one variable at a time, e.g., duration OR intensity, to prevent overuse or acute injuries stemming from too rapid an increase in exercise volume.

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**LEARNING POINTS**

- **Weight loss requires a multifaceted approach, with isolated dietary control or exercise unlikely to achieve a clinically significant weight loss.**
  - **Physical activity in obese or overweight persons is targeted at weight loss and to reduce other health risks arising from physical inactivity or sedentary behaviour.**
  - **Most individuals with no contraindications do not require medical clearance prior to starting light-to moderate-intensity physical activity. However, all should be educated on the caveats of pre-participation screening and warning symptoms and signs during physical activity.**
  - **Physical activity should be assessed regularly as it provides a glimpse of the individual's health status and should be prescribed specifically with regular review and progression.**
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