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Unit No. 4

MOVING IT FOR WEIGHT LOSS

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ABSTRACT

The rate of overweight and obesity is increasing worldwide, with significant health impact. Obesity is a risk factor for morbidity and mortality and weight loss should take a multi-pronged approach, including dietary control and physical activity. The lack of physical activity, sedentary behaviour, as well as poor cardiorespiratory fitness are all also 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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INTRODUCTION

Overweight and obesity is a worldwide problem, including in Singapore. The 2022 National Population Health Survey carried out jointly by the Ministry of Health (MOH) and Health Promotion Board (HPB) found that 11.6 percent of Singaporeans and permanent residents (PRs) aged 18-74 years of age are obese, while 40.2 percent are at least overweight, an increase from 10.5 percent and 39.3 percent respectively two years prior.[1] Sixteen percent of children in schools (from primary to pre-university level) are overweight in 2021, an increase from 13 percent in 2017.[2] The impact of obesity on health is significant, with high body mass index (BMI) being the third leading risk factor contributing to disability-adjusted life years (DALYs) in Singapore in 2019, with an increase of 36 percent from its impact in 2009.[3]

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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 5-10 percent of initial weight over six months.[4] Studies have shown that physical training on its own rarely achieves more than 3 percent initial weight loss, whereas a combined diet and physical activity intervention programme can result in 5-15 percent weight loss.[5,6]

AEROBIC PHYSICAL ACTIVITY IN WEIGHT LOSS

General physical activity guidelines recommend that adults aged 18 years and above undergo at least 150 to 300 minutes of moderate-intensity aerobic physical activity per week, or 75 to 150 minutes of vigorous-intensity aerobic physical activity per week, or a mixture of both, where 1 minute of vigorous-intensity aerobic physical activity is equivalent to 2 minutes of moderate-intensity aerobic physical activity.[7] Exercise is defined as "planned, structured, and repetitive, and with an objective of improving or maintaining one or more components of physical fitness".[8] It is a subset of physical activity, which is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure".[8] Other domains of physical activity include: work, play, house chores, leisure time activities, and active transportation. Regardless of duration, any moderate- to vigorous-intensity aerobic physical activity can confer health benefits.[9]

The above targets are related to general health and apply to overweight or obese persons as well. 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 5-7.5 kg over 3-16 months, while 200 to 300 minutes per week of aerobic physical activity is required to prevent weight regain following weight loss.[10]Lung, and Blood Institute (NHLBI Moderate- to vigorous-intensity aerobic physical activity carried out a minimum of three days a week resulted in approximately 2-3 percent weight loss at six months, while daily low-intensity walking and achieving daily "step counts" of at least 10,000 steps resulted in 1-1.5 percent weight loss at 3-6 months.[5]

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

An easy way to estimate the intensity of aerobic physical activity is to use the "talk test". An individual carrying out

moderate-intensity aerobic physical activity should still be able to talk comfortably but will find it difficult to sing. Both singing and prolonged talking becomes difficult when an individual is carrying out aerobic physical activity at vigorous intensity.[7]

RESISTANCE EXERCISE IN WEIGHT LOSS

Resistance exercise alone does not appear to result in significant weight loss, with a maximum of 1 percent of initial weight loss expected.[6]improved cardiometabolic risk factors, and facilitated weight loss through creating a negative energy balance. Clinicians need to counsel overweight and obese patients on how much PA/ET is needed to promote weight loss and weight loss maintenance. This will help establish realistic expectations and maximize improvements in CV risk factors. Although the minimum guidelines for aerobic PA (150 min of moderate or 75 min of vigorous physical activity per week In fact, resistance exercise without diet control may result in weight gain, though this might be a result of increased fat-free mass.[5] Resistance training may be useful in increasing resting metabolic rate, and has shown other benefits on health regardless of weight lost.[5] When coupled with an adequate diet, resistance training may increase strength and decrease body fat in older adults.[12]

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

SEDENTARY BEHAVIOUR IN WEIGHT LOSS

Sedentary behaviour is defined as "any waking behaviour characterised by an energy expenditure of 1.5 metabolic equivalents (METs) or less, while in a sitting, reclining, or lying posture".[13] Conversely, physical inactivity is defined as the inability to achieve physical activity guideline targets.[13] Thus, one can be physically active, yet also engage 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, as well as the incidence of cardiovascular disease, cancer, and type 2 diabetes.[14] 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).[15] 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.[9]

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 medical examination and symptom-limited exercise testing prior to initiating moderate or vigorous intensity physical activity, depending on their risk profile.[16] This was aimed at picking up individuals who might have occult cardiovascular disease that might put them at higher risk of developing an acute cardiac issue during physical activity.[17] 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 prior to embarking on brisk walking.[16]

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, and this risk is further attenuated with regular physical activity and increasing fitness levels.[18] Taking these factors into consideration, preparticipation screening guidelines have evolved.

The current American College of Sports Medicine (ACSM) preparticipation screening guidelines[18] 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:

- Asymptomatic individuals with none of the abovementioned diseases do not need to seek attention from a healthcare professional prior to doing physical activity, though those who have not been regularly physically active should start with light- to moderate-intensity physical activity.
- 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.
- 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 healthcare professional as part of the process of medical clearance.

Individuals should also be encouraged to participate in self-administered pre-participation screening questionnaires regularly to assess if they have any signs or symptoms of medical conditions that may warrant medical advice prior

to starting exercise.[19] Examples of such questionnaires include the Physical Activity Readiness Questionnaire for Everyone (PAR-Q+)[20] and the Get Active Questionnaire (GAQ) developed by Canadian Society for Exercise Physiology.[21] 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 to seek medical attention if they develop warning symptoms or signs during exercise, including chest pain, palpitations, giddiness or fainting spells, seizures, unexplained breathlessness, or extreme fatigue.[19] 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 might 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 150-300 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 twice a week.[22] 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

There is increased glucose uptake by muscles following a bout of prolonged aerobic physical activity, which may persist for 24 to 48 hours, depending on the intensity of physical activity.[23] To benefit from this effect, individuals with diabetes might want to consider moderate- or high-intensity physical activity daily or at least every other day.[23]

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

Individuals with diabetes mellitus should also be assessed for any complications that might affect physical activity. For example, those with foot ulcers should avoid jogging or water activities.[23]

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.[24]

Anti-hypertensive medication might also affect the mode of monitoring the intensity of physical activity. Individuals who are hypertensive on beta-blockers might not reach the target heart rate with moderate- to vigorous-intensity physical activity, thus rating of perceived exertion should be considered to monitor the intensity of physical activity in these individuals.[25]

Knee Osteoarthritis

Evidence suggests that overweight and obese persons experience more forces in their knee joints while walking.[26]more than 1.4 billion adults, age 20 and older, were overweight. Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. The World Health Organization defines overweight as having a body mass index (BMI Weight loss is also associated with a decrease in knee joint forces that is equal to at least or even up to four times the absolute weight lost.[27,28] However, overweight and obese persons might 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 might be prescribed analgesia and advised to avoid aggravating activities. Yet, the decrease in walking activity can result in muscle atrophy, as well as worsening joint stiffness, resulting in a vicious cycle of knee pain and inactivity.

For such individuals, it might 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,[29]also drag forces have to be considered that act opposite to the relative motion of the body segments and require higher muscle activity. Due to these opposing effects on joint loading, the load-reducing effect during aquatic exercises remains unknown. The aim of this study was to quantify the joint loads during various aquatic exercises and to determine the load reducing effect of water. Instrumented knee and hip implants with telemetric data transfer were used to measure the resultant joint contact forces in 12 elderly subjects (6x hip, 6x knee 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, as well as proper footwear, should be emphasised. A physiotherapy referral may be warranted to improve muscle and joint strength and flexibility, which can help to improve the pain from knee osteoarthritis.

PUTTING IT ALL TOGETHER: THE FITT EXERCISE PRESCRIPTION

Along with dietary intervention, the importance of physical activity in health and in the management of overweight and obesity is well-known. However, physicians may be stumped as to how to give specific advice on physical activity.[30]the WHO ranks it as the fourth leading risk factor for overall morbidity and mortality worldwide. In Canada, at least 4 of 5 adults do not meet the Canadian Physical Activity Guidelines of 150 min of moderate-to-vigorous physical activity per week. Physicians play an important role in the dissemination of physical activity (PA A systematic way to advise on physical activity will be to consider it as a "prescription". Much like how 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.

To be able to prescribe physical activity, it is important to know the individual's current physical activity level. This can provide a glimpse of the individual's health status, and has been advocated as a "vital sign".[31] By enquiring about the average number of days per week of moderate- to vigorous-intensity physical activity that one engages in, as well as the average time spent per day, one can estimate the level of physical activity of the individual. Further specific questions can ascertain if the individual has issues with any physical activity, and modifications made as necessary.

Although hitting recommended levels of physical activity has been 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 might 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, and are advising him on lifestyle measures, as well as 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 10 years ago. His height is 1.69 m, and his weight 90 kg, 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 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 9am to 6pm 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 on weekdays and 20 minutes of physical activity on weekends at this point in time.

Considerations when prescribing physical activity to Mr. A include:

- 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.
- 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 might 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)[22]

   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[32]

   Duration: 2 sets of all exercises[32]

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, i.e., duration OR intensity, so as to prevent overuse or acute injuries stemming from too rapid an increase in exercise volume.

CONCLUSION

Physical activity plays an important role in the management of obese and overweight persons. It is important to prescribe physical activity safely and specifically, using an individualised exercise prescription, with considerations of any comorbidities that the individual might have.

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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 not only at weight loss, but also 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, although all should be educated on the caveats of pre-participation screening, as well as 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.**