



WARMING UP WITH RESISTANCE EXERCISES

Reducing severity and duration of hypoglycaemia

Hypoglycaemia refers to the condition when our blood glucose level drops below 3.9mmol/l (70mg/dl). It occurs commonly in people with type 1 and advanced type 2 diabetes mellitus, and especially those treated with insulin and oral medications such as sulfonylureas. It is the most feared complication of diabetes treatment, with a reported figure of 2% to 4% deaths attributed to hypoglycaemia.

Hypoglycaemia is often related to the treatment of diabetes. However, a variety of conditions, although rare, can cause low blood sugar in people without diabetes. Like fever, hypoglycaemia is not a disease but an indicator of a health problem.

Hypoglycaemia symptoms are signs triggered by our body's physiological defence when our blood glucose level falls below the glycaemic threshold. Hence, understanding the signs of hypoglycaemia for early treatment is important.

The two categories of hypoglycaemia symptoms are the Neurogenic symptoms and the Cholinergic-mediated symptoms. Neurogenic hypoglycaemia is activated by the autonomic nervous system (ANS). It causes a person to feel shakiness,

anxiety, nervousness, palpitations, sweating, dry mouth, pallor, and pupil dilation. Cholinergic-mediated symptoms can be identified from profuse perspiration and itch or tingling feelings of the body.

Over a period of time, repeated episodes of hypoglycaemia can lead to hypoglycaemia unawareness. The body and brain does not produce signs and symptoms that warn of low blood sugar, such as shakiness or irregular heartbeats. This can prove rather dangerous because it increases the risk of severe, life-threatening hypoglycaemia.

The glycaemic threshold that triggers the hypoglycaemia response differs individually. It depends on the types of treatments and occurrence frequency.

SHAPE UP

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Patients with higher HbA1c were observed to perceive hypoglycaemia symptoms at a higher blood glucose level which may be above the normal range. In the opposite manner, patients with intensive medical treatment to control their blood glucose level may recognise the symptoms at a lower than the normal physiological glycaemic thresholds.

Antecedent and persistent hypoglycaemia also blunt or reduce the sensitivity to subsequent hypoglycaemia responses at a lower glycaemic threshold. In fact, early research from Segel and colleagues (2002) already reported a shift of glycaemic threshold to a lower concentrations in recent antecedent hypoglycaemia and the counter-regulatory response was virtually absent in advanced insulin-treated type 2 diabetes. In other words, our body may not respond to hypoglycaemia with any symptoms until we reach the critical stage as the number of episodes of hypoglycaemia increases.

Exercise has been advocated as the best medicine and treatment for people with diabetes especially type 2 diabetes. The physiological benefits even at cellular level are not seen in dietary and medication interventions.

The improvements such as increasing Mitochondria (powerhouses of the cell) content, glucose transporter type 4 (Glut4) content, pancreatic insulin secretion, and reducing endoplasmic reticulum (ER) stress and inflammation through proper structured training

are well documented. However, prolonged physical activity without sugar compensation and medication adjustment may also lead to hypoglycaemia and dull our physiological defences.

The effect of a single bout of exercise may last up to 17 hours. Thus, hypoglycaemia symptoms may occur even hours after exercise. Patients with previous episodes of hypoglycaemia are also at a higher risk of hypoglycaemia during or post-exercise. During a bout of moderate intensity exercise, insulin secretion is reduced by 40 to 60% with the compensation of an increase in Glut4 connectors for glucose uptake. In other words, the rate of glucose uptake is increased with just a small amount of insulin.

Depending on intensity and duration of activity, supplements of 10g to 20g of carbohydrates for every 30 to 60 minutes of physical activity may be needed to maintain healthy blood glucose level. With improved insulin sensitivity, medication doses such as insulins and sulfonylureas may need to be reduced in a 24-hour period to prevent post-exercise hypoglycaemia.

Interestingly, exercise order may also help in preventing exercise-induced hypoglycaemia. Yardley and colleagues (2012) did the interesting study with type 1 diabetes and found that performing resistance exercise first before continuing with aerobic exercises improves glycaemic stability throughout the exercise and

reduces the duration and severity of hypoglycaemia. It sounds like it may be a good practice to integrate some simple resistance exercises into your warm-up routine before going for your big walk.

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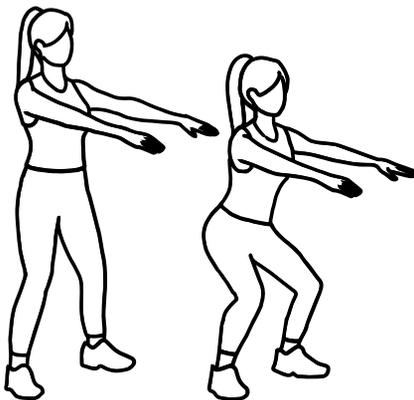
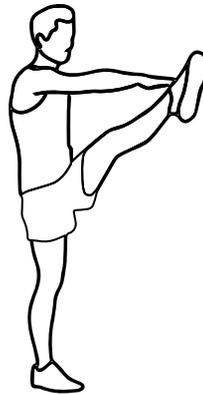


A warm-up routine that requires only about 10 minutes is illustrated below and on the next page.

For those with lower limb conditions, please consult your health care professionals for alternative exercises.

Leg Swings

- Stand with hand support if needed, swing leg to reach opposite hand.
- Perform 20 repetitions for each leg.

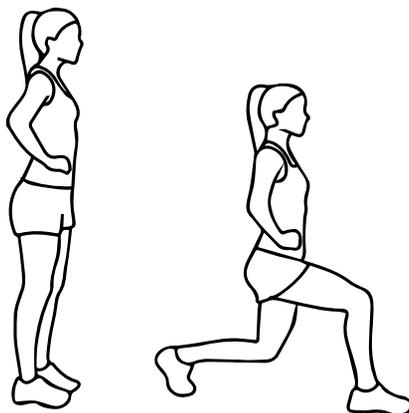
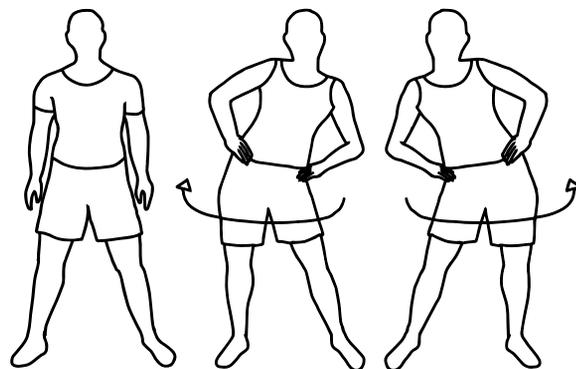


Half Squats

- Stand with feet shoulder width apart, keeping body upright, lift arms and lower the body through the hips till arms and thigh is parallel to the floor. Hold for 2 seconds and return to standing position.
- Repeat 10 to 20 times.

Hip Circles

- Stand with feet shoulder width apart. Place hand by your waist and circle your hips clockwise and anti-clockwise.
- Repeat 20 repetitions or as needed for each direction.



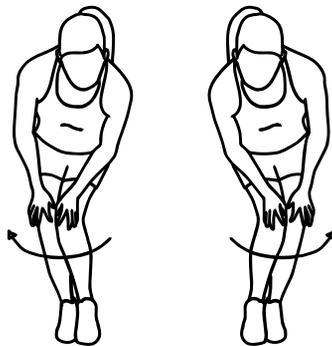
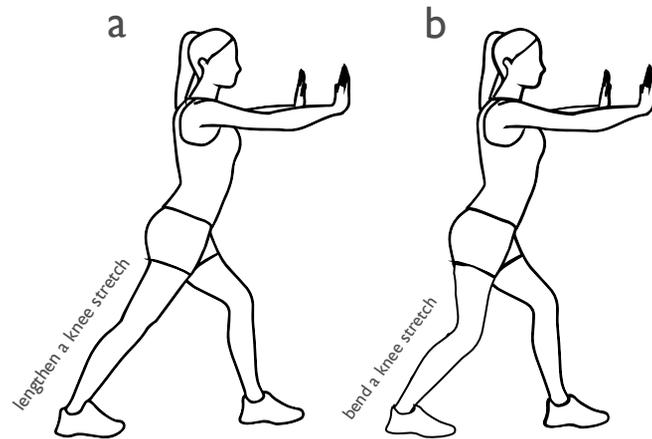
Forward Lunges

- Stand with feet shoulder width apart, place hand by your waist and take a step forward, keep body upright and lower the body till the front and back knees are almost 90 degrees. Hold for 2 seconds and return. Repeat with the other leg.
- Repeat 10-20 repetitions.

Calf Stretch

(perform a then b)

- Stand with both hands against the wall, place one foot back. Holding heel on the ground, while keeping the back knee straight, bend the front knee till you feel a stretch in the calf. Hold for 20 seconds before returning. Repeat 3-4 times for each leg.
- Stand with both hands against the wall, place one foot back. Holding heel on the ground, bend the back and front knee at the same time until you feel a stretch on the lower calf. Hold for 20 seconds before returning. Repeat 3-4 times for each leg.

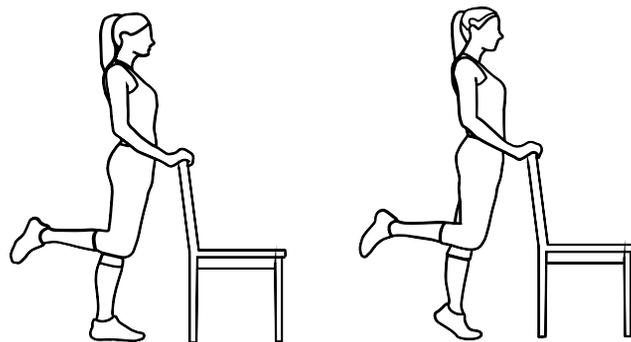


Knee Circles

- Stand with feet together. Place hand by your waist, bend knee and rotate clockwise and then anti-clockwise.
- Repeat 20 repetitions each or as needed.

Single Leg Curl

- Stand on a single leg with support. Lift heel as high as possible quickly and return slowly.
- Repeat 20 repetitions for each leg.



References

Briscoe VJ, & Davis SN. (2006). Hypoglycemia in type 1 and type 2 diabetes: Physiology, pathophysiology, and management. *Clinical Diabetes*, 24(3):115-121.

Yardley et al. (2012). Effects of performing resistance exercise before versus after aerobic exercise on glycemia in type 1 diabetes. *Clinical care* 35(1):669-675.

About the author: Ray Loh is an exercise physiologist at the Sports Medicine and Surgery Clinic, Tan Tock Seng Hospital. He has been an active volunteer with Diabetes Singapore, giving talks and demonstrations on exercise and workouts.