The Effects of Common Medications in Response to Exercise and Training

Habib Noorbhai1*, Gary Gabriels2 and Aslam Noorbhai3

1MRC/UCT Research Unit for Exercise Science and Sports Medicine, Sports Science Institute of South Africa, Department of Human Biology, University of Cape Town, South Africa
2Division of Clinical Pharmacology, Department of Medicine, Faculty of Health Sciences, University of Cape Town, South Africa
3Department of General Surgery, School of Clinical Medicine, Faculty of Health Sciences, University of Kwa-Zulu Natal, South Africa

Abstract

Medications have various effects and responses to individuals who exercise. Many common over-the-counter and prescription medications can cause side-effects if an individual exercises and these side effects are dependent on the type of medication one consumes. Beta blockers, ACE inhibitors, diuretics, statins and oral hypoglycemics have similar and differential physiological effects on the body during exercise. Exercise intensity, exercise frequency and targeted heart rates need to be adjusted in accordance with the type of medication consumed and its dosage. While there is a much generic composition for medication consumption and exercise guidelines, health professionals should adhere to a holistic, individualistic approach when consulting with a wide-range of patients.

Keywords: Medications; Physiological effects; Exercise guidelines and response

Taking the Pill

Medications have various effects and responses to individuals who partake in exercise [1]. The purpose of this article will discuss the five most common used medications prescribed by general practitioners worldwide (Beta blockers, ACE inhibitors, diuretics, statins and oral hypoglycemics) for patients in relation to exercise routines.

Many common over-the-counter and prescription medications including analgesics may cause side-effects if an individual exercises, and also if they become reliant on the drug [2]. While most people are aware that the caffeine found in coffee, sodas and aspirin is a stimulant, many may not realize that cold medications, diet pills, allergy remedies and herbal teas may also contain compounds (and stimulants) that can elevate the heart rate [1,2]. For most, utilizing any one of these in a normal dose, probably would not cause a problem. However, with the addition of exercise (also a stimulant) an individual may experience unwanted side-effects such as heart palpitations, hot flushes, dizziness or nausea [3]. These unwanted effects may also be amplified if the products are used in combination or simultaneously [2,3].

Common Prescribed Drugs and Exercise

Beta blockers

Beta blockers are commonly prescribed medications for hypertension and heart disease. Beta blockers function by preventing the binding of epinephrine to receptors in the heart (Figure 1) [3]. This results in both decreased resting and exercise heart rate (HR) and blood pressure (BP) values [4]. Commonly prescribed beta blockers include atenolol and metoprolol [3].

ACE inhibitors

An angiotensin-converting-enzyme (ACE) inhibitor is a medication primarily used for the treatment of hypertension. Common ACE inhibitors include captopril, enalapril and lisinopril [3]. ACE inhibitors reduce the activity of the complex renin-angiotensin-aldosterone system. In addition, ACE inhibitors block the conversion of angiotensin I to angiotensin II primarily in the lungs (Figure 1). The molecule angiotensin II is a potent vasoconstrictor of blood vessels [4]. Therefore, reduced production of this molecule results in relaxation of the blood vessels and lower blood-pressure values.

Diuretics

Diuretics are another class of medications commonly used for the treatment of hypertension [1,3]. One of the most common types of diuretics is hydrochlorothiazide (HCTZ) [5]. Diuretics act on the kidney and lead to increased urine output (Figure 1). An increase in urine excretion in turn leads to a lower plasma volume, which helps lower blood pressure [3,5].

Statins

Statins are the most commonly prescribed medication for high cholesterol (common examples include: Lipitor, Zocor and Pravachol) [5]. Statins function by inhibiting a key enzyme involved in the production of cholesterol in the liver (Figure 1) [3].

Oral Hypoglycemics

Oral hypoglycemics are a class of medications commonly prescribed for individuals with type II diabetes [5]. There are three major groups of oral hypoglycemics used to control blood glucose: 1) ß-cell stimulants for insulin release, 2) drugs to improve insulin sensitivity and 3) drugs that decrease intestinal absorption of carbohydrates. ß-cell stimulants function by inciting insulin release from the pancreas (Figure 1) [5]. These medications are taken with meals and help alleviate excessive increases in post-meal blood glucose levels. The latter two oral hypoglycemic categories have little effect on the exercise response [3,5].

Other Medication

Other sorts of medications such as bronchodilators, nicotine and thyroid replacement medications should not be taken immediately...
before exercise as these cause profound increases in heart rate, blood pressure and a decrease in exercise capacity [3-5]. These can be detrimental to an individual, especially those with high blood pressure, persons with frequent anxiety attacks, smokers and the elderly [3-5].

How can Medications Affect Exercise Capacity and Training?

Previous studies have clearly documented an inhibitory effect of ibuprofen on muscle hypertrophy suggesting that ibuprofen administration during resistance training inhibits training-induced skeletal muscle hypertrophy [6,7]. In addition, similar effects have been demonstrated during endurance training [8].

Beta blockers

The therapeutic effect provided by beta blockers also creates an altered physiological response to exercise [3] (Table 1). Beta blocker treatment blunts the usual increases in HR and BP that correspond to higher exercise intensities and workloads [4]. Beta blockers also cause glucose intolerance in people with diabetes by masking the symptoms of hypoglycaemia [3,4,6].

The fact that beta blockers attenuate the HR response to exercise means traditional methods for establishing target HR (eg: peak HR variability or HR reserve) are likely to be invalid [4]. HR variability refers to the fluctuations of heart rate during exercise whereas HR reserve points to the end-point of HR after an exercise session [4]. Therefore, the most important programme for individuals taking a beta blocker is to use an alternative method for setting target intensity [3]. The rating of perceived exertion (RPE) scale is an excellent option for beta blockers.

Diuretics

Diuretics are one of the most commonly prescribed classes of antihypertensives and have few detrimental effects on exercise performance but have adverse metabolic effects on exercise performance [1,3]. Unlike beta blockers, agents which have the least potential for adverse effects on exercise performance and metabolic effects are the converting enzyme inhibitors, calcium channel blockers, alpha blockers and central alpha agonists [3,5]. Much like those who take ACE inhibitors, individuals on diuretics will have both lower resting and exercise BP values [4] (Table 1). It is imperative to note that some patients consume ACE inhibitors and diuretics together. In this case, a principle concern is that the combination of the reduction in blood pressure from the ACE inhibitors and the diuretics, coupled with the naturally occurring post-exercise hypotension, can result in excessive reductions in BP [3,6,7].

When taking diuretics one should unfailingly perform a gradual cool-down after all exercise sessions [3]. It’s also advisable to perform a daily weight check to ensure that the prescribed dosage of diuretic is continuing to have the desired effects such as increased urine excretion, lowered plasma volume and reduced blood pressure [3,4,7]. A sudden change in body weight can help alert that something may be amiss and that one should get in touch with their physician [7]. Since diuretics have lower plasma volume, maximal performance usually decreases. Consuming diuretics while exercising in hot and humid conditions can have an effect on BP and HR [4,6].

Statins

Caution with regard to exercise is advised for individuals consuming statins [3]. Some statins have been shown to reduce skeletal muscle mitochondrial content and oxidative capacity lowering running capacity [9]. Additionally, simvastatin has been recently shown to impair exercise training adaptations [10].

Although not common, there are occasional instances where statins have also been associated with exertional rhabdomyolysis (ER) [3,6,11]. ER is a condition in which damaged skeletal muscle tissue breaks down and releases cellular content such as protein myoglobin into the blood.
that can be harmful to the kidneys [12]. The incidence of ER is higher in deconditioned individuals performing high-intensity exercise, most notably performing resistance training and eccentric exercises [6,12]. The condition is also likely to be exacerbated if the high-intensity exercise is also performed in hot and humid environments [3,12].

There are several preventative measures one can use to avoid statins in order to prevent ER:

1. All exercise programming (aerobic and resistance training) should begin at low-intensity and be progressed gradually [3,4].
2. Know the signs and symptoms of ER, which may include muscle stiffness and/or pain, fatigue and dark-coloured urine [12].
3. Training sessions should be planned for cooler times of the day if exercise is to be performed outside and adequately hydrate before, during and after exercise [3,6,7].

**Oral hypoglycemics**

The transport of glucose from the blood into the muscle cell is facilitated by the transporter protein GLUT-4 and responds to two signals (insulin and exercise) [6]. Because of the insulin stimulation from β-cell stimulants, when combined with exercise, there is increased potential for hypoglycaemia [6,11].

The most important programme modification for taking oral hypoglycemics is frequent monitoring of blood glucose values [3]. Initially, this should include checking levels pre-exercise, at the mid-point of exercise and post-exercise [3,4] (Table 1). Once it has been established how much blood glucose values typically drop for a usual exercise session (provided these changes in glucose levels are within an acceptable range), less-frequent monitoring would be required [3,6,7].

**Swallowing the Pill**

It is evident that exercise responses have varied effects for individuals consuming medications [13]. Health professionals and exercise specialists should be both aware of the patients’ or clients’ exercise programme, lifestyle and the effects that such medications would have on their habitual modifications. While there is a much generic composition for medication consumption and exercise guidelines, health professionals should adhere to a holistic, individualistic approach when consulting with a wide-range of patients.

**References**