

EXPLORING THE INTERACTION BETWEEN EXERCISE AND MEDICATION FOR CHRONIC DISEASE: CONSIDERATIONS FOR FITNESS PROFESSIONALS

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Introduction

The prevalence of chronic diseases like cardiovascular disease, type 2 diabetes and cancer are sizeable and are often related to unhealthy lifestyle choices. Given the fact that many of the more prevalent chronic diseases are associated with overweight and obesity, frontline management strategies generally include diet and physical activity. In addition, many people attempting to increase regular daily physical exercise as a disease management strategy will also be taking some form of prescription medication.

According to recent market surveillance data from the United States¹, drugs used to treat cardiovascular disease make up nearly half of the top 10 medications prescribed in 2007. Although not listed in the top 10 prescription medications, agents used to regulate elevated circulating blood glucose levels (hyperglycemia) are also commonly prescribed, particularly among those who are concurrently taking cardiovascular disease related medications. Therefore, because current chronic disease management includes both lifestyle modification (i.e., diet and physical exercise) and probably some type of prescription medication, fitness professionals need to consider some of the more notable interactive effects of these agents when considering individualized fitness regimes. Thus, the goal of this article is to briefly describe some of the more commonly prescribed medications for people with chronic disease and to discuss the potential interactions between medication use and physical exercise.

High Blood Pressure

The benefits of short-term elevations in blood pressure are well known. However, long-term pathologic elevations in blood pressure are not beneficial. Many older adults have sustained elevations in blood pressure without exertion and this is more commonly

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known as hypertension. According to the Canadian Hypertension Education Program, blood pressure should be decreased to lower than 140/90 mmHg, and to lower than 130/80 mmHg for individuals with type 2 diabetes².

Although participation in regular daily physical exercise can reduce elevated blood pressure³, current evidence-based recommendations target greater reductions with both lifestyle modification and pharmacologic management². The pharmacologic action of antihypertensive medications is achieved through blockage of the normal physiologic pathways and a number of different agents with different mechanisms of action can be used to treat hypertension.

Blood pressure is chiefly regulated by the hormones epinephrine and norepinephrine. The natural release of these hormones results in an elevated heart rate, vasoconstriction and bronchodilation. In order for epinephrine and norepinephrine to produce these physiologic responses, they must specifically or non-specifically bind to alpha or beta receptors on the target tissues. The receptors are not all equal and therefore a number of different agents can be used to block the receptors resulting in heart rate reduction and vasodilatation and thus a reduction in blood pressure. Medications belonging to the alpha and beta – blocker classes can influence exercise capacity both positively and negatively and some of the important effects are listed in **table 1**.

In simple terms, a reduction in blood pressure can be achieved through a reduction in blood volume. The kidney and hormones renin, angiotensin and aldosterone are primarily responsible for managing the bulk of fluid levels in the body. Drugs classified as Angiotensin Convertor Enzyme (ACE) inhibitors act by blocking the enzyme conversion of angiotensin I to angiotensin II leading to reduced blood pressure acting primarily in the kidney. Angiotensin Receptor Blockers (ARBs) act to reduce blood pressure by blocking the receptor site for angiotensin II which leads to vasodilation and reduced secretion of the hormones vasopressin and aldosterone. A reduction in fluid volume with these medications can influence exercise in a number of different ways and some of the exercise related issues to consider are also listed in **table 1**.

Hyperglycemia

Elevated circulating glucose as a result of reduced insulin secretion, insulin action or both is generally defined as type 2 diabetes. The normal range for circulating blood glucose before meals is 4.0 - 6.0 mmol/L and two hours after a meal is 5.0 - 8.0 mmol/L. In order to normalize elevated blood glucose, a number of different oral agents and exogenous insulin can effectively reduce circulating blood glucose as can the participation in regular physical exercise (which includes resistance training)⁴.

There are two general classes of oral anti-diabetic medications (see **Table 2**). Agents that increase pancreatic insulin secretion (secretagogues) and agents that increase the sensitivity of tissues like skeletal muscle to the action of insulin (sensitizers). A third agent for normalizing blood glucose is exogenous insulin (animal based or synthetic analogs) which is injected by most (inhaled insulin is available but is not widely used). Exogenous insulin acts to reduce circulating glucose in the same manner that endogenous insulin does (i.e., binding to insulin receptors on target tissues).

The most commonly prescribed medication for reducing circulating blood glucose is Metformin. Interestingly, the mechanism by which Metformin reduces blood sugar is not fully understood. It is thought to reduce circulating blood glucose through inhibiting glucose production in the liver. Despite no definitive mechanism of action, Metformin has few side effects and is very effective for reducing blood glucose.

The combination of anti-hyperglycemic medication(s) and exercise are a perfect marriage for achieving good glycemic control. Since people with type 2 diabetes by definition have elevated circulating glucose, the risk of hypoglycemia is generally low when participating in physical exercise. However, the combination of these 2 treatment modalities may elevate the risk for abnormally low circulating blood glucose. Low blood glucose (< 4.0 mmol/L) usually presents with the signs and symptoms including hunger, trembling, cold sweats, anxiety, weakness, headache and fainting. The signs and symptoms of hypoglycemia may be observed after a prolonged fast and can be

precipitated by physical exercise of greater intensity and longer duration. Reversing low blood sugar can be easily achieved by providing a source of simple carbohydrate (i.e. fruit juice or sugar candy).

Practical Considerations

In general, when working with clients who are taking antihypertensive or anti-hyperglycemic medications, be certain that they have received clearance from their family physician or a cardiologist to participate in any exercise program.

A systematic pre-exercise assessment (i.e., Canadian Society for Exercise Physiology's Physical Activity Readiness Questionnaire - PAR-Q) is recommended before fitness program initiation. This assessment does include questions pertaining to prescription medication use. However, the medication assessment component of the PAR-Q focuses only on cardiovascular related medications. Consequently, knowledge regarding the use of medications for type 2 diabetes may be overlooked. As a result, fitness professionals should consider collecting more medication related information, particularly when working with adults who are older and overweight since they may be taking one or more medications with different mechanisms of action for type 2 diabetes and cardiovascular disease.

Without question, the goal of most fitness programs is to increase daily physical exercise. If this goal is in fact realized, the client will need to be re-evaluated by you and their family physician. If you detect improvements in your client's blood pressure or you feel they are experiencing the signs and symptoms of hypoglycemia, encourage them to meet with their physician or pharmacist so that their medication can be adjusted (hopefully reduced). Because many people carry a list outlining the medication(s) they are currently taking, keeping track of these medications would help you, the client, the pharmacist and the physician when managing your client, especially if there are profound improvements (i.e., weight reduction and overall fitness) or in the event of an emergency.

Table 1. Drug Classification for treatment of hypertension and considerations for fitness professionals

<i>Drug Class</i>	<i>Generic Names</i>	<i>Things to Consider:</i>
Beta-blockers*	<i>Atenolol, Metoprolol</i>	May limit exercise induced (<120 beats/minute) Perception of exertion reduced Muscle Cramping
Alpha-blockers	<i>Terazosin, Prazosin, Doxazosin</i>	Hypotension associated dizziness fainting
Calcium channel blockers	<i>Amlodipine, Nifedipine, Felodipine</i>	Hypotension Perception of exertion reduced
Angiotensin Convertor Enzyme (ACE) inhibitors	<i>Captopril, Enalapril, Ramapril</i>	Hypotension Exertional heartburn Elevated potassium with pe weakness and/or spasm
Angiotensin Receptor Blockers (ARBs)	<i>Valsartan, Telmisartan, Losartan</i>	Hypotension associated dizziness fainting
Diuretics*	<i>Furosemide</i>	Altered hydration status Electrolyte imbalance Cramping Hypotension associated dizziness fainting

- HR= heart rate

Table 2 Drug Classification for treatment of Type 2 Diabetes and considerations for fitness professionals

<i>Drug Class</i>	<i>Generic Names</i>	<i>Things to Consider:</i>
Biguanides	Metformin	Hypoglycemia Potential for elevated circulating lactate with renal impairment Bloating
Thiazolidinediones	Rosiglitazone, Pioglitazone	Hypoglycemia Fluid retention Weight gain Fat redistribution to the waist
Sulfonylureas	Glipizide, Glyburdie	Exertional Heartburn
Alpha-glucosidase inhibitors	Acarabose, meglitol	Hypoglycemia Bloating Gas
Meglitinides	Repaglinide,	Hypoglycemia Fluid retention
Exogenous insulin		Hypoglycemia Weight gain

Multiple choice questions:

A 63 year old client has type 2 diabetes mellitus and has been told to increase daily exercise by his family physician. Upon completing the PAR-Q and MED- you detail that the client has a history of cardiovascular disease. A cardiologist has approved moderately intense levels of physical activity. An electrocardiogram indicated no significant myocardial abnormalities. You are to suggest a program for the client. Answer questions 1-4 based on this scenario.

1. What medication(s) is this client most likely to be on?

- A. Oral anithypoglycemic agent(s)
- B. Aspirin
- C. Statin
- D. Angiotensin Convertor Enzyme
- E. A and C
- F. All of the above
- G. None of the above

2. This client has complained about cramping in his lower legs, what are the most likely explanations for this?

- A. Age
- B. Statin use
- C. Antibiotic use
- D. Peripheral arterial disease (occluded vessels)
- E. Ibuprofen
- F. A and C
- G. B and D
- H. None of the above

3. You want to estimate the clients level of fitness, what medication(s) may alter the outcome of a sub-maximal graded exercise test?

- A. Aspirin
- B. Antacid
- C. Imodium
- D. Beta-blockers
- E. Non of the above
- F. All of the above

A 48 year old woman has been running on the treadmill, she complains to you that she feels cold and dizzy but is sweating.

4. What is this woman experiencing?

- A. Hypoglycemia
- B. Hyponatremia
- C. Hyperglycemia
- D. Hyperphagia

5. What hormone(s) are mainly responsible for vasodilation?

- A. leptin
- B. insulin
- C. epinephrine
- D. oxytocin
- E. cholecystokynin
- F. All of the above
- G. A and B

A client has complained to you that he has been experiencing pain in his throat when he walks his dog after dinner. Has been told that exercise by his family physician that he does not have angina.

6. Could this be related to his medication?

- A. YES

B. NO

7. The kidney is an important target for regulating blood pressure

- A. True
- B. False

8. The optimal approach for treating blood pressure should include:

- A. Medication
- B. Physical exercise
- C. Healthy diet
- D. All of the above
- E. None of the above

9. Drugs used to lower blood sugar act by:

- A. Increasing heart rate
- B. Reducing appetite
- C. Increasing insulin secretion from the pancreas
- D. Decreasing insulin secretion from the pancreas
- E. Reducing cell sensitivity to insulin

10. The most commonly prescribed oral agent to treat hyperglycemia works by:

- A. Increasing heart rate
- B. Reducing insulin secretion
- C. Increasing heart rate
- D. None of the above