Why Should Physical Therapists Care about Their Patients' Diet?

Chetan P. Phadke

Physical therapists treat their patients using a holistic approach that takes into account the impact of exercise on the whole person. Conversely, the whole person (including diet) can have a significant impact on exercise. Diet can influence the risk of chronic disorders such as type II diabetes, hypertension, and cardiovascular disease,¹ and being aware of the role of dietary factors in patient outcomes will enhance the physical therapy practice. This editorial provides examples of vascular changes associated with diet, discusses the influence of diabetes and insulin resistance, and describes the effect of oxidative damage on muscle function, all to argue the case that physical therapists need to consider their patients' diet.

VASCULAR CHANGES ASSOCIATED WITH DIET

Billinger² summarized studies indicating that muscle deconditioning can result in decreased blood flow to the muscles; however, the metabolic requirements during exercise demand an increase in blood flow. As demonstrated by Raper et al.,³ factors that promote an increase in blood flow, such as physical activity,² can also potentially improve exercise tolerance. Diet is another condition that can positively or negatively affect blood flow to the muscles. For example, research⁴ has documented an increase in microvascular vasodilation within 6 hours of a patient consuming two cups (500 ml) of orange juice, and another study⁵ reported additional changes, such as a decrease in diastolic blood pressure and an increase in the anti-inflammatory and anti-atherogenic genetic expression, after an individual consumed orange juice every day for 4 weeks.⁴ Similarly, Kapil et al.⁶ reported that beet juice, which is rich in dietary nitrates, significantly reduced hypertension within 24 hours of consumption. Physical therapy can stimulate neuroplasticity in patients with brain and spinal cord injuries, and dietary nitrates such as those from beet juice can, as shown by Presley et al.,⁷ increase brain perfusion and complement these neuroplastic changes. Thus, diet, such as a cup of orange juice or beet juice or nitrate-rich green

vegetables,⁶ can have a significant impact on blood flow to the muscles and the brain.

GLUCOSE UPTAKE AND INSULIN RESISTANCE

During aerobic exercise, the body's demands for glucose are primarily met by the concentrations of glucose in the blood. It is well known that during high-intensity anaerobic exercise, demand for glucose is met by intramuscular glycogenolysis, but this quickly depletes the body's glycogen levels.⁸ Any difficulty in transporting blood glucose into the muscles (insulin resistance) to replenish the depleted muscle glycogen⁸ can result in (1) fatigue, reported by patients with insulin resistance surveyed in the study by Van der Does and colleagues;⁹ (2) hyperglycemia, or excess blood glucose levels, as indicated by Adams;⁸ (3) walking impairment, as shown by Akbal and colleagues;¹⁰ and (4) neuromotor difficulty, reported by Li and colleagues.¹¹ Sweeney¹² showed that insulin resistance related to a high fat intake can skyrocket blood glucose levels to twice that of a high-carbohydrate diet. Roden and colleagues¹³ showed that insulin resistance was seen within 3 hours of an individual's eating a high-fat meal; Roden and colleagues¹⁴ also showed that insulin resistance can interfere with intramuscular restocking of glycogen levels and glucose oxidation and may reduce the availability of blood glucose for the muscles during exercise. It is now well understood that insulin resistance is caused by the intramyocellular lipids (the fat inside the muscles) as well as the free fatty acids circulating in the bloodstream, which can inhibit insulin activity.¹⁴ Exercise can improve insulin sensitivity,⁸ but this response is impaired when the free fatty acids in the blood are high.

The increased blood flow that occurs during both aerobic and anaerobic exercise is the key to delivering essential nutrients to the muscles and removing metabolic waste products. The delivery of oxygen during aerobic exercise, and the removal of lactic acid during anaerobic exercise, is essential, but these processes may be impaired by the reduced blood flow that occurs after

From the: Spasticity Research Program, West Park Healthcare Centre; Department of Physical Therapy, University of Toronto; Graduate Program in Kinesiology and Health Science, York University, Toronto.

Correspondence to: Chetan P. Phadke, West Park Healthcare Centre, 82 Buttonwood Ave., Toronto, ON M6M 2J5; chetan.phadke@westpark.org.

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an individual consumes a high-fat meal. A simple instruction to the patient to refrain from eating high-fat foods during rehabilitation, or to at least minimize the amount of such foods, may significantly improve the body's use of glucose, synthesis of glycogen, and resistance to insulin.

EFFECTS OF A HIGH-FAT DIET ON BLOOD CIRCULATION

Previous studies showed that compared with a low-fat^{15,16} meal, a single high-fat meal can significantly increase blood pressure and total peripheral vascular resistance,¹⁵ and it can also activate blood-clotting factors that may increase blood coagulability.¹⁷ There is consensus among studies^{3,18} that high-fat foods cause oxidative damage to the endothelial cells lining the blood vessels, and the decreased blood flow that results can significantly impair the ability of the blood to transport nutrients and waste products to and from the muscles. Data from several studies have suggested that a plant-based diet with no added oils or fats is important to arrest the atherosclerotic changes¹⁸ and improve physical fitness.¹⁹ More trials are needed to assess the effects of a high-fat versus a low-fat diet on rehabilitation outcomes.

OXIDATIVE DAMAGE AND ANTIOXIDANT-RICH FOODS

In recent studies, Black and Billette^{20,21} have shown that only 26% of Canadians consumed the minimum number of daily servings of fruits and vegetables, based on national dietary guidelines, and those who ate fewer fruits and vegetables were more likely to eat fast foods rich in refined grains and fat. Thus, it is likely that a large proportion of the patients seen by a physical therapist are not eating the recommended levels of fruits and vegetables. These are the most abundant sources of antioxidants, and they can counter the oxidative effects of high-fat diets associated with damage to the endothelial cells of the blood vessels. Evidence from large-cohort studies such as the Nurses' Health Studies has indicated that diets high in fruits and vegetables and low in fat and refined carbohydrates (including sugar), along with exercise, can decrease the risk of cardiovascular disease.²²

THE FUTURE OF REHABILITATION

Future studies need to specifically examine the effects of dietary patterns on rehabilitation outcomes in the body structures and functions as well as the activities and participation categories. There is a need for rehabilitation researchers to team up with nutrition researchers to design clinical trials that address the current knowledge gaps. A variety of clinical conditions such as cancer, multiple sclerosis, cardiovascular disease, and other metabolic disorders¹ have benefited from research aimed at understanding the impact of diet. This area of nutritional rehabilitation needs to receive more attention from both nutrition and rehabilitation researchers.

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Pourquoi les physiothérapeutes devraient-ils s'intéresser à l'alimentation de leurs patients?

Chetan P. Phadke

Les physiothérapeutes traitent leurs patients en adoptant une approche holistique qui tient compte de l'impact de l'exercice sur la personne entière. À l'inverse, la personne entière (y compris son régime alimentaire) peut avoir un impact considérable sur l'exercice. L'alimentation peut notamment augmenter le risque de développer des maladies chroniques telles que le diabète de type 2, l'hypertension et des maladies cardiovasculaires¹, et le fait d'être conscient des habitudes alimentaires sur les résultats d'un patient s'avère par conséquent un atout certain pour la pratique de la physiothérapie. Cette collaboration spéciale présente des exemples de changements vasculaires reliés à l'alimentation, traite de l'effet du diabète et de l'insulinorésistance et décrit les répercussions du stress oxydatif sur la fonction musculaire, tout cela dans le but de faire valoir l'importance pour les physiothérapeutes de prendre en considération les habitudes alimentaires de leurs patients.

LES CHANGEMENTS VASCULAIRES ASSOCIÉS À L'ALIMENTATION

Billinger² résume les études en indiquant que le déconditionnement musculaire peut mener à une diminution du débit sanguin dans les muscles, alors que pendant l'exercice, les besoins métaboliques nécessitent plutôt une augmentation de ce débit. Par ailleurs, tel que l'ont démontré Raper et coll.³, les facteurs qui favorisent l'augmentation du débit sanguin, comme l'activité physique², peuvent aussi venir accroître la tolérance à l'effort.

L'alimentation est un autre élément qui peut avoir un effet, positif ou négatif, sur la circulation sanguine dans les muscles. Par exemple, une étude fait état d'une augmentation de la vasodilatation microvasculaire dans les six heures suivant la consommation de deux verres de 500 ml de jus d'orange⁴, tandis qu'une autre recherche fait état de divers changements⁵, notamment une baisse de la pression artérielle diastolique et une augmentation de l'expression génique orientée vers un profil anti-inflammatoire et anti-athérogène, après la consommation d'un verre de jus d'orange par jour pendant 4 semaines⁴. Kapil et coll.⁶ signalent quant à eux que le jus de betterave, riche en nitrates alimentaires, réduit l'hypertension de façon considérable dans les 24 heures suivant son ingestion. La physiothérapie peut stimuler la neuroplasticité chez les patients ayant subi des traumatismes cérébraux ou médullaires, et les nitrates comme ceux que l'on retrouve dans le jus de betterave, tel que l'ont mis en évidence Presley et coll.⁷, peuvent augmenter la perfusion cérébrale et compléter ces changements neuroplastiques. Par conséquent, le régime alimentaire, par exemple la consommation d'un verre de jus d'orange ou de jus de betterave ou de légumes verts riches en nitrates⁶, peut avoir un effet significatif sur la circulation sanguine dans les muscles et le cerveau.

L'ABSORPTION DU GLUCOSE ET L'INSULINORÉSISTANCE

Pendant un effort aérobique, les besoins du corps en glucose sont principalement comblés par la concentra-

Affiliations : Spasticity Research Program, West Park Healthcare Centre; Department of Physical Therapy, University of Toronto; Graduate Program in Kinesiology and Health Science, Université York, Toronto.

Correspondance à : Chetan P. Phadke, West Park Healthcare Centre, 82 Buttonwood Ave., Toronto, ON M6M 2J5; chetan.phadke@westpark.org.

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