
FIS Medical Committee Educational Series

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Fit to Ski - Nutritional Concerns

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Performance Eating

Skiing and physical training can be both an aerobic and an anaerobic activity, and the fuel sources for both need to be adequately replaced. During gate training, skiers are required to go hard for bouts of 10-120 seconds. Depending on the drills, training sessions may last from 1-2 hours and be repeated twice a day. Training camps require similar demands and may last from 3 days to 2-3 weeks.

Energy Sources

The primary energy source for muscle and nerve cells while doing this type of anaerobic (fast, less than 2 minutes) work is glycogen. Glycogen comes from eating simple and complex carbohydrates (CHO), i.e. fruits, vegetables, grains, pasta, bread, and cereals. Simple and complex CHOs are classified by the number of sugar units present in their chemical structure. The five most common simple sugars are glucose, fructose, maltose, lactose, and sucrose. The four most common sources of complex CHOs are rice, wheat, corn, and potatoes.

Carbohydrate foods are given a "speed rating" (glycaemic index) of fast, moderate, or slow, depending on how quickly they affect blood sugar levels. Listed below are the "speed ratings" of a variety of foods, particularly simple and complex CHO sources. These are all compared to a glucose drink, which is set as a standard of 100%. Foods rated from 70-100 or more are considered "fast", from 50-69 are "moderate," and below 50 are "slow". Glucose, maltose, and foods derived from corn and potatoes give faster blood sugar responses than porridge, for example, as shown in the chart below.

How Foods Affect Performance

An awareness of the glycaemic index of carbohydrate (CHO) foods is important for athletes. The type of CHO eaten prior to or during exercise is of significance to athletes involved in snowsports, since eating fast CHOs as part of the pre-activity meal may cause a large shift in the blood sugar, which in turn can have a negative effect on skill development or performance, due to fatigue and inability to concentrate. Fast CHOs can go as far as doubling the resting blood sugar level within one hour of eating. This response triggers a compensation reaction, resulting in a drop in blood sugar to below the resting level within 1-3 hours after eating. This "rebound" effect can often occur just as play is starting or in the middle of a match.

FAST (speed rating)

100-110%	100%	90-99%	80-90%	70-79%
maltose	glucose**	carrots parsnips lucozade	Cornflakes potatoes (inst) honey Puffed Wheat	bread (whole meal) white bread millet white rice Weetabix potatoes (new) broad beans

MODERATE-SLOW (speed rating)

60-69%	50-59%	40-49%	30-39%	20-29%	10-19%
brown rice shredded wheat Ryvita Dig.biscuits raisins Mars bar Muesli shortbread	spaghetti (white) All Bran sweet potatoes yams sucrose sweet corn pastry	spaghetti (whole meal) porridge oats sponge cake custard tinned beans	butterbeans blackeye peas chick peas apple ice cream skim milk yogurt whole milk tomato soup	kidney beans lentils fructose sausages	soya beans peanuts bananas

Symptoms of rebound

- Headaches
- Lack of energy
- Inability to concentrate
- General irritability

Controlling the Blood Glucose Response

Unfortunately, situations occur in which slow CHO sources are not available or are not prepared in a suitable form. In this case, the effect of the fast CHOs can be reduced by eating raw, lightly cooked or unprocessed forms. For instance, a raw apple will have less risk than would applesauce. All fast CHOs should be taken with fiber-rich foods which assist in slowing the blood glucose response.

Essentially, the key for skiers is to choose meals and snacks as outlined below.

- Before and during activity - containing slow and moderate CHO
- After activity - a combination of fast and slow CHOs
- Pre-sleep snack - fast CHOs

Obviously, these symptoms are not conducive to skill development or performance. In the light of this information, it makes sense to recommend a pre-competition meal of slow CHOs, such as fresh fruits, vegetables, grains, cereals, breads, pasta, and beans, together with lean protein.

Replacing Glycogen Stores

Since glycogen stores take 24-48 hours to replenish, they must be replaced daily, using slow and moderate CHOs. To aid in glycogen storage, water should be consumed along with this CHO. It takes 3 grams of water to store 1 gram of glycogen.

It is best to replenish CHOs within 20-40 minutes following exercise, this way it takes only 12-16 hours to reload your muscles.

However, at this time there may be very little appetite or opportunity. Using a liquid CHO allows for glycogen replacement and also promotes hydration. Using a CHO supplement mixed with

water or skim milk immediately following strenuous activity will help replenish glycogen stores. This is particularly important in order to help prevent fatigue when traveling a long distance, and training and racing day after day especially at high altitude.

ABC's of Ski Nutrition

A proper diet and nutritional knowledge are essential elements of training that should not be ignored until the night prior to a competition. There are a few simple steps one can take to maximise nutritional preparation for ski training and competition. The following ABC's of meal planning have been adapted from guidelines specified by Sport Scientist Dr. Istvan Balyi.

Step A: Advance Planning

Planning for a balanced diet should be an ongoing and daily part of training. This way a routine is established which can be followed prior to heavy training sessions or competitions. All meals should include a good mix of protein and carbohydrates.

Roughly 1/3 of each meal plate should contain protein and the remaining 2/3 or more should be carbohydrate.

Protein helps to build muscle tissues and cells that may be damaged with exercise. Carbohydrates ensure adequate energy stores in the muscle tissue. Choose lean protein foods wherever possible and drink plenty of water. (Carrying a water bottle and using it will assist in this matter.)

In addition to ensuring the body stays hydrated, water helps to modify the appetite and may help the body metabolize stored fat. To ensure adequate hydration, it is also vital to avoid alcohol within 6 hours of strength or anaerobic training. Alcohol may cause hormonal changes that can inhibit the adaptive process, resulting in a loss of the effects of the training session. If you do use alcohol, be sure to drink twice the amount of water to promote hydration. If you crave the taste of alcohol, try de-alcoholised beer or wine. Ideally, stick to caffeine-free beverages, such as fruit juices or herbal teas.

A further advanced planning suggestion is to eat in the early evening and avoid overeating because it puts stress on the digestive system and may not allow for adequate relaxation and sleep.

MEAL A SUGGESTION (Pre-Race Dinner):

- skinless baked chicken, fish, or lean beef
- rice pilaf or pasta (light tomato/vegetable sauces)
- steamed vegetables
- fresh green salad
- whole wheat bread
- dessert: fresh fruit/oatmeal cookies
- beverages: skim milk, fruit juice, herbal tea

Step B: Breakfast before Activity

The pre-activity meal should be eaten at least 2-3 hours prior to training and should consist mainly of complex carbohydrates (e.g. hot or cold cereal, grains, breads, muffins, waffles, fresh fruits, and juices). Avoid high fat foods (e.g. bacon, eggs, sausage, fried foods). Eat foods high in fiber with a moderate-slow glycaemic index. Once again, include adequate fluid.

MEAL B SUGGESTION (Breakfast):

- 1-2 glasses fresh fruit juice
- Shredded wheat cereal with banana and skim milk
- Bran muffin
- Beverage: water, herbal tea, decaf coffee

Step C: Competition Food

Eat light, and ensure low fat carbohydrate choices from the slow-moderate groups. Avoid overeating. Drink water more frequently and in small quantities. Try to eat this meal 2-3 hours before your competition.

MEAL C SUGGESTION:

- Broth-based soups (chicken or vegetable)
- Crackers, bread, or rolls
- Beverage: water, skim milk, or fruit juice
- Whole wheat bread sandwich with chicken, roast beef or peanut butter and jelly
- Beverage: water

Step D: Replenishing Carbohydrates

Be sure to plan for post-competition or training replenishment of carbohydrates and fluid. This helps prepare the body for the next day's activities. Obviously, if training and racing day after day, you will need to maintain your consistent balanced diet.

MEAL D SUGGESTION:

- Pasta with tomato and meat sauce
- Fresh green salad
- Whole wheat bread or rolls
- Dessert: fresh fruit, homemade low fat cookies
- Beverage: water, fruit juices

Post Exercise Carbohydrate Supplement

(Approximately 50-70 grams CHO)

- 3 oz. cereal (raisin bran) + 1/2 cup skim milk + 1 banana
- 1 Cup Yogurt
- 1/2 Cup Raisins
- Medium sized potato
- Sports Drink or Bars containing 50-70 grams of CHO

Fit to Ski -Nutritional Tips

1. Start the day with complex carbohydrates like hot or cold cereal, oatmeal, oatbran or other. They are high in fiber and you can easily add protein with milk, yoghurt or soy milk.
2. Eat plenty of fruits and vegetables. Try for 5-6 servings per day (portion roughly the size of a tennis ball). They provide an excellent source of carbohydrate as well as antioxidants.
3. Eat lean protein from a variety of sources, but be sure to include a fish source several times per week. Beans and legumes are also a good source of daily protein. Make a salad out of my favorites - chick peas, red and white kidney beans, lentils and black beans.
4. Commit to establishing a regular habit of eating and drinking immediately after training or competing.

Top 10 Recovery Foods for Athletes

With Dallas Parsons, RD/Sport Dietitian

Food	Serving Size	Calories (kcal)	Carb (g)	Protein (g)	Fat (g)
1. 1% chocolate milk	2 cups	320	54	16	6
2. Low fat (1% M.F.) fruit yogurt	175g	150	26	6	2
3. Peanut butter & honey sandwich	1	430	73	13	14
4. Cinnamon raisin bagel	1 small (71g)	200	39	7	1.7
5. Sports Drinks (read label) (carbohydrates & electrolytes)	varies	varies	varies	0	0
6. High Carbohydrate Energy Bars (read label)	1 bar	varies	varies	varies	varies
7. Dried fruit bars (read label)	1 bar	varies	varies	varies	varies
8. Bananas	1 large (118g)	109	28	1.2	0.6
9. Low fat granola cereal (Go Lean)	$\frac{3}{4}$ cup (40g)	120	28	8	1
10. Meal replacement drink	1 can (227ml)	240	41	10	4

Sport Nutrition Supplements

In the competitive spirit of sport, it is inevitable that supplementation is often part of an athlete's training diet. Sport nutrition products can be used for convenience, to provide the body with fuel before, during and after training, but for the most part, nutrition should come from whole grains, fruits, vegetables, lean protein and low fat dairy. Under the existing regulatory environment, there is no way to accurately identify all of the constituents of every ingredient found in supplement preparations. Consequently there is no way to guarantee the safety and purity of these products. Talk to your sport dietitian before using nutritional supplements.

Product	Possible Uses	Comments
Sports bars	Before, during and after training	Should have carb to protein ratio of 4:1 and \leq 3g fat/100 cal
Protein bars	After training or as snack	Provide between 12-35g protein/bar; common protein sources are whey and soy
Sports drinks	Before, during and after training	Should have 4-8% carbohydrate solution and include sodium; may also have calcium and magnesium
Energy gels or fruit chews	Before, during and after training	Supply quick energy; electrolyte content varies
Protein powders	After training or part of a meal or snack, for weight gain, or travel	Check whether also supplies carbs; may be artificially sweetened
Meal replacement drinks	Before or after training	Quickly digested & provide fluids, good for a "nervous" stomach before competition
Vitamins and minerals	Daily	Individual requirements should be assessed by a dietician or physician

Tips for Nutrition When Traveling

Finding proper nutrition on the road can be difficult. Regardless of whether you are training or competing you need to consume high carbohydrate, low fat food to optimize performance. A little thought and planning will help ensure you get good nutrition away from home.

Domestic Travel

- Always pack your water bottle and use it
- Pack a high carbohydrate low fat nutrition basket for the road
- Supplement fast food meals with raw vegetables and fruits
- Avoid deep fried foods, cream sauces and gravy
- Remove visible fat, e.g. chicken skin
- Choose pizzas with thick crust and vegetable and fruit toppings
- Choose chicken, fish or hamburgers with vegetables and condiments. Avoid cheese, bacon or sauce toppings

Adapted from the SNAC Card "Checklist for the Traveling Athlete & Coach", produced by the Sport Nutrition Advisory Committee of the Sport Medicine and Science Council of Canada.

International Travel

- Always pack your water bottle and use or drink only bottled water
- Pack a high carbohydrate low fat nutrition basket for the road
- Pre-order your airline food (airlines often have various menus to choose from)
- Avoid washed uncooked vegetable and peeled and washed fruits especially in developing countries
- Purchase fruits that have skins you can peel off
- Wash vegetables in bottled water or cook them
- Avoid eating from roadside vendors

Sample High Carbohydrate Low Fat Snacks (no refrigeration necessary)

- Whole grain breads, muffins and cereals
- Hot cereals like porridge (just add boiling water)
- Rice cakes and breads
- Bagels, pita breads, raisin breads
- Tuna or salmon in water
- Jams and jellies
- Juice packs
- Fresh fruits and vegetables; also dried fruits (raisins, cranberries, apricots)
- Plain cookies like digestives or graham crackers

Two months before heading off for training take a detailed look at your diet. Does it provide the vitamins, minerals, proteins, fat and carbohydrates that your body needs to perform? Follow Canada's Food Guide to Healthy Eating or the USDA's food pyramid by consuming a variety of foods each day. It's also recommended that you should talk to a dietitian.

Canada Food Guide - www.hc-sc.gc.ca/fn-an/food-guide-aliment/index_e.html

USDA – Food Pyramid www.mypyramid.gov

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