

運動營養教育系列手冊
SPORT NUTRITION
EDUCATION SERIES IX

運動恢復營養學
Recovery Nutrition



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引言

你可能是一名在一天有多場賽時的乒乓球球員或是一名在連續數天有數項預賽的泳手或是一名在連續兩天均有全天比賽的劍擊運動員。你所的關注是：如何保持體力作賽？

運動恢復營養學的重點

運動後的恢復對於補給肝醣、肌醣及補充汗液中流失的水分與電解質是尤其重要。即時攝取碳水化合物有助肝醣的重組，特別是高血糖指數的碳水化合物食物(見表一)。對於一名只有少於8小時休息而再要進行大量運動的運動員而言，盡快恢復肌醣儲備尤其重要。

加速恢復的因素

1. 低量肌醣儲備 — 餘下的儲備愈少，恢復的速度愈快。
2. 即時攝取碳水化合物 — 運動後30分鐘內攝取每公斤體重 1.5克的碳水化合物 (你的體重：_____公斤
 $\times 1.5 =$ _____ 克碳水化合物)
然後在24小時內共攝取每公斤體重7-10克碳水化合物。(你的體重：_____公斤
 $\times 10 =$ _____ 克碳水化合物)
3. 高血糖指數的碳水化合物食物(高血糖指數飲食示例見表二)可加速恢復。
4. 足夠的水份與電解質補充。



Introduction

You may be a table tennis player who has a few matches on the same day, or a swimmer who has a few heats in consecutive days, or a fencer who has whole day competition for two days. Your concern is: How can I stay energized for my events?

The Key to Recovery Nutrition

Recovery after exercise is important in restoring liver and muscle glycogen and replacing fluid and electrolytes lost in sweat. Rapid resynthesis of muscle glycogen stores is aided by the immediate intake of carbohydrate (CHO) and particularly with CHO-rich foods of high Glycemic Index (GI) (see table 1). Rapid refuelling is especially important to those athletes who have less than eight hours rest between strenuous sessions.

Factors which enhance the rate of recovery

1. Depleted muscle glycogen stores — the lower the stores the faster the rate of recovery.
2. Immediate CHO intake 1.5 g CHO/ kg body weight within 30 minutes after exercise (Your body weight: ___ kg x 1.5 = ___ g CHO).
7-10 g CHO/kg body weight per 24 hrs (Your body weight: ___ kg x 10 = ___ g CHO).
3. CHO-rich foods with high GI (see Table 2 for example of a high GI diet) promote recovery.
4. Adequate fluid and electrolyte intake.



減慢恢復的因素



1. 肌肉創傷。
2. 運動後遲了進食碳水化合物。
3. 碳水化合物進食量不足。
4. 主要進食了低血糖指數的碳水化合物食物。
5. 恢復期間進行高強度運動。
6. 水份與電解質攝取量不足。

碳水化合物

進食碳水化合物的方式，例如：少吃多餐或正常三餐，並不是最重要，關鍵是必需達到碳水化合物的每天總需要量。可是少吃多餐比只吃兩大餐在生理上是較為易接受。蛋白質及其它營養素例如：維他命及礦物質也對恢復過程十分重要，例如：修補與重組程序、免疫反應。即時補充有助促進這些活動。

運動後補充碳水化合物的其它建議

1. 當碳水化合物需要提高，但胃口差時，可用高濃度碳水化合物，
 - i. 低纖維碳水化合物，例如：白麵包、飯、含豐富碳水化合物的代餐產品
 - ii. 高糖份食物，例如：果汁、甜的飲品、水果
 - iii. 運動補充劑，例如：能量棒、糖漿。
2. 低血糖指數碳水化合物食物，例如：意粉及河粉對於醣原的迅速恢復並不適合，所以在恢復飲食中不能是以此為主要碳水化合物的來源。
3. 即使腸胃不適而令飲食不能滿足熱量需要時，亦不可依賴進食高脂高蛋白質食物而疏忽了碳水化合物食物。應優先攝取高碳水化合物食物。

Factors which slow the rate of recovery

1. Damage to the muscle.
2. Delayed CHO intake after exercise.
3. Inadequate amounts of CHO.
4. Reliance on CHO-rich foods with low GI.
5. High intensity exercise during recovery.
6. Inadequate fluid and electrolyte intake.

Carbohydrates

It is not as important whether the CHO is eaten as small frequent meals or as three main meals over the day, provided that the total daily requirement of CHO is met. However, it is physiologically more comfortable to eat smaller meals throughout the day than eating two big meals. Protein and other nutrients like vitamins and minerals are important in the recovery process, e.g. in repairing and rebuilding activities and immune responses. An immediate intake may be useful in promoting these activities.

Other guidelines for promoting post-exercise CHO refuelling

1. When CHO needs are high, and appetite is suppressed focus on compact forms of CHO,
 - i. low fibre forms of CHO foods such as white bread, rice, commercial meal supplements rich in carbohydrates
 - ii. sugar-rich foods such as juice, sweetened beverages, fruits
 - iii. sports supplement such as energy bars, CHO gels.
2. Low GI CHO foods such as spaghetti and rice noodles may be less suitable for speedy glycogen recovery and should not be the principal CHO source in recovery meals.
3. Even when gastric discomfort limits total food intake, high fat foods and excessive amounts of protein foods should not be consumed at the expense of CHO foods. Focus on high CHO foods first.

以下各食物提供約50克碳水化合物。在大量訓練後可吃一至三份，在兩小時後重覆這程序直至重新開始正常飲食規律來確保迅速恢復。

運動飲品650-800毫升

甜的飲品800毫升

果汁500毫升

香蕉(中型)1 1/2隻

中型水果3個

果占三文治(厚切)1份

能量棒1條

白飯1碗(中號)



水份與電解質

正確的補充水份應當在運動後的短時間內(2小時內)補充汗液失去的物質。補充汗液失去的鈉質對於保存攝入的水份十分重要。理想的水份補充需要50-90mmol/L(1.15-2.07g/L)的鈉含量，但一般運動飲品的鈉含量只屬中等，約10-25 mmol/L(230-575mg/L)，因需顧及廣泛使用性及味道。鈉的需要能從加進食鹽或含鹽份的食物中得以攝取足夠。含酒精的飲品不是理想的水份補充飲品因它們會加速水份的流失。由於運動員在運動後會繼續從汗液、小便失去水份，所以需要攝取150%失去的水份以達到完整的水份補充。

在運動後飲用大量清水會稀釋血內的物質，影響血容量的恢復。為保持血濃度在健康水平，身體會自動關掉口渴的感應以停止運動員喝水及同時製造小便來減低血液的稀釋程度。結果是即使運動員脫水也製造大量小便。如果在補充飲品中加鈉，血容量及濃度都得到較佳的復原，身體亦毋須製造過量的小便。

Each of the following provides approximately 50 g of CHO. Eat one to three of these portions to ensure fast recovery after a heavy exercise session and repeat this pattern after two hours or until normal eating patterns have been resumed.

650- 800 ml of sports drink

800 ml of sweetened drinks

500 ml of fruit juice

1 1/2 banana (medium)

3 medium pieces of fruits

1 jam sandwich made with two thick slices of bread and plenty of jam

1 energy bar

1 bowl (regular) rice



Fluid and Electrolytes

Proper rehydration requires a replacement of sweat losses in the acute phase (2 hrs) of recovery. Replacement of sodium lost in sweat is important in maximizing the retention of ingested fluids. A sodium content of 50-90 mmol/L (1.15-2.07g/L) may be necessary for optimal rehydration, however, most commercial sports drinks are formulated with a more modest sodium content, about 10-25 mmol/L (230-575mg/L), to allow greater overall usage and palatability. However, sodium requirement can be met via salt added or eaten with meals and snacks. Alcoholic beverages are not ideal rehydration fluids because they promote diuresis. The athlete will continue to lose fluid, by urination and sweat after exercise, therefore, it is necessary to consume 150% of fluid losses to allow for complete fluid restoration.

Consuming large amounts of plain water after exercise causes dilution of blood content that interferes with the restoration of the entire blood volume. In order to preserve blood concentrations within healthy limits, the body shuts off the thirst mechanism to stop the athlete from drinking, and at the same time produces urine to reduce the dilution. As a result, the athlete produces large amounts of dilute urine despite being dehydrated. By adding sodium in the rehydration fluids, blood volume and concentration can be restored better without the need for excessive urine production.

運動後促進補充水份的指引

1. 遵照計劃補充水份而非只依賴口渴的感覺。監督運動前後的體重變化來評估運動中補充水份的方法及運動後需要補充水份的份量。基本上每失去一公斤便等如失去一公升水份，即是需補充1½公升飲料來達到水平衡。

運動前的體重_____公斤

運動後的體重_____公斤

體重差異+/-_____公斤

所需水份補充_____公升

2. 緊記運動員在恢復期間仍會繼續從小便及汗液流失水份，所以這些流失也需被填補。運動後的兩小時內需補充在相等於150%體重差異的水份來達到水平衡，所以要確保有足夠口感佳的飲品。

3. 水份需要增加時，選甜的飲品而非清水，因大多數人喜歡飲甜味的飲品，這樣可增加水份攝取量。保持飲品在一個清涼的溫度也可增加攝取量。清涼的飲品(例如：攝氏10-15度)在大部份情況下均為人受落。凍的飲品(例如：攝氏0-5度)於熱環境或對熱的運動員在心理上有助，但其吸收比清涼的飲品慢。含碳水化合物的飲品亦對於肌糖的恢復有幫助。

4. 緊記還需要補充失去的鈉(例如：用運動飲品)以保存攝入的水份及減少小便的流失。



Guidelines for promoting post-exercise rehydration

1. Drink according to a rehydration plan rather than relying on thirst. Monitor changes in body weight from pre to post exercise to evaluate drinking strategies during exercise and the fluid deficit that must be replaced after exercise. Basically, a loss of 1 kg in weight = 1L fluid deficit and 1.5L fluid will be needed to reach fluid balance.



Pre-exercise body weight _____ kg
Post-exercise body weight _____ kg
Difference in body weight +/- _____ kg
Fluid replacement needed _____ L

2. Remember that an athlete will continue to lose fluid during recovery via urine losses and ongoing sweating and that these losses must also be replaced. Typically a volume equal to 150% of post exercise weight loss will need to be consumed over the subsequent two hours to fully restore fluid balance. Therefore, an athlete must ensure that an adequate supply of palatable drinks is available.
3. Try a sweetened drink rather than plain water when fluid needs are increased because most people prefer sweet-tasting drinks. Keep drinks at a cool temperature to encourage intake because cool drinks (e.g. 10-15°C) are preferred in most situations. Very cold fluids (e.g. 0-5°C) may seem psychologically pleasing when the environment or the athlete is hot; however, it is absorbed more slowly than cool drinks. CHO containing drinks are also useful in assisting with muscle glycogen recovery.
4. Be sure to replace sodium losses to help maximize the retention of ingested fluids and minimize urine losses, e.g. sports drinks.

5. 含酒精的飲品均不是理想的恢復飲品因為它們加速排出小便。
6. 若有肌肉創傷或有傷患應避免在運動後的24-36小時內飲用酒精飲品。酒精加速血管膨脹從而影響恢復及修補的過程。酒精引起的血管膨脹或會增加在寒冷環境(例如：冬季運動)中的熱力流失。運動員需多加留意在這情況下保暖。酒精飲品並非理想的補充飲品，更不是主要的碳水化合物來源。有關資料，請參看運動營養教育系VIII“酒精一對運動表現的影響”。
7. 避免運動後再作加速流汗的活動，例如：熱浴、桑拿浴、陽光。
8. 有關補充水份的其它資料，可參看運動營養教育系列手冊IV“生命之泉—水”。

常見問題

問：我太累了，不能預備食物。

答：你可以出外吃飯或預先準備適當的食物或使用即食的食物。

問：我太忙。

答：你可以吃自助餐，因多款食物早已準備好。

問：我不能找到適合的食物。

答：你可以自攜食物到場地或請隊長預備運動員所需的食物。

問：我沒胃口進食。

答：你可以在運動後先選吃小點或高能量飲品而非立刻吃正餐。在運動後，清涼的食物常較吸引。



5. Alcoholic beverages are not ideal rehydration beverages since they increase urine losses.
6. Avoid alcohol 24-36 hours after exercise that results in muscle damage or injury. Alcohol promotes vasodilation and may impair recovery and repair processes. The vasodilation caused by alcohol may increase heat loss in cold environment (e.g. in winter sports). Take care to stay warm in such environment. Alcoholic drinks are not ideal rehydration beverages. Nor do they provide a significant source of CHO. For more information, please refer to Sport Nutrition Education Series VIII "Alcohol-Effects on Sports Performance".
7. Avoid engaging in post-exercise activities that exacerbate sweat losses, e.g. long exposure to hot spas, saunas or the sun.
8. For other information on rehydration, please refer to Sport Nutrition Education Series IV "Water -The Fountain of Life".

Frequently Asked Questions



Q: I'm too tired to prepare meals.

A: You may eat out or make foods that are easy to prepare or use ready to eat foods.

Q: I'm too busy.

A: You may go to buffet style restaurants where a variety of foods are available quickly.

Q: I have poor access to suitable foods.

A: You may bring your own food to the venue, or ask the team manager to organize foods for athletes.

Q: I don't have an appetite.

A: You may choose small snacks rather than meals immediately after exercise, or take high-energy drinks which are easily consumed. Foods that are cool may be more appealing after exercise.

**表一：不同食物的血糖指數
高血糖指數食物**

食物	份量	血糖指數	碳水化合物(克)
白麵包	1片(35克)	80	17
麥胚片	3/4杯	74	24
玉米片	1杯(30克)	84	26
卜卜米麥片	1杯(30克)	82	27
白飯	1杯(180克)	109	39
梳打餅	3塊	74	17
啫喱豆糖果	5粒(10克)	80	9
焗薯	1隻(120克)	93	15
西瓜	1杯	72	8
新鮮菠蘿	2片	66	10
運動飲品	1杯	78	15



中血糖指數食物

食物	份量	血糖指數	碳水化合物(克)
天使蛋糕	1件(30克)	67	17
香蕉	1隻(中)	55	32
茄汁焗豆	1/2杯	48	21
消化餅	2件	59	21
中東包	1塊	57	38
全麥麵包	1片	69	14
Nutri-grain麥片	1杯	66	20
牛油蛋糕	1件(60克)	46	32
紅蘿蔔 (去皮·滾熟)	1/2杯	49	3
牛角包	1個	67	27
雪糕	50克	61	10
奇異果	1個	52	8
芒果	1個	55	19
橙汁	1杯	46	21
士多啤梨果占	1湯匙	51	18
青葡萄	1杯	46	15
蜜糖	1湯匙	58	16
葡萄乾	1/4杯	64	28
米粉(熟)	1杯	58	58
砂糖	1茶匙	65	5
粟米粒	1/2杯	55	18



Table 1: GI of Different Foods
Foods with High GI

Food	Serving size	GI	CHO (g)
White bread	1 slice (35 g)	80	17
Bran flakes	3/4 cup	74	24
Corn flakes	1 cup (30 g)	84	26
Rice krispies	1 cup (30 g)	82	27
Rice (long grain, steamed)	1 cup (180 g)	109	39
Premium soda crackers	3 biscuits	74	17
Jelly beans	5 pieces (10 g)	80	9
Potatoes (baked)	1 (120 g)	93	15
Watermelon	1 cup	72	8
Pineapple (fresh)	2 slices	66	10
Sports drink	1 cup	78	15

Foods with Moderate GI

Food	Serving size	GI	CHO (g)
Angel food cake	1 slice (30 g)	67	17
Banana	1 (medium)	55	32
Baked beans in tomato sauce	1/2 cup	48	21
Digestives biscuits	2 biscuits	59	21
Pita bread	1 piece	57	38
Wholemeal bread	1 slice	69	14
Nutri-grain cereal	1 cup	66	20
Sponge cake	1 slice (60 g)	46	32
Carrots (peeled, boiled)	1/2 cup	49	3
Croissant	1	67	27
Ice cream	50 g	61	10
Kiwi fruit	1	52	8
Mango	1	55	19
Orange juice	1 cup	46	21
Strawberry jam	1 tbsp	51	18
Grapes (green)	1 cup	46	15
Honey	1 tbsp	58	16
Raisins	1/4 cup	64	28
Rice vermicelli (cooked)	1 cup	58	58
Sugar	1 tsp	65	5
Sweet corn	1/2 cup	55	18

低血糖指數食物

食物	份量	血糖指數	碳水化合物(克)
蘋果汁(沒加糖)	1杯	40	33
杏脯乾	5-6粒(30克)	31	13
全麥維	1/2杯	42	22
蘋果	1個(中)	38	18
櫻桃	20粒	22	10
西柚	1/2個(中)	25	5
橙	1個(中)	44	10
梨	1個(中)	38	21
脫脂奶	1杯	32	13
意粉(熟)	1杯	41	56
花生(烘·加鹽)	1/2杯	14	11
河粉(新鮮)	1杯	40	44
低脂士多啤梨 乳酪	200克	28	33
去核西梅乾	6粒(40克)	29	25
白朱古力	29克	42	18

高血糖指數飲食示例

(含2500卡路里及390克碳水化合物，適合55公斤的運動員在恢復期使用。)

早餐

果占白麵包	2片
運動飲品	500毫升

午餐

燒牛肉三文治 (白麵包做)	1份
薯仔沙律	1杯
鮮榨橙汁	12安士

小食

梳打餅	8片
葡萄	1杯
運動飲品	500毫升



晚餐

白飯	2杯
燒雞腿	1隻
粟米粒紅蘿蔔	1杯
西瓜	2杯

切記碳水化合物、水份、
電解質是恢復的重點。

Foods with Low GI

Food	Serving size	GI	CHO (g)
Apple juice (unsweetened)	1 cup	40	33
Dried apricots	5-6 pieces (30 g)	31	13
All bran cereal	1/2 cup	42	22
Apple	1 (medium)	38	18
Cherries	20	22	10
Grapefruit	1/2 medium	25	5
Orange	1 medium	44	10
Pear	1 medium	38	21
Skim milk	1 cup	32	13
Spaghetti (cooked)	1 cup	41	56
Peanuts (roasted, salted)	1/2 cup	14	11
Rice noodles (fresh)	1 cup	40	44
Yogurt (extra-low fat strawberry)	200 g	28	33
Dried prunes (pitted)	6 pieces (40 g)	29	25
Plain white chocolate	29 g	42	18

Table 2. Example of a High GI Diet

(It contains 2500 kcal and 390 g CHO, suitable for a 55 kg athlete for recovery.)

Breakfast

White bread with Jam	2 pieces
Sports drink	500 ml

Lunch

Roast Beef Sandwich made with white bread	1 portion
Potato salad	1 cup
Fresh orange juice	12 oz

Snack

Soda crackers	8 pieces
Grapes	1 cup
Sports drink	500 ml

Dinner

Rice, cooked	2 cups
Roast chicken leg	1 piece
Sweet corn and carrot	1 cup
Watermelon	2 cups



Remember Carbohydrates, Fluid, Electrolytes are the keys to recovery.



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歡迎轉載以上資料，惟事先須得本局許可；轉載時亦需鳴謝本局。

**如有查詢，請致電 26816277 與
運動科學部聯絡。**

The above information is provided by the Sport Nutrition Unit of the Elite Training and Sports Development Group. All information is for reference only.

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