Migraine, Stress and Peanut M&Ms
Diagnosis of Migraine
# Diagnosis of Migraine

## Symptoms associated with your headaches

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually one-sided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate or severe pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Throbbing pain</td>
<td></td>
<td></td>
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<tr>
<td>Pain aggravated by routine activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aversion to light or sound</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*If you checked 3 or more of the YES boxes, you have several of the diagnostic criteria for migraine. You should talk to your doctor about diagnosing and treating your headaches.*
Migraine and Stress

Migraine is an inherited disorder occurring in people who have both an undue tendency to seek stress and at the same time a deficiency in their physiological adaptation to stress.

John R. Graham (1952)
Migraine and Stress

Background...

- Stress is the #1 “cause” of migraine
  - Graham, 1952
  - Henryk-Gutt and Rees, 1973
  - Levor et al, 1986
  - Amery and Vandenberg, 1987
  - Kohler and Haimerl, 1990
  - Holm et al., 1996
  - Wacogne et al, 2003
Stress

Definition...

And you thought there was stress in *your* life!

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Stress

Definition...

- a specific adaptive and defensive physiological reaction by the sympathetic nervous system (SNS) to a wide variety of physiological and/or psychological stimuli.
Migraine and Stress

Background...

- Numerous formal studies have shown that subjective ratings of stress are significantly higher in migraineurs than in age-matched controls.
Stress, anxiety and depression measures were obtained in a sample of migraineurs (n = 141) and a control group (n = 109). Stress and anxiety measures were higher in the migraine group than in the control group. The highest scores of migraineurs were reported for 'morning fatigue', 'intrusive thoughts about work', 'feeling under pressure', 'impatience' and 'irritability'.
In one study, between 50% and 70% of migraineurs showed significant, substantial and meaningful temporal correlations between their daily stress and their daily migraine activity.
Migraine and Stress

Key question…

Why?
Migraine and Stress

*Current answer...*
Migraine and Stress

Nonetheless...

- Stress management is required to manage migraine optimally
Stress Treatment Options

However...

- stress management may be one of the most difficult tasks in medicine

- disappointingly little effort has been devoted to stress management in migraine
Stress Treatment Options

*Non-pharmacological approaches…*

- Relaxation
- Exercise
- Meditation
- Biofeedback
Stress Treatment Options
Stress Treatment Options

Raskin, 1988...

- periods of exhilaration can induce a dramatic remission of headache disorders
Stress Treatment Options

Raskin, 1988...

- periods of exhilaration can induce a dramatic remission of headache disorders
- “falling in love is by far the most common circumstance”
Final Treatment Option

ANTI-STRESS KIT

1. PLACE ON A FIRM SURFACE
2. FOLLOW DIRECTIONS IN CIRCLE
3. REPEAT UNTIL YOU ARE UNSTRESSED OR BECOME UNCONSCIOUS

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Migraine and Stress:

Practical Applications
The Biology of Stress

A practical clinical example...

- The most likely time to experience an acute attack is in the morning
Migraine frequency is highest in the morning

(Adapted from Solomon, *Cephalalgia* 11:178-180, 1991; Solomon, 1992)

<table>
<thead>
<tr>
<th>Time of the Day</th>
<th>Number of Migraine Attacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN-2</td>
<td>0</td>
</tr>
<tr>
<td>2-4</td>
<td>5</td>
</tr>
<tr>
<td>4-6</td>
<td>10</td>
</tr>
<tr>
<td>6-8</td>
<td>20</td>
</tr>
<tr>
<td>8-10</td>
<td>35</td>
</tr>
<tr>
<td>10-noon</td>
<td>40</td>
</tr>
<tr>
<td>noon-2</td>
<td>35</td>
</tr>
<tr>
<td>2-4</td>
<td>20</td>
</tr>
<tr>
<td>4-6</td>
<td>15</td>
</tr>
<tr>
<td>6-8</td>
<td>10</td>
</tr>
<tr>
<td>8-10</td>
<td>5</td>
</tr>
<tr>
<td>10-MN</td>
<td>0</td>
</tr>
</tbody>
</table>
Morning Stress

Physiology...

- Mental stress due to awakening
- Physiological stress (e.g. orthostatic changes)
- Overnight fast
- Bright light
- Increased auditory stimulation
Morning Stress

Physiology...

- Getting ready for work
Morning Stress

Physiology...

- Getting ready for work
- Getting to work
Morning Stress

Physiology...

- Getting ready for work
- Getting to work
- Work
The Biology of Stress

A practical clinical example...

- The most likely time to experience an acute attack is in the morning
- The second most common time is late in the afternoon
Migraine frequency is highest in the morning
(Adapted from Solomon, *Cephalalgia* 11:178-180, 1991; Solomon, 1992)
Food for Thought:
Diet and migraine
A long recognized problem

- Dietary factors have often been implicated in migraine

- However, “elimination diets” in which certain “trigger” foods are avoided have not been found to be very useful in the management of migraine
Elimination Diets Have Failed
67% of migraines occur after 5 hours of “fasting”

“Missing a meal” is one of the most common reasons cited as an cause of migraine (by approximately 50% of patients)
A 25 hour religious fast in Israel induced a headache in:

- 66% of headache sufferers
- 29% of non-headache sufferers (p<0.000002)

Only 7% of non-fasters developed a headache during this same time period (p < 0.000001)
Yom Kippur Headache


A direct relationship exists between the duration of the fast and headache frequency.
Brain Nutrition Background

Key facts

- The brain is 2.5% of a human’s body weight but uses 25% or more of daily energy.
- The brain is 100% dependent on glucose for its energy needs (requiring 4-5 g glucose/hour).
- Dietary carbohydrates are the primary source of glucose and can be stored as glycogen in the liver.
Nutrition Background Information

Average daily energy needs
(2000 calorie total)

Muscle
50%

Brain
25%
(glucose only)

Other
25%

The brain requires ~100-120 g glucose per day
Carbohydrates are the most powerful ingested “drugs” that affect human brain function, yet they are rarely “dosed” properly in the modern diet.
The supply of glucose for the brain…

- **serum glucose** (2 hours; ~20 g)
- **liver glycogen** (2 -12 hours; max = ~100 g)
- **gluconeogenesis** (glucose production from fat and protein stores)
  - requires activation of the sympathetic nervous system (i.e., a “stress response”)

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### The biology of eating

Energy stores of a 155 pound human

<table>
<thead>
<tr>
<th>Supply</th>
<th>Grams</th>
<th>Calories</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbohydrate</td>
<td>400</td>
<td>1,600</td>
<td>0.8 days</td>
</tr>
<tr>
<td>protein</td>
<td>6,000</td>
<td>24,000</td>
<td>12 days</td>
</tr>
<tr>
<td>fat</td>
<td>12,250</td>
<td>110,000</td>
<td>55 days</td>
</tr>
</tbody>
</table>
The act of eating, although necessary for the provision of energy, is a particularly disruptive event in a homeostatic sense.
The biology of eating

SNS activation
norepinephrine release
thermogenesis

% change in serum glucose

Hours after carbohydrate ingestion

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Migraine and Diet

Therefore…

- “Fasting” for more than a few hours can lead to activation of sympathetic nervous system (SNS) (i.e., a “stress response”)
- Rapid changes in serum glucose also lead to an immediate activation of the SNS
- Activation of the SNS is a physiological “stress” than can trigger and/or worsen a migraine attack
Therefore…

how can a dietary program be developed that minimizes “dietary stress”?

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The Glycemic Index

“the most fascinating and promising area in nutrition research today”

Simon Liu
Nutritional epidemiologist
Harvard Medical School
Science News Online
April 8, 2000
A quantitative measure of the serum glucose increase caused by the ingestion of carbohydrates, based upon the area under the serum glucose curve following ingestion of a standard meal (usually 50 g glucose).

The higher the GI of a food, the higher will be the serum glucose changes.
Glycemic Index Patterns

Changes in serum glucose following isocaloric carbohydrate ingestions

% change in serum glucose

Time of the day

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Serum glucose levels following a 40 g carbohydrate ingestion ($n = 3$)

Time after ingestion (mins)
Serum glucose levels following a 40 g carbohydrate ingestion (n = 3)

- Glucose 40 g (GI = 100), calories = 160
- Peanut M&Ms (GI = 32), calories = 340
The Glycemic Index

Carbohydrates release their glucose at very different rates based on a variety of factors:

- fructose vs. glucose
- amylose vs. amylopectin
- fiber
- particle size
- food processing
- acidity
- fat
The Glycemic Index

- **High GI foods (i.e. > 75)**
  - glucose
  - donuts
  - waffles
  - breakfast bars
  - corn flakes
  - pretzels
  - potatoes
  - rice

- **Low GI foods (i.e. < 50)**
  - fructose
  - oatmeal
  - yogurt
  - milk
  - many fruits
  - pasta
  - sponge cake
  - Peanut M&Ms

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Dietary recommendations

- Individuals with frequent migraine should not go more than 4-5 hours without eating while awake.

- Moreover, the content of the food eaten must be considered since it can have a significant effect on SNS activity.
Dietary recommendations

- Avoid the glucose-insulin-adrenaline roller coaster by proper carbohydrate dosing!

- Three dosing factors must be considered:
  - the chemical composition of the food (i.e., amount or “dose” of carbohydrate)
  - the physiological effect of the food (i.e., the GI value)
  - the timing of the food ingestion (i.e., the frequency of a given dose)
Dietary recommendations

Daily Guidelines

- Eat a breakfast containing a 4-5 hour dose of carbohydrate soon after awakening
- Identify and use snacks that provide a 2-4 hour dose of carbohydrate as “bridges” between meals
- Always have a bedtime snack with the proper carbohydrate dose
Possible migraine snacks
Possible migraine snacks

A novel slow release “drug” delivery system…
Possible migraine snacks

- Peanut M&Ms (24 pieces)
  - GI = 32 (i.e., ~10 g carbohydrate per hour)
  - Calories = 250 (30 g carb; 5 g protein; 13 g fat)
Recommended migraine snacks

- Yogurt (with fruit)
  - GI = 33 (i.e., ~ 14 g carbohydrate per hour)
  - Calories = 210 (40 g carb; 9 g protein; 2 g fat)

- Sourdough bread (one slice)
  - GI = 52 (i.e., ~ 13 g carbohydrate per hour)
  - Calories = 110 (25 g carb; 4 g protein; 0 g fat)
Recommended migraine snacks

- **Banana (one medium)**
  - GI = 55 (i.e., ~ 14 g carbohydrate per hour)
  - Calories = 105 (27 g carb; 1 g protein; 1 g fat)

- **Apple (one)**
  - GI = 38 (i.e., ~ 8 g carbohydrate per hour)
  - Calories = 80 (21 g carb; 0 g protein; 0 g fat)
Proper “dosing” of carbohydrates can eliminate a common physiological “stress” associated with the induction of headache.
Conclusions

- Formal studies are needed to confirm the hypothesis that proper “dosing” of carbohydrates can reduce headache frequency
“An apple a day keeps the doctor away”

Cultural myth
or
scientific fact?