CLASP Lecture – Fall 2018

The Symbiotic Relationship Between Exercise and Nutrition for Health

Changing Paradigms in our Understanding of Nutrition and Exercise

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Rene Descartes (1596 - 1650)

“Never accept anything as true unless recognized evidently as such. Carefully avoid prejudgment, and include nothing in conclusions unless it presented itself so clearly and distinctly that there is no doubt.”

Karl Popper (1902 – 1994)

“No theory ever solves all the puzzles with which it is confronted at a given time; nor are the solutions already achieved often perfect. On the contrary, it is just the incompleteness and imperfection of the existing data-theory fit that, at any given time, define many of the puzzles that characterize normal science.”
Exercise Devices (1970-1980’s)

“This device not only helps to develop muscles but also improves blood circulation. The high-frequency vibrating wave can efficiently target areas with excess fat. Two-way massaging belts can cover two body areas at once or allow two users to exercise at the same time. With a patented 5-speed system, it meets the requirements of all ages to choose either the massaging or body slimming effect.”
Dynamic Nature of Knowledge

- Muscle Contraction from the 1930s – 1940s
- Myostatin
- Blood Flow Occlusion Training
- Dietary and Exercise Recommendations for health


Accumulation Theory of Science

Figure 5.5 – Accumulation theory of science. Although not completely accurate it somewhat reflects the structure of the introduction section of a paper.

Theory – It doesn’t matter how much I eat as long as I exercise hard.

Theory: An adipocyte (fat cell) is just a storage contain for lipid droplets

Table.
Major Molecules Released by Adipocytes or Adipose Tissue Macrophages

<table>
<thead>
<tr>
<th>Adipokine(s)</th>
<th>Site of Action</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leptin</td>
<td>Hypothalamus</td>
<td>Represses hunger, increases energy metabolism</td>
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<tr>
<td></td>
<td>Immune system</td>
<td>Keeps immune system up-regulated</td>
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<td></td>
<td>Cardiovascular system</td>
<td>Anti-inflammatory effect</td>
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<td></td>
<td>Endocrine system</td>
<td>Regulates puberty and reproduction</td>
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<td></td>
<td>Skeletal muscle</td>
<td>Improves insulin sensitivity</td>
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<tr>
<td>Adiponectin</td>
<td>Immune system</td>
<td>Decreases release of inflammatory molecules</td>
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<tr>
<td></td>
<td>Skeletal muscle</td>
<td>Increases fatty acid oxidation, glucose uptake, and lactate production</td>
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<tr>
<td></td>
<td>Liver</td>
<td>Reduces levels of molecules involved in gluconeogenesis, increases free fatty acid metabolism</td>
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<tr>
<td></td>
<td>Cardiovascular system</td>
<td>Antiatherosclerotic effect</td>
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<tr>
<td>Resistin</td>
<td>Immune system</td>
<td>Stimulates inflammation</td>
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<tr>
<td></td>
<td>Cardiovascular system</td>
<td>Impairs vascular relaxation</td>
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<tr>
<td>Retinol-binding protein 4</td>
<td>Plasma</td>
<td>Transports vitamin A</td>
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<tr>
<td></td>
<td>Skeletal muscle</td>
<td>Impairs insulin signaling</td>
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<tr>
<td>Tumor necrosis factor alpha (TNF-α)</td>
<td>Skeletal muscle</td>
<td>Impairs insulin signaling</td>
</tr>
<tr>
<td>Visfatin</td>
<td>Skeletal muscle</td>
<td>Binds to insulin receptors and mimics insulin</td>
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<tr>
<td></td>
<td>Immune system</td>
<td>Causes release of TNF-α and interleukins (inflammatory signals)</td>
</tr>
<tr>
<td>Interleukin 6</td>
<td>Skeletal muscle</td>
<td>Impairs insulin signaling</td>
</tr>
<tr>
<td>Angiotensinogen and angiotensin II</td>
<td>Vascular system</td>
<td>induces smooth muscle cell contraction and raises blood pressure</td>
</tr>
<tr>
<td></td>
<td>Adipose tissue</td>
<td>Pro-inflammatory effect</td>
</tr>
<tr>
<td>Free fatty acids</td>
<td>Skeletal muscle</td>
<td>Promotes insulin resistance</td>
</tr>
<tr>
<td></td>
<td>Liver</td>
<td>Promotes insulin resistance</td>
</tr>
</tbody>
</table>

Adipocytes and other cells within fat tissue release molecules that work locally or are transported throughout the body.

Theory: The Food Guide Pyramid

The heart disease – lipid hypothesis – where did it come from?

- In 1977 the Senate Select Committee on Nutrition published their dietary guidelines for Americans to embrace a diet low in saturated and animal fat.

- The underlying scientific rationale for this recommendation was based on a theory known as the Lipid-Heart hypothesis (1). Some evidence at the time suggested that saturated fat and cholesterol were major influencers of obesity, heart disease and strokes.

- Thus, the recommendations by the Senate Select Committee were for Americans to reduce the consumption of fat from 40% to 20%, and saturated fat from 20% to less than 7% of all consumed calories.

- The Lipid-Heart hypothesis changed the way Americans eat such that most Americans consume a diet high in refined, and processed grains, added sugar, and vegetable oils.

Percentage of Population with Diabetes

Number and Percentage of U.S. Population with Diagnosed Diabetes

- Number with Diabetes
- Percent with Diabetes

Year:
- 1958
- 62
- 66
- 70
- 74
- 78
- 82
- 86
- 90
- 94
- 98
- 02
- 2006

Number with Diabetes (Millions)
- 0
- 2
- 4
- 6
- 8
- 10
- 12
- 14
- 16
- 18
- 20

Percent with Diabetes
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Image retrieved from:
Population Based Changes in Health Status in the United States

- Geographic Distribution of Risk Factors
- Economic Burden of Disease
What is the Culprit?
Insulin Resistance!

Lustig, R. H., & Malhotra, A. (2018). The cholesterol and calorie hypotheses are both dead—it is time to focus on the real culprit: insulin resistance. Stroke, 13, 57.
Insulin Response to a Meal

Blood Sugar Level

- Carbohydrate, such as bread, rice, cereal, pasta, starchy vegetables, fruit, sugar, honey, milk, and yogurt
- Protein, such as meat, fish, cheese, peanut butter
- Fat, such as butter, salad dressing, oils

Hours After Eating
Obesity and Insulin Resistance

Image retrieved from: https://herbscientist.com/doctors-give-amazingly-bad-advice-diabetics-everyone-else/
INSULIN RESISTANCE

HIGH CARB DIET ➔ CONSTANT HIGH GLUCOSE IN BLOOD ➔ CONSTANT HIGH INSULIN DEMAND

Increased insulin demand leads to increased insulin resistance

- GLUCOSE NOT ABSORBED
- CELLS STARVING
- DRIVES HUNGER
- HIGH GLUCOSE AND HIGH INSULIN LEVELS BUT INSULIN RECEPTORS ARE RESISTANT

INSULIN RECEPTORS BECOME RESISTANT (DOWN REGULATED)

LOWCARBRN.COM
DITCHTHECARBS.COM

Slow, steady state exercise is better for your heart; interval training is only for athletes


Practical Recommendations

- Ensure that the majority of your carbohydrates come from leafy green vegetables with a low glycemic index.
- Significantly reduce or eliminate bread, pasta, potatoes, rice, etc.
- Stop eating so much SUGAR!
- Stop eating so processed foods!
- Eat a diet higher in healthy fats, especially Omega-3 fatty acids (cold water fish).
- Eat 20-30g of protein 4 times per day.
- Consider low intensity physical activity immediately after meals.
- Increase your muscle mass through resistance training.
- Under supervision, incorporate high intensity interval training for improved glucose control!
Questions?