

Lecture 23 Weight Control and Obesity

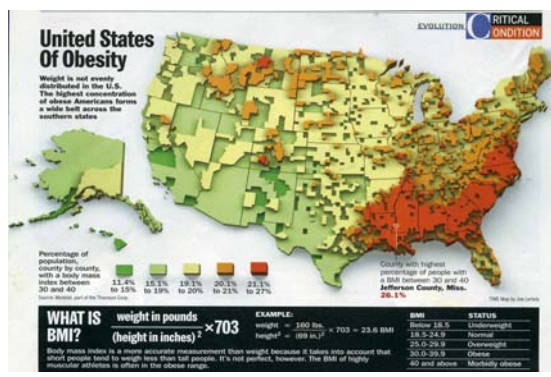
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Life style (diet, lack of exercise) and genes

Obesity is Chronic, stigmatized and costly disease



Obesity Has Many Origins

Mutation in Genes

Lepin, Lepin Receptor
 Cholecystokinin & its receptor
 Ghrelin like peptide and its receptor
 Tumor Necrosis Factor, Neuropeptide and its receptor, Cholecystokinin releasing hormone and its receptor, Adiponectin specific transcription factor and many others
 Uncoupling proteins (UCPs)

Hormonal Imbalance

Excess glucocorticoids
 Hypothyroidism
 Hyperinsulinism

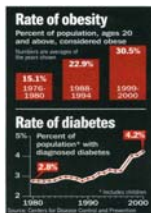
Other Causes

Injury to hypothalamus and brain stem
 Socio-cultural feeding behavior, over eating
 Inactivity

There is an imbalance between energy input and output
 There are many risk factors- some genetic; others environmental
 Genetic factors are real and one sees a familial predisposition
 There are risk factors that combine genetic and environmental factors
 Economic, Access to education, healthy foods, supermarkets with wide food options
 High fat diet
 Sedentary life style

Overweight and Obesity: Health Consequences

- Hypertension (high blood pressure)
- Osteoarthritis (a degeneration of cartilage and its underlying bone within a joint)
- Dyslipidemia (high total cholesterol or high levels of triglycerides)
- Type 2 diabetes
- Coronary heart disease
- Stroke
- Gallbladder disease
- Sleep apnea and respiratory problems
- Some cancers



Crude Economic Costs Alone:

Americans spend >\$ 117 billion a year on obesity-linked illnesses

Tobacco as a cause of preventable death

Half of obese adults have hypertension

How to cure this health problem?

Public health education



Drug strategies for the treatment of obesity:

- A). inhibitors of food intake, which reduce hunger perception and, consequently, food intake
- B). inhibitors of nutrient absorption, which reduce energy disposal through a peripheral gastrointestinal mechanism
- C). thermogenic drugs, which increase energy expenditure.

Public Health Education

Diet Therapy

Diet modification – caloric intake – Low fat diet- Reducing dietary fat (controversial). Epidemiological studies demonstrate a positive correlation between dietary fat and increased prevalence of obesity

Low fat and high complex carbohydrate,

High protein and low carbohydrate

Very low calorie diet (VLCD)- controversial but under a team supervision accepted as weight loss treatment

Options:

- Exercise: Energy expenditure
- Behavior modification- mental attitude about one's self image, perception about food; cooking in vs. eating out; life style change, and much more
- Family and friends must be involved to be successful
- Diet modification is needed and needs to begin at early age
- Dietary Supplements
- Surgery

Drug safety is a challenge issue

- Suppress diet
- CNS-depression
- Cardiovascular-increase blood pressure and heart rate
- Digestive system
- Public health awareness
- Alteration of lifestyle and food choices

Phentermine (Aventis)-Phentermine hydrochloride, an anorectic agent for oral administration; amine with pharmacologic activity similar to the prototype drugs of this class used in obesity, the amphetamines. Actions include central nervous system stimulation and elevation of [blood pressure](#).

Sibutramine (Abbott)

Orlistat (Roche)

How about plant based medicines and dietary supplements?

Phentermine (Aventis)

- Adult obese subjects instructed in dietary management and treated with "anorectic" drugs, lose more weight on the average than those treated with placebo and diet, as determined in relatively short-term clinical trials.
- The magnitude of increased weight loss of drug-treated patients over placebo-treated patients is only a fraction of a pound a week. The rate of weight loss is greatest in the first weeks of therapy for both drug and placebo subjects and tends to decrease in succeeding weeks. The possible origins of the increased weight loss due to the various drug effects are not established.

Warnings Only.....

- Contraindications**
- Advanced arteriosclerosis, cardiovascular disease, moderate to severe hypertension, hyperthyroidism, known hypersensitivity to isosynorsy to the sympathomimetic amines, glaucoma.
 - Agitated states.
 - Patients with a history of drug abuse.
 - During or within 14 days following the administration of monoamine oxidase inhibitors (hypertensive crises may result).
- Warnings**
- Phentermine hydrochloride tablets and capsules are indicated only as short-term monotherapy for the management of exogenous obesity. The safety and efficacy of combination therapy with Phentermine and any other drug products for weight loss, including selective serotonin reuptake inhibitors (e.g., fluoxetine, sertraline, fluvoxamine, paroxetine), have not been established. Therefore, concomitant use of these drug products for weight loss is not recommended.
 - Primary Pulmonary Hypertension (PPH) – a rare, frequently fatal disease of the lungs – has been reported to occur in patients receiving a combination of Phentermine with fenfluramine or dexfenfluramine. The possibility of an association between PPH and the use of Phentermine alone cannot be ruled out; there have been rare cases of PPH in patients who reportedly have taken Phentermine alone. The initial symptom of PPH is usually dyspnea. Other initial symptoms include: angina pectoris, syncope or lower extremity edema. Patients should be advised to report immediately any deterioration in exercise tolerance. Treatment should be discontinued in patients who develop new, unexplained symptoms of dyspnea, angina pectoris, syncope or lower extremity edema.
 - Valvular Heart Disease: Serious regurgitant cardiac valvular disease, primarily affecting the mitral, aortic and/or tricuspid valves, has been reported in otherwise healthy persons who had taken a combination of Phentermine with fenfluramine or dexfenfluramine for weight loss. The etiology of these valvulopathies has not been established and their course in individuals after the drugs are stopped is not known. The possibility of an association between valvular heart disease and the use of Phentermine alone cannot be ruled out; there have been rare cases of valvular heart disease in patients who reportedly have taken Phentermine alone.
 - Tolerance to the anorectic effect usually develops within a few weeks. When this occurs, the recommended dose should not be exceeded in an attempt to increase the effect; rather, the drug should be discontinued.
 - Phentermine hydrochloride may impair the ability of the patient to engage in potentially hazardous activities such as operating machinery or driving a motor vehicle; the patient should therefore be cautioned accordingly.
 - Usage with Alcohol: Concomitant use of alcohol with Phentermine hydrochloride may result in an adverse drug interaction.
- Precautions**
- General
 - Caution is to be exercised in prescribing Phentermine hydrochloride for patients with even mild hypertension.
 - Insulin requirements in diabetes mellitus may be altered in association with the use of Phentermine hydrochloride and the concomitant dietary regimen.
 - Phentermine hydrochloride may decrease the hypotensive effect of guanethidine.
 - The least amount feasible should be prescribed or dispensed at one time in order to minimize the possibility of overdose.
 - Carcinogenesis, Mutagenesis, Impairment of Fertility
 - Studies have not been performed with Phentermine hydrochloride to determine the potential for carcinogenesis, mutagenesis or impairment of fertility.

Pregnancy

Teratogenic Effects Pregnancy Category C. Animal reproduction studies have not been conducted with Phentermine hydrochloride. It is also not known whether Phentermine hydrochloride can cause fetal harm when administered to a pregnant woman or can affect reproductive capacity. Phentermine hydrochloride should be given to a pregnant woman only if clearly needed.

Nursing Mothers

Because of the potential for serious adverse reactions in nursing infants, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother.

Pediatric Use

Safety and effectiveness in pediatric patients have not been established.

Adverse Reactions

Cardiovascular: Primary pulmonary hypertension and/or regurgitant cardiac valvular disease (see WARNINGS), palpitation, tachycardia, elevation of blood pressure.
Central Nervous System: Overstimulation, restlessness, dizziness, insomnia, euphoria, dysphoria, tremor, headache, rarely psychotic episodes at recommended doses.
Gastrointestinal: Dryness of the mouth, unpleasant taste, diarrhea, constipation, other gastrointestinal disturbances.

Allergic: Urticaria, changes in libido.

Drug Abuse and Dependence

Phentermine hydrochloride is related chemically and pharmacologically to the amphetamines. Amphetamines and related stimulant drugs have been extensively abused, and the possibility of abuse of Phentermine hydrochloride should be kept in mind when evaluating the desirability of including a drug as part of a weight reduction program. Abuse of amphetamines and related drugs may be associated with intense psychological dependence and severe social dysfunction. There are reports of patients who have increased the dosage to many times that recommended. Abrupt cessation following prolonged high dosage administration results in extreme fatigue and mental depression; changes are also noted on the sleep EEG. Manifestations of chronic intoxication with anorectic drugs include severe dermatoses, marked insomnia, irritability, hyperactivity and personality changes. The most severe manifestation of chronic intoxications is psychosis, often clinically indistinguishable from schizophrenia.

Overdosage

Manifestations of acute overdosage with Phentermine include restlessness, tremor, hyperreflexia, rapid respiration, confusion, assaultiveness, hallucinations, panic states. Fatigue and depression usually follow the central stimulation. Cardiovascular effects include arrhythmias, hypertension or hypotension and circulatory collapse. Gastrointestinal symptoms include nausea, vomiting, diarrhea, and abdominal cramps. Fatal poisoning usually terminates in convulsions and coma.
 Management of acute Phentermine intoxication is largely symptomatic and includes lavage and sedation with a barbiturate. Experience with hemodialysis or peritoneal dialysis is inadequate to permit recommendations in this regard. Acidification of the urine increases Phentermine excretion. Intravenous phenolamine has been suggested for possible acute, severe hypertension, if this complicates Phentermine overdosage.

Dietary Products Used for Weight Loss and Obesity

- Bitter Orange (*Citrus aurantium*, Synephrine)
- Bladderwrack (*Fucus vesiculosus*)
- Carnitine
- Chitosan
- Conjugated Linoleic Acid (CLA)
- Guarana (*Paullinia cupana*)
- Hydroxycitric Acid (HCA), *Garcinia cambogia*
- Ma Huang (*Ephedra sinensis*, Ephedrine)-banned
- Pyruvate
- Hoodia
- Other Herbs

Bitter Orange (Zhi Shi)
Citrus aurantium
(Synephrine)

- Bitter orange contains an ephedrine alkaloid, synephrine.
- Synephrine appears to be safer, less potent and different in mechanism of action from ephedrine.
- Some evidence for application in weight loss, almost none for athletic performance despite its alleged CNS stimulant activity.



U: www.solarnavigator.net/
L: www.bodyfitness.com/images/nw_bitter_orange...

Bitter Orange (Zhi Shi)
***Citrus aurantium* (con't)**

- Synephrine stimulates the brown adipose tissue of dogs indicating it can stimulate thermogenesis yet little that shows it does the same for humans.
- Octopamine, also found in bitter orange was reported to suppress appetite insects- but in humans?
- The naturally occurring form of synephrine is p-synephrine

Bitter Orange, con't

Kalman et al. (2000):

- Randomized, placebo-controlled design with 30 subjects with body mass indexes >27kg/m² were given a preparation of ephedrine alkaloids (20 mg) synephrine (5 mg), caffeine (200 mg), and salicin (15 mg) or a matched placebo 2x/week. This study does 3 days/week.
- Results: Treatment group dropped 16% decrease in body fat; control group had 1% increase

Bladderwrack (*Fucus vesiculosus*)

- *Fucus vesiculosus* is a brown seaweed that grows on the northern coasts of the Atlantic and Pacific oceans and the North and Baltic seas (not to be confused with kelp)
- Generally formulated with other DSs in weight loss, fat burning, enhancing thyroid function, and increasing energy.
- High iodine content – this may be one reason why its used in weight loss. Those with low thyroid levels often see weight gain, with high iodine comes increased thyroid hormones
- High trace minerals
- Fibers
- Vitamin B₁₂ content
- No evidence showing effective weight loss product



U: www.fimr.tv/_default/815.jpg;
L: www.nexternal.com/_images/bladderwrack.jpg

Bladderwrack, con't

Warnings

- Consumption of Bladder wrack harvested from polluted waters may cause nephrotoxicity due to the presence of heavy metals such as arsenic, cadmium and mercury (5).

Contraindications

- Bladder wrack acts as an estrogenic receptor modulator and should be used with caution in patients with hormonal-sensitive cancers.

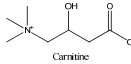
Herb-Drug Interactions

- Theoretically, bladder wrack may have an additive effect when taken with cholesterol-lowering and antihypertensive medications (1).

Source: Sloan Kettering



- An amino acid found in meats and dairy and also synthesized by liver and kidneys from lysine and methionine.
- Involved in transport and metabolism of long chain FAs from cytosol into the mitochondrial matrix for β -oxidation and energy generation.
- Marketed to increase fat metabolism, enhance endurance, lower cholesterol and triglyceride levels and improve cardiovascular performance.
- Only speculative that increased carnitine would lead to increased fat transport and metabolism thereby potentially impacting weight loss by stimulating fat oxidation.
- There are two forms of carnitine- the physiologically inactive form (D-carnitine) and the form active in humans (L-carnitine).
- Little support showing this product to be effective in weight loss or even in enhancing fat burning.

Carnitine



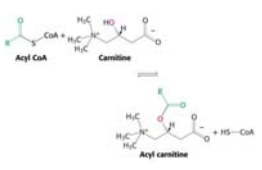
Carnitine

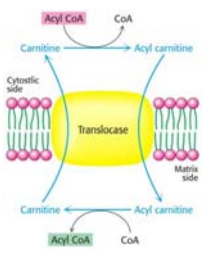
Villani et al (2000):
 Double-blind study using 36 moderately overweight women over 2 mos. (18 received 4g carnitine/day and 18 received placebo. Subjects also walked 4 days/wk. NSD in body weight, fat mass, or amount of fat oxidation at rest or during exercise

www.perfectfitness.de/produktbilder/grossver...

Carnitine Transports Activated Fatty Acids to the Matrix
 After activation, the long chain acyl CoA molecules are transported into the matrix of the mitochondrion by a *carnitine shuttle*:





Source: dbs.umt.edu/_/041/images/carnitine-rxn.jpg

Chitosan

- Made from shells of shellfish, considered a dietary fiber- an aminopolysaccharide (protein + sugar).
- A charged molecule* it binds to FAs* in our diet and blocks fat absorption, up to 4-6X its weight.
- Appears to be effective under a reduced calorie diet.
- Safety: Also used as a pharmaceutical drug delivery product adjunct, it was found to be very safe. Only concern is that it could absorb not only fats, but also the fat-soluble vitamins and carotenoids.
- Chitosan may cause gas, bloating, diarrhea and should be avoided by anyone with allergies to shellfish.

Chitosan

Clinical Summary

- Chitin is extracted from the exoskeleton of crustaceans, including shrimp, lobster, and clams. A derivative of chitin, chitosan is used as an excipient in pharmaceutical formulations for weight loss, hyperlipidemia, and wound healing. It is also made into an edible film to protect food from spoilage (3).
- Although it is said to bind fat in the gut, several clinical trials found no increase in fecal excretion of fat or weight loss as compared to placebo (2) (3) (5).
- Chitosan may lower low-density lipoprotein (LDL) cholesterol, although an optimal dose and long-term efficacy are not yet established (2). Limited clinical data are available regarding efficacy for anemia of chronic renal failure, although chitosan did show benefit in a small randomized study (6). Reported adverse events include constipation and gastrointestinal distress (4). Patients allergic to shellfish should not use this supplement. Pregnant women should not consume due to binding of fat soluble vitamins (ADEK) and calcium.



planning.up.nic.in/.../images/chitosan.jpg

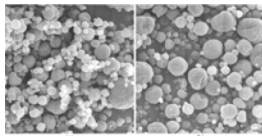
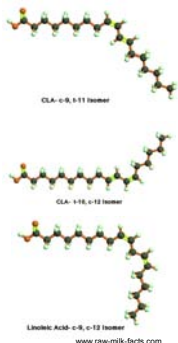


Figure 3: SEM microphotographs of chitosan microspheres obtained by spray drying from aqueous solutions with 20.0 Phos'n chitosan, 10.2 Phos'n chitosan (average diameter of 3000Å).
http://www.scielo.br/ing/revistas/tyoe/v22n3/2593111.jpg

http://www.mskcc.org/mskcc/html/69179.dfm

Conjugated Linoleic Acid (CLA)

- Linoleic acid is found in vegetable oils, whereas the conjugated CLA is found primarily in meat and dairy.
- CLA in most dietary supplements come from sunflower and other vegetable oils.
- Linoleic acid is an ω -6 FA (its unsaturated, with a double bond at C6)
- CLA is an isomer with conjugated double bond at C10 and C12 or at C9 and C11- resulting in altered chemical functions.



www.rnw-mix-facts.com

Conjugated Linoleic Acid (CLA), con't

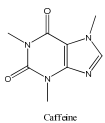
- Evidence is suggesting a modest effect on CLA in prompting fat loss in moderately overweight adults.
- No benefit apparent for athletes;
- In rat's CLA leads to increased lean body mass and less body fat.
- In small animals, CLA has led to increased energy expenditure, enhanced growth, suppressed fat accumulation.
- Mixed results in humans in body weight even when reduced body fat and increase in lean body mass found in moderately overweight sedentary individuals.



U www.supplierlist.com; L www.solaltech.com/

Guarana (*Paullinia cupana*)

- Brazilian herb, GRAS, popular herb
- Seeds are used to generate a wide range of products- beverages, stimulant, antifatigue
- Weight loss due to caffeine yet seeds also contain polyphenols and saponins
- No clinical studies to date with guarana as a single supplement in humans



For Weight Loss:

- Had been formulated with ephedra or supplements with ephedrine alkaloids and together studies showed fat and weight loss;
- Another study included ephedra, caffeine, and chromium picolinate and guarana and showed weight loss
- Safety concerns relate to high caffeine levels and when ephedrine alkaloids were included

Hydroxycitric Acid (HCA), *Garcinia cambogia*

- A small fruit containing (-)HCA
- Support exists for use in weight loss, speculating that garcinia inhibits citrate lyase which is needed for conversion of CHOs to fat. The excess CHOs lead to build up of stored glycogen, which then may suppress appetite.
- In animal studies, HCA showed body weight loss in rats, appetite suppression and reduced food intake but in clinical trials mixed results. May be due to diet differences- those on high CHOs where citrate lyase is more important would show more differences; those on higher fiber diets may inadvertently bind to the HCA thus blocking its effect.
- Do the dietary supplements containing HCA work? Are they prepared the best?



U:<http://nativemedies.com>
L:<http://www.thefind.com/beauty/browse/natoli-citrimax>

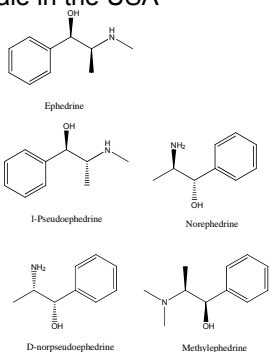
HealthJournal*: What does it do?

- (-)-Hydroxycitric acid (HCA) is a fruit extract with a chemical composition similar to citric acid (the primary acid in citrus fruits).
- Preliminary research, based on laboratory experiments and animal research, suggests that HCA may be a useful weight loss aid.
- HCA has been demonstrated in the laboratory (but not yet in trials with people) to reduce the conversion of carbohydrates into stored fat by inhibiting certain enzyme processes.
- Animal research indicates that HCA suppresses appetite and induces weight loss.
- One case report found that eating 1 gram of the fruit containing HCA before each meal resulted in the loss of 1 pound per day.
- A double blind trial that provided either 1,500 mg of HCA or a placebo to 135 overweight men and women who also were on a calorie-restricted diet found after twelve weeks that the HCA supplementation did not produce a significant change in weight loss.
- Uncontrolled and/or preliminary evidence from several other human trials suggest the possibility that weight loss might occur; however, none of these studies is as methodologically strong as the negative trial previously mentioned.

*References:
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 2. Triscari J, Sullivan AC. Comparative effects of (-)-hydroxycitrate and (+)-allo-hydroxycitrate on acetyl CoA carboxylase and fatty acid and cholesterol synthesis in vivo. *Lipids* 1977;12(4):357-62.
 3. Chenna-Dhand B, Harjoto M, Lacroix CC. Inhibition of enzymes which interact with citrate by (-)-hydroxycitrate and 1,2,3,6-tetrakisobutyrate. *Eur J Biochem* 1975;38:98-102.
 4. Sullivan AC, Hamilton JG, Miller CN, et al. Inhibition of lipogenesis in rat liver by (-)-hydroxycitrate. *Ann Biochem* 1972;130:153-59.
 5. Lovelison JM, Chena B, Chena B, et al. Effect of (-)-hydroxycitrate on development of obesity in the Zucker obese rat. *Am Phys J* 1981;240:572-76.
 6. Sullivan AC, Triscari J. Metabolic regulation as a control for lipid disorders. *Am J Clin Nutr* 1977;30:767-79.
 7. Sullivan AC, Triscari J, Hamilton JG, et al. Effect of (-)-hydroxycitrate upon the accumulation of lipid in the rat. II. Appetite. *Lipids* 1974;9(2):124-34.
 8. Sullivan AC, Triscari J, Hamilton JG, et al. Effect of (-)-hydroxycitrate upon the accumulation of lipid in the rat. I. Lipogenesis. *Lipids* 1974;9(1):1-12.
 9. Sanyal W. Natural food: metabolic treatment may be effective in the treatment of obesity. *Med Hypotheses* 1992;27:42.
 10. Hamfield SB, Allison DB, Vasanki J, et al. *Garcinia cambogia* hydroxycitric acid as a potential antiobesity agent. *JAMA* 1998;280:1598-1600.
 11. Sanyal W. Response to JAMA HCA report. *Tourism Letter to Doctors and Patients* 1999;120-21.
 [beta:review]<http://www.bodyandmind.com/information/WeightLossResearch/garcinia.htm>

**Ma Huang (*Ephedra sinensis*, Ephedrine)-
Banned for Sale in the USA**

- This product and its associated ephedrine alkaloids were the most popular dietary supplement products for weight loss and studies Ephedra caused weight loss particularly when used in combination with caffeine.
- Ephedra was found to induce central nervous system stimulation, bronchodilation, and vasoconstriction. In combination with caffeine, ephedrine resulted in weight loss in both short and longer term studies.
- Also was available in pure form (pseudoephedrine) in OTC, crude herbal medicine, extract, tea, or dried plant.
- One of ca. 40 species
- Other species, such as *Sida cordifolia* contain ephedrine.



Ma Huang (*Ephedra sinensis*), con't:

- At one point the combination of Ma Huang, caffeine and White Willow bark (*Salix alba*, for its salicylic acid and salicylates) was the most popular weight loss.
- Aspirin and White Willow bark alone have no weight loss effect.
- Ephedra and kola nuts over a 6-month study period promoted weight loss without significant adverse effects using randomized double-blind placebo-controlled study (Boozler et al. 2002)

What Lead to its Banning?

- On February 6, 2004, the U.S. Food and Drug Administration (FDA) issued a final rule prohibiting the sale of dietary supplements containing ephedrine alkaloids (ephedra) because such supplements present an unreasonable risk of illness or injury. The rule became effective 60 days from the date of publication.
- In 2005 this rule was struck down in Utah but reversed again four months later, so ephedra is currently banned throughout the United States. It remains unclear whether ephedra will re-appear on the market, despite widespread acknowledgement of significant safety risks, including serious potential cardiovascular events or death.
- Major safety concerns have been associated with ephedra or ephedrine use, including hypertension (high blood pressure), tachycardia, CNS excitation, arrhythmia, myocardial infarction (heart attack), and stroke.
- Despite widely publicized safety concerns and the highly publicized 2003 death of a U.S. major league baseball pitcher thought to be related to ephedra, prior to the ban on ephedra, 14% of individuals using non-prescription weight-loss products in the United States continued to take ephedra or ephedrine-containing products.

Source: http://www.mayoclinic.com/health/ephedra/NS_patient-ephedra

Pyruvate

- Marketed to enhance weight loss and increase energy
- Pyruvate is a salt form of pyruvic acid (two 3C molecules from glucose in glycolysis); it's the carboxylate anion of pyruvic acid ((CH₃COCO₂H))
- Usually combined with minerals- Na, Ca, Mg, K, to improve stability.
- Pyruvic acid under aerobic conditions generally converted to acetyl coenzyme A (Krebs cycle) in the mitochondria yielding energy.
- Evidence is weak to show that pyruvate as a dietary supplement can effect weight loss.
- May be in part that most commercial products contain low concentrations (>1g pyruvate/serving), 20-25X the amount needed to be effective.
- Some clinicals showed modest loss of body fat, slow weight regain and re-accumulator of body fat following a weight loss diet after 3-4 weeks.
- No adverse reports except for when mega concentrations were ingested, minor gastrointestinal disturbances including diarrhea and flatulence were noted.



<http://www.vitacost.com/Source-Natural-Pyruvate-Creatine>



Slimming Formula

Lose almost 30% more fat!
 It's true! Beachbody test groups have shown that those who enhanced their workouts with Slimming Formula lost almost 30% more fat than those who didn't.*
Naturally Potent Ingredients
 Forget about ephedra. We DON'T use it in any of our products, period! If you want to lose weight the safe and natural way, you want the powerful combination of all natural pyruvate and green tea extract. These proven ingredients will get you the slimming results you want, without flimsy side effects.

*These statements have not been evaluated by the FDA. This product is not intended to diagnose, treat, cure, or prevent any disease.

Hoodia (*Hoodia gordonii*, *H. currorri* and other *H. spp.*)

- Also called ghapp;
- The sap is used by the traditional Xhmani bushman in the Kalahari Desert to suppress



Photos from: Van Wyk and Gericke, 2000. People's Plants

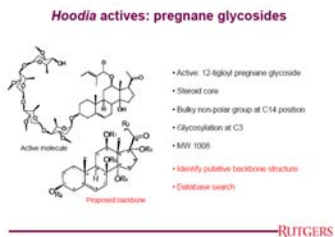
Thorny stem and flower of yellow ghaap (*Hoodia flava*)
 Source: Van Wyk & Gericke, 2000. People's Plants.

- A compound named P57 was discovered from this succulent.
- Appears to be more on the market than exists in the wild
- The exports from this region are high and it is unclear as to which *Hoodia* spp. is exported.
- Not all *Hoodia* spp are the same phenotypically or chemically.



Preled slice of Xanthophae Hoodia gordonii

Main BioActive Compounds in Hoodia*



*Prepared by and Kormarnytsky and Raskin

Additional Herbs Used in Weight Loss

- Alfalfa
- Chickweed
- Burdock
- Cardamom
- Cayenne Peppers
- Cinnamon
- Dandelion Root
- Fennel Seed
- Flax Seed
- Green Tea
- Guar Gum
- Hawthorn
- Kola Nut
- Parsley
- Psyllium

These Herbs May Function via*:

- Stimulating the Body Functions
 - Metabolism
 - Digestion
- Diuretics – Get rid of excess water weight
- Carthartics – Impedes digestion, moves bowels
- Suppressants – Reduces cravings, “full feeling”

*K. Tong

- Chickweed – Tea cuts cravings
- Cayenne Pepper – Increases metabolism, raises core body temperature
- Dandelion Root- Increases metabolism
- Flax seed- Lowers cholesterol, weight loss in men
- Guar Gum- soluble fibers, curbs hunger, feeling of fullness, reduces appetite, lowers cholesterol
- Green Tea- Increases metabolism & energy
- Parsley- Reduces hunger, used in low carb diets

Weight Control and Obesity

- Genetics vs. Environment
- Psychological
- Behavior and Habit
- Life Style
- Exercise
- Food Industry
- And those dietary supplements.....

Main sources used in these presentations:
Talbot and Hughes, 2007
Robbers and Tyler, 2000.
