

CHIROCREDIT.COM PRESENTS

NUTRITION 101

RESISTANCE EXERCISE AND BLOOD LIPIDS

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- Aerobic activity can lower blood lipid levels
- Elevated levels of high-density lipoprotein cholesterol (HDL-C) can provide protection against development of atherosclerosis
- In postmenopausal women, HDL-C levels appear to be a more potent risk factor for CHD than LDL-C
- The effect of resistance training on blood lipid profiles is unclear
- Can resistance exercise be substituted for aerobic exercise and still get the benefits of lipid lowering?

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Study (Bemben, 2000)

- 16-week Dynaband resistance exercise program
- 18 Caucasian postmenopausal women aged 60-80 years
- Exercise program included a 10-minute warm-up followed by progressive resistance exercises 1-2 sets, 10-15 repetitions three times per week
- Strength improved for each of the muscle groups tested
- Improvements in HDL and in TC/HDL ratio occurred after training
- HDL serum levels increased by 13%
- *Conclusion - Dynaband exercise program was associated with improvements in HDL*

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Study (Bakker, 2018)

- Study compared resistance exercise with the risk of developing hypercholesterolemia in men
- >7,000 men (18–83yr) without hypercholesterolemia (TC \geq 240 mg/dL) at baseline - average follow up of 4 years
- Subjects doing resistance exercise \geq 2 days/week had a 13% lower risk of developing hypercholesterolemia
- Subjects with less than 1 hour/week of resistance exercise had a 32% lower risk of hypercholesterolemia
- Subjects with 2 sessions/week of resistance exercise had a 31% lower risk of hypercholesterolemia
- This was independent of aerobic exercise

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Study (Zapata-Lamana, 2015)

- High intensity and low volume resistance training
- 12 weeks
- 40 sedentary women (30-60 years) randomly assigned to an experimental group and a control group
- 4 body weight strength exercises
- Reduction in total cholesterol and triacylglycerol
- An increase in HDL cholesterol in the experimental group

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Study (Xin, 2022)

- Meta analysis - total of 38 studies involving 1407 postmenopausal women patients
- Resistance training - greatest effect on LDL-C
- Water Exercise - greatest effect on systolic blood pressure and total cholesterol
- Combined training - greatest effect on triglycerides, HDL and diastolic blood pressure

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Negative Study

- Study (Hornbuckle, 2012)
- Inactive middle-aged African-American women
- Walked with resistance training
- No affect on HDL cholesterol or triglycerides

However:

- Upper and lower body strength increased
- Waist circumference, total fat mass, HbA1c and mean glucose decreased

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Combination Exercise

- Combined training programs of aerobic training and resistance training has been shown to reduce peripheral and central blood pressure, increase cardiorespiratory fitness, increase body strength and increase lean body mass
- Many patients can do less aerobic activity if resistance training is added to their exercise program
- May be of benefit to certain patient populations

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Study (Shaw, 2009)

- Combination of aerobic and resistance training on LDL-C concentrations
- 38 subjects (avg age: 25) with borderline high blood LDL-C concentrations were divided into three groups
- (16 weeks of no exercise), (aerobic training - combination of treadmills, rowers, steppers and cycle ergometers) or (a combination of aerobic and resistance training - combination of aerobic training at 60% of HR max and resistance training using 8 exercises at 2 sets of 15 reps at 60% of one-repetition maximum (1-RM))
- No-exercise group - no significant change in blood LDL-C concentrations
- Aerobic training and combined training groups - significant and similar decreases in blood LDL-C concentrations

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Study (Schroeder, 2019)

- Study compared the effects of aerobic, resistance, and a combination of both aerobic and resistance training on CVD risk factors including peripheral and central BP, cardiorespiratory fitness (CRF), muscular strength, body composition, blood glucose and lipids
- 69 adults (58±7 years) with an elevated blood pressure or hypertension, overweight/obesity, and sedentary lifestyle were randomized to one of the three 8-week exercise programs or a non-exercise control group
- 3 days/week (aerobic: 60 minutes/session vs. resistance: 60 minutes/session vs. combination: aerobic 30 minutes/session plus resistance 30 minutes/session)

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- Greater reduction of CVD risk factors with combination training
- Decreased peripheral and central diastolic BP
- Increase in upper and lower body strength
- Increase in lean body mass
- Increase in cardiorespiratory fitness
- Aerobic training - only increased CRF and reduced body weight and fat mass
- Resistance training - only increased lower body strength and reduced waist circumference

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Study (Liang, 2021)

- Meta-analysis of 15 studies - compared the effects of aerobic, resistance, and combined exercise on metabolic syndrome and CVD risk factors
- Combined exercise most effective at controlling glucose and total Tg levels
- Aerobic exercise was superior to resistance exercise regarding BMI
- Combined exercise - best for improving weight, WC, DBP, TG, TC, glucose, and insulin levels
- Resistance exercise - most effective at reducing BF, LDL-C levels, and SBP
- Aerobic exercise was the optimal way of improving BMI and HDL levels
- *Conclusion - combined exercise is the most effective choice in improving the metabolic syndrome and cardiovascular risk parameters*

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Study (Isayeva, 2021)

- 167 subjects - cross-sectional study - subjects regularly practicing yoga or resistance training at least 2x/week for more than one year
- HDL-cholesterol was significantly higher in "yoga training" compared to "resistance training" group and control group
- LDL cholesterol was the lowest in subjects that had the highest level of vigorous physical activity
- Conclusions: People practicing yoga and resistance training had more favorable blood lipid profile and anthropometric parameters than control group
- "Yoga training" had more pronounced positive effect on HDL
- LDL levels were associated with intensity of physical activity than with type of physical activity

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Morning vs Evening Training

- Study (Krčmářová, 2018)
- If young – probably better to do weight training in the evening
- 12-week strength training program in 31 healthy older women
- Morning, evening or non-training control subjects
- Whole-body strength training - 3 sets of 10-12 reps - 2-3 minutes rest
- Measured by leg press, seated-row and functional capacity tests, whole-body skeletal muscle mass and fat mass
- Basal blood samples (in the intervention groups only) taken before and after the intervention assessed low-density lipoprotein, high-density lipoprotein, blood glucose, triglycerides, high-sensitive C-reactive protein concentrations and total antioxidant status

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- Control group - no changes in any variable
- Both weight training groups significantly improved leg press and seated-row strength and functional capacity outcomes
- Morning lifters were the only group to increase muscle mass
- Both exercising groups significantly decreased blood glucose with greater decrease in the evening compared to the morning group
- Only the evening group significantly decreased triglycerides - the morning group increased it
- *Conclusion - weight training in the evening may be optimal in regards to blood lipids*

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Polling Question

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The Use Of Boswellia In Treating Arthritis

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Boswellia Serrata

- Tree in India that produces a gummy oleoresin when tapped
- Active constituents of essential oils, gum and terpenoids
- Boswellic acids are typically used as a standardization measure and consist of four pentacyclic triterpene acids
- Most commercial preparations are standardized to at least 37.5% boswellic acids
- USES - *Clinical trials and pharmacological studies have demonstrated Boswellia to be a non-steroidal anti-inflammatory agent and an antioxidant*

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A Natural NSAID

- In vitro studies have shown boswellic acids to be selective inhibitors of 5-lipoxygenase, which leads to decreased production of leukotrienes (inflammatory pathways)
- Significant reduction in swelling and pain compared to placebo
- Reduced ESR
- Reduced intake of NSAIDs normally taken by patients
- Improvement of clinical symptoms
- Excellent tolerance with minor side effects
- Study (2015) - in vitro experimental model of intestinal inflammation - Boswellia protected the intestinal epithelial barrier from inflammatory damage

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2 Animal Studies - Inflammation

- Study (2014) - Boswellia had protective anti-inflammatory and antioxidant effects that inhibited inflammatory mediators in acute experimental rat colitis
- Study (2014) - induced arthritis in rats - Boswellia reduced levels of inflammatory mediators (IL-1 β , IL-6, TNF- α , IFN- γ and PGE₂) and caused a reduction in bone histology and arthritis scoring

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Osteoarthritis Studies

- Study (2018) - meta-analysis (11 studies - 1009 people) - knee OA - Boswellia was effective for pain relief and functional improvement
- Study (2019) - double-blind, placebo-controlled - 48 patients with knee OA - significant improvement in physical function by reducing pain and stiffness - Radiographs showed improved knee joint gap and reduced osteophytes - also serum levels of high-sensitive C-reactive protein was decreased

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- Study (2003) - randomized, double blind, placebo-controlled crossover design for 8 weeks
- 30 patients with Knee OA (15 received the active compound and the other 15 received a placebo)
- All patients receiving Boswellia had decreases in knee pain, increases in knee flexion and increases in walking distance
- Frequency of swelling in the knee joint was decreased with Boswellia
- Radiologically there was no change
- Boswellia was well tolerated except for minor gastrointestinal effects

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- Study (2014) - 4 weeks - Knee OA - FlexiQule (a standardized Boswellia extract) and combined with "standard management" (SM)
- 27 subjects used BS with SM and 28 subjects only had SM
- Patients performed a treadmill walking test and questionnaire
- Decreased pain, stiffness and physical function compared to SM - Both groups improved walking distance but higher in Boswellia group
- Social and emotional functions improved better in Boswellia group
- Need for other drugs was less in Boswellia group

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- Pain Study (2014)
- Analgesic activity
- 12 subjects
- Boswellia serrata 125 mg, 2 capsules or placebo
- Mean Percentage change from baseline in Pain Tolerance force and time with Boswellia significantly increased at 1 hr, 2 hr and 3 hrs
- "Boswellia serrata significantly increased the Pain Threshold and Pain Tolerance force and time compared to placebo"

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Combinations with Boswellia

- Study (2018) - Boswellia and a curcuminoid complex extract (CuraMed®) - 201 patients aged 40 to 70 with osteoarthritis -12 weeks
- CuraMed® 500-mg capsules (333 mg curcuminoids) and Curamin® 500-mg capsules (350 mg curcuminoids and 150 mg boswellic acid) taken (tid)
- Both compounds had favorable effects after three months
- Significant effect of Curamin® compared to placebo on physical performance tests and the WOMAC joint pain index
- Conclusion - curcumin in combination with boswellic acid reduces pain-related symptoms in patients with OA and is more effective than plain curcumin

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- Study (2020) - Boswellia serrata and Bromelain -
- 49 patients (6 men and 43 women, aged 23 – 92yrs), with knee, hip, or generalized OA took combo from 1 – 6 months
- After three months a significant improvement was found for 7 of 10 QoL questions and overall, for the total QoL score
- No adverse events
- Conclusion - combining Boswellia serrata with another natural anti-inflammatory agent such as bromelain can be used as an effective therapeutic agent for generalized osteoarthritis

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Dose - Side Effects - Safety

- In General - Standardized extract of the gum oleoresin containing 37.5% boswellic acids at 150mg (tid)
- For OA, RA, Strain/sprain, Bursitis/Tendonitis - 100 - 150mg (tid)
- For ulcerative colitis - 300-350mg (tid)
- Treatment should last 8-12 weeks
- Less side-effects than most NSAIDS and may be as effective
- Side effects - mild and rare - diarrhea, urticaria and nausea
- Toxicity studies in animals have indicated no harmful effects from long term ingestion - Pregnant rat studies have demonstrated no teratogenic effects
- Up to 6 months is considered safe

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Can Green Tea Promote Weight Loss?

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Green Tea Extract

- All from *Camellia sinensis* plant leaves - Black tea, oolong tea, and green tea
- Green tea leaves are not fermented before steaming and drying - they are withered and steamed at high temperatures
- Contain polyphenols - (catechins) have antioxidant, anticancer, anti-inflammatory and antiviral properties
- *Contains 2% to 4% caffeine*

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- Consumption of thermogenic ingredients such as caffeine and tea (green, white and oolong) can be weight loss strategies and maintenance as they may increase energy expenditure (4-5%) and fat oxidation (10-16%)
- Data from laboratory studies shows that green tea has important roles in fat metabolism by reducing food intake, interrupting lipid emulsification and absorption, suppressing adipogenesis and lipid synthesis and increasing energy expenditure via thermogenesis, fat oxidation and fecal lipid excretion
- In some studies, green tea causes an increase in thermogenesis and substrate with fat oxidation by affecting the sympathetic nervous system

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Obesity Management

- Human studies indicate green tea and green tea extracts may help reduce body weight – mainly body fat
- It increases postprandial thermogenesis and fat oxidation
- Study - systematic review of 15 articles - daily consumption of green tea with doses of EGCG between 100 and 460 mg/day has shown greater effectiveness on body fat and body weight reduction in intervention periods of 12 weeks or more

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Is Caffeine the Active Component?

- Study – 10 healthy male subjects - randomly assigned among three treatments on three separate occasions
- One treatment – green tea extract (50mg of caffeine and 90mg epigallocatechin gallate) caffeine (50mg) and placebo
- Significant 4% increase in 24-hour energy expenditure with green tea demonstrating the stimulatory effect it has on thermogenesis
- Contribution of fat oxidation to 24-hour EE was 41.5% for the green tea and 31.6% with the placebo
- The effects of the caffeine content of green tea could not explain the changes in EE or fat oxidation itself
- Thus - the metabolic effects of the tea was not from the caffeine

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- Study (Boschmann, 2007)
- Randomized double blind, placebo-controlled, cross-over pilot study
- 6 overweight men were given 300 mg EGCG/per day for 2 days
- Fasting and postprandial changes in energy expenditure and substrate oxidation were assessed
- EGCG alone has the potential to increase fat oxidation and may contribute to the anti-obesity effects

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3 Positive Human Studies - Body Fat

- Study (2021) 12 females - 30-min treadmill walk - moderate intensity
- 1-gram 3x/day for 3 weeks - final dose (1 gram) two hours before the walk
- Higher fat oxidation
- Lower carbohydrate oxidation
- Dutch Study - Subjects who drank caffeinated and decaffeinated green tea lost more body weight and decreased waistlines than controls
- Japanese Study - 240 men and women - 3 months - variable amounts of Green tea
- Those who got the highest amount lost fat and weight and had lower blood pressure and lower LDL cholesterol

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2 Positive Human Studies - Abdominal Fat

- Study (2009) - 132 overweight/obese adults - 12 weeks - 180 min/wk exercise - 625mg GTCatechins and 39mg caffeine or caffeine only
- GTE group - greater weight loss - lower total and subcutaneous abdominal fat
- Study - 35 Japanese men - 2 groups - 3 months
- First group - oolong tea with green tea of 690mg of catechins
- 2nd group - drank oolong tea -22mg catechin
- First group - lost more weight , waist size, greater decrease in BMI, and total body fat

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Negative Human Study - Weight Loss

- (Cochrane Database Review - 2012) Meta-analysis
- "Green tea preparations appear to induce a small, statistically non-significant weight loss in overweight or obese adults
- Because weight loss is small - not likely to be clinically important
- Green tea had no significant effect on the maintenance of weight loss"

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Dose and Side Effects

- *Doses vary significantly*
- Range between 1 – 10 cups daily?
- Range of Catechins 150 – 700mg?
- 3 to 4 cups per day, providing 240 – 320mg of the active ingredients
- SAFE - for most adults
- Stomach upset and constipation
- > 5 cups per day – multiple side effects even fatalities

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Contraindications

- *Many drug interactions exist*
- If pregnant/breast feeding - limit intake to 2 cups/day (200mg caffeine)
- May make anemia and anxiety worse
- Increases the risk of bleeding - do not take with bleeding disorders
- Irregular heartbeat
- May affect blood sugar levels - be careful if diabetic
- Makes glaucoma worse - increases pressure in the eyes
- May increase high blood pressure
- May make liver damage worse - even cause liver damage

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Polling Question

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Exercise And Water Replacement

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Heat Removal

- Muscles release heat during exercise
- Blood is warmed with exercise and increases core temperature -
- Stimulates hypothalamus to initiate the sweating mechanism
- Blood removes the heat by rushing to the skin so heat can be lost by sweating and thus evaporation
- 80% of all heat liberated is via evaporation

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Regulation of Fluids

- When fluid is lost via sweat
- Plasma volume decreases
- Plasma osmolality increases [Cl] and [Na]
- Vascular pressure receptors and hypothalamic osmoreceptors sense these changes
- Increases Vasopressin (ADH) - from pituitary
- Increases Renin - released from the kidneys
- Both of these increase water/sodium retention (kidneys) - retains water
- Provokes an increase in thirst

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- Under normal situations - Fluid intake will eventually exceed any fluid losses
- For athletes - difficult to get back to normal many do not ingest enough fluid to offset large losses during training
- Thirst mechanism is not reliable to maintain core balance
- If fluids are not replaced - dehydration will result and decrease performance
- Water replacement maintains core temperature

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Daily Fluid Loss

- Total volume of fluid loss depends on–
- Environmental conditions (heat, humidity, cold, wind, etc)
- Size and surface area of the person
- Metabolic rate of person
- Volume of excreted fluids

- Daily sedentary losses - 2-3 liters/day
- Athlete who trains 2 hrs./day can lose additional 2 liters
- Total loss for athletes can be up to 5 liters/day

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Fluid Intake - Adequate?

- 13 cross-sectional surveys in 13 countries (2015)
- 3,611 children (4-9 years) and 8,109 adolescents (10-18 years)
- CONCLUSIONS: High amounts of children and adolescents are at risk of inadequate fluid intake (especially males)
- Data from the 2005-2006, 2007-2008 and 2009-2010 (NHANES) - 15,702 adults
- Younger adults satisfied DRIs for water
- Older people (83% of women and 95% of men) ≥ 71 y failed to meet guidelines (short in daily water from 603ml - 1218 ml)

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Institute of Medicine Guidelines for Daily Water Consumption

- From all beverages and food
- Women 2.7 liters (91 ounces)
- Men - 3.7 liters (125 ounces daily - about 1 gallon)
- No upper level for water

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Water Fluid Guidelines for Exercise

- 24 hrs prior to exercise - drink in excess
- 2 hrs prior to exercise 16 - 24oz
- 15 minutes prior 8 - 16oz
- Immediately prior 3 - 6oz (100 - 200ml)
- Every 15-20 minutes during exercise 6 - 8oz
- After exercise - enough to restore lost weight
- *20oz of fluid for every pound of BW lost*
- In warm environment - additional 8 – 16oz of fluid in the 30 minutes prior to exercise

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Dehydration

- Many people are chronically dehydrated
- Voluntary fluid intake during exercise replaces only 50% of loss
- Results in varying amounts of dehydration
- Often exceeds 3% of body weight
- Dehydration of 1% bw can impair ability to do a set task
- Dehydration of $\geq 2\%$ bw can elevate cardiovascular strain and impair aerobic exercise performance
- Dehydration of 4% can cause a 20-30% decrease in work

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How to Check Dehydration Status

- 1. Check your urine - should urinate every 2-4 hours
Normal urine should be pale and there should be enough of it
If Dehydrated - Small volume and dark color of urine
- 2. Weigh yourself before and after exercise
For every pound lost during exercise you need to drink 20oz
- 3. Consume 1 liter (1 quart) for every 1000 calories that are lost

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The Red Wine Cardiovascular Connection

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French Paradox

- Named in 1992
- Tried to explain why there is a low incidence of cardiovascular disease in the French population, despite a high dietary intake of saturated fats
- The effect is thought to be due to the consumption of red wine
- Red wine intake has been related to a lower risk of coronary heart disease
- Many epidemiological studies have demonstrated an inverse relationship between cardiovascular disease and moderate red wine consumption
- It is thought that light to moderate intake of red wine positively affects all phases of the atherosclerotic process, from atherogenesis (early plaque development and growth) to vessel occlusion

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Mechanism of Action of Red Wine

- Decrease oxidative stress
- Decrease blood viscosity
- Enhance cholesterol efflux from vessel walls (mainly by increasing levels of HDL cholesterol) - Inhibit lipoproteins oxidation, macrophage cholesterol accumulation, and foam-cell formation
- Increases nitric oxide bioavailability
- Improves insulin sensitivity
- Counteracts platelet hyperactivity, inhibits platelet adhesion to fibrinogen-coated surfaces, and decreases plasma levels of fibrinogen and coagulation factor VII

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Active Components of Red Wine

- Alcohol and Polyphenols (a heterogeneous group of phytochemicals containing phenol rings)
- Principal classes of red wine polyphenols - flavonols (quercetin and myricetin), flavanols (catechin and epicatechin), anthocyanin and stilbenes (resveratrol)
- *Are the effects from the alcohol or from something else such as the flavonoids?*
- Both the alcohol content and polyphenols contribute to lipid regulation, being an antioxidant and having anti-inflammatory effects
- Many studies have attributed beneficial outcomes to the presence of polyphenolic compounds such as resveratrol, catechin, epicatechin, quercetin, and anthocyanin

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Study (2011)

- 67 males at high-risk for CVD
- Subjects received red wine (30g alcohol/d), equivalent amount of dealcoholized red wine or gin (30g alcohol/d) for 4 weeks

Conclusion –

- Phenolic content modulates leukocyte adhesion molecules
- Both ethanol and polyphenols modulate soluble inflammatory mediators

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Flavonoid Synergism

- Study (Pignatelli) - two flavonoids
- Catechin (50-100umol/L) and quercetin (10-20umol/L) inhibited collagen induced platelet aggregation and platelet adhesion to collagen
- Combination of the two at 25umol catechin/L and 5umol quercetin/L inhibited collagen induced platelet aggregation and platelet adhesion to collagen
- At this dose - no effect on platelet function when used alone
- Study demonstrates the synergistic effects of specific flavonoids

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Resveratrol

- Resveratrol(3,5,4'-trihydroxy-trans-stilbene) is a polyphenol phytoalexin present in a variety of plant species
- Considered the most effective wine compound with respect to the prevention of CHD
- Stimulates endothelial production of nitric oxide, reduces oxidative stress of LDL, inhibits vascular inflammation, prevents platelet aggregation, changes lipid profiles and reduces insulin resistance
- In animal models of CVD - resveratrol protects the heart from ischemia-reperfusion injury, reduces blood pressure and cardiac hypertrophy in hypertensive animals, and slows the progression of atherosclerosis

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THE END

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Resistance Exercise - References

- Bakker EA, et al. Association of Resistance Exercise With the Incidence of Hypercholesterolemia in Men. *Mayo Clin Proc.* 2018 Apr;93(4):419-428
- Bemben, Debra A. and Bemben, Michael G. "Effects of Resistance Exercise and Body Mass Index on Lipoprotein-Lipid Patterns of Postmenopausal Women" *Journal of Strength and Conditioning Research*, 2000, 14(1), 80-85
- Hornbuckle, LM et al. Effects of resistance training and walking on cardiovascular disease risk in African-American women. *Med Sci Sports Exerc.* 2012 Mar;44(3):525-33.
- Isayeva, Anna Sergeevna et al. "Blood lipids and anthropometric parameters in healthy subjects practicing yoga or resistance training in leisure time. What matters: type or intensity of physical activity?" *Pol Merkur Lekarski.* 2021 Jun 16;49(291):203-208.
- Krčmářová, B et al. The effects of 12-week progressive strength training on strength, functional capacity, metabolic biomarkers, and serum hormone concentrations in healthy older women: morning versus evening training. *Chronobiol Int.* 2018 Oct;35(11):1490-1502.
- Liang, Minyu et al. "Effects of aerobic, resistance, and combined exercise on metabolic syndrome parameters and cardiovascular risk factors: a systematic review and network meta-analysis." *Rev Cardiovasc Med.* 2021 Dec 22;22(4):1523-1533.
- Schroeder, EC et al. Comparative effectiveness of aerobic, resistance, and combined training on cardiovascular disease risk factors: A randomized controlled trial. *PLoS One.* 2019 Jan 7;14(1): e0210292.
- Shaw, J et al. "Comparison of aerobic and combined aerobic and resistance training on low-density lipoprotein cholesterol concentrations in men." *Cardiovascular Journal of Africa* 2009 Sep-Oct;20(5):290-5
- Xin, Chenxi et al. "Effect of Exercise on Vascular Function and Blood Lipids in Postmenopausal Women: A Systematic Review and Network Meta-Analysis." *Int J Environ Res Public Health.* 2022 Sep 23;19(19):12074.
- Zapata-Lamana, R et al. [Resistance exercise improves serum lipids in adult women]. [Abstract in English, Article in Spanish] *Rev Med Chil.* 2015 Mar;143(3):289-96.

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Boswellia References

- Abdel-Tawab, M et al. "Boswellia serrata: an overall assessment of in vitro, preclinical, pharmacokinetic and clinical data" Clin Pharmacokinet. 2011 Jun 1;50(6):349-69.
- Bannuru, RR et al. Efficacy of curcumin and Boswellia for knee osteoarthritis: Systematic review and meta-analysis. Semin Arthritis Rheum. 2018 Dec;48(3):416-429.
- Belcaro, G et al. FlexiQule (Boswellia extract) in the supplementary management of osteoarthritis: a supplement registry. Minerva Med. 2014 Dec;105(6 Suppl 2):9-16.
- Brown, Donald J ND, Botanical Medicine: Integrating Herbal Medicine into Clinical Practice -Seminar textbook, Portland, Oregon, 1999.
- Haroyan, Armine et al. Efficacy and safety of curcumin and its combination with boswellic acid in osteoarthritis: a comparative, randomized, double-blind, placebocontrolled study. BMC Complement Altern Med. 2018 Jan 9;18(1):7.
- Italiano, G et al. Benefits of a Food Supplement Containing Boswellia serrata and Bromelain for Improving the Quality of Life in Patients with Osteoarthritis: A Pilot Study. J Altern Complement Med. 2020 Feb;26(2):123-129.
- Kimmatkar, N et al. Efficacy and tolerability of Boswellia serrata extract in treatment of osteoarthritis of knee--a randomized double blind placebo controlled trial. Phytomedicine. 2003 Jan;10(1):3-7.
- Majeed, M et al. A pilot, randomized, double-blind, placebo-controlled trial to assess the safety and efficacy of a novel Boswellia serrata extract in the management of osteoarthritis of the knee. Phytother Res. 2019 May;33(5):1457-1468.
- Onakpoya, IJ et al. Effectiveness of curcuminoids in the treatment of knee osteoarthritis: a systematic review and meta-analysis of randomized clinical trials. Int J Rheum Dis. 2017 Apr;20(4):420-433

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Green Tea References

- Boschmann, M and Thielecke, F "The effects of epigallocatechin-3-gallate on thermogenesis and fat oxidation in obese men: a pilot study". J Am Coll Nutr. 2007 Aug;26(4):389S-395S.
- Cisneros, LCV et al. Effects of green tea and its epigallocatechin (EGCG) content on body weight and fat mass in humans: a systematic review. Nutr Hosp. 2017 Jun 5;34(3):731-737. [Article in Spanish]
- Dulloo, AG et al. "Efficacy of a green tea extract rich in catechin polyphenols and caffeine in increasing 24-hour energy expenditure and fat oxidation in humans." American Journal of Clinical Nutrition 1999;70(6):1040-5
- Huang, J et al. The anti-obesity effects of green tea in human intervention and basic molecular studies. Eur J Clin Nutr. 2014 Oct;68(10):1075-87.
- Hursel, R and Westerterp-Plantenga, MS. Thermogenic ingredients and body weight regulation. Int J Obes (Lond). 2010 Apr;34(4):659-69.
- Türközü, D and Tek, NA. A minireview of effects of green tea on energy expenditure. Crit Rev Food Sci Nutr. 2017 Jan 22;57(2):254-258.
- Willems, Mark ET et al. "Three Weeks Daily Intake of Matcha Green Tea Powder Affects Substrate Oxidation during Moderate-Intensity Exercise in Females." J Diet Suppl. 2021;18(5):566-576.
- Xu, Y et al. The anti-obesity effect of green tea polysaccharides, polyphenols and caffeine in rats fed with a high-fat diet. Food Funct. 2015 Jan;6(1):297-304.
- Yoneshiro, T et al. Tea catechin and caffeine activate brown adipose tissue and increase cold-induced thermogenic capacity in humans. Am J Clin Nutr. 2017 Apr;105(4):873-881.

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Water Replacement and Exercise References

- Ayotte Jr, David and Corcoran, MP. Individualized hydration plans improve performance outcomes for collegiate athletes engaging in in-season training. *J Int Soc Sports Nutr.* 2018 Jun 4;15(1):27.
- Buskirk, Elsworth and Puhl, Susan. *Body Fluid Balance: Exercise and Sport.* CRC Press. New York. 1996.
- Drewnowski A, et al. Water and beverage consumption among adults in the United States: cross-sectional study using data from NHANES 2005-2010. *BMC Public Health.* 2013 Nov 12;13:1068.
- Iglesia, I, et al. Total fluid intake of children and adolescents: cross-sectional surveys in 13 countries worldwide. *Eur J Nutr.* 2015 Jun;54 Suppl 2(Suppl 2):57-67.
- Kenefick, RW. Drinking Strategies: Planned Drinking Versus Drinking to Thirst *Sports Med.* 2018 Mar;48(Suppl 1):31-37.
- Shirreffs, SM and Sawka, MN. "Fluid and electrolyte needs for training, competition, and recovery" *J Sports Sci.* 2011;29 Suppl 1:539-46.
- Winger, JM et al. "Beliefs about hydration and physiology drive drinking behaviours in runners" *Br J Sports Med.* 2011 Jun;45(8):646-9.
- Wolinsky, Ira. *Nutrition in Exercise and Sport.* Third edition. CRC Press. New York. 1998

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Red Wine References

- Castaldo, Luigi et al. Red Wine Consumption and Cardiovascular Health. *Molecules.* 2019 Oct 8;24(19):3626.
- Chiva-Blanch, G et al "Differential effects of polyphenols and alcohol of red wine on the expression of adhesion molecules and inflammatory cytokines related to atherosclerosis: a randomized clinical trial" *Am J Clin Nutr.* 2011 Dec 28.
- Ditano-Vázquez, Paola et al. The Fluid Aspect of the Mediterranean Diet in the Prevention and Management of Cardiovascular Disease and Diabetes: The Role of Polyphenol Content in Moderate Consumption of Wine and Olive Oil. *Nutrients.* 2019 Nov 19;11(11):2833.
- Golan, R et al. Wine and Health-New Evidence. *Eur J Clin Nutr.* 2019 Jul;72(Suppl 1):55-59. Li, H et al. "Cardiovascular effects and molecular targets of resveratrol" *Nitric Oxide.* 2012 Jan 4.
- Lippi, G et al. Moderate red wine consumption and cardiovascular disease risk: beyond the "French paradox" *Semin Thromb Hemost.* 2010 Feb;36(1):59-70.
- Pignatelli, Pasquale et al "The flavonoids quercetin and catechin synergistically inhibit platelet function by antagonizing the intracellular production of hydrogen peroxide" *American Journal of Clinical Nutrition.* 2000;72(5):1150-5.
- Wu, JM et al "Cardioprotection by resveratrol: a review of effects/targets in cultured cells and animal tissues" *Am J Cardiovasc Dis.* 2011;1(1):38-47. Epub 2011 Apr 27.

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