

Capsaicinoids and Red Pepper Human Studies Review

Authors /References	Experimental System & Grouping	Test material quantity and conditions of use	Duration	Observations & Findings
<p>Yoshioka et al; J Nutr Sci Vitaminol; 41; 647-656(1995)</p>	<p>2 experiments carried out with 8 male long distance runners(about 20 years) for the effect of red pepper on the energy metabolism at rest and 7 males(about 21 years) for evaluating the inhibitory effect of the β-adrenergic blocker(propranolol) on the increase of energy due to red pepper</p> <p>i) The subjects consumed a standardized dinner protein: fat: carbohydrate(15:25:60). The next morning consumed a breakfast(650 Kcal) either with or without 10 g red hot pepper</p> <p>ii) In the second experiment after a dinner like above, the subjects consumed a breakfast with 10 g red hot pepper after an oral administration of propranolol(0.50 mg) or a placebo</p>	<p>Red hot pepper(3 mg capsaicin per gram of red hot pepper)</p> <p>The expired gas was collected after 20 mins of breakfast for 10 mins and later every 10 mins until 90 min and then every 30 minutes from 90-150 min. The expired gas was analyzed by a spinometer. The energy expenditure and substrate oxidation rate were measured and calculated in both experiments 1 & 2.</p>	<p>Overnight.</p>	<p>During the initial 30 min after breakfast, the energy expenditure is higher in the red pepper diet than the control diet. In the next 20 min there is no difference in energy expenditure between the two.</p> <p>Carbohydrate oxidation was significantly higher and lipid oxidation significantly lower in the red hot pepper diet than in the control diet.</p> <p>In the second experiment the propranolol nullified the increase in energy expenditure arising from red hot pepper in initial 30 min. In the later period 120 min, there is no difference found between propranolol and placebo.</p> <p>The energy expenditure arising immediately after a meal containing red hot pepper is caused by β-adrenergic stimulation.</p>

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<p>Yoshioka et al; British J Nutri; 80, 503-510(1998)</p>	<p>Thirteen healthy Japanese women (22-30 years) were subjected to the effects of red pepper added to High Fat(HF) and High Carbohydrate(HC) meals on energy metabolism and substrate utilization. After ingesting a standardized dinner(15%:25%:60 % nergy from protein fat and carbohydrates) and the breakfast (1883 KJ) was a s follows: HF Meal, HF +Red Pepper(10g), HC+Red Pepper(10g). The expired air was collected immediately for 10 minutes and then every 10 min for the first hour and every 30 min from 90 to 210 min. The gases were analyzed by Spinometer and by medical gas analyzer. Lipid and carbohydrate oxidation rates were estimated.</p>	<p>Red pepper had capsaicin content of 3 mg/g(Saengaul kongjang variety) and the powder mixed uniformly in the meal consisting of soy rice, scallops, shrimps, bacon, green pepper, peas, onions & tomatoes sautéed in veg oil.</p>		<p>Diet induced thermogenesis was significantly higher after the HF meals and it was significantly increased by the addition of red pepper to the experimental meals. The impact of red pepper on diet induced thermogenesis was more pronounced in the HF meals. The addition of red pepper significantly increased lipid oxidation in the HF meal while the same significantly decreased the carbohydrate oxidation in the HC meals. The above findings have shown that red pepper increases both diet induced thermogenesis and lipid oxidation.</p>

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<p>Yoshioka et al; British J. Nutri.; 82; 115-123(1999)</p>	<p>The study is aimed to correlate the decrease of food intake in diet containing red pepper(capsaicin) vs uncrease in SNS activity. In study(1) 13 healthy Japanese females(age 22-30 yrs) were given a standardized dinner and the next morning were given breakfast meal as per the design: HF meal HF+red pepper HC Meal HC+red pepper After breakfast meal and rest(3 hrs) energy measurements were performed. Lunch was provided to eat until satiety and based on food intake, energy intake was calculated from protein, fat and carbohydrates present in grams. The desire to eat, fullness, satiety were measured by a visual scale. study(2) 10 healthy Caucasian</p>	<p>Red pepper had capsaicin content of 3 mg/g(Saengaul kongjang variety). Power spectra were calculated from a consecutive series of 512 R-R intervals. The value of low and high frequencies obtained .</p>		<p>The addition of red pepper(10 g or capsaicin 30 mg) to breakfast significantly decreased both protein and fat intake in both HF and HC conditions. That is, it significantly reduced the desire to eat(appetite) before lunch in case of females. The addition of red pepper(6 g) to the appetizer significantly reduced the cumulative food intake(both energy and carbohydrate) at lunch and snack meals of Caucasians. The power spectra analysis of heart rate showed an increase in the Sympathetic:Perisymphathetic Nervous System activity. Thus it provides information regarding overfeeding and underfeeding.</p>

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	<p>males (avg age 33 yrs) participated. The study aimed to understand the effects of an appetizer containing red pepper on subsequent energy and macronutrients intake. They were given a standardized breakfast. Later the subjects were given an experimental appetizer (644 KJ) at lunch time and asked to eat till satiety. Mixed diet plus appetizer containing red pepper (6g). The food intake and the corresponding energy were calculated. Heart rate, power spectral analysis were performed and the low high frequency components of spectra were attributed to Sympathetic and Para-sympathetic neuron system activity.</p>			
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<p>Matsumoto et al J Nutr. Sci Vitaminol.; 46, 309-315(2000)</p>	<p>The study deals with the effect of Capsaicin containing yellow curry</p>	<p>The curry sauce contained 3mg Capsaicin.</p>		<p>ECG, R-R interval changes and the power spectral data of the control and obese</p>

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	<p>sauce on Sympathetic nervous system activity and energy metabolism(diet induced thermogenesis) in 8 lean(control) and 8 obese young women of age around 28 years. The Sympatho-vagal activities were assessed by Spectral analysis of heart rate variability(HRV)during the resting conditions and after the rice and curry sauce meal(2016 KJ) with capsaicin. Energy expenditure was also measured under 2 conditions -using ECG and gas-exchange measurement</p>			<p>subjects at rest appeared similar. After ingestion of Capsaicin diet, the very low frequency component related to the thermogenic SNS activity predominantly increased in the control group whereas the very low frequency component remained unchanged in obese subjects. Energy expenditure was significantly increased in the control group while no significant thermogenic response was detected in the obese group.</p>
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<p>Yoshioka et al. British J. Nutr.; 85, 203-211(2001)</p>	<p>Eight healthy Caucasian volunteers (25 years) participated in 2 randomly designed conditions of control & experimental (red-pepper and caffeine). The subjects consumed a standardized breakfast (until satiety) at home; moved to laboratory &</p>	<p>The 2 appetizers containing 6 g red pepper(ie 18 mg capsaicin) were given before lunch and dinner. The lunch meal contained 8.6 g red pepper(ie 25.8 mg Capsaicin). Dinner meal contained 7.2 g red pepper(21.6 mg</p>	<p>Experimental protocol lasted for 24 hours</p>	<p>The study reports the combined effects of red pepper and caffeine consumption on subjects given free access to food for 24 hour period. The addition of red pepper and caffeine significantly decreased cumulative energy and</p>

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stayed till 11 hrs the next day. In the laboratory breakfast, 2 appetizers with red pepper (& control) followed by lunch containing red pepper(& control)and dinner containing red pepper(& control) and next morning breakfast. In between snacks and coffee(4 times) with 200 mg added caffeine(and control) were given. Visual analogue Scale measurements were carried regarding desire to eat, hunger, fullness and satiety both before and after consumption of meal. Energy expenditure measurements were performed and the energy balance calculated. Based on food intake, (protein, fat and carbohydrate) energy intake(KJ) was calculated and the energy

expenditure from gas analysis. Heart rate power spectral analysis was performed to obtain SNS and para-sympathetic

Capsaicin). Total Capsaicin intake is 86.4 mg/24 hours.

macro-nutrient intakes of protein, fat and carbohydrates. The hunger level and the desire to eat immediately after the red pepper appetizer lowered significantly compared to the control, and similarly caffeine also. Red pepper +caffeine reduced the cumulative intake and increased energy expenditure. These effects are mediated by an increase in the SNS:PNS activity ratio measured by HR power spectral analysis.

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<p>Tsi et al; J. Nutr Sci Vitaminol.; 49, 437-441(2003)</p>	<p>nervous system activity.</p> <p>9 healthy male and eight healthy female subjects were given 4 test sample tablets containing Capsaicin, Green Tea Extract and Chicken Essence(free of fat). While placebo consisted of 4 casein tablets. The expired gas was analyzed. Resting energy expenditure was calculated from the oxygen consumption and respiratory quotient. Body fat was measured daily using a body fat monitor. The body fat in the male and female subjects was over 28% and 33% respectively.</p>	<p>The test material (Tablets) consisted of Capsaicin(0.4 mg), Green tea Extract(625 mg with 125 mg Catechins +50 mg caffeine), Chicken Essence Spray Dried(water extract).</p>	<p>2 weeks supplementation of the test material.</p>	<p>The mean resting energy expenditure of subjects consuming the test supplement were significantly higher than the placebo. After 2 weeks supplementation the mean body fat % of males and females was significantly less than the initial values. The mean reduction of body fat among mean was 0.6% compared to 0.7% for females which corresponds to 486 g and 445 g respectively. The resting energy expenditure of the subjects taking test samples was significantly higher compared to placebo. The test material consists of natural thermogenic food inducing ingredients on body fat . Capsaicin(via β-adrenergic pathway), caffeine(by nor-epinephrine and inhibiting cyclic AMP) and Catechins (by nor-epinephrine and inhibiting</p>

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Lejeune et al; British J Nutrition; 90, 651-659(2003)	<p>The study examines the effect of Capsaicin in weight maintenance by limiting regain among subjects who lost 5-10% by weight. This is a randomized double-blind placebo-controlled study consisting of 91 moderately overweight subjects.</p> <p>After 4 weeks of very low energy diet(supplied in 3 sachets per day dissolved in water to obtain milk shake, pudding, soup, and fruits /vegetables) to result in body weight loss of at least 4 kg/4 week period. In the next weight maintenance period, ie 3 months, 42 subjects received a capsule(Capsaicin 22.5 mg+202.5 mg veg oil) . 49 subjects received only 222.5 ml oil in a capsule. Each subject was given 2 capsules during breakfast,</p>	<p>The Capsaicin was given to the subjects 3 times (22.5 mgx2 capsulesx3 times a day) equivalent to 135 mg Capsaicin per day.</p>	<p>The duration of the study was 17 weeks : initial 4 weeks for weight reduction and the next 13 weeks after giving capsaicin for weight maintenance.</p>	<p>catechol-o-methyl transferase.)</p> <p>With respect to the body weight loss the subjects lost a significant amount of body weight ie 6.6 kg resting energy expenditure and respiratory quotient decreased during weight loss. The actual experiment on body weight maintenance after body weight loss showed that for 135 mg capsaicin/day vs placebo did not improve body weight maintenance in originally moderately overweight men and women after a modest weight loss of 7.8%. Respiratory quotient was significantly less increased during weight maintenance in the treatment group compared to placebo. Fat oxidation (g/h) after weight maintenance was higher in Capsaicin group.</p>

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<p>Westerterp-Plantenga; Int. J. Obes.; 28, 682-688(2005)</p>	<p>lunch and dinner(total 6 capsules /day).</p> <p>The study evaluated the sensory and gastro-intestinal contributions to capsaicin-induced satiety and its effect on food intake. After screening 12 men and 12 women(Caucasian subjects) were selected. The assessment of satiety effect was carried out by providing:</p> <ul style="list-style-type: none"> i) 200 ml tomato juice+0.9 g red pepper ii) Plain 200 ml tomato juice(placebo) iii) 200 ml tomato juice + red pepper of the same dosage as i) above in 2 capsules iv) 200 ml tomato juice + 2 placebo capsules <p>Each of the above subjects was given the experimental tomato juice containing</p>	<p>The red pepper used showed 0.25 % Capsaicin.</p>	<p>The duration of the study was 2 days x 4 weeks.</p>	<p>After consuming 0.9 g red pepper or the same quantity in capsules, the capsules decreased their energy intake: the vales were 10-16% in case of 0.25% Capsacin in tomato juice, and 10-12% in case of red pepper in capsules taken with tomato juice. After ingestion of Capsaicin, AUC for satiety increased, and AUC for hunger decreased-both in men and women.</p>

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	<p>red pepper/placebo 30 in prior to lunch and dinner for 2 days. This experiment was continued for 2 days in a week and the 3 subsequent weeks. Hunger and satiety were recorded 9 times a day- before and after breakfast, lunch, dinner, and between mid-morning and mid-afternoon using visual analogue scale. Averaged values of energy intake, weight of food intake, macro-nutrient composition and energy density were obtained for 2 consecutive days, and for each subject there were 4 treatments(with or without red pepper and placebo).</p>			
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<p>Ahuja & Ball; Brit. J. Nutri., 96, 239-242(2006)</p>	<p>The study investigated the effects of regular consumption of red peppers(chillies) on in vitro serum , lipoprotein oxygen and total anti-oxidant status in healthy adult male(14 nos.) and female(13 nos.) subjects</p>		<p>Duration of the study was for 4 weeks.</p>	<p>The results of the total cholesterol, LDL, HDL, tri-acylglycerol, rate of oxidation and total anti-oxidant status of serum from red pepper and bland diets have shown that capsaicin in red pepper helps inhibit the oxidation of serum</p>

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(Age 46 years, Weight 70-96 kgs).

A randomized cross-over study with the subjects provided to consume “red-pepper” or “no red-pepper” diets for 4 weeks.

The red pepper diet included 30 g of freshly chopped red peppers each day in in the usual meal. The bland meal was without red pepper. The diet of 4 days each week of both groups was analyzed for complete macronutrient intake,

On the 29th day , the serum fasting venous blood samples of all the subjects was drawn and analyzed for serum lipids, lipoproteins and total anti-oxidant status.

lipoproteins by reducing the rate and the susceptibility to oxidation.