The Effect of Dietary MCT and LCT Oils on Acyl Ghrelin and Relationships to Hunger and Satiety

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- **Introduction:** Obesity is a prominent health concern that results, in part, from excess energy intake. Both hunger and satiety are mechanisms that govern energy intake. Ghrelin is a gut hormone that stimulates food intake and appetite in rodents and humans. In order to become active, ghrelin is acylated by an 8-carbon fatty acid ghrelin octanyl acyl transferase (GOAT). The source of this fatty acid is unknown, but it has been suggested that specific dietary components, such as medium chain triglycerides (MCT) and long chain triglycerides, may play a role.

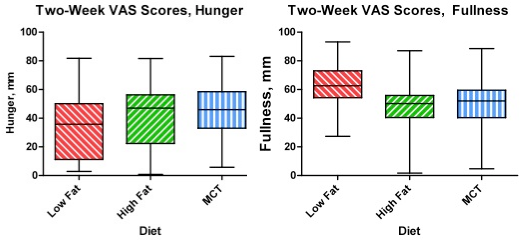
- **Objectives/Aims:**

  Specific Aim 1: Compare the daily average hunger and satiety scores in lean and obese subjects during two-week meal cycles consisting of meals with different dietary fat macronutrient content: High fat (HF), high fat with high MCT (MCT), and low fat, high-CHO diets (CHO).

  Specific Aim 2: Correlate the changes in plasma concentrations and ratio of active (acyl) ghrelin to total immunoreactive ghrelin in response to isocaloric meals differing in fat content to the changes in hunger or satiety levels experienced by lean and obese subjects during those meals.

- **Methods:**
  - 15 lean and 6 obese subjects (9 female, 12 male; ages 23-56)
  - Three two-week periods in which subjects consumed isocaloric diets that were either: low-fat/high CHO, high fat, or high MCT
  - Visual analog scores to measure hunger and fullness were collected daily
  - At the end of each 2-week feeding period, subjects were admitted to the CTRC for standardized meals of identical composition to their diet assignment as breakfast, lunch, and dinner
  - Every 30 minutes from 7:30 AM to 9:00 PM, subjects completed visual analog scores and had blood drawn every 30 minutes to measure acyl and desacyl ghrelin levels

  Results: Our data show a significantly greater hunger (P=0.02) and lower fullness (P=0.034) on the MCT diet compared to the low fat diet. The ratio of acyl ghrelin to des-acyl ghrelin was significantly higher in the MCT diet than the high fat diet (P=0.002) and approached significance between the low fat and MCT diets, at (P=0.05). Hunger and ghrelin levels followed a similar pattern, increasing before a meal and decreasing after the meal, in all subjects.



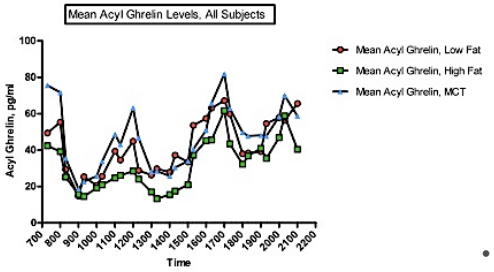
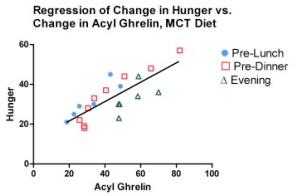


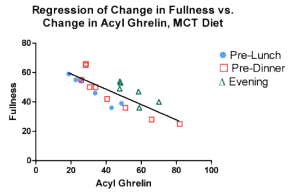
Table 1. Effect of diet fat and carbohydrate on ghrelin levels in lean and obese subjects (n=21)

	MCT	HF	LF	ANOVA *P*-value	MCT vs. HF *P*-value	MCT vs. LF *P*-value	HF vs. LF *P*-value
Acyl Ghrelin							
AUC (pg-13 hr/mL)	587 ± 371	404 ± 181	533 ± 274	**0.025**	**0.012**	0.69	**0.03**
Fasting	73.7 ± 49.4	40.8 ± 22	51.6 ± 39	**0.032**	**0.009**	0.113	0.275
Des Acyl Ghrelin							
AUC (pg-13 hr/mL)	308.4 ± 251.3	418.6 ± 266.4	480.4 ± 316.9	**<0.001**	**0.016**	**<0.001**	0.058
Fasting	47.6 ± 33	62.1 ± 46	61.1 ± 49.6	0.143	0.112	0.071	0.818
Acyl:Des Acyl Ghrelin							
AUC (pg-13 hr/mL)	47.7 ± 33.1	23.1 ± 14.6	33.2 ± 34.4	**0.02**	**0.005**	0.134	0.165
Fasting	3.1 ± 3.8	2.1 ± 3.9	1.4 ± 1.6	0.256	0.926	0.109	0.614
Total Ghrelin							
AUC (pg-13 hr/mL)	895.7 ± 544.2	822.2 ± 409.4	1008.1 ± 491	**0.011**	0.342	**0.039**	**0.004**
Fasting	121.2 ± 60.6	102.8 ± 54.3	112.6 ± 78.8	0.486	0.266	0.856	0.35
Acyl:Total Ghrelin							
AUC (pg-13 hr/mL)	8.4 ± 1.8	6.7 ± 2.1	6.6 ± 2.1	**0.04**	**0.017**	0.052	0.62
Fasting	0.6 ± 0.2	0.5 ± 0.3	0.5 ± 02	0.197	0.089	0.175	0.719

Results are mean ± SD. AUC- area under the curve. MCT-medium chain diet. HF-high fat diet. LF-low fat diet.

- **Results:**
  - There was a significant positive correlation between change in hunger and change in acyl ghrelin for all three diets (P=<0.001, LF diet; P=0.001, HF diet; P=<0.001, MCT diet). The correlation between change in desacyl ghrelin and hunger is less significant, at P= 0.004 for LF diet and P=0.006 for high fat diet, no significance for MCT diet.
  - The correlations for change in fullness and change in acyl ghrelin were negative, and significant across all three diets (P=<0.001, LF diet; P=<0.001, HF diet; P=<0.001, MCT diet). The correlation for fullness and desacyl ghrelin were also negative, and less significant (P=0.02, LF diet; P=0.012, HF diet).





- **Conclusion:** Compared to a low-fat diet, a diet high in MCT increases hunger and decreases fullness. We also report that the proportion of ghrelin in its active form is higher during a high MCT diet. These data suggest that 1) the acyl group that activates ghrelin can be derived from dietary sources and 2) the increase in acyl ghrelin while on a high MCT diet may mediate the enhanced hunger experienced by the participants.

- **Limitations:**
  - Small sample size. Inadequate number of both lean and obese to compare outcomes between the two groups
  - Specified meal times during visit to CTRC but not at home during two week diets
  - Did not measure fatty acid moiety on ghrelin directly to confirm it is C8 during MCT
  - Could not rule out that increase acyl group from endogenous synthesis rather than diet

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