

The association between a single nucleotide polymorphism in the SOCS-3 gene and caloric intake is modified by body mass index

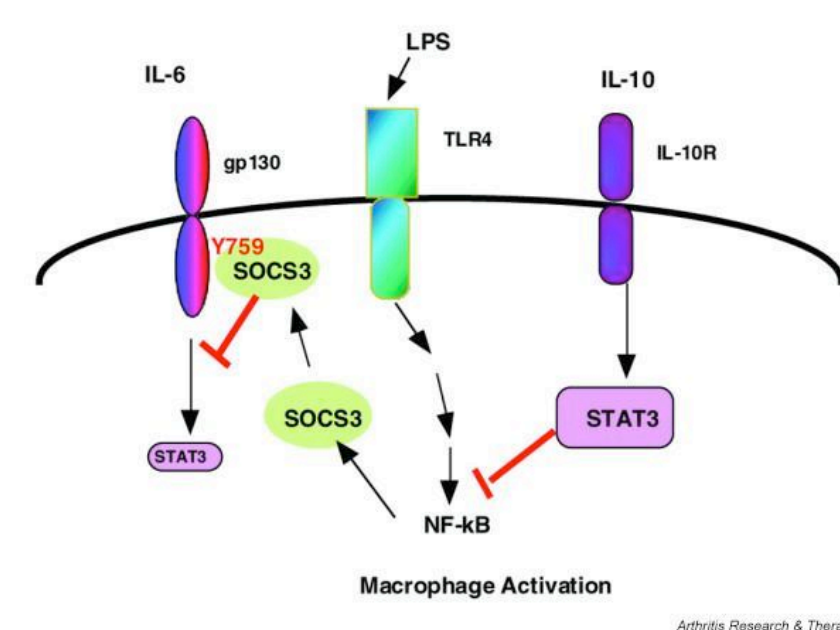
Boehm, Kaitlin¹, Murray, Julie¹, Fontaine-Bisson, Bénédicte¹, El-Sohmey, Ahmed²

¹ Program of Nutrition Sciences, University of Ottawa, Ottawa, Ontario

² Department of Nutritional Sciences, University of Toronto, Toronto, Ontario

Introduction

- Obesity is characterized by an excess of adipose tissue in the body.
- Obesity is strongly associated with leptin resistance.
- Leptin is a crucial hormone regulating appetite and energy balance in the human body.
- Leptin is produced by the adipose tissue (adipocytes).
- Leptin resistance is associated with excessive energy intake.
- SOCS-3 (suppressor of cytokine signaling) is a protein that inhibits leptin signalling.
- Overexpression of SOCS-3 is associated with leptin resistance.
- A single nucleotide polymorphism (SNP) lies at the -4874th nucleotide upstream from the SOCS-3 gene (rs4969170) and consists of an A to G substitution.



Objectives

- 1) To determine whether there is an association between the single nucleotide polymorphism (rs4969170) in the SOCS-3 gene and indices of obesity.
- 2) To determine if caloric intake is influenced by the rs4969170 SNP in the SOCS-3 gene.
- 3) To determine if the rs4969170 SNP in the SOCS-3 gene modifies the association between indices of obesity (body mass index and waist circumference) and caloric intake.

Methods

Population:

~219 University of Toronto students between the ages of 20-29.

Method:

- Dietary assessment was performed using a 196-item Food Frequency Questionnaire (FFQ).
- Height and weight were measured to calculate body mass index (BMI in kg/m²).
- Waist circumference was measured at the mid-point between the iliac crest and the lower ribs.
- Physical activity was recorded in Metabolic Equivalent Task Score (METS) - leisure and occupational activity only.
- Genotyping was completed using Real-time PCR with high resolution melt function using ECO Instrument (Illumia).



Statistical Analyses

- Analysis of variance (continuous variables) or X² (sex variable) were used to test for a difference between genotypes (SOCS-3) for the general characteristics of the population including BMI and caloric intake.
- General linear models were used to test for an interaction between SOCS-3 polymorphism and indices of obesity on caloric intake adjusted for sex and physical activity.

Results

Table 1: General characteristics of the population by SOCS-3 genotype (rs4969170)

Variable	SOCS-3 Genotypes			P
	AA	AG	GG	
Age	22.8±2.5	22.5±2.7	22.7±2.5	0.75
Sex (M/F %)	25/26	43/42	32/32	0.97
WC ¹	75.2±9.7	73.7±8.7	76.6±11.0	0.20
Physical Activity (METS) ²	1.9±0.4	1.7±0.4	1.9±0.4	0.008

¹Waist Circumference

²Metabolic Equivalent Task Score

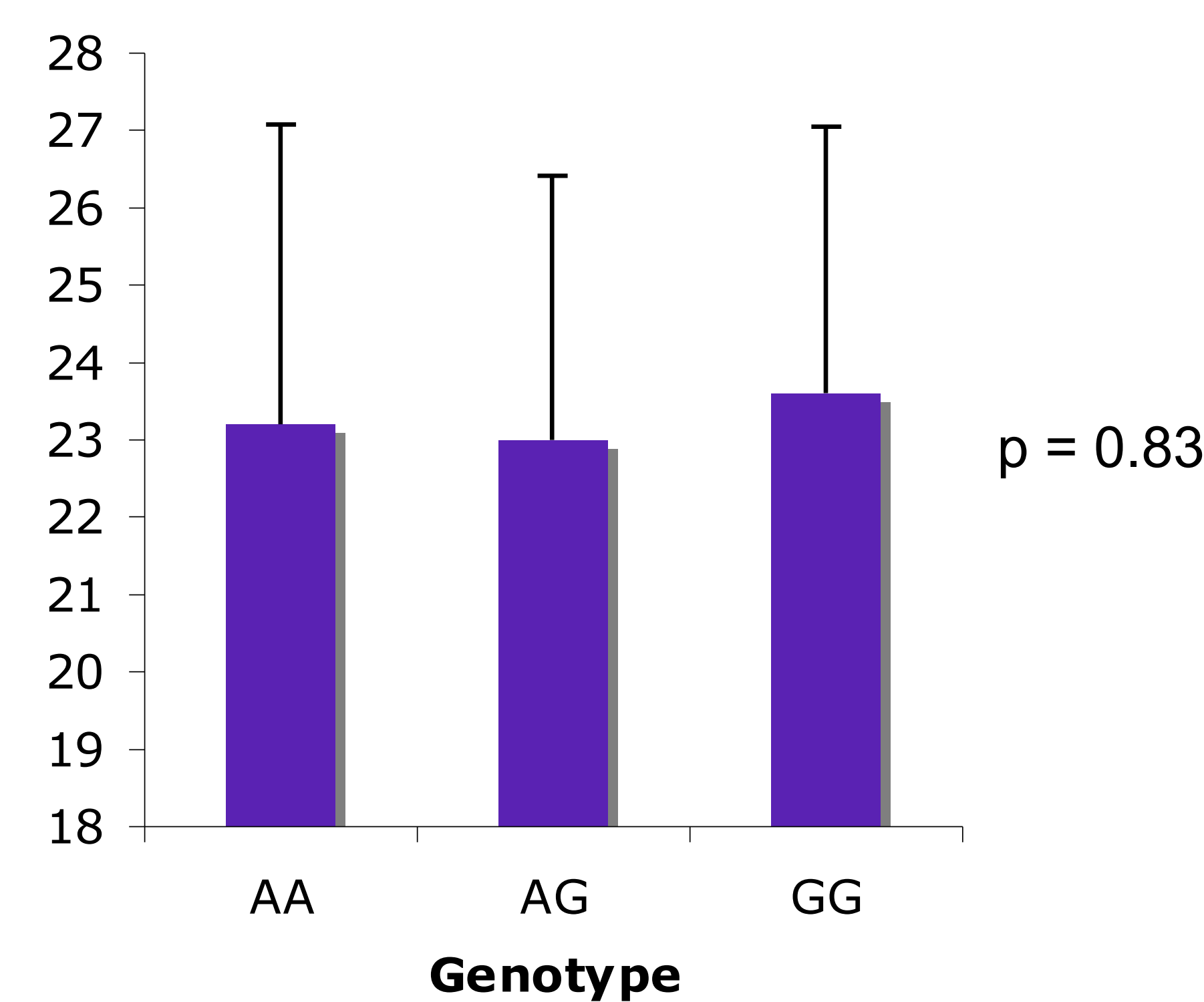


Figure 1: Association between SOCS-3 polymorphism (rs4969170) and body mass index (kg/m²). The analysis was adjusted for sex and physical activity.

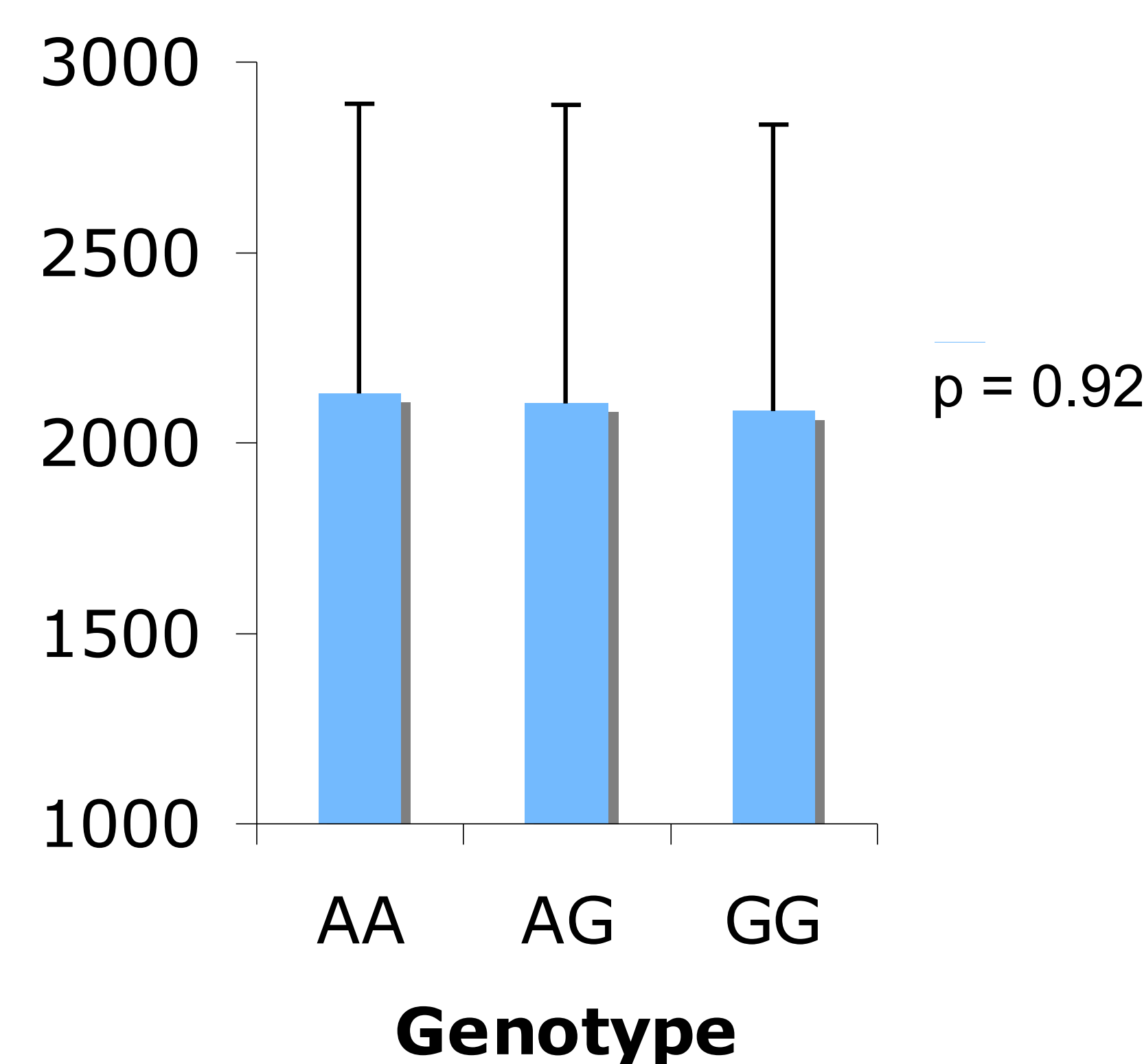


Figure 2: Association between SOCS-3 polymorphism (rs4969170) and caloric intake (kcal). The analysis was adjusted for sex and physical activity.

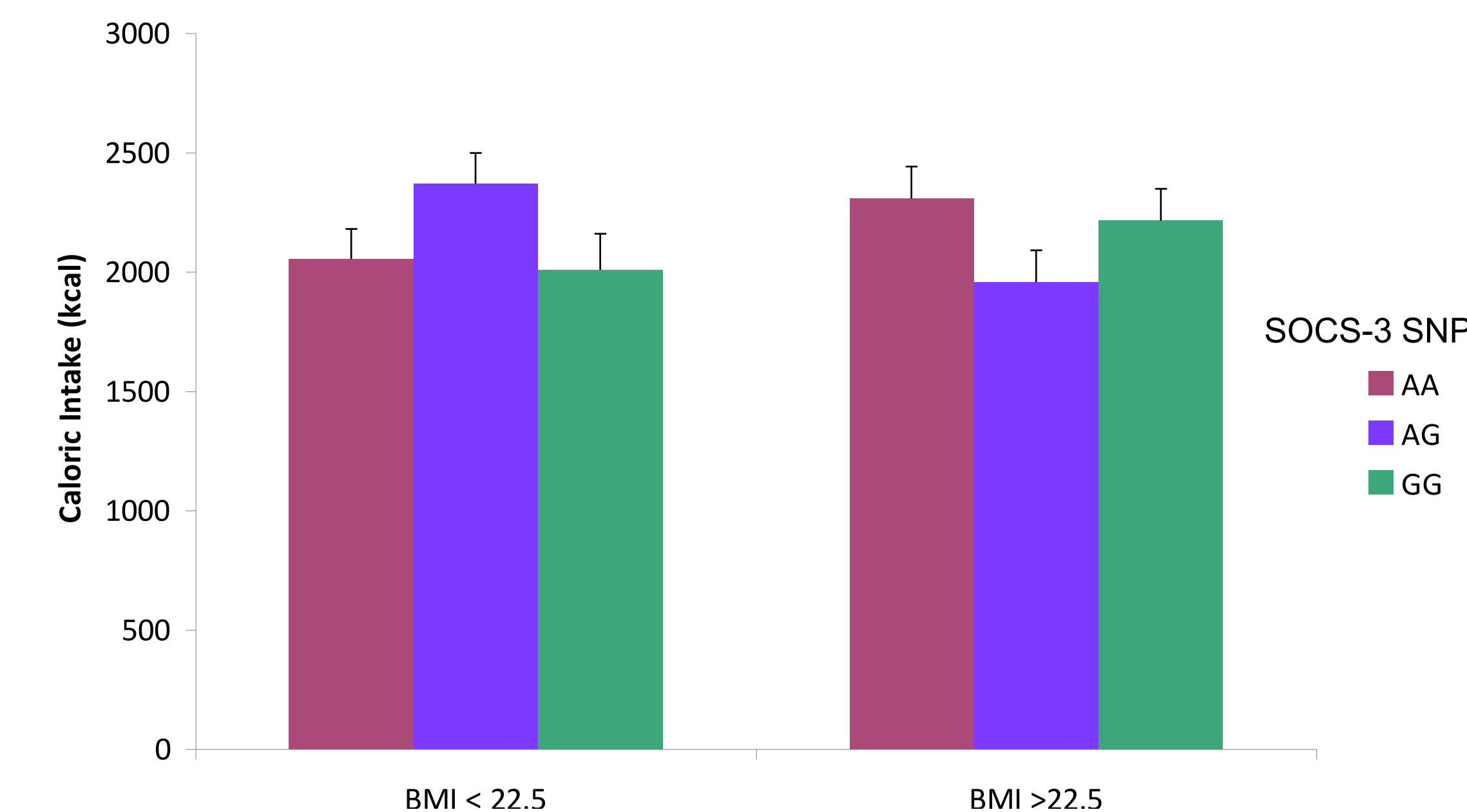


Figure 3: Body mass index (median - kg/m²) modifies the association between SOCS-3 polymorphism (rs4969170) and caloric intake (kcal). P = 0.007 for interaction adjusted for sex and physical activity.

Conclusions

- The rs4969170 SNP in the SOCS-3 gene does not have a significant influence on BMI or Caloric Intake when analyzed individually.
- When BMI (or waist circumference), caloric intake and genotype are analyzed jointly, a unique relationship for the AG genotype is observed.
- Among individuals with the AG genotype, having a lower BMI is associated with a greater caloric intake whereas having a larger BMI is associated with a smaller caloric intake.
- Blood leptin levels and other polymorphisms in the SOCS-3 gene must be examined to further understand this relationship.
- These findings may have implications for individualized obesity prevention strategies

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Advanced Foods and Materials Network