Postprandial glycaemic responses in women co-ingesting green leafy vegetables with a carbohydrate meal: interactions with the sirtuin system

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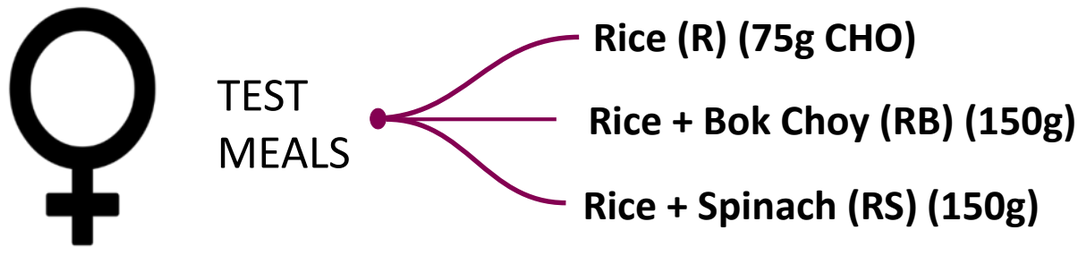
Introduction

Co-ingestion of vegetables with carbohydrate-based meals may reduce postprandial glucose[1]. Conclusive evidence is hindered by inter-individual variation and limited research on sex-specific variation[2]. The sirtuins and associated genes involved in producing the chemical, nicotinamide adenine dinucleotide (NAD), are emerging as key players in metabolic health, lipid homeostasis and blood glucose control and may contribute to variable responses[3].

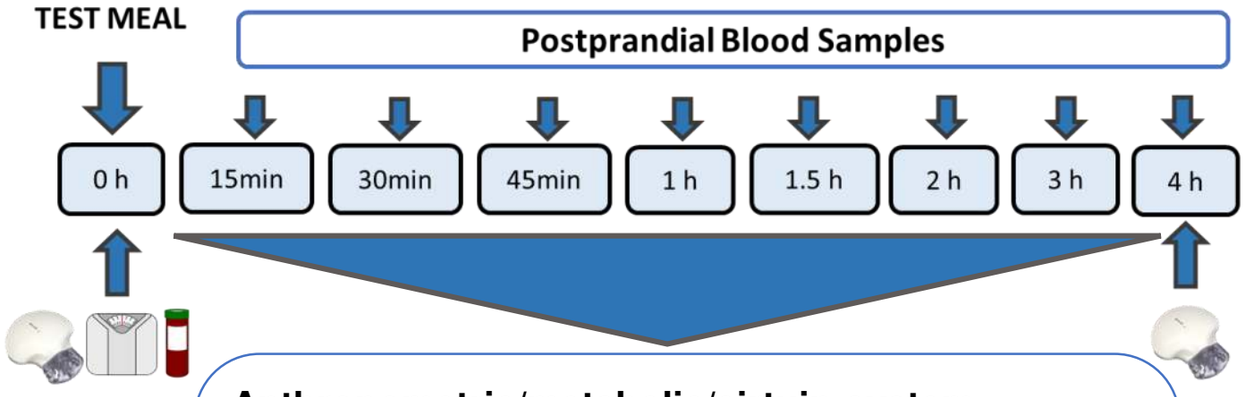
Aim

Determine interactions with the sirtuin system linked to inter-individual variation in postprandial glucose regulation in women co-ingesting green leafy vegetables (GLV) with a carbohydrate meal (VegGI study: Research Registry 3117).

VegGI Study protocol



Healthy 23-70 y (BMI 24.8 – 30.5 kg/m^2) with no evidence of chronic illness (n=25)



Anthropometric/metabolic/sirtuin system markers:

- Weight, BMI, waist and hip circumference, waist/hip ratio, fat mass%, blood pressure
- Plasma glucose, insulin and sex hormones
- Fasted cholesterol and HbA1c
- hSIRTNADplex[3] blood gene expression profiles

Anthropometric and plasma analysis

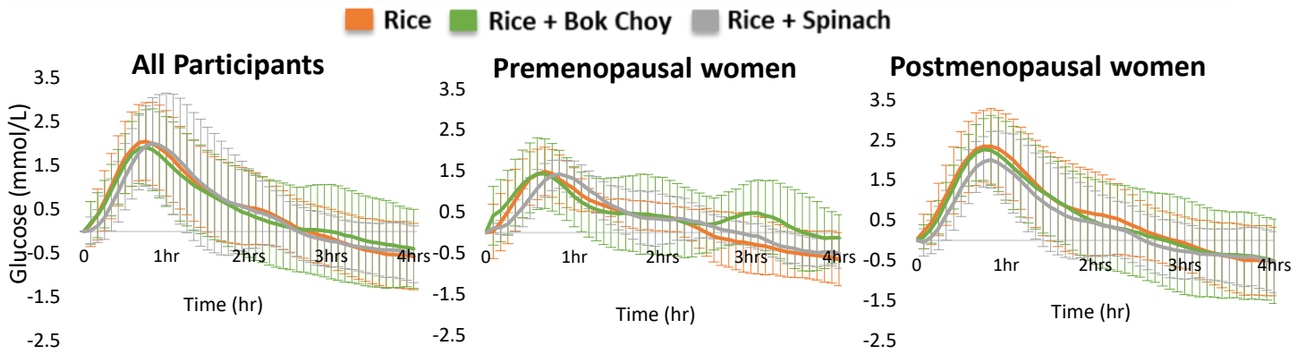
Variables	All (n=25)	Premenopausal (n=8)	Postmenopausal (n=15)
Age	52.3 ± 14	**35.5 ± 10.2**	**61 ± 6.3**
Height (cm)	162.6 ± 8.5	163.5 ± 9.1	161.7 ± 8.4
Weight (kg)	73.7 ± 8.4	75.2 ± 8.6	72.1 ± 8.4
BMI (kg/m^2)	27.8 ± 1.7	28.1 ± 1.8	27.5 ± 1.8
Total cholesterol (mmol/L)	5.4 ± 1	**4.5 ± 1**	**5.9 ± 0.7**
HbA1c (%)	5.3 ± 0.3	**5.1 ± 0.2**	**5.4 ± 0.2**
Sys BP (mmHg)	127.6 ± 17.2	**112.9 ± 10.2**	**133.3 ± 15.8**
Dias BP (mmHg)	74.4 ± 8.5	**69.7 ± 7.7**	**75.4 ± 7.6**
Fat mass %	39.1 ± 7.3	37 ± 5.8	41.2 ± 7.8
Waist Circumference (cm)	85.7 ± 6	84.7 ± 5.6	85.7 ± 6.5
Hip Circumference (cm)	103.6 ± 7.5	102 ± 10.6	104.1 ± 5.9
Waist:Hip	0.8 ± 0.1	0.8 ± 0.1	0.8 ± 0.05
Fasted Glucose (mmol/L)	4.9 ± 0.9	4.6 ± 0.3	5.1 ± 1.1

Mean± SD; BP: Blood pressure; Bold in red indicate P<0.05 using Independent t-test

Variables	Premenopausal (n=8)	Perimenopausal (n=2)	Postmenopausal (n=14)
Oestradiol (nmol/L)	0.5±0.4^a	0.2±0.3^b	0.1±0^b
Progesterone (nmol/L)	13.8±16^a	1.4±0.5^b	0.7±0.6^b
FSH (IU/L)	4.8±2.4^a	61.3±32.3^b	77.7±23.2^b
Testosterone (nmol/L)	0.9±0.3^a	0.9±0.0^{ab}	0.7±0.3^b

Mean± SD; FSH: Follicular Stimulating Hormone; Different superscript letters indicate significant differences between the means (P<0.05) using ANOVA

Postprandial glucose response to GLV

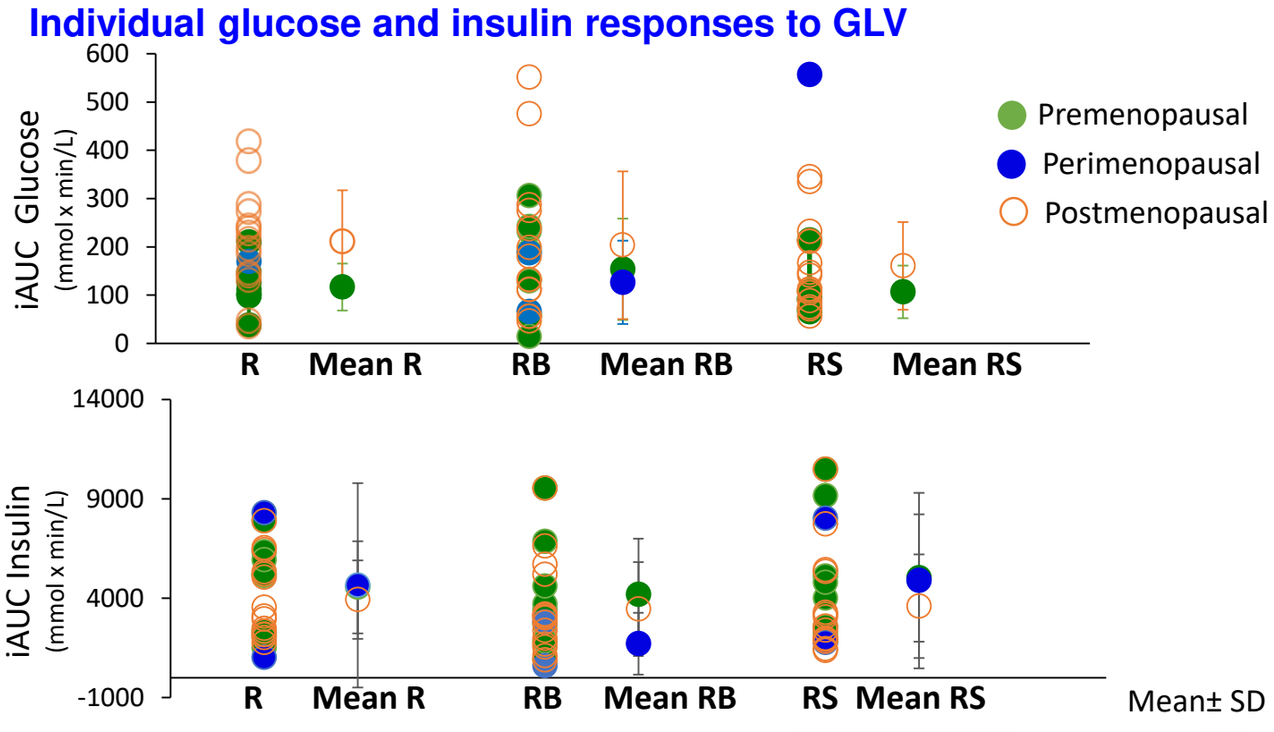


Postprandial iAUC* insulin (mmol x min/L) response to GLV

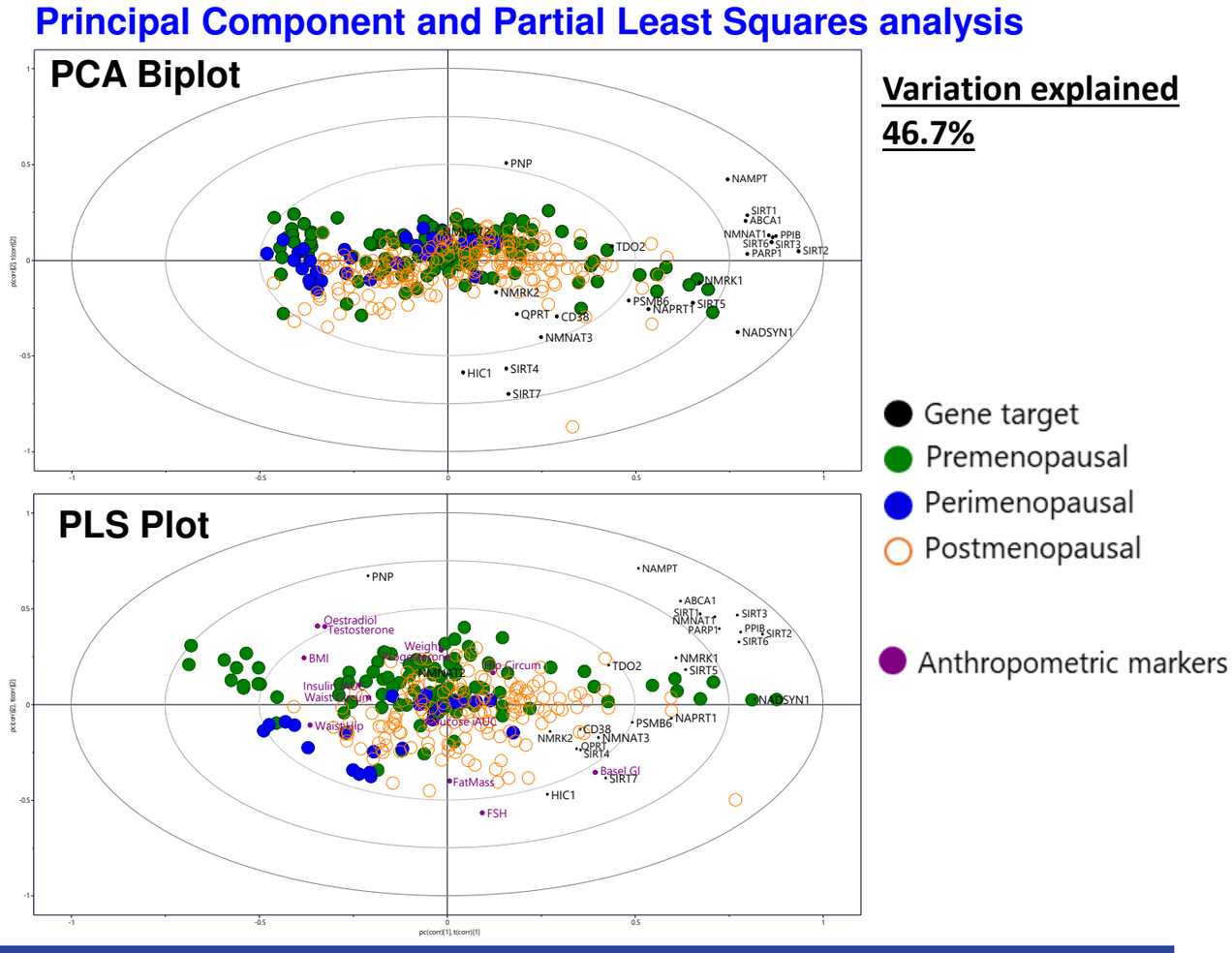
Test meals	All	Premenopausal	Postmenopausal
R	4186.7 ± 2246.5	4550.7 ± 2314.5	3930.6 ± 1977.0
RB	3551.8 ± 2467.0	4191.1 ± 2805.6	3455.2 ± 2364.8
RS	4156.6 ± 2873.4	5021.8 ± 3206.0	3597.0 ± 2604.2

Mean± SD, R n=24, RB n=24, RS n=22; *Incremental area under the curve; NS using Independent t-test

Individual glucose and insulin responses to GLV



Principal Component and Partial Least Squares analysis



Conclusions

- GLV did not reduce mean postprandial glucose or insulin responses in women (BMI 24.8 – 30.5 kg/m^2).
- Inter-individual variation in postprandial glucose was marked.
- Attenuated sirtuin system associated with higher BMI, oestrogen, testosterone, waist:hip ratio and elevated postprandial glucose and insulin responses.
- Activation of the sirtuin system associated with lower iAUC glucose and insulin, irrespective of menopausal status.

1. Sun L et al (2014). Eur J Nutr 53(8):1719-1726;
2. Sayegh et al (2019). Proceedings of the Nutrition Society, 78(OCE2)
3. Gray et al (2018). Appl Physiol Nutr Metab. 43 (1):84-93.

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