Effects of High-amylose Rice Supplementation on Gycemic Control

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Background: Rice is a major source of carbohydrates. Resistant starch (RS) is digested in the human small intestine but fermented in the large intestine. The primary goal of this study was to investigate whether consuming heat-treated and powdered brown rice cultivars 'Dodamssal' (HBD) and 'Ilmi' (HBI), with relatively high and less than 1% RS content, respectively, improved glucose metabolism in obese individuals. The secondary outcome was to confirm whether metabolic profiles related to obesity, including total body fat, waist circumference, visceral fat area, lipid profiles and inflammatory markers improved together.

Methods: Clinical trial meals were prepared by adding ~80% HBI or HBD powder to HBI and HBD meals, respectively. A total of 33 obese participants recruited through advertisements were randomly assigned to either the test or control group according to the order of enrollment. All participants received three half-cooked meals and snacks every day for two weeks by delivery. There was no difference in the calorific content or menu composition, other than the fact that the HBD study group participants received an RS content of 19.6 g/day.

Results: There were no statistically significant differences in the results of the OGTT (oral glucose tolerance test) and glycated hemoglobin (HbA1c). This may be due to the short duration of the intervention and the small number of participants. Nevertheless, the homeostasis model assessment for insulin resistance decreased by $0.05 \pm 0.14\%$ and $1.5 \pm 1.40\%$ after 2 weeks (p=0.021) in the HBI control group and HBD study group, respectively. The advanced glycation end products increased by $0.14 \pm 0.18\%$ in the HBI group and decreased by $0.06 \pm 0.14\%$ in the HBD group (p=0.003).

Conclusion: Although there were no significant differences in body weight, body composition, cholesterol levels, and OGTT measurements, even after 2 weeks of intervention, increased RS consumption showed a statistically significant positive effect on glucose metabolism. RS supplementation for 2 weeks appears to have a beneficial effect on glycemic control in obese participants. Large-scale studies are needed to determine whether these results are influenced by differences in the gut microbiome, underlying dietary variability, or other environmental factors.

Differences between the initiation of the study and after 2-week intervention in the two groups

	Control group (%)	Study group (%)	*p*-value
Weight, kg	-2.86 ± 0.69 (3.54)	-2.29 ± 0.41 (2.82)	0.070
WC, cm	-2.86 ± 0.69 (3.06)	-4.14 ± 0.66 (4.40)	0.872
Total body fat, %	-1.14 ± 0.29 (3.39)	-1.01 ± 0.35 (3.03)	0.905
Visceral fat area, cm^2	-5.64 ± 1.20 (2.14)	-5.86 ± 1.20 (4.76)	0.114
Lean body mass, kg	-1.43 ± 0.25 (4.71)	-1.43 ± 0.77 (4.71)	0.937
Fasting glucose, mg/dL	-0.50 ± 1.98 (0.50)	-1.64 ± 3.01 (1.62)	0.345
Plasma insulin, uU/dL	-2.21 ± 0.58 (17.68)	-5.71 ± 5.30 (37.54)	0.021
HbA1c, %	0.01 ± 0.11 (0.18)	-0.04 ± 0.11 (0.70)	0.221
HOMA-IR	-0.50 ± 0.14 (16.29)	-1.50 ± 1.40 (38.17)	0.023
AGEs, AU	0.14 ± 0.18 (7.45)	-0.06 ± 0.14 (2.99)	0.003
Triglyceride, mg/dL	-22.86 ± 11.30 (17.0)	-17.86 ± 12.78 (13.51)	0.772
Total cholesterol, mg/dL	-20.0 ± 4.34 (10.34)	-26.57 ± 6.22 (13.38)	0.395
LDL cholesterol, mg/dL	-5.14 ± 2.53 (4.45)	-8.29 ± 4.15 (7.24)	0.451
HDL cholesterol, mg/dL	-8.50 ± 1.98 (51.23)	-10.79 ± 2.25 (18.70)	0.524
Apo A1, mg/dL	-16.64 ± 3.43 (10.10)	-26.07 ± 4.22 (15.57)	0.095
Apo B, mg/dL	0.93 ± 2.40 (0.96)	-4.57 ± 4.00 (4.56)	0.252
AST, U/L	1.0 ± 1.21 (5.24)	2.07 ± 2.84 (9.63)	0.553
rGTP, U/L	-5.14 ± 1.98 (20.98)	-7.57 ± 2.41 (26.37)	0.443
Uric acid, mg/dL	-0.07 ± 0.19 (1.18)	-0.43 ± 0.17 (7.0)	0.127

AGE: advanced glycation end product, Apo A1: Apolipoprotein AI, Apo B: Apolipoprotein B, ALT: alanine aminotransferase, AST: aspartate aminotransferase, AU: arbitrary units, BMI: body mass index, HBI: heat treated brown rice Ilmi, HBD: heat treated brown rice Dodamssal, HbA1c: glycated hemoglobin, HDL: high-density lipoprotein, HOMA-IR: homeostasis model assessment for insulin resistance, LDL: low-density lipoprotein, rGTP: gamma-glutamyltransferase, WC: waist circumference

Oral glucose tolerance test results after 2 weeks in the (a) heat treated Brown rice Ilmi and (b) heat treated Brown rice Dodamssal groups.