

研究報告

The 6 th Asian Congress of Dietetics, August 21-25, 2014, Taipei Taiwan.

EFFECTS OF LOW-CARBOHYDRATE DIET ON PHYSICAL STRENGTH

Koichi Okita¹⁾, Shingo Takada²⁾, Tomofumi Taniura¹⁾, Noriteru Morita³⁾
Tomoyasu Kadoguchi²⁾, Hiroko Sasaki⁴⁾, Takashi Yokota²⁾
Shintaro Kinugawa²⁾, Hiroyuki Tsutsui²⁾

1) Department of Sport Education, Hokusho University

2) Department of Cardiovascular Medicine, Hokkaido University Graduate School of Medicine

3) Hokkaido University of Education, Iwamizawa 4) Department of Education, Hokusho University

I. Background

Recently, low-carbohydrate diets (LCD) for weight control and management of the metabolic syndrome has become increasingly popular¹⁻¹⁰⁾. However, there is a paucity of research about effects of LCD on physical performance^{12,13)}.

II. Objective

In the present study, we examined the effects of LCD vs low-calorie diets on physical performance in untrained subjects.

III. Methods

We recruited 12 sedentary young subjects (20 ± 2

LOW-CARBOHYDRATE DIET



LOW-CALORIE DIET



Fig 1. Representative menus of low-carbohydrate diets and low-caloric diet.

Changes in obesity measures

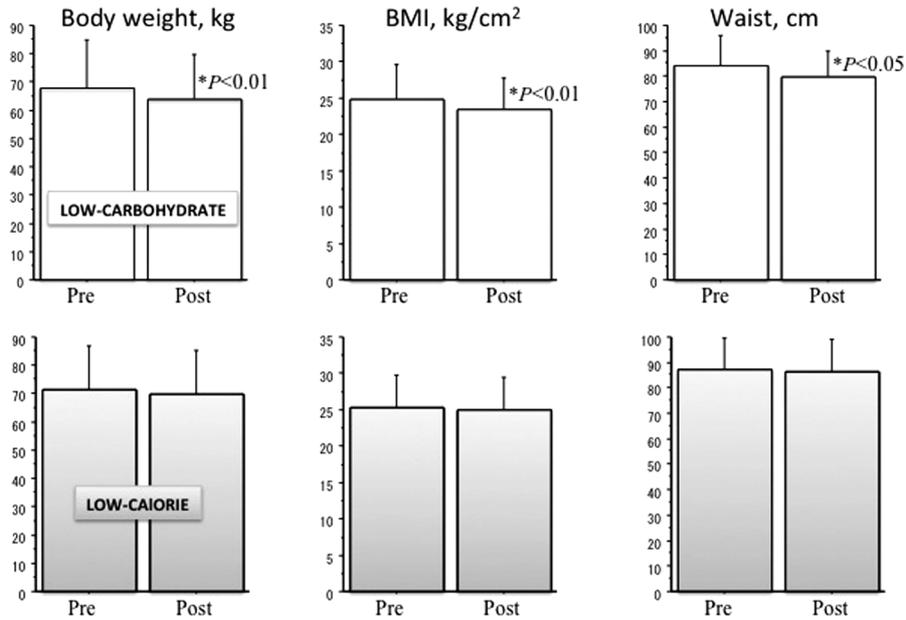


Fig 2. Significant decreases in body weight, BMI (body mass index) and waist were seen only in low-carbohydrate group.

Changes in glucose tolerance measures

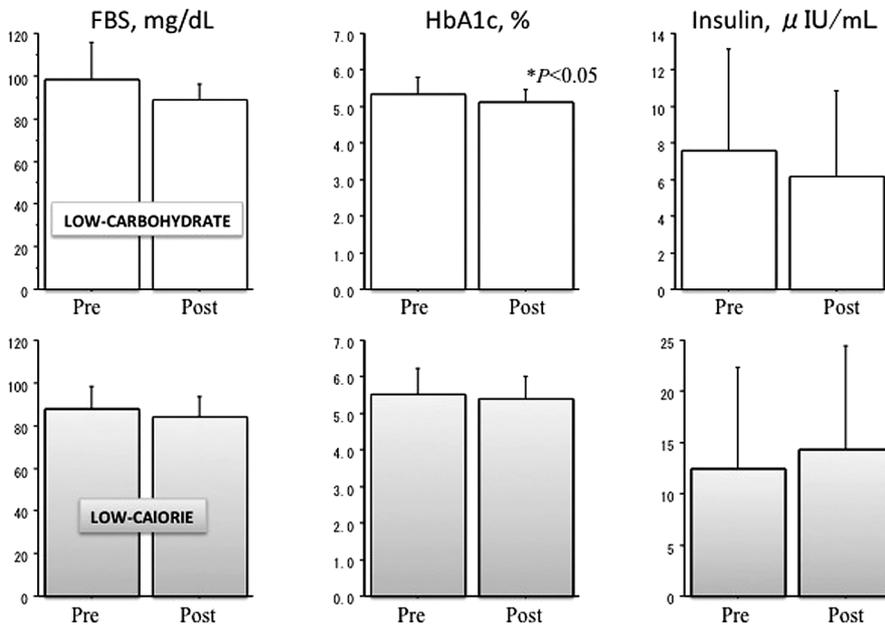


Fig 3. Significant decrease in HbA 1 c was seen only in low-carbohydrate group.

yr). Subjects were randomly assigned to LCD (carbohydrate intake<20g) and low-calorie diet group (Fig 1). We measured body composition, various performance aspects (Thigh muscle thickness, leg extension power, exercise tolerance by bicycle ergometer), blood metabolic parameters (fasting glu-

cose sugar:FBS, hemoglobin A 1 c: HbA 1 c, insulin, lipids, ketone bodies), inflammatory markers (C-reactive protein:CRP, white blood cell count: WBC and thiobarbituric acid reactive substance:TBARS) before and after 1 month of each diet therapy.

Changes in inflammatory markers

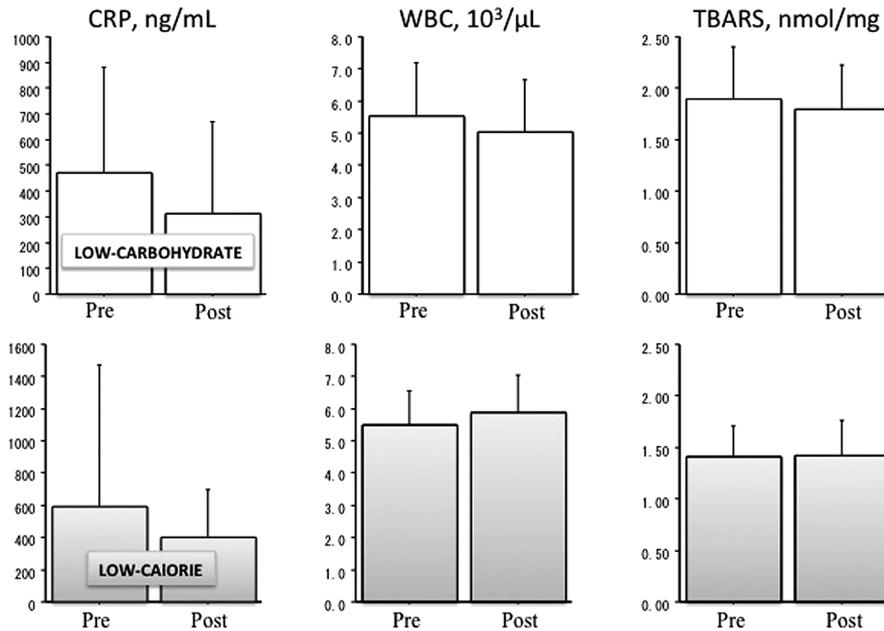


Fig 4. Significant decreases in inflammatory markers were not seen in both group.

Changes in ketone bodies

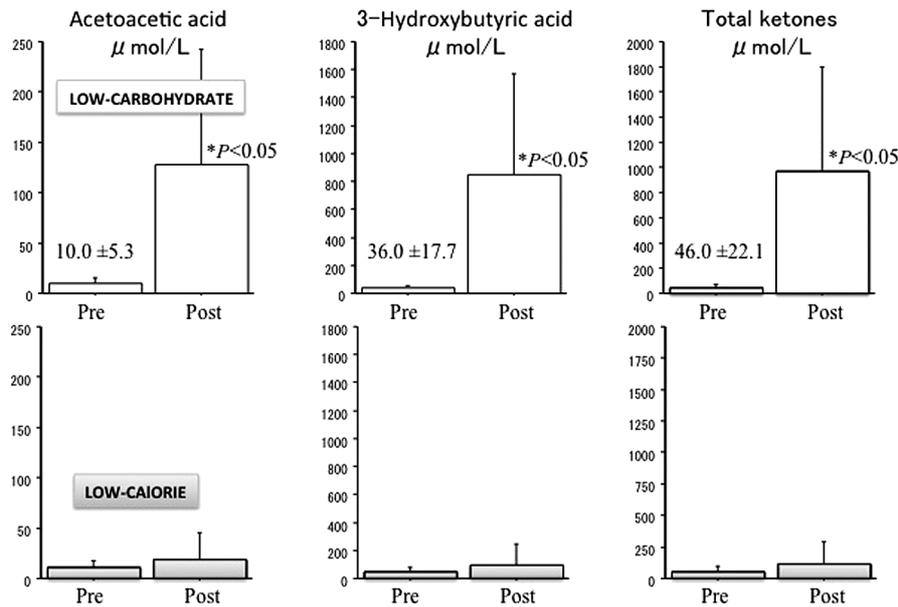


Fig 5. Remarkable increases in ketone bodies were seen in low-carbohydrate group.

IV. Results

Body weight, fat and waist significantly decreased (p < 0.05) in LCD groups, whereas no significant changes were seen in low-calorie diet group (Fig

2). HbA1c level was significantly decreased (p < 0.05) only in LCD groups (Fig 3). CPR, WBC and TBARS did not significantly change in both groups (Fig 4). The other parameters also did not significantly change in both groups. Acetoacetic acid, 3-hydroxybutyric acid, total ketones were remarkably

Changes in muscle mass and physical strength

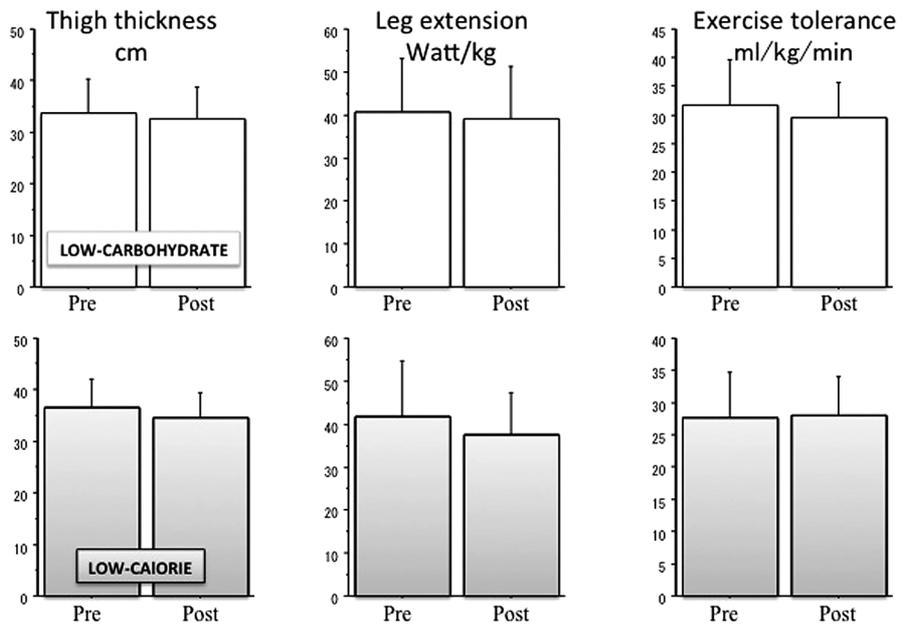


Fig 6. Significant decreases in muscle mass, strength and exercise tolerance were not seen in both group.

elevated in LCD group (Fig5, $p < 0.05$), while those were not change in low-calorie group. On the other hand physical performance aspects similarly maintained in both groups (Fig 6).

V. Conclusions

We have demonstrated that LCD for a relatively short-term can decrease body weight and body fat without negative effects on physical strength.

Acknowledgments

This study was supported in part by a grant of Northern Regions Academic Information Center (2014).

References

1. Samaha FF, Iqbal N, Seshadri P, et al: A low-carbohydrate as compared with a low-fat diet in severe obesity. *N Engl J Med.* 2003 ; 348 (21) : 2074–81.
2. Kirk JK, Graves DE, Craven TE, Lipkin EW, Austin M, Margolis KL. Restricted-carbohydrate diets in patients with type 2 diabetes: a meta-analysis. *J Am Diet Assoc.* 2008 ; 108(1) : 91-100.
3. Nakamura Y, Okuda N, Okamura T, et al: Low-carbohydrate diets and cardiovascular and total mortality in Japanese: a 29-year follow-up of NIPPON DATA 80. *Br J Nutr.* 2014 ; 112 (6) : 916-24.
4. Noto H, Goto A, Tsujimoto T, et al: Low-carbohydrate diets and all-cause mortality: a systematic review and meta-analysis of observational studies. *PLoS One.* 2013 ; 8 (1) : e55030.
5. Willett WC. Low-carbohydrate diets: a place in health promotion? *J Intern Med.* 2007 ; 261(4) : 363-5.
6. Trichopoulou A, Psaltopoulou T, Orfanos P, et al: Low-carbohydrate-high-protein diet and long-term survival in a general population cohort. *Eur J Clin Nutr.* 2007 ; 61(5) : 575-81.
7. Lagiou P, Sandin S, Lof M, et al: Low carbohydrate-high protein diet and incidence of cardiovascular diseases in Swedish women: prospective cohort study. *BMJ.* 2012 ; 344 : e4026.
8. Sjögren P, Becker W, Warensjö E, et al: Mediterranean and carbohydrate-restricted diets and mortality among elderly men: a cohort study in Sweden. *Am J Clin Nutr.* 2010 ; 92(4) : 967-

- 74.
9. Fung TT, van Dam RM, Hankinson SE, et al: Low-carbohydrate diets and all-cause and cause-specific mortality: two cohort studies. *Ann Intern Med.* 2010 ; 153(5) : 289-98.
 10. Halton TL, Willett WC, Liu S, et al: Low-carbohydrate-diet score and the risk of coronary heart disease in women. *N Engl J Med.* 2006 ; 355(19) : 1991-2002.
 11. Sawyer JC, Wood RJ, Davidson PW, et al: Effects of a short-term carbohydrate-restricted diet on strength and power performance. *J Strength Cond Res.* 2013 ; 27(8) : 2255-62.
 12. Paoli A, Grimaldi K, D'Agostino D, et al: Ketogenic diet does not affect strength performance in elite artistic gymnasts. *J Int Soc Sports Nutr.* 2012 ; 9(1) : 34.

第6回アジア栄養療法学会議 (2014年7月21-24日, 台北, 台湾) における研究発表 糖質制限食が体力面へ与える影響

沖田 孝一¹⁾ 高田 真吾²⁾ 谷浦 有史¹⁾ 森田 憲輝³⁾ 門口 智泰²⁾
佐々木 浩子⁴⁾ 横田 卓²⁾ 絹川 真太郎²⁾ 筒井 裕之²⁾

1) 北翔大学生涯スポーツ学部スポーツ教育学科 2) 北海道大学医学研究科循環病態内科学
3) 北海道教育大学教育学部 4) 北翔大学教育文化学部教育学科

日本語要約

近年、肥満症、メタボリック症候群、糖尿病患者の予防・改善を目的とした低糖質食療法が、米国糖尿病学会で推奨され、我が国では、民間を中心に普及してきている。しかしながら、一方で低糖質食が体力面などに与える悪影響が懸念されている。本研究では、低糖質食および総カロリーが体力指標に与える影響を検討した。12人（男性5人、女性7人、平均年齢20才）の被験者を低糖質食と総カロリー制限群に無作為に割り付け、1ヶ月間の介入を施行し、前後において、身体計測、筋力、持久力および血液生化学的検査を行なった。介入後、糖質制限群のみにおいて、体重、体格指数、腹囲およびHbA1cが有意に減少した ($p < 0.05$)。一方、血中ケトン体は、糖質制限群で極めて顕著に増加していた ($p < 0.05$)。膝伸展筋力、最大酸素摂取量および大腿四頭筋厚は、両群で有意な変化および差異を認めなかった。低糖質食では、比較的短期間に有効な減量が得られ、体力面への悪影響は明らかではないことが示された。