

Mini Review

Volume 10 Issue 3 - April 2019
DOI: 10.19080/CRDOJ.2019.10.555790

Curre Res Diabetes & Obes J

Copyright © All rights are reserved by Hiroshi Bando

Clinical Spread of Low Carbohydrate Diet (LCD)



Hiroshi Bando*

Tokushima University, Japan

Submission: March 21, 2019; **Published:** April 17, 2019

***Corresponding author:** Hiroshi Bando, Tokushima University /Medical Research, Nakashowa 1-61, Tokushima 770-0943, Japan

Keywords: Low carbohydrate diet; Calorie restriction; Non-communicable disease; Atherosclerosis risk; Obesity; Diabetes; Metabolic syndrome; Nutritional treatments; Saturated fat; Trans-fat; Carbohydrates; Proteins; Fats; Mortality rate; Low-glycemic index diet; Nutritional guidelines; Meal tolerance

Abbreviations: LCD: Low Carbohydrate Diet; CR: Calorie Restriction; NIPPON DATA: National Integrated Project for Prospective Observation of Non-communicable Disease and its Trends in the Aged; PURE: Prospective Urban Rural Epidemiology; ARIC: Atherosclerosis Risk in Communities; JLCDPA: Japanese LCD Promotion Association; REE: Resting Energy Expenditure; TEE: Total Energy Expenditure

Mini Review

Non-communicable diseases (NCD) have been increasing in the world, such as obesity, diabetes and metabolic syndrome [1]. Consequently, adequate nutritional treatments would be necessary as the fundamental therapy in each country [2].

There have been several dietary guidelines, which focus on not overall macronutrients ratio or total fat, but on the lower amount of saturated fat and trans-fat [3,4]. On contrast, decreasing intake of total fat less than 30% in energy has been recommended in other guidelines [5].

Historically speaking, Low Carbohydrate Diet (LCD) was launched in 1980-1990 by two known investigators in European and North American regions [6,7]. After that, LCD has been recognized and accepted for many people in comparison of Calorie Restriction (CR). One of the reasons was that the exchange carbohydrates with greater intake of protein or fat have gained clinical efficacy [8,9]. They include ability of LCD to bring remarkable weight reduction in short-term [10]. On the other hand, there have been conflicting and incomplete results for long-term clinical influence for health outcomes [11,12]. Furthermore, data from meta-analyses such as some large cohort studies have suggested possible relationship between low carbohydrate intake and elevated mortality rate [13,14].

There were two important reports in 2012, where negative and positive results were found, respectively. The former showed that Low carbohydrate-high protein diets are associated with increased risk of cardiovascular disease [15]. The latter showed that isocaloric meal after weight reduction 10-15% have resulted in decreases in resting energy expenditure (REE) and total energy

expenditure (TEE), which were the greatest in the low-fat diet, intermediate in the low-glycemic index diet, and the least in the very low-carbohydrate diet [16].

NIPPON DATA (National Integrated Project for Prospective Observation of Non-communicable Disease And its Trends in the Aged) analyzed 9200 from 13771 subjects. The results showed that moderate diets lower in carbohydrate and higher in protein and fat were significantly inversely associated with CVD and total mortality in women [17].

One of the reliable mega study was the 2017 Prospective Urban Rural Epidemiology (PURE) study. It included many individuals from 18 countries across five continents with 7.4 years follow up in median and 5796 deaths from 135,335 subjects. The result was that high carbohydrate intake was found with elevated risk ratio of mortality [18]. According to the obtained data, the discussion concerning the influence of carbohydrate ratio has continued for the possible revision to some standard nutritional guidelines [19].

Thus, LCD has developed with such situations in Europe and the United States. On the other hand, Dr. Ebe has launched LCD treatment in Japan, who is our research collaborator [20]. After that, we have developed various kinds of clinical practice and research of LCD for years. Among them, research themes include i) weight reduction efficacy in thousands of patients, ii) daily profile of blood glucose and Morbus (M) value in comparison with CR and LCD, iii) hyperketonemia due to continuation of LCD, iv) elevated ketone bodies in the axis of fetus, placenta, newborn and mother, v) meal tolerance test using CR breakfast with 70g of carbohydrate, and so on [21-23].

In primary care setting, the proposal of three kinds of LCD meal to the patients would be simple and effective, which are super-LCD, standard-LCD and petit-LCD [24]. Using these three methods, we have established Japanese LCD Promotion Association (JLCDPA) and developed the knowledge and practice of what is LCD like to many people in Japan through various activities.

LCD has become rather popular, and the continuation of LCD seems to be clinically beneficial from various points of view. According to Feinman & Bernstein et al. [25] suggested definitions for various types of low-carbohydrate diets are as follows: 1) Very low-carbohydrate ketogenic diet (VLCKD), 2) Low-carbohydrate diet: <130 g/d or <26% total energy, 3) Moderate-Carbohydrate Diet: 26%–45%, 4) High-Carbohydrate Diet: >45%.

Recently, there is a report that has an objection data to previous clinical efficacy of LCD. The Atherosclerosis Risk in Communities (ARIC) Study has started and continued for some decades [26]. ARIC study included more than 432 thousand subjects with 25 years [27]. From ARIC cohort study after multivariable adjustment, there was a U-shaped association between the percentage of energy of carbohydrate (mean 48.9%, SD 9.4) and mortality. By calculating and comparing total carbohydrate ratio, daily meal with high (>70%) or low (<40%) percentage of energy from carbohydrates were associated with increased mortality, with minimal risk observed between 50–55% [27].

Obtaining the optimal carbohydrate intake amount for the evidence to guidance recommendations, a population-based study of overall carbohydrate consumption was performed. In particular, the association of carbohydrate intake with mortality and residual lifespan was specifically investigated. When LCD is chosen for weight reduction or cardiometabolic risk reduction, replacement of carbohydrates with proteins and plant-based fats would be recommended for an adequate approach for healthy life and aging [27].

However, careful interpretation of this result may be necessary. The reason is from several variables and adjusted data, including that i) results differ depending on whether the substitute food is animal or vegetable, ii) lowest total mortality rate is not consistently found under various conditions, iii) multiple factors are adjusted and calculated such as country, disease, diabetes, physical activity, smoking, west-hip ratio and so on.

In summary, this article showed the development and outline of LCD. Comparison between CR and LCD, effect of LCD, and arteriosclerotic influence on mega study would be expected to be investigated in the future. Further study will bring each patient in each country beneficial diet style, better QOL, ADL and happiness.

References

1. NCD Risk Factor Collaboration (NCD-RisC) (2016) Worldwide trends in diabetes since 1980: a pooled analysis of 751 population based studies with 4.4 million participants. *Lancet* 387(10027): 1513-1530.
2. Ogurtsova K, da Rocha Fernandes JD, Huang Y, Linnenkamp U, Guariguata L, et al. (2017) IDF Diabetes Atlas: Global estimates for the

- prevalence of diabetes for 2015 and 2040. *Diabetes Res Clin Pract* 128: 40-50.
3. Sacks FM, Lichtenstein AH, Wu JHY, Appel LJ, Creager MA, et al. (2017) Dietary fats and cardiovascular disease: a presidential advisory from the American Heart Association. *Circulation* 136(3): e1-23.
4. (2015) Dietary Guidelines for Americans 2015-2020. (8th ed.), US Department of Agriculture, US Department of Health and Human Services.
5. (2015) Healthy diet fact sheet. World Health Organization.
6. Atkins RC (1981) Dr. Atkins' diet revolution. Bantam Books, New York, USA.
7. Bernstein RK (1997) Dr. Bernstein's Diabetes Solution. Little, Brown and company, New York, USA.
8. Nordmann AJ, Nordmann A, Briel M, Keller U, Yancy WS Jr, et al. (2006) Effects of low-carbohydrate vs low-fat diets on weight loss and cardiovascular risk factors: a meta-analysis of randomized controlled trials. *Arch Intern Med* 166(3): 285-293.
9. Shai I, Schwarzfuchs D, Henkin Y, Shahar DR, Witkow S, et al. (2008) Weight loss with a low-carbohydrate, Mediterranean, or low-fat diet. *N Engl J Med* 359(20): 229-241.
10. Naude CE, Schoonees A, Senekal M, Young T, Garner P, et al. (2014) Low carbohydrate versus isoenergetic balanced diets for reducing weight and cardiovascular risk: a systematic review and meta-analysis. *PLoS One* 9(7): e100652.
11. Trichopoulos A, Psaltopoulou T, Orfanos P, Hsieh CC, Trichopoulos D (2007) Low-carbohydrate-high-protein diet and long-term survival in a general population cohort. *Eur J Clin Nutr* 61(5): 575-581.
12. Fung TT, van Dam RM, Hankinson SE, Stampfer M, Willett WC, et al. (2010) Low-carbohydrate diets and all-cause and cause-specific mortality: two cohort studies. *Ann Intern Med* 153(5): 289-298.
13. Nilsson LM, Winkvist A, Eliasson M, Jansson JH, Hallmans G, et al. (2012) Low-carbohydrate, high-protein score and mortality in a northern Swedish population-based cohort. *Eur J Clin Nutr* 66(6): 694-700.
14. Noto H, Goto A, Tsujimoto T, Noda M (2013) Low-carbohydrate diets and all-cause mortality: a systematic review and meta-analysis of observational studies. *PLoS One* 8(1): e55030.
15. Laggiu P, Sandin S, Lof M, Trichopoulos D, Adami HO, et al. (2012) Low carbohydrate-high protein diet and incidence of cardiovascular diseases in Swedish women: prospective cohort study. *BMJ* 344: e4026.
16. Ebbeling CB, Swain JF, Feldman HA, Wong WW, Hachey DL, et al. (2012) Effects of dietary composition on energy expenditure during weight-loss maintenance. *JAMA* 307(24): 2627-2634.
17. Nakamura Y, Okuda N, Okamura T, Kadota A, Miyagawa N, et al. (2014) Low-carbohydrate diets and cardiovascular and total mortality in Japanese: a 29-year follow-up of NIPPON DATA80. *Br J Nutr* 112(6): 916-924.
18. Dehghan M, Mentz A, Zhang X, Swaminathan S, Li W, et al. (2017) Associations of fats and carbohydrate intake with cardiovascular disease and mortality in 18 countries from five continents (PURE): a prospective cohort study. *Lancet* 390(10107): 2050-2062.
19. Ramsden CE, Domenichiello AF (2017) PURE study challenges the definition of a healthy diet: but key questions remain. *Lancet* 390(10107): 2018-2019.
20. Ebe K, Ebe Y, Yokota S, Matsumoto T, Hashimoto M (2004) Low Carbohydrate diet (LCD) treated for three cases as diabetic diet therapy. *Kyoto Medical Association Journal* 51: 125-129.

21. Bando H, Ebe K, Muneta T, Bando M, Yonei Y (2017) Effect of low carbohydrate diet on type 2 diabetic patients and usefulness of M-value. *Diabetes Res Open J* 3(1): 9-16.
22. Muneta T, Kagaguchi E, Nagai Y, Matsumoto M, Ebe K (2016) Ketone body elevation in placenta, umbilical cord, newborn and mother in normal delivery. *Glycative Stress Research* 3(3): 133-140.
23. Ebe K, Bando H, Yamamoto K, Bando M, Yonei Y (2018) Daily carbohydrate intake correlates with HbA1c in low carbohydrate diet (LCD). *J Diabetol* 1(1): 4-9.
24. Bando H, Ebe K, Muneta T, Bando M, Yonei Y (2017) Proposal for Insulinogenic Index (IGI)-Carbo70 as Experimental Evaluation for Diabetes. *J Clin Exp Endocrinol* 1: 102.
25. Feinman RD, Pogozelski WK, Astrup A, Bernstein RK, Fine EJ, et al. (2015) Dietary carbohydrate restriction as the first approach in diabetes management: Critical review and evidence base. *Nutrition* 31(1): 1-13.
26. (1989) The Atherosclerosis Risk in Communities (ARIC) Study: design and objectives. The ARIC investigators. *Am J Epidemiol* 129(4): 687-702.
27. Seidemann SB, Claggett B, Cheng S, Henglin M, Shah A, et al. (2018) Dietary carbohydrate intake and mortality: a prospective cohort study and meta-analysis. *Lancet Public Health* 3(9): e419-e428.



This work is licensed under Creative Commons Attribution 4.0 License
DOI: [10.19080/CRDOJ.2019.10.555790](https://doi.org/10.19080/CRDOJ.2019.10.555790)

Your next submission with Juniper Publishers will reach you the below assets

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats

(Pdf, E-pub, Full Text, Audio)

- Unceasing customer service

Track the below URL for one-step submission

<https://juniperpublishers.com/online-submission.php>