Asploro Journal of Biomedical and Clinical Case Reports
(ISSN: 2582-0370)
Commentary
DOI: https://doi.org/10.36502/2024/ASJBCCR.6337

Beneficial Effects of Low Carbohydrate Diet (LCD) with Recently Emerged Solid Evidence

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Received date: 18 February 2024; **Accepted date**: 14 March 2024; **Published date**: 21 March 2024

Citation: Wood M, Bando H, Ebe K. Beneficial Effects of Low Carbohydrate Diet (LCD) with Recently Emerged Solid Evidence. Asp Biomed Clin Case Rep. 2024 Mar 21;7(1):65-68.

Abstract

Various discussions have continued concerning low carbohydrate diet (LCD) and calorie restriction (CR). The American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD) have gradually recognized LCD as the recommendation for nutritional treatment. Recent reports have shown the predominance of LCD with clinical evidence from the accumulated data of the Nurses' Health Study (NHS) and Health Professionals Follow-up Study (HPFS), with analyses of total LCD scores (TLCDS). Using TLCDS to analyze 139 thousand person-years, the hazard ratio (HR) of total mortality was 0.87 for TLCDS and 0.76 for vegetable (VLCDS). Authors continue developing LCD activities through the Japan LCD Promotion Association (JLCDPA).

Keywords

Low Carbohydrate Diet, Calorie Restriction, Nurses' Health Study, Total LCD Scores, Japan LCD Promotion Association

Abbreviations

LCD: Low Carbohydrate Diet; CR: Calorie Restriction; NHS: Nurses' Health Study; TLCDS: Total LCD Scores; JLCDPA: Japan LCD Promotion Association

Commentary

For the adequate treatment of diabetes, obesity, hyperlipidemia, and lifestyle-related diseases, various discussions and controversies have been observed concerning low carbohydrate diet (LCD) and calorie restriction (CR) [1,2]. The statement of the American Diabetes Association (ADA) has changed according to the existing evidence. In 2006, LCD was not adopted due to insufficient evidence [3]. After that, the ADA announced dietary recommendations in 2008, stating that LCD became one of the recommended dietary therapies [4]. LCD has been evaluated and recommended in the US and European countries, but its safety has been debated. According to the ADA statement, LCD has the most evidence for improving glucose variability, and CR and Mediterranean diets can be applied based on patient preference [5]. Successively, the European Association for the Study of

Diabetes (EASD) followed suit [6].

On the other hand, Ebe in Japan first adopted and reported the clinical efficacy of LCD in 2004 [7]. After that, authors and collaborators developed the activities of LCD medically and socially through seminars, textbooks, and medical papers via the Japan LCD Promotion Association (JLCDPA) [8,9]. JLCDPA has continued presenting useful LCD methods, which are super-LCD, standard-LCD, and petite-LCD [10]. In light of a systematic review, LCD data in Japanese diabetic patients were reported by Yamada [11]. Recently, several useful papers have been published about LCD and CR. From this clinical data, the continuing discussion, with various controversies thus far, will be resolved, and the predominance of LCD may be clarified. Some crucial points from these reports will be summarized and presented in this article.

For the latest research on LCD, the relationship between post-diagnosis LCD patterns and the mortality of T2D individuals was investigated. The protocol included participants from the Nurses' Health Study (NHS) and Health Professionals Follow-up Study (HPFS), as well as the application of the total LCD score (TLCDS) [12]. Among 139 thousand person-years, 4.6 thousand deaths were observed. As TLCDS shows a 10-point increase, the hazard ratio (HR) for total mortality was 0.87 for TLCDS, 0.76 for vegetable (VLCDS), and 0.78 for Healthy LCDS (HLCDS). Both VLCDS and HLCDS showed significantly lower cardiovascular disease (CVD) and cancer mortality. Each 10% increment of TLCDS, VLCDS, and HLCDS from the pre- to post-diagnosis period showed lower total mortality by 12%, 25%, and 25%, respectively. In conclusion, T2D patients showed moderate adherence to LCD patterns, providing high-quality macronutrients associated with lower total mortality.

The current report from NHS and HPFS in 2023 showed the clinical efficacy of LCD. In contrast, a previous report in 2010 from NHS and HPFS showed opposite results [13]. The different aspects can be analyzed. The characteristic points in the previous report include: i) NHS: female nurses (n=121,700), ii) male medical staff (n=51,529), iii) these are prospective cohorts from 1976 and 1986, iv) applicants include all cases with and without diabetes. In contrast, the present report includes i) analyzed cases that are all newly-diagnosed with type 2 diabetes (T2D) until 2018, ii) cases who were previously diagnosed with T2D were excluded, iii) cases with previous cancer or cardiovascular diseases were excluded, iv) analyzed data were smaller for females (n=7,224) and males (n=2,877). The conclusion was that the group with fewer carbohydrates showed decreased mortality when cases are limited to T2D [12].

For cardiovascular risk, the benefit of LCD was studied in a prospective study. The protocol included 5,677 cases, and they were followed up for 6.3 years, totaling 39,401 person-years with 1,432 deaths during the period [14]. After adjustment for HbA1c and lifestyle factors, the third quartile of the overall LCD score showed the lowest risk for mortality with an HR of 0.65. The multivariable-adjusted HR for mortality was 1.00, 0.78, 0.73, and 0.74 in the first to fourth quartiles, respectively. When replacing 2% of energy from carbohydrates with polyunsaturated fatty acids (PUFA) or plant-based protein, total mortality decreased by about 23% to 37% with clinical efficacy. Consequently, HLCDS showed a significant relationship with decreased mortality in T2D adults. By continuing a well-balanced LCD, such as PUFA or plant-based protein, premature death in T2D may be prevented.

Regarding the long-term efficacy of LCD on mortality, the quality and source of carbohydrates have been investigated in a prospective cohort study. The protocol included 20,206 cases (including 13.8% with diabetes), and vegetable- and meat-based LCD scores were calculated for hazard ratios (HRs) [15]. Concerning the data from the highest vs. lowest quartiles, vegetable-based LCD showed HRs of 1.16 and 1.30 for all-cause and CVD mortality, respectively. In contrast, meat-based LCD showed HRs of 0.89 and 0.81 for the same outcomes. The detailed carbohydrate content ratios in Quartile 1 vs. 4 were 67.6% vs. 46.5% in total LCD scores, 60.9% vs. 52.2% in vegetable LCD scores, and 65.9% vs. 48.0% in meat LCD scores. Thus, vegetable-LCDS was positively associated, and meat-LCDS was negatively associated with both mortality outcomes in elderly Asian people.

In the latest report, a newly introduced smoothie with modified carbohydrate content (SMMC) was compared with the standard diabetes-specific nutritional formula (DSNF) in terms of glucose variability, insulin response, and lipid changes for patients with obese type 2 diabetes (T2D) [16]. SMMC showed a significantly lower glucose response, associated with lower insulin, C-peptide, and NEFA responses, and a higher glucagon response. It may have a unique composition of carbohydrates, fats, and amino acids in the current smoothie, associated with several positive effects.

Regarding metabolic-dysfunction-associated fatty liver disease (MAFLD), a comparison study was conducted on LCD and CR. The study included 3,961 adult cases, and the relationship between MAFLD and LCD/CR scores was analyzed [17]. As a result, cases in the highest tertile of healthy LCDS (0.63) or healthy CR score (0.64) showed a lower risk of MAFLD. In addition, cases with unhealthy CR scores in the second and third tertiles showed 49% and 77% higher risks of MAFLD, respectively. Thus, healthy LCD and CR showed protection against MAFLD, however, unhealthy CR may increase the risk of MAFLD. Both the quality and quantity of macronutrients possibly influence MAFLD development.

As mentioned above, LCD seems to show clinical predominance compared to CR in recent reports with medical evidence. Authors will continue various activities concerning LCD and hope that LCD will provide people and patients with physical, psychological, and social benefits in the future.

Conflict of Interest

The authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

Funding

There was no funding received for this paper.

References

[1] Sun J, Ruan Y, Xu N, Wu P, Lin N, Yuan K, An S, Kang P, Li S, Huang Q, Yingzhang, Li Y, Su J, Ma W, Chen B, Zhang X, Chen X, Liang Y, Lu Z, Deng G, Zhang Z, Wang Y, Wen W, Zhang H, Chen H. The effect of dietary carbohydrate and calorie restriction on weight and metabolic health in overweight/obese individuals: a multi-center randomized controlled trial. BMC Med. 2023 May 24;21(1):192. [**PMID**: 37226271]

[2] Shai I, Schwarzfuchs D, Henkin Y, Shahar DR, Witkow S, Greenberg I, Golan R, Fraser D, Bolotin A, Vardi H, Tangi-Rozental O, Zuk-Ramot R, Sarusi B, Brickner D, Schwartz Z, Sheiner E, Marko R, Katorza E, Thiery J, Fiedler GM, Blüher M, Stumvoll M, Stampfer MJ; Dietary Intervention Randomized Controlled Trial (DIRECT) Group. Weight loss with a low-carbohydrate, Mediterranean, or low-fat diet. N Engl J Med. 2008 Jul 17;359(3):229-41. Erratum in: N Engl J Med. 2009 Dec 31;361(27):2681. [**PMID**: 18635428]

[3] Bantle JP, Wylie-Rosett J, Albright AL, Apovian CM, Clark NG, Franz MJ, Hoogwerf BJ, Lichtenstein AH, Mayer-Davis E, Mooradian AD, Wheeler ML. Nutrition recommendations and interventions for diabetes--2006: a position statement of the American Diabetes Association. Diabetes Care. 2006 Sep;29(9):2140-57. [**PMID**: 16936169]

[4] American Diabetes Association; Bantle JP, Wylie-Rosett J, Albright AL, Apovian CM, Clark NG, Franz MJ, Hoogwerf BJ, Lichtenstein AH, Mayer-Davis E, Mooradian AD, Wheeler ML. Nutrition recommendations and interventions for diabetes: a position statement of the American Diabetes Association. Diabetes Care. 2008 Jan;31 Suppl 1:S61-78. doi: 10.2337/dc08-S061. Erratum in: Diabetes Care. 2010 Aug;33(8):1911. [**PMID**: 18165339]

[5] Evert AB, Dennison M, Gardner CD, Garvey WT, Lau KHK, MacLeod J, Mitri J, Pereira RF, Rawlings K, Robinson S, Saslow L, Uelmen S, Urbanski PB, Yancy WS Jr. Nutrition Therapy for Adults With Diabetes or Prediabetes: A Consensus Report. Diabetes Care. 2019 May;42(5):731-54. [**PMID**: 31000505]

[6] Davies MJ, Aroda VR, Collins BS, Gabbay RA, Green J, Maruthur NM, Rosas SE, Del Prato S, Mathieu C, Mingrone G, Rossing P, Tankova T, Tsapas A, Buse JB. Management of hyperglycaemia in type 2 diabetes, 2022. A consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). Diabetologia. 2022 Dec;65(12):1925-66. [**PMID**: 36151309]

[7] Ebe K, Ebe Y, Yokota S, Matsumoto T, Hashimoto

M, Sakai Y. Low Carbohydrate diet (LCD) treated for three cases as diabetic diet therapy. Kyoto Medical Association Journal. 2004;51:125-29.

[8] Muneta T, Hayashi M, Nagai Y, Matsumoto M, Bando H, Ebe K, Watanabe H, Watanabe S. Ketone Bodies in the Fetus and Newborn During Gestational Diabetes and Normal Delivery. International Journal of Diabetes. 2022 May 14;3(1):142-48.

[9] Wood M, Ebe K, Bando H. Prolonged Honeymoon Period in Type I Diabetes (T1D) Patients on Low-Carbohydrate Diet (LCD). Asp Biomed Clin Case Rep. 2023 Oct 24;6(3):248-53.

[10] Bando H, Ebe K. Beneficial and Convenient Method of Low Carbohydrate Diet (LCD) as Petite, Standard and Super LCD. Asp Biomed Clin Case Rep. 2023 Nov 04;7(1):1-4.

[11] Yamada S, Kabeya Y, Noto H. Dietary Approaches for Japanese Patients with Diabetes: A Systematic Review. Nutrients. 2018 Aug 13;10(8):1080. [**PMID**: 30104491]

[12] Hu Y, Liu G, Yu E, Wang B, Wittenbecher C, Manson JE, Rimm EB, Liang L, Rexrode K, Willett WC, Hu FB, Sun Q. Low-Carbohydrate Diet Scores and Mortality Among Adults With Incident Type 2 Diabetes. Diabetes Care. 2023 Apr 1;46(4):874-84. [**PMID**: 36787923]

[13] Fung TT, van Dam RM, Hankinson SE, Stampfer M, Willett WC, Hu FB. Low-carbohydrate diets and all-cause and cause-specific mortality: two cohort studies. Ann Intern Med. 2010 Sep 7;153(5):289-98. [**PMID**: 20820038]

[14] Wan Z, Shan Z, Geng T, Lu Q, Li L, Yin J, Liu L, Pan A, Liu G. Associations of Moderate Low-Carbohydrate Diets With Mortality Among Patients With Type 2 Diabetes: A Prospective Cohort Study. J Clin Endocrinol Metab. 2022 Jun 16;107(7):e2702-e2709. [**PMID**: 35429400]

[15] Sun C, Zhang WS, Jiang CQ, Jin YL, Deng XQ, Woo J, Cheng KK, Lam TH, Thomas GN, Xu L. Low-Carbohydrate Diets and Mortality in Older Asian People: A 15-Year Follow-Up from a Prospective Cohort Study. Nutrients. 2022 Mar 28;14(7):1406. [**PMID**: 35406019]

[16] Mongkolsucharitkul P, Pinsawas B, Surawit A, Pongkunakorn T, Manosan T, Ophakas S, Suta S, Pumeiam S, Mayurasakorn K. Diabetes-Specific Complete Smoothie Formulas Improve Postprandial Glycemic Response in Obese Type 2 Diabetic Individuals: A Randomized Crossover Trial. Nutrients. 2024 Jan 30;16(3):395. [**PMID**: 38337679]

[17] Hu C, Huang R, Li R, Ning N, He Y, Zhang J, Wang Y, Ma Y, Jin L. Low-Carbohydrate and Low-Fat Diet with Metabolic-Dysfunction-Associated Fatty Liver Disease. Nutrients. 2023 Nov 13;15(22):4763. [**PMID**: 38004162]

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