



## Recent Topic of Saturated Fatty Acid (SFA) for Atherosclerotic Diseases

Masahiro Bando<sup>1\*</sup>, Hiroshi Bando<sup>2</sup>

<sup>1</sup>Department of Gastroenterology and Oncology, Institute of Biomedical Sciences, Tokushima University Graduate School, Tokushima, Japan

<sup>2</sup>Medical Research / Tokushima University, Tokushima, Japan

Corresponding Author: **Masahiro BANDO, RD, PhD**

**Address:** Tokushima University, Kuramoto 3-18-15, Tokushima 770-8503, Japan.

**Received date:** 06 January 2021; **Accepted date:** 08 February 2021; **Published date:** 15 February 2021

**Citation:** Bando M, Bando H. Recent Topic of Saturated Fatty Acid (SFA) for Atherosclerotic Diseases. J Health Care and Research. 2021 Feb 15;2(1):13-16.

**Copyright** © 2021 Bando M, Bando H. This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### Abstract

Whether saturated fatty acid (SFA) has a clinical influence on atherosclerotic cardiovascular disease (ASCVD) or not has been disputed. Prospective Urban Rural Epidemiology (PURE) study was recently summarized from 21 countries with about 150 thousand data. Dairy intake was negatively correlated with the prevalence of metabolic syndrome and the incidence of diabetes and hypertension. To increase the intake of dairy products would be easy and inexpensive to continue for treatment. Polyunsaturated fatty acid (PUFA) and monounsaturated fatty acid (MUFA) may reduce atherosclerotic diseases with beneficial effects. Clinical evidence of SFA will be hopefully accumulated for practice and research in the future.

### Keywords

Saturated Fatty Acid (SFA), Atherosclerotic Cardiovascular Disease (ASCVD), Prospective Urban Rural Epidemiology (PURE), Monounsaturated Fatty Acid (MUFA), Low Carbohydrate Diet (LCD)

In recent years, the incidence of coronary artery disease (CAD) and cerebral vascular accident (CVA) has increased across the world. It has become a major problem of atherosclerotic cardiovascular disease (ASCVD). Consequently, the policy of refraining from lipids has been known from many years as recommended nutrition and diet therapy. The rationale for this lies in the study, which Keys et al. conducted formerly a Seven Countries study [1]. In addition, some reports showed that CAD is associated with a high-saturation diet (saturated fatty acid intake of 20% or more of total energy) in some countries with high frequency [2].

After that, however, different results were reported. In other words, there was no significant correlation

between saturated fatty acid (SFA) and lipid intake/mortality / cardiovascular disease incidence, or the risk was lower with converse correlation [3]. Then, reports showing various relationships continued, and it was in a state of controversy [4]. Under such circumstances, the Prospective Urban Rural Epidemiology (PURE) study was conducted. This is a prospective cohort study conducted jointly in 18 countries on five continents. And the main results were reported in 2017 [5]. A new finding was that fat intake was negatively correlated with total mortality, with higher fat intake resulting in lower total mortality. Furthermore, carbohydrate intake was positively correlated with total mortality, with higher carbohydrate intake resulting in higher total mortality. The evidence of the effectiveness of a low carbohydrate

diet (LCD) had a great impact on the world.

What is going on in actual clinical practice? The Guidelines of the American Heart Association (AHA) in 2019 recommend replacing SFA with unsaturated fatty acids [6]. However, the evidence level is B-NR. As per the criteria, A is the best, B is the second-best, and B-NR is lower than BR [moderate quality randomized controlled trial (RCT)].

Currently, the latest PURE study report was reported [7]. The previous paper of PURE (2017) was from 18-country with 7.4 years, and the current paper (2020) was from 21 countries with 153,320 data. Actually, 147,812 data were analyzed with 9.1 years on average. Dairy intake was negatively correlated with the prevalence of metabolic syndrome and the incidence of diabetes and hypertension. The relationship was found in whole-fat milk and butter, but less in low-fat milk. This report will be important in considering the ideal intake of SFA and the ideal dietary recommendations.

As dairy intake becomes higher, blood pressure, abdominal circumference, BMI, TG, and blood glucose levels become lower [7]. The prevalence of metabolic syndrome was significantly lower in the population with higher dairy intake. The odds ratio (OR) for total dairy intake serving 0, 1, 2, 2< per day was 1.00, 0.91, 0.87, 0.76 ( $P < 0.0001$ ), respectively. The OR for whole-fat dairy was 1.00, 0.90, 0.79, 0.72 ( $P < 0.0001$ ), and the OR for butter with much amount of SFA was 1.00, 0.84, 0.72, 0.71 ( $P < 0.0001$ ), respectively. These relationships were the same when analyzed separately for the amount of salt intake, the amount of potassium intake, and the amount of fruit and vegetable intake. These data are from PURE (2020) [7], and the related data of PURE (2017) showed that the incidence of CVA was 1, 1.01, 0.78, 0.66 ( $p=0.0003$ ) [8].

According to a previous PURE study, a negative correlation was found between dairy intake values and cardiovascular event incidence and overall mortality [9]. The relationship was strong in whole-fat milk in this study as well [7]. From the above, increasing the intake of dairy products is easy and inexpensive to continue. This method enables effective way against

metabolic syndrome, hypertension, and diabetes. As a result, it can lead to reduced cardiovascular events and mortality. Consequently, dairy products are not necessarily low-fat milk.

Previous RCTs examined how much ratio SFA would be reduced for the efficacy. It assessed the effect of reducing SFA intake and replacing it with carbohydrate, polyunsaturated fatty acid (PUFA), or monounsaturated fatty acid (MUFA), and/or protein on mortality and cardiovascular morbidity [10]. As a result, no clear figures can be obtained, but it seems that about 10% is the cutoff level. When the control group takes 10% and >10 % of SFA and the target group takes <10% of SFA, the intervention group suggests a decrease in cardiovascular events. It was 9% in 2015, but it changed to 10% in the 2020 update report.

In the previous meta-analysis of cohort studies, it was expected that replacing SFA intake with PUFA would reduce CAD [11]. A recent National Health and Nutrition Examination Survey (NHANES) and meta-analysis reported that total fat intake reduced mortality, while saturated fat intake increased mortality and that negative associations were found between stroke mortality and MUFA (HR 0.80) and PUFA (HR 0.84) intakes [12]. Concerning MUFA and PUFA, a Mediterranean diet includes them much amount and can reduce CVD in older people [13]. Their beneficial effects are found for extending lifespan and lipids profile [14], which may be involved in the mechanism of senescence-accelerated mouse-prone 8 (SAMP8) and senescence-accelerated mouse resistant 1 (SAMR1) [15].

Some reports revealed that replacing SFA with PUFA in RCTs reduces heart disease [16], and conversely, others showed that heart disease might increase [17,18]. Under the above circumstances, various studies such as RCTs and cohort studies have been conducted on the relationship between lipids and arteriosclerosis. However, consistent results have not been obtained. The causes may be i) diets are different every day and do not always contain constant ingredients, ii) diversity emerges in many countries with a large number of subjects, iii) there are

inhomogeneous conditions and complications for several diseases of arteriosclerosis.

As a result, it is difficult to conclude that lipids should be restricted or SFA should be restricted. On the other hand, the author and collaborators have been providing medical care for diabetes, dyslipidemia, hypertension, and obesity for many years [19,20]. Furthermore, we have developed and enlightened the importance of a low carbohydrate diet (LCD) [21,22]. Previous research on lipids and ASCVD suggest that lipid restriction and energy restriction may lead to the negative direction, and conversely, LCD may lead to the positive direction for better management of ASCVD.

In summary, the current PURE study would become a meaningful report for the problem concerning lipids and metabolic syndrome. It may become a milestone about the appropriate diet for ASCVD diseases. Further research will be expected to accumulate significant data in the future.

## References

[1] KEYS A. Atherosclerosis: a problem in newer public health. *J Mt Sinai Hosp N Y*. 1953 Jul-Aug;20(2):118-39. [PMID: 13085148]

[2] Puska P. Fat and heart disease: yes we can make a change--the case of North Karelia (Finland). *Ann Nutr Metab*. 2009;54 Suppl 1:33-38. [PMID: 19641348]

[3] Siri-Tarino PW, Sun Q, Hu FB, Krauss RM. Meta-analysis of prospective cohort studies evaluating the association of saturated fat with cardiovascular disease. *Am J Clin Nutr*. 2010 Mar;91(3):535-46. [PMID: 20071648]

[4] Malhotra A. Saturated fat is not the major issue. *BMJ*. 2013 Oct 22;347:f6340. [PMID: 24149521]

[5] Dehghan M, Mente A, Zhang X, Swaminathan S, Li W, Mohan V, Iqbal R, Kumar R, Wentzel-Viljoen E, Rosengren A, Amma LI, Avezum A, Chifamba J, Diaz R, Khatib R, Lear S, Lopez-Jaramillo P, Liu X, Gupta R, Mohammadifard N, Gao N, Oguz A, Ramli AS, Seron P, Sun Y, Szuba A, Tsolekile L, Wielgosz A, Yusuf R, Hussein Yusufali A, Teo KK, Rangarajan S, Dagenais G, Bangdiwala SI, Islam S, Anand SS, Yusuf S; Prospective Urban Rural Epidemiology (PURE) study investigators. Associations of fats and carbohydrate intake with

cardiovascular disease and mortality in 18 countries from five continents (PURE): a prospective cohort study. *Lancet*. 2017 Nov 4;390(10107):2050-62.

[PMID: 28864332]

[6] Arnett DK, Blumenthal RS, Albert MA, Buroker AB, Goldberger ZD, Hahn EJ, Himmelfarb CD, Khera A, Lloyd-Jones D, McEvoy JW, Michos ED, Miedema MD, Muñoz D, Smith SC Jr, Virani SS, Williams KA Sr, Yeboah J, Ziaeian B. 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*. 2019 Sep 10;140(11):e596-46. [PMID: 30879355]

[7] Bhavadharini B, Dehghan M, Mente A, Rangarajan S, Sheridan P, Mohan V, Iqbal R, Gupta R, Lear S, Wentzel-Viljoen E, Avezum A, Lopez-Jaramillo P, Mony P, Varma RP, Kumar R, Chifamba J, Alhabib KF, Mohammadifard N, Oguz A, Lanas F, Rozanska D, Bengtsson Bostrom K, Yusoff K, Tsolekile LP, Dans A, Yusufali A, Orlandini A, Poirier P, Khatib R, Hu B, Wei L, Yin L, Deeraili A, Yeates K, Yusuf R, Ismail N, Mozaffarian D, Teo K, Anand SS, Yusuf S. Association of dairy consumption with metabolic syndrome, hypertension and diabetes in 147 812 individuals from 21 countries. *BMJ Open Diabetes Res Care*. 2020 Apr;8(1):e000826. [PMID: 32423962]

[8] Dehghan M, Mente A, Zhang X, Swaminathan S, Li W, Mohan V, Iqbal R, Kumar R, Wentzel-Viljoen E, Rosengren A, Amma LI, Avezum A, Chifamba J, Diaz R, Khatib R, Lear S, Lopez-Jaramillo P, Liu X, Gupta R, Mohammadifard N, Gao N, Oguz A, Ramli AS, Seron P, Sun Y, Szuba A, Tsolekile L, Wielgosz A, Yusuf R, Hussein Yusufali A, Teo KK, Rangarajan S, Dagenais G, Bangdiwala SI, Islam S, Anand SS, Yusuf S; Prospective Urban Rural Epidemiology (PURE) study investigators. Associations of fats and carbohydrate intake with cardiovascular disease and mortality in 18 countries from five continents (PURE): a prospective cohort study. *Lancet*. 2017 Nov 4;390(10107):2050-62. [PMID: 28864332]

[9] Dehghan M, Mente A, Rangarajan S, Sheridan P, Mohan V, Iqbal R, Gupta R, Lear S, Wentzel-Viljoen E, Avezum A, Lopez-Jaramillo P, Mony P, Varma RP, Kumar R, Chifamba J, Alhabib KF, Mohammadifard N, Oguz A, Lanas F, Rozanska D, Bostrom KB, Yusoff K, Tsolekile LP, Dans A, Yusufali A, Orlandini A, Poirier P,

Khatib R, Hu B, Wei L, Yin L, Deeraili A, Yeates K, Yusuf R, Ismail N, Mozaffarian D, Teo K, Anand SS, Yusuf S; Prospective Urban Rural Epidemiology (PURE) study investigators. Association of dairy intake with cardiovascular disease and mortality in 21 countries from five continents (PURE): a prospective cohort study. *Lancet*. 2018 Nov 24;392(10161):2288-97. [PMID: 30217460]

[10] Hooper L, Martin N, Abdelhamid A, Davey Smith G. Reduction in saturated fat intake for cardiovascular disease. *Cochrane Database Syst Rev*. 2015 Jun 10;(6):CD011737. [PMID: 26068959]

[11] Jakobsen MU, O'Reilly EJ, Heitmann BL, Pereira MA, Bälter K, Fraser GE, Goldbourt U, Hallmans G, Knekt P, Liu S, Pietinen P, Spiegelman D, Stevens J, Virtamo J, Willett WC, Ascherio A. Major types of dietary fat and risk of coronary heart disease: a pooled analysis of 11 cohort studies. *Am J Clin Nutr*. 2009 May;89(5):1425-32. [PMID: 19211817]

[12] Mazidi M, Mikhailidis DP, Sattar N, Toth PP, Judd S, Blaha MJ, Hernandez AV, Penson PE, Banach M; International Lipid Expert Panel (ILEP) & Lipid and Blood Pressure Meta-analysis Collaboration (LBPMC) Group. Association of types of dietary fats and all-cause and cause-specific mortality: A prospective cohort study and meta-analysis of prospective studies with 1,164,029 participants. *Clin Nutr*. 2020 Dec;39(12):3677-86. [PMID: 32307197]

[13] Estruch R, Ros E, Salas-Salvadó J, Covas MI, Corella D, Arós F, Gómez-Gracia E, Ruiz-Gutiérrez V, Fiol M, Lapetra J, Lamuela-Raventos RM, Serra-Majem L, Pintó X, Basora J, Muñoz MA, Sorlí JV, Martínez JA, Martínez-González MA; PREDIMED Study Investigators. Primary prevention of cardiovascular disease with a Mediterranean diet. *N Engl J Med*. 2013 Apr 4;368(14):1279-90. [PMID: 23432189]

[14] Han S, Schroeder EA, Silva-García CG, Hebestreit K, Mair WB, Brunet A. Mono-unsaturated fatty acids link H3K4me3 modifiers to *C. elegans* lifespan. *Nature*. 2017 Apr 13;544(7649):185-90. [PMID: 28379943]

[15] Bando M, Masumoto S, Kuroda M, Tsutsumi R, Sakaue H. Effect of olive oil consumption on aging in a senescence-accelerated mice-prone 8 (SAMP8) model. *J Med Invest*. 2019;66(3.4):241-47. [PMID: 31656282]

[16] Mozaffarian D, Micha R, Wallace S. Effects on coronary heart disease of increasing polyunsaturated fat in place of saturated fat: a systematic review and meta-analysis of randomized controlled trials. *PLoS Med*. 2010 Mar 23;7(3):e1000252. [PMID: 20351774]

[17] Ramsden CE, Zamora D, Leelarthaepin B, Majchrzak-Hong SF, Faurot KR, Suchindran CM, Ringel A, Davis JM, Hibbeln JR. Use of dietary linoleic acid for secondary prevention of coronary heart disease and death: evaluation of recovered data from the Sydney Diet Heart Study and updated meta-analysis. *BMJ*. 2013 Feb 4;346:e8707. [PMID: 23386268]

[18] Ramsden CE, Zamora D, Majchrzak-Hong S, Faurot KR, Broste SK, Frantz RP, Davis JM, Ringel A, Suchindran CM, Hibbeln JR. Re-evaluation of the traditional diet-heart hypothesis: analysis of recovered data from Minnesota Coronary Experiment (1968-73). *BMJ*. 2016 Apr 12;353:i1246. [PMID: 27071971]

[19] Fujikawa T, Kato Y, Bando H, Kakutani H, Kawata T, Yamamoto M, Wada K, Ishikura K, Shirai Y, Narutaki M, Matsuzaki S, Waka S. The Administration of Xultophy for Diabetic Patients on Hemodialysis. *Diab Res Open Access*. 2020 Oct 20;2(3):72-78.

[20] Kato Y, Bando H, Yamashita H, Yada S, Tokuhara S, Tokuhara H, Mutsuda T. Seasonal changes in HbA1c values from young to elderly diabetic patients. *Journal of Diabetes, Metabolic Disorders & Control*. 2019 Aug 30;6(3):89-92.

[21] Ebe K, Bando H, Muneta T, Bando M, Yonei Y. Glucose-lowering effect for low carbohydrate diet (LCD) in diabetic patients with positive glutamic acid decarboxylase antibody (GADA). *Endocrinology and Metabolism: Open Access*. 2019 May 23;3(1):115.

[22] Bando H. Useful tips for actual low carbohydrate diet (LCD) with super-, standard-and petit-LCD methods. *EC Nutrition*. 2020 Apr 8;15(5):1-4.

