

This is the peer reviewed version of the following article:

Ibanez B, Fernandez-Alvira JM. Breakfast Is a Marker for Cardiovascular Risk Prediction. *J Am Coll Cardiol*, 2019. 73(16): p. 2033-5

which has been published in final form at: <https://doi.org/10.1016/j.jacc.2019.02.033>

Breakfast: a marker for cardiovascular risk prediction

Borja Ibanez^{1,2,3}, MD PhD; Juan M Fernández-Alvira¹, PhD.

¹Centro Nacional de Investigaciones Cardiovasculares (CNIC)

²Cardiology Department, IIS-Fundación Jiménez Díaz University Hospital.

³CIBERCV.

Correspondence: Borja Ibanez, MD PhD FESC. Clinical Research Department, Centro Nacional de Investigaciones Cardiovasculares (CNIC). c/Melchor Fernandez Almagro, 3. 28029, Madrid, Spain. Tel: +3491 4531200 (EXT 4302). Fax: +3491 4531340.

Email; bibanez@cnic.es

Cardiovascular disease represents a global health challenge largely influenced by health behaviors, being diet one of the main lifestyle factors influencing risk (1). The study of the association between diet and disease during the last decades has been carried out focusing on different aspects of diet and food intake. Dietary patterns (including frequency, quantity and quality of diet) have all been shown to be associated with cardiovascular disease (2).

Compelling evidence shows that irregular eating patterns are associated with impaired cardio-metabolic profiles (3), being skipping breakfast one of the most prevalent irregular eating features. Skipping breakfast has been linked to a higher prevalence of several cardiovascular and metabolic risk factors, such as overweight and central obesity, hypertension, glucose intolerance and raised cholesterol levels (4).

Furthermore, skipping breakfast has been shown to be associated with adverse cardiovascular outcomes, including coronary heart disease (5) and stroke (6), but less is known about the impact of skipping breakfast on cardiovascular death.

In this issue of the Journal, Rong et al. (7) reported the prospective associations between self-reported skipping breakfast and mortality (total and cardiovascular-related) in 6,674 adults aged 40 to 75 years who participated in the National Health and Nutrition Examination Survey III (1988-1994). In accordance with the results of the study, participants who report that never consume breakfast were at higher risk for all cause death and cardiovascular death, especially stroke-specific mortality. This association remained significant after the adjustment for age, gender, race/ethnicity, socioeconomic status, dietary and lifestyle factors and BMI.

The results from Rong et al (7) here reported are relevant because they show for the first time the prospective association between skipping breakfast and risk of cardiovascular

mortality. As the authors point out, the results are in line with previous literature on the association between skipping breakfast and cardiovascular disease, including higher risk of coronary heart disease (5), stroke and hemorrhage (6) and subclinical atherosclerosis (8).

Association is not necessarily causation.

One limitation to most of the studies reporting associations between dietary patterns and clinical outcomes is the observational nature of the examinations, as is the case in the report here commented (7). A common denominator to most of these studies is that subjects at the highest risk for clinical outcomes (breakfast-skippers in the present study) usually have a worse risk profile at baseline. In the present study, the group of subjects reporting that never have breakfast were more frequently smokers, alcohol drinkers, physically inactive, and obese. Besides the poorer lifestyle habits, the group reporting that never have breakfast had a higher incidence of hypertension, diabetes, and dyslipidemia. Whether all these differences are secondary to the breakfast pattern is unknown but highly improbable. Despite the elegant statistical approach undertaken by authors to control for all these baseline disparities, there is still a chance for residual confounders. Therefore, despite there is plausible mechanistic explanation for the impact of skipping breakfast on cardiovascular risk profile (explained below), it is unclear whether skipping breakfast is causally involved in the increased risk of mortality or by contrast is an epiphenomenon.

Another limitation of the present study is important aspects such as what type of foods and beverages were consumed for breakfast or whether participants changed their breakfast habits during the follow-up period were not accounted for.

What is clear is that skipping breakfast pattern identifies a population at risk. Surveying the breakfast pattern might be useful in improving risk prediction in the general population. In fact, cardiovascular risk scores accounting only for lifestyle habits (i.e. without laboratory tests), such as the Fuster-BEWAT Score or the Ideal Cardiovascular Health Score, have been shown to be able to predict atherosclerosis presence (9). Including a question related to breakfast pattern might further improve the performance of such scores.

Potential mechanism explaining the association between skipping breakfast and adverse cardiovascular events.

The proximal factors explaining the association between skipping breakfast and cardiovascular disease, namely the cardio-metabolic disorders, are influenced by several physiological mechanisms that may explain how these abnormalities are induced. Some of these mechanisms include decreased satiety caused by skipping breakfast causing overeating later in the day leading in turn to overweight and insulin resistance, raised blood pressure levels due to over-activity in the hypothalamic-pituitary-adrenal axis, and deleterious changes in lipid levels. As the authors of the article point out, other than causing metabolic changes, skipping breakfast may be a behavioral marker for unhealthy dietary patterns and lifestyle habits, including poorer physical activity patterns and impaired sleep (10,11). Even if the results provided are adjusted for several dietary and lifestyle factors including smoking, alcohol intake, physical activity levels, total energy intake and overall diet quality, health behaviors are influenced by a broad range of psychological, socio-economic, physical (built-environment) political and

cultural factors that act as barriers or facilitators. As shown by the literature, the effect of these barriers and facilitators are present since childhood (10,12,13), when skipping breakfast is already a matter of concern (12,14). Since both metabolic disorders such as overweight and obesity and health habits track from childhood into adulthood (15), early prevention and health promotion need to be a priority.

Beyond the links between breakfast habits and cardiovascular disease, other longitudinal studies reported that skipping breakfast may exert detrimental influence over cardio-metabolic risk factors. Obesity, central adiposity, hypertension, total cholesterol and LDL cholesterol levels, plasmatic glucose and metabolic syndrome which have been linked to skipping breakfast and in turn can partially explain the associations between this lifestyle bad habit and total and cardiovascular mortality.

Very recently, it has been demonstrated in the Progression of Early Subclinical Atherosclerosis (PESA) study that skipping breakfast is associated with the presence and severity of subclinical atherosclerosis (8) . The increased prevalence and extension of atherosclerosis might explain the higher incidence of cardiovascular events later in life.

In summary, this study expands our knowledge into the associations between dietary patterns and cardiovascular outcomes. Either causally linked or just as an epiphenomenon, skipping breakfast appears as a marker of atherosclerosis presence and poor cardiovascular outcomes.

REFERENCES

1. Yu E, Malik VS, Hu FB. Cardiovascular Disease Prevention by Diet Modification: JACC Health Promotion Series. *J Am Coll Cardiol* 2018;72:914-926.
2. Mozaffarian D. Dietary and Policy Priorities for Cardiovascular Disease, Diabetes, and Obesity: A Comprehensive Review. *Circulation* 2016;133:187-225.
3. St-Onge MP, Ard J, Baskin ML et al. Meal Timing and Frequency: Implications for Cardiovascular Disease Prevention: A Scientific Statement From the American Heart Association. *Circulation* 2017;135:e96-e121.
4. Odegaard AO, Jacobs DR, Jr., Steffen LM, Van Horn L, Ludwig DS, Pereira MA. Breakfast frequency and development of metabolic risk. *Diabetes Care* 2013;36:3100-6.
5. Cahill LE, Chiuve SE, Mekary RA et al. Prospective study of breakfast eating and incident coronary heart disease in a cohort of male US health professionals. *Circulation* 2013;128:337-43.
6. Kubota Y, Iso H, Sawada N, Tsugane S, Group JS. Association of Breakfast Intake With Incident Stroke and Coronary Heart Disease: The Japan Public Health Center-Based Study. *Stroke* 2016;47:477-81.
7. Rong S SL, Xu G, Sun Y, Liu B, Wallace RB, Bao W. Association of Skipping Breakfast with Cardiovascular and All-Cause Mortality: a Population-Based Prospective Cohort Study. *J Am Coll Cardiol* 2019;In press.
8. Uzhova I, Fuster V, Fernandez-Ortiz A et al. The Importance of Breakfast in Atherosclerosis Disease: Insights From the PESA Study. *J Am Coll Cardiol* 2017;70:1833-1842.
9. Fernandez-Alvira JM, Fuster V, Pocock S et al. Predicting Subclinical Atherosclerosis in Low-Risk Individuals: Ideal Cardiovascular Health Score and Fuster-BEWAT Score. *J Am Coll Cardiol* 2017;70:2463-2473.
10. Smith KJ, Breslin MC, McNaughton SA, Gall SL, Blizzard L, Venn AJ. Skipping breakfast among Australian children and adolescents; findings from the 2011-12 National Nutrition and Physical Activity Survey. *Aust N Z J Public Health* 2017;41:572-578.
11. Dominguez F, Fuster V, Fernandez-Alvira JM et al. Association of Sleep Duration and Quality With Subclinical Atherosclerosis. *J Am Coll Cardiol* 2019;73:134-144.
12. Okada C, Tabuchi T, Iso H. Association between skipping breakfast in parents and children and childhood overweight/obesity among children: a nationwide 10.5-year prospective study in Japan. *Int J Obes (Lond)* 2018.
13. van Kleef E, Vingerhoeds MH, Vrijhof M, van Trijp HCM. Breakfast barriers and opportunities for children living in a Dutch disadvantaged neighbourhood. *Appetite* 2016;107:372-382.
14. Ramsay SA, Bloch TD, Marriage B, Shriver LH, Spees CK, Taylor CA. Skipping breakfast is associated with lower diet quality in young US children. *Eur J Clin Nutr* 2018;72:548-556.
15. Smith KJ, Gall SL, McNaughton SA, Blizzard L, Dwyer T, Venn AJ. Skipping breakfast: longitudinal associations with cardiometabolic risk factors in the Childhood Determinants of Adult Health Study. *Am J Clin Nutr* 2010;92:1316-25.