



Breakfast and subclinical atherosclerosis: a novel association that highlights the importance of dietary habits in the prevention of atherosclerotic diseases

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Provenance: This is a Guest Editorial commissioned by Editor-in-Chief Xi-Hua Liu, MD (Chinese Research Hospital Association, Beijing, China).

Comment on: Uzhova I, Fuster V, Fernández-Ortiz A, *et al.* The importance of breakfast in atherosclerosis disease: insights from the PESA Study. *J Am Coll Cardiol* 2017;70:1833-42.

Received: 16 July 2018; Accepted: 27 August 2018; Published: 10 September 2018.

doi: 10.21037/arh.2018.08.03

View this article at: <http://dx.doi.org/10.21037/arh.2018.08.03>

Atherosclerosis is the prevailing cause of cardiovascular disease (CVD), including heart failure, ischemic stroke and peripheral vascular disease (1). It appears that behavioral risk factors, such as dietary patterns, are as important as physiological risk factors in the onset of CVD (2,3). Nonetheless, whether specific eating habits such as skipping breakfast regardless of nutrient composition can influence risk of CVD has started to be investigated.

Nowadays it is known that deleterious effects of omitting breakfast include: higher cardio-metabolic health markers (4), diabetes (5), weight gain (6) and a direct association to coronary heart disease (7,8). The growing body of scientific evidence is increasing the awareness of eating breakfast. In fact, it is in line with current UK guidance from the National Institute for Health and Care Excellence (NICE) as part of a campaign on preventing weight gain (9). Still, to encourage this habit it is important to support and strengthen scientific research focused on demonstrating the importance of breakfast behavior, as a part of intervention to effectively reduce CVD.

Recently, Uzhova *et al.* have published an article entitled: “*The importance of breakfast in atherosclerosis disease: insights from the PESA study*” in where the authors showed an interesting association between breakfast skipping and atherosclerosis, independent of the presence of conventional cardiovascular risk factors (10). This cross-sectional study was conducted as part of the PESA (Progression of Early

Subclinical Atherosclerosis) study. PESA is an on-going observational prospective research with a cohort of 4,082 subjects (employees from the Bank Santander Headquarters in Madrid, Spain) designed to illustrate factors associated with the development and evolution of atherosclerosis.

Uzhova and colleagues aimed to examine the association between different breakfast patterns with subclinical atherosclerosis development and progression. A cohort of 4,052 asymptomatic male and female volunteers were enrolled in the study aged 40 to 54 years (without evidence of CVD or chronic kidney disease, body mass index over 40 kg/m², or diseases that affected the life expectancy). The participants were asked to complete a computerized questionnaire in where they reported foods consumed in the previous 15 days, from a list of 861 food items that included typical Spanish meals. Importantly, the eating occasions such as breakfast, lunch, dinner and morning/afternoon snacks were taken into account to calculate the frequency of consumption. The variable “energy consumed during breakfast” was calculated based on the daily energy intake. The authors defined breakfast as the meal consumed before 10:00 am. They differentiated the group into three subgroups for the study, based on the energy intake at breakfast. Participants were classified as (I) high energy breakfast consumers (HBF) if their energy intake at breakfast outpace 20% of the total daily energy intake, (II) low energy breakfast consumers (LBF) those with

energy consumption at breakfast between 5–20% of total daily intake and (III) skipping breakfast (SBF) whose breakfast energy intake did not exceed 5% of total energy daily consumption.

Authors described anthropometrical and clinical measurements to define cardiovascular risk factors in the population studied. The assessment of atherosclerosis plaques was estimated by cross-sectional scan from proximal to distal segments of bilateral carotid, infrarenal abdominal aorta and iliofemoral arteries to assess the presence of plaques, define plaque area, and in case of aorta, calculate the maximal vessel diameter, using a vascular 2-dimensional ultrasound, as described previously (11). Coronary artery calcium was also evaluated using a non-contrast electrocardiography-gated prospective acquisition with a 16-slice computed tomography scanner. The authors defined subclinical atherosclerosis as the presence of plaque at least in one of the above vascular territories or as the presence of calcium in the coronary arteries. Non-coronary atherosclerosis was defined only by the presence of plaques in the previously stated vascular territories without coronary artery calcium. Finally, generalized atherosclerosis was defined when 4 out of total 6 sites were affected.

In this novel study, Uzhova *et al.* described for the first time, a link between lower breakfast energy intake and a higher risk of subclinical atherosclerosis. In comparison to the HBF group, both LBF and SBF subjects were characterized by consuming greater amounts of calories at lunch. SBF participants showed higher dietary cholesterol, lowest fiber and carbohydrates intake, and tended to consume more alcoholic and sugar-sweetened drinks than LBF and HBF groups. LBF subjects were more likely to consume greater daily energy intake, including higher animal protein and cholesterol and lower fiber and carbohydrates than HBF subjects. Eating patterns resulted in differentiated breakfast dietary habits across the groups. Compared to HBF participants, LBF and even more SBF subjects showed significant higher cardio-metabolic risk markers. Subclinical atherosclerosis was predominantly observed in the SBF group (74.6%), while the LBF and HBF groups evidenced atherosclerosis prevalence of 64.5% and 56.6% respectively. Higher odds of having plaques in SBF subjects were observed in abdominal aorta (OR: 1.79), followed by carotid atherosclerotic plaques and iliofemoral plaques (OR: 1.76 and 1.72, correspondingly). The SBF group also demonstrated higher odds of non-coronary atherosclerotic plaques (OR: 1.55) and generalized atherosclerosis (OR: 2.57) among groups, even after the

adjustment with CVD risk factors and overall nutritional value (10).

Although Uzhova *et al.* have provided a major inflection point in the field, it is important to consider some limitations of the study. Firstly, the nature of the study itself, being a cross-sectional study, does not analyze the behavioral skipping breakfast habit over a period of time; thus the determination of cause and effect remains unclear. Secondly, the study reported a discreet 2.9% (118 volunteers) of the population classified as SBF in comparison to LBF and HBF (69.4% and 27.7%, respectively). Even though, the SBF group reported the most extreme measurements and was considered by the authors as representative of the overall 4,052 volunteers enrolled in the investigation. It might be interesting to validate and replicate these experiments in other cohorts and in different regions and ethnicities.

In addition, the SBF group was found to follow an unhealthy lifestyle, along with a high number of participants reporting to be on a diet to lose weight. In fact, subjects of SBF group were found to have an average BMI of 28.04 ± 4.66 in comparison to LBF and HBF groups (26.55 ± 3.85 and 25.01 ± 3.39 , accordingly) demonstrating a higher prevalence of obese individuals in the SBF group. Obesity is a source of inflammation that directly relates to atherosclerosis (12). The omission of breakfast can be explained as a dietary habit, part of a diet to lose weight, in an obese population (SBF group) that demonstrated the highest values of subclinical atherosclerosis. These observations might result in a weak association between breakfast skipping and atherosclerosis. To overcome this, the authors effectively adjusted the statistical analyses, which resulted in a decreased 4.7% in the association (data not shown), which translated into a partial association between skipping breakfast and prevalence of atherosclerosis. However, taken into account that this observational study does not evaluate follow-up data, it is not possible to address a cause-effect relationship. Thus, further studies are needed to provide evidence on the impact of skipping breakfast on atherosclerosis and to persuade public policy makers to advocate breakfast as an essential requirement for a healthier lifestyle.

Despite these limitations, morning meals, in general, have demonstrated a beneficial outcome on appetite, total daily energy intake (13,14). It cannot be ruled out that pre-existing obesity in SBF participants might be the underlying condition. The findings from Uzhova *et al.* are nevertheless important to health professionals. They provide a scientific

base to support public health strategies and to support the creation of dietary guidelines, validating the importance of quality breakfast patterns in daily routines. This may delay or reverse atherosclerosis.

This important observational research highlights a potential association between omitting breakfasts with the presence of atherosclerosis in a middle-aged population. The results from this study suggest that the importance is not only in the nutritional value of breakfast but also its consumption. This approach can be an interesting low-cost intervention to prevent atherosclerotic diseases.

Acknowledgements

We would like to thank Aston Medical School, Dr. Tim Watts of Pertemps Medical and the British Heart Foundation for supporting the research in Aston Medical Research Institute where Dr. Sanchez-Aranguren and Professor Ahmed are based.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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doi: 10.21037/arh.2018.08.03

Cite this article as: Sanchez-Aranguren L, Ahmed A. Breakfast and subclinical atherosclerosis: a novel association that highlights the importance of dietary habits in the prevention of atherosclerotic diseases. *Ann Res Hosp* 2018;2:10.