Healthy Diets and Lung Health

Connecting the Dots

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Great emphasis has historically been placed by the pulmonary community on obstructive lung diseases, particularly asthma and chronic obstructive pulmonary disease (COPD). Discovery of an obstructive pattern on pulmonary function testing plays an essential role in the recognition and diagnoses of these common diseases. There is increased recognition, however, that many individuals (perhaps equally many as have obstructive physiology) manifest proportional reductions in both FVC and FEV_1, such that the calculated FEV_1/FVC ratio remains normal. This symmetric reduction in forced spirometric volumes has been termed "spirometric restriction," although what precisely restricts expiration of individuals with this spirometric pattern may be uncertain. Some possibilities include central obesity impairing diaphragmatic excursion, lung edema that is either clinically apparent or subclinical, early or occult interstitial lung disease, or interestingly, just a diminished overall lung capacity resulting from impaired lung growth or an accelerated decline in lung volume caused by factors that are presently unknown.

Given these many possible causes, plus several documented adverse outcomes associated with reduced lung function (whether in the FEV_1, FVC, or both), even when still in the "normal" range, a better way to designate these findings might be considered in the context of lung health, rather than lung disease.

In this month's issue of *AnnalsATS,* Hanson and colleagues (pp. 643–650) place lung function in the context of overall health, using data from the National Health and Nutrition Examination Surveys (1). They document that participants with the greatest intake of dietary fiber had the highest lung function and also were more likely to have normal lung function. Those with lower fiber intake did not have COPD or obstructive lung physiology, but instead tended to have spirometric restriction. This analysis, therefore, squarely emphasizes the association between dietary intake of fiber and lung health, rather than focusing on lung disease, and adds to a body of literature of association between high-fiber diets and health in general.

Associations between impaired lung health and adverse health consequences have long been documented in the literature. In both the Framingham (2) and Tecumseh (3) cohorts in the 1960s, FVC, even with small-magnitude reductions that would be included in the normal range, was associated with cardiovascular mortality. Lange found that lung function impairment was associated with cardiovascular death, but not with myocardial infarction (4), while Engström found that lung function predicted heart failure (5), raising the possibility that impaired lung health is specifically associated with nonatherosclerotic forms of cardiovascular disease.

Our group has pursued a life-course approach to lung health in the Coronary Artery Risk Development in Young Adults (CARDIA) cohort study, and examined the associations among peak lung function, loss of lung health, and a variety of clinical and subclinical outcomes. One paper found that decline from peak FVC attained in young adulthood was associated with future hypertension, which is associated with both atherosclerotic and nonatherosclerotic cardiovascular disease (6). A second paper found that loss of lung health (i.e., decline in FVC) from young adulthood was associated with a hypertrophic, high-output cardiac phenotype with increased left ventricular mass and signs of diastolic dysfunction (7).

The mechanism of association between impaired lung health and adverse health outcomes, however, cannot be solved by observational epidemiology. Lung function has been associated not only with cardiovascular disease but also adverse cognitive or behavioral health conditions, such as dementia (8) and suicide (9). That association intensifies our curiosity regarding exactly what poor lung health actually indicates. We have found that lung function decline is associated with systemic inflammation (10), endothelial dysfunction (11), and adiponectin (12). Conversely, lung health is better on average among those with high serum carotenoids (13), a maker of a high-quality diet and less oxidative stress.

Limiting the study of lung function to the context of disease limits the scope of our understanding how differences in lung function, even within the normal range, affect both overall health and disease. By not focusing exclusively on disease and also examining dietary predictors of lung health, Hanson and colleagues make a meaningful

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contribution to the overall study of lung health (1).

Diet is probably even harder to understand than is lung function. Diet is the consumption of food; all food originated as an organism, which developed under evolutionary control. Food is therefore constituted of complex arrangements of thousands of biochemicals, suitable for sustaining the life of the organisms that make up food (14). Attempts to make food choices based on single nutrients are likely to lead to errors, even if the nutrient in isolation is truly good for health or bad for health (14). This is perhaps even a larger problem for food production: Almost all food is produced by industry, and industry follows official dietary policy, regulation, and simple ideas that sell (such as eat a diet low in fat or eat a diet low in carbohydrates). Thus, we assert that the single nutrient approach to choosing food has a history of corrupting the food supply.

There is probably not a single optimal diet; instead, there may be a wide range of satisfactory approaches to diet. Many papers have identified one of several patterns that conform to principles of Mediterranean/prudent diet or other guideline-recommended diets (14). In this sense, choosing foods to eat is not an exact science (which is fortunate, because it leaves plenty of room for enjoyment and social aspects of eating).

Using data generated by the Iowa Women's Health Study, we studied the *A priori* Diet Quality Score (originally formulated by us) and the Alternate Healthy Eating Index (originally formulated by nutritional epidemiologists at Harvard) (15). Both were intended to capture "good" diets, following both guidelines and primary literature (16, 17). Both scores, on their face, resemble the Mediterranean and the prudent diets. They are highly correlated with one another ($r = 0.65$), in accord with the theme that the best diets have a lot of latitude and are defined in broad strokes. The outcome variable of our Iowa Women's Health Study analysis was death, and both scores predicted 20–30% lower rates of total mortality, cardiovascular mortality, and noncardiovascular, noncancer inflammatory-related disease mortality, with less strong prediction of lower cancer rates (15).

One of the unifying principles of all of these diets is that they are centered around plant foods rich in many compounds, generally prepared for consumption with minimal processing. All such diets also include a wide variety of other foods. These diets tend to be fairly high in dietary fiber. Dietary fiber marks cell walls in plants, thereby indirectly marking the highly bioactive and varied contents of those plant cells (18). Notwithstanding known effects of dietary fiber on laxation and care and feeding of bacteria and other organisms in the gut microbiome, dietary fiber (and specifically cereal fiber) is more likely to be a marker of a good diet than to be an active constituent of the good diet (18). The fact that the *A priori* Diet Quality Score and the Alternate Healthy Eating Index both predicted noncardiovascular, noncancer inflammatory-related causes of death (15) is relevant to the work of Hanson and colleagues, because this broad classification includes lung-related conditions and dementia (1).

How, then, should we view the National Health and Nutrition Examination Surveys findings of Hanson and colleagues (1)? Although "only" a cross-sectional study, focusing on a very selective aspect of diet in relation to lung function, this contribution is in effect related to all of the above issues. Their outcome is important despite the relative absence of chronic obstructive lung disease. Their findings for diet fall in line with theory about healthy dietary patterns, if not interpreted literally as "effect of fiber itself." Therefore, this cross-sectional study evokes many issues. It leads us to muse on the importance of the lung to health, at least as a general marker, on the inadequacy of the term "restrictive lung disease," and on further confirmation of the importance of certain dietary patterns to overall health and disease. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

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