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Omega-3 fatty acid: A promising pathway linking personality and health

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A broad and growing literature indicates that conscientiousness, neuroticism, and other major personality traits are robust predictors of a wide range of health outcomes [1–3], including prevalent conditions such as obesity [4, 5] and dementia [6]. There is also consistent evidence that personality traits are related to health behaviors, such as diet, physical activity, and smoking, which in turn partly explain the association between personality and health outcomes [1, 2]. Health-risk behaviors are only one potential pathway. Models of personality and health recognize other pathways, such as meaning and stress derived from work and relationships. Less is known, however, about the mechanisms and biomarkers through which personality may influence health and longevity [3].

This Editorial discusses the association between personality and plasma levels of omega (n)-3 polyunsaturated fatty acid (omega-3 PUFA) found in the large (n=2,912) and well-characterized Netherlands Study of Depression and Anxiety [7]. Thesing and colleagues (2018) [7] report that low omega-3 PUFA are associated with higher levels of neuroticism and lower levels of extraversion and conscientiousness. The effect sizes were modest, which is to be expected, in part because of dietary fluctuations in omega-3 PUFA intake. Although modest, similar associations have been found in previous smaller studies (see [7]). In sensitivity analyses, the study [7] further found that the associations between personality and omega-3 PUFA were not significantly different between people with and without major depression. This similarity suggests that the association is not likely to be caused by a depressive state. The associations also remained comparable after the exclusion of participants taking an omega-3 PUFA supplement and participants taking statins.

Thesing and colleagues (2018) [7] examined personality traits mainly as endophenotypes that underlie mood disorders. While we agree that personality is relevant for mood disorders, we broaden the discussion of the findings by emphasizing the role of personality in a context broader than mental health. This growing line of research suggests that omega-3 PUFA are promising biomarkers that can contribute to the elucidation of the mechanisms that link personality to health, particularly because omega-3 PUFA have pleiotropic effects on metabolism, inflammation, and brain health.

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Given the observational study design [7], it is not possible to disentangle the causal direction of the association between personality and omega-3 PUFA. It is possible, however, to speculate about it. Omega-3 PUFA could influence personality levels, but as argued by Thesing and colleagues [7], a more likely determining factor for this association is the role of personality traits in dietary choices. Several studies have found that higher neuroticism, lower extraversion, and lower conscientiousness are associated with unhealthy diet and disordered eating habits [4, 8–10], including a lower likelihood of consuming fish, seeds, nuts, and other foods that are sources of omega-3 PUFA. These studies have relied on food-frequency questionnaires. To the extent that omega-3 PUFA assessed in plasma reflects dietary intake of foods rich in omega-3 fatty acid, the biomarker measure of omega-3 PUFA corroborates the self-reported evidence. Surprisingly, however, although openness is a strong and consistent predictor of a healthier diet in the literature on food choices [8, 9], it was unrelated to omega-3 PUFA in the adjusted model [7] (perhaps because of the high overlap between openness and many of the covariates).

To the extent that it may help reduce obesity [11], omega-3 PUFA are a promising mediator in the pathway from personality to adiposity. Across a diverse range of populations, for example, conscientiousness is associated with healthier weight gain and lower risk of obesity [4, 5]. Conscientiousness may contribute to healthier weight through greater consumption of omega-3 PUFA. Omega-3 PUFA would join other biomarkers, including leptin (an adipose-derived hormone that regulates appetite) that have been found to mediate the relation between Conscientiousness and body weight [12]. Other pathways have also been identified. In addition to diet, for example, personality traits are robust predictors of physical activity patterns [13], with higher conscientiousness, as well as higher extraversion and openness and lower neuroticism predicting greater activity levels and less sedentary behavior. Interestingly, Conscientiousness may not be associated with adiposity in Asian populations [14], which is consistent with the one study that did not find a relation between this trait and omega-3 PUFA (see [7]).

In addition to obesity and metabolic health, omega-3 PUFA may play a significant role in a mechanistic model that links personality to other health outcomes, particularly through food choices and the resulting cascade of inflammation and physiological dysregulation. Lower conscientiousness and higher neuroticism have been associated with inflammatory markers [15] and risk of physiological dysregulation, as measured by the metabolic syndrome, allostatic load, and frailty [16, 17]. More complex models of personality and health will articulate pathways through serial mediators. For example, individuals high in conscientiousness may consume more foods rich in omega-3 PUFA, and omega-3 PUFA may, in turn, reduce inflammation, which then contributes to more positive health outcomes. Alternatively, omega-3 PUFA and inflammation may be independent mediators of the relation between conscientiousness and health. Comprehensive, well-powered, and longitudinal datasets are needed to evaluate the possible models.

While personality traits are related to a wide array of biomarkers, it is not surprising that the strongest concurrent associations are with measures of mood and cognition. Even in prospective studies, personality traits are significant predictors of psychiatric and neurodegenerative diseases, such as major depression [18] and Alzheimer's disease [6]. The

omega-3 PUFA, and in particular the docosahexaenoic acid (DHA) component, are implicated in brain health [19], and again may function as mediators in the associations between personality and psychiatric and neurodegenerative diseases.

Finally, the association between personality and omega-3 PUFA is of interest for the potential translational impact. Evidence for the benefits of omega-3 PUFA for mood and cognitive health is limited, but a meta-analysis of randomized placebo-controlled trials suggests modest benefits of omega-3 PUFA supplementation on depressive symptoms [20]. Future intervention research would benefit from the inclusion of personality measures for several reasons. First, it would be possible to test whether higher intake of omega-3 PUFA has an impact on personality traits. Traits are outcomes of significant interest on their own because of their relations with a wide range of life outcomes. Furthermore, personality traits could function as explanatory dimensional variables for potential effects of interventions on clinical outcomes. Second, it would provide an assessment of the psychological profile of the study sample to evaluate generalizability and to account for differences in treatment adherence and study attrition. Third, it would be possible to examine heterogeneity of treatment effects and identify who benefits (or is harmed) from a higher intake of omega-3 PUFA.

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