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Perceived Body Weight Status of Youngsters Interferes With Headache in Obese and Non-Obese Subjects: A Response

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We appreciate Trovato and colleagues' comment on our review titled "Obesity and headache: Part I – A systematic review of the epidemiology of obesity and headache."¹ In our review, we summarized the existing, general population epidemiological data on the migraine-obesity association. In summary, the population data suggest that migraine is comorbid with obesity and that this increased risk of migraine in those with obesity is most evident in those under the age of 50 (ie, those of reproductive age) and women.²

In their letter, Dr. Trovato and colleagues present unpublished data examining the association between headache in general and the combined group of over-weight and obese (as estimated by body mass index [BMI] in teenagers and adults between 13 and 30 years of age) as compared with those of normal weight. While the authors report in their letter that they did not find an association between headache and overweight/obesity in their study population, their preliminary findings suggest that the relationship between overweight/obesity and headache was different depending on whether subjects "falsely" or "correctly" perceived their obesity status as measured by BMI.

While the results they have presented in their letter are of interest, particularly in regards to self-perception, it is difficult to place these findings in context of the extant literature for a few reasons. It is important to note that BMI is not the gold standard for determining obesity status. Obesity is most accurately estimated by direct demonstration of an increase in adipose tissue to fat-free mass (FFM), such as with imaging.³ However, direct measurements are expensive and often not practical. Consequently, obesity is often "*de facto*" defined as excessive relative bodyweight (which, in addition to adipose tissue, includes skin, organs, and muscle mass) rather than just excessive adipose tissue mass.³ When evaluating perceptions of obesity this point may be particularly relevant, as using BMI-cut-offs to characterize obesity status have limitations in their accuracy. These limitations are especially magnified when estimating obesity in children, younger adults, and athletes.^{4,5} For example, it is not uncommon for athletes who are highly fit to have a BMI 30 and have entirely normal and healthy body fat percentages. Therefore, it is problematic to identify one's perception of their body composition as "true" or "false" based on BMI measurements alone. In fact, some of those with BMI 25 may actually have correctly perceived themselves as non-overweight/obese if their body fat% or adipose tissue was actually measured. Furthermore, it is likely that males and females differ in how they

characterize themselves even at the same BMI. It may be, and perhaps the authors have already explored this possibility, that the relationship between “erroneous” perception of overweight/obesity and headache is explained by sex differences in headache sufferers, as the presented data are not sex-stratified.

Further, it would be relevant to determine whether headache participants included migraine only, tension-type headache (TTH) only, or all headache diagnosis in general. As discussed in our review, previous general population data for adolescents has shown a positive association between overweight/obesity and migraine (odds ratio [OR] = 1.6, confidence interval [CI] 1.4-2.2, $P < .0001$).⁶ However, no significant association was found between overweight/obesity and non-classifiable headache (OR = 1.4, CI 1.0-1.9, $P = .06$).⁶ In the adult population, the majority of studies have not found an association between TTH (especially episodic TTH) and obesity.¹

Additionally, although population data suggest that the risk of migraine is increased in obese (BMI ≥ 30) individuals of reproductive age and that this risk increases with increasing BMI, prior studies have not demonstrated a robust association between headache or migraine in those who are only overweight (ie, BMI 25-29.9).^{2,7,8} By BMI standards, it appears that the population in Trovato et al's study is mostly of normal weight (mean BMI 22.44 ± 3.27), which would extrapolate to less than 2% of their population having obesity or BMI ≥ 30 (2+ standard deviations above the mean). Given that the prevalence of obesity in Italy has been estimated to be around 9-11% in young adults,^{9,10} the very low prevalence of obesity in Trovato et al's study population may have masked the true relationship between obesity and migraine.

Finally, it is unclear if their data were adjusted for psychiatric disorders, as PTSD, depression, and anxiety have all been found to be comorbid with migraine.^{11,12} As the concept of “false perception of self” investigated by Trovato et al may constitute lower self-esteem or underlying psychiatric disorders, this would be important to identify.

Multiple general population studies, reviewed in our manuscript, have shown a strong relationship between migraine and obesity based on height and weight in those of reproductive age.¹ We welcome and look forward to learning more about this topic as additional data unfold. The accumulation of unbiased, reliable, general population data is imperative in furthering our understanding and propelling our efforts to provide better advice and care to our headache patients. Dr. Trovato et al's suggestion that perception could play a role in the migraine-obesity association is intriguing and is of potential interest pending the previously noted clarifications, and we look forward to reading the published version of their manuscript.

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