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Letter to Editor

Feasibility of Phenylthiocarbamide (PTC) Bitter Taste Perception Assessment for Individual Specific Vaccine

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Abstract:

Easy and affordable assessment of variation in PTC bitter taste perception makes it an attractive candidate for evaluating its association with COVID-19 vaccine efficacy, as bitter taste receptor's extraoral role in immune system and its phenotype association with COVID-19 outcomes is being suggested by literature. As we have multiple vaccine choices, individual specific vaccine selection would be possible if there is a correlation between their taster phenotype and the COVID-19 vaccine response with aspiration of increasing the immunogenicity of vaccines through such a simple test. Thus, this proposal was presented.

Keywords: PTC, bitter taste, COVID-19, Vaccine

To Editor,

The increasing prevalence of COVID-19 and mortality of thousands of people have led to increased efforts to develop vaccines to curb the disease, which has so far led to the development of emergency or Food and Drug Administration approved vaccines being administered in large populations around the world. Although the exact duration of immunity after vaccine injection is unknown, vaccine-based immunity appears to remain stable for months. According to studies published around the world, a relative decline in immunity may occur after this period, putting people at risk for COVID -19 (1,2). While this is an issue that will take time to resolve, the COVID-19 pandemic has shown unpredictable aspects and there is no time to lose. More doses, known as boosters, may be needed for people to reach optimal immunity levels months later. With multiple platforms available for vaccination against COVID-19, researchers suspect that certain vaccines may be more effective for different populations. Currently, several different vaccines are in use worldwide, including Moderna® (mRNA-1273), BioNTech / Pfizer® (BNT162b), Janssen® (Ad26.COV2.S), AstraZeneca® (ChAdOx1 nCoV-19), Novavax ® (protein), Sinopharm® (inactivated) and Sputnik V® (Ad26, Ad5). Previous studies have shown that certain types of this vaccine may have different immunogenicity for different age groups. While there might be no significant association between sex and vaccine response, the role of race remains unclear (3, 4).

The genetic background of a host may influence the response to the vaccine (5). By discovering genetic variants associated with greater or lesser vaccine efficacy prior to vaccination, specific vaccination strategies can be tailored to specific populations with different genetic backgrounds (6).

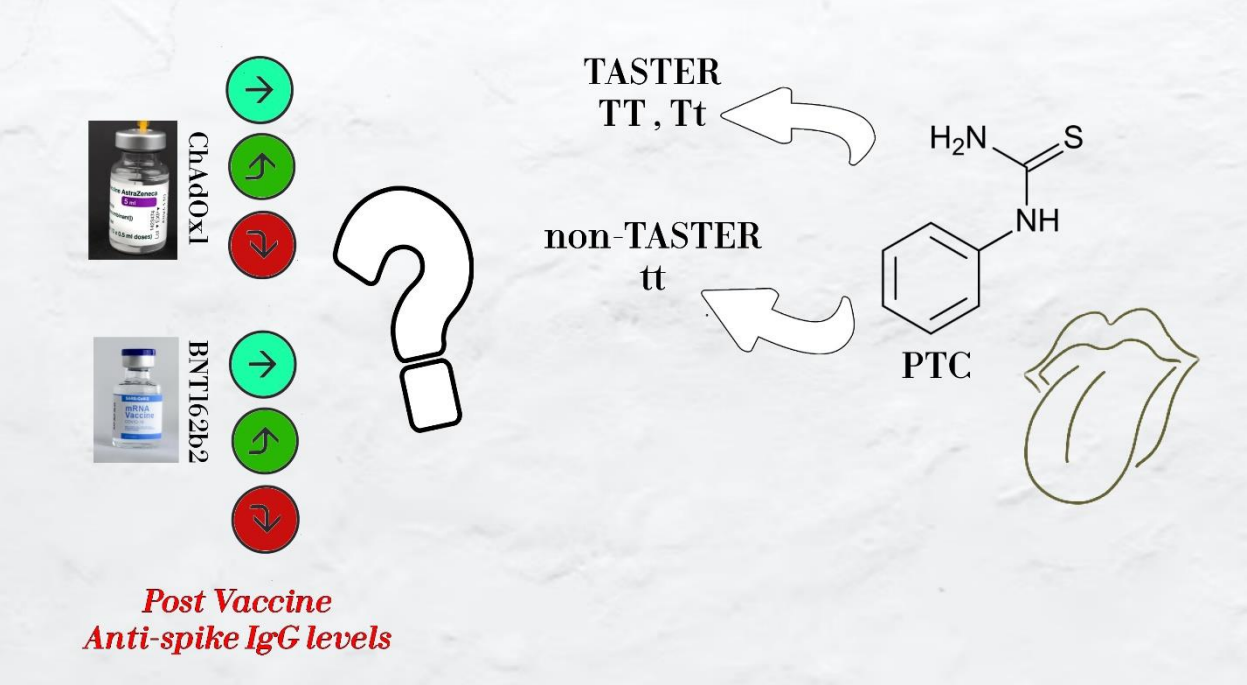

Figure 1. Schematic of study concept

The phenylthiocarbamide (PTC) bitter taste perception phenotype is one of the simplest classic examples of a phenotype that is strongly representative of its genotype, although genotype assessment requires cohorts of tens of thousands of people. PTC is a chemical with a bitter taste. Although some people refer to PTC as tasteless, some are tasting PTC as a very bitter substance. It is one of the best compounds for measuring bitterness sensitivity. The ability of individuals to taste the bitter taste of PTC is an important and useful tool in the study of human genetic diversity. Diversity in the ability to taste PTC has also been considered from the perspective of evolution and natural selection. Those who can taste PTC perceive the bitter taste, and this trait is controlled by the dominant allele. There are many studies and researches on the ability to taste PTC and its association with various diseases.

Interestingly, this idea was also evaluated in COVID-19 era. In a study by Barham et al., bitter taste nontasters were found to be more vulnerable to SARS-COV2 (7). Their other research on this subject revealed that nontasters have more chance of being admitted for COVID-19 (8). Taha et al. proposed classification of patients based on bitter taste receptor phenotypes to receive specific protocols of COVID-19 treatment (9). Bouazza et al. had hypothesized that COVID-19 therapeutic effects of Chloroquine might be due to its role as a bitter taste receptor agonist and following airway relaxation (10). Where Watanabe et al. mentioned that TAS2R expression might alter response to medications such as Chloroquine (11). Parsa et al.'s study showed that polymorphism of TAS2R38 gene in different countries might be correlated with mortality rate of COVID-19 in each country (12).

The study design of our proposed study would be a retrospective evaluation of serum antibody levels to build a statistical model to predict vaccine response, to assess SARS-COV2 antibody positivity after vaccination (Figure 1). However, a Mendelian study has prerequisites that require modifications in the application of this study design. Based on Gagliano and Evans' guide to conducting a Mendelian study (13), the following research questions were designed to evaluate our relationships of interest.

1. does a specific PTC taste phenotype lead to higher / longer immunogenicity than other phenotypes, regardless of vaccine type?

2. does a specific PTC taste phenotype lead to higher / longer immunogenicity than other phenotypes for different vaccine platforms / types?

Some key Mendelian laws also need to be considered. While genetic variants should not be associated with environmental and genetic confounding variables according to Mendelian principles of segregation and independent selection (13), an environmental confounding variable could bias the proposed study. COVID -19 induced olfactory and gustatory disturbances are one of the variables that may strongly influence the results. There are also reports that vaccinated individuals rarely exhibit symptoms of loss of sense of smell and taste (14). The study by Doty and De Fonte found that PTC tasters performed significantly better than non-PTC tasters in perceiving the intensity of various suprathreshold tastes in subjects with olfactory and gustatory disorders due to various etiologies. They showed that chemosensory disorders could confound the PTC taste test (15); however, this was not investigated in COVID -19 or vaccine-induced anosmia.

In the proposed study, interrogation could be performed by Phenylthiourea (PTC) Paper Strips - Genetic Taste Testing [by Nasco] (16) after the subject has been given full instructions for use. To ensure that no chemosensory disturbances are present at the time of PTC Paper Strips use, subjects must be evaluated during an interview using the AAO-HNS anosmia reporting tool (17). Patients with possible active or previous anosmia should be excluded from the samples. The following results could be entered into their logistic regression models adjusting for age, sex, previous COVID -19 infection, days post-vaccination, and type of vaccine.

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Author contributions: RA and AB designed the idea behind the proposal. AAS, OHA, and MNA performed the literature review. All authors contributed to drafting and revisions.

Competing interests: None.

Ethical approval: Not Applicable.

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