



# Individual differences in bitter taste preferences are associated with antisocial personality traits



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## ABSTRACT

In two studies, we investigated how bitter taste preferences might be associated with antisocial personality traits. Two US American community samples (total  $N = 953$ ; mean age = 35.65 years; 48% females) self-reported their taste preferences using two complementary preference measures and answered a number of personality questionnaires assessing Machiavellianism, psychopathy, narcissism, everyday sadism, trait aggression, and the Big Five factors of personality. The results of both studies confirmed the hypothesis that bitter taste preferences are positively associated with malevolent personality traits, with the most robust relation to everyday sadism and psychopathy. Regression analyses confirmed that this association holds when controlling for sweet, sour, and salty taste preferences and that bitter taste preferences are the overall strongest predictor compared to the other taste preferences. The data thereby provide novel insights into the relationship between personality and the ubiquitous behaviors of eating and drinking by consistently demonstrating a robust relation between increased enjoyment of bitter foods and heightened sadistic proclivities.

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## 1. Introduction

Eating and drinking are universal social phenomena. Although they satisfy the most fundamental human needs, they also relate to a number of more complex psychological phenomena such as morality (Rozin, Haidt, & Fincher, 2009) and emotional distress (Heatherton, Herman, & Polivy, 1991; Ulrich-Lai et al., 2010). Recently, Meier and his colleagues (Meier, Moeller, Riemer-Peltz, & Robinson, 2012) reported that taste preferences are associated with personality processes in that sweet taste preferences were positively linked to prosocial personality characteristics. In this study, we aimed at further investigating the association between the sense of taste and personality traits. Specifically, we set out to investigate to what extent bitter taste preferences are associated with traits related to the darker side of personality.

The sense of taste is innately hedonic and biased. A preference for sweet tastes and an aversion to bitter and sour tastes have been demonstrated in human newborns and primate infants and adults (e.g., Cowart, 1981; Rosenstein & Oster, 1988; Steiner, Glaser, Hawilo, & Berridge, 2001). Indeed, even oysters (Parker, 1910) and

protozoans (Schaeffer, 1910) reject bitter tasting food. These preferences are grounded in omnivore phylogenesis. Survival depends on the consumption of sweet and the rejection of bitter substances, because sweet foods typically feature high caloric density whereas bitterness is often a marker for toxins. Despite these innate reactions to oral intake, however, there are a number of non-biological circumstances that have the potential to diversify our taste preferences throughout the life span. Among them are cultural, social, economic, and health determinants (Birch, Zimmerman, & Hind, 1980; Drewnowski, 1997; Higgs, 2015; Rozin & Vollmecke, 1986). Moreover, taste preferences are by far not the only guide to what is actually consumed. One can easily imagine people passing on a preferred food because it is too expensive or because they fear a gain in weight, just as they may consume a non-preferred food in order to eat more healthily or to be social. In fact, some of the most popular foodstuffs such as coffee, wine, beer, and chili pepper are initially aversive to us. Yet, humans acquire liking for originally unpalatable food due to simple mere exposure (Stein, Nagai, Nakagawa, & Beauchamps, 2003), which may be enforced by the abovementioned extrinsic reasons. In these cases the food is not consumed for its actual taste but for its physiological (Goldstein & Kaizer, 1969; Mattes, 1994) or social consequences (Birch et al., 1980; Lesschaeve & Noble, 2005; Rozin & Zellner, 1985), which may themselves be adaptive behaviors (e.g., Higgs, 2015).

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## 2. Personality and taste

Could it be that the extent to which people learn to relish bitter substances is related to their personality? While there are a variety of studies that suggest a close link between individual differences in taste sensitivity, food consumption, and personality traits, the number of studies investigating taste preferences in relation to personality is quite limited (cf. [Elfhag & Erlanson-Albertsson, 2006](#); [Saliba, Wragg, & Richardson, 2009](#)). Supertasting, that is, having a high sensitivity to bitter compounds, has been consistently linked to increased emotionality in humans and rats (e.g., [Dess & Chapman, 1990](#); [Dess & Edelhait, 1998](#); [Macht & Mueller, 2007](#); [Whittemore, 1986](#)). Nontasters, in contrast, report being more relaxed and placid than tasters ([Mascie-Taylor, McManus, MacLarnon, & Lanigan, 1983](#)). Increased taste sensitivity to bitter compounds has also been linked to food consumption. For example, children who are tasters of the bitter compound PROP (6-*n*-propylthiouracil) are more likely to pick sweet foods from a varied buffet than are nontasters (K. L. [Keller et al., 2014](#)). Recently, C. [Keller and Siegrist \(2015\)](#) reported complex relationships between personality and food consumption. Direct influences included openness to experience promoting the consumption of fruits and vegetables, while the relation between neuroticism and unhealthy food consumption was mediated by overeating behavior. Moreover, rats selectively bred for low saccharin intake have a lower social status in a dyadic interaction with a high saccharin rat ([Eaton, Dess, & Chapman, 2012](#)), as well as increased impulsivity and stress vulnerability ([Carroll, Morgan, Anker, Perry, & Dess, 2008](#)). However, how sensitive people are to bitter compounds is only weakly related to how much people like and consume bitter foods (e.g., [Rozin & Vollmecke, 1986](#)).

What do we know about the specifics of the interrelationship between preferences for the different taste categories and personality traits? Sensation seeking is one of the personality characteristics that has often been associated with individual differences in taste preferences. For example, people high in sensation seeking tend to have an increased preference for spicy food (e.g., [Byrnes & Hayes, 2013](#); [Logue & Smith, 1986](#); [Ludy & Mattes, 2012](#); [Terasaki & Imada, 1988](#)) and for caffeine ([Mattes, 1994](#)). Additionally, caffeine consumption is positively correlated with other facets of sensation seeking behavior, such as experience seeking and disinhibition ([Mattes, 1994](#)). Increased preferences for sweet foods appear to co-occur with higher levels of agreeableness ([Meier et al., 2012](#)) and trait neuroticism (K. L. [Keller et al., 2014](#); [Kikuchi & Watanabe, 2000](#)). Similarly, a preference for sweet white wine over dry white wine is associated with more trait neuroticism and lower levels of openness ([Saliba et al., 2009](#)). Overall, some connection between taste preferences and personality has been established, yet the evidence is still scarce.

## 3. Rationale of the present research

The present research further investigates the relationship between general taste preferences and personality. There is growing evidence that food preferences are genetically influenced ([Breen, Plomin, & Wardle, 2006](#); [Falciglia & Norton, 1994](#)). Moreover, abundant findings show that earliest taste experiences in utero influence the development of food preferences (see [Ventura & Worobey, 2013](#); for a review). In particular, studies by [Mennella](#) and her colleagues (e.g., [Mennella & Castor, 2012](#); [Mennella, Griffin, & Beauchamps, 2004](#); [Mennella, Jagnow, & Beauchamp, 2001](#)) demonstrated that prenatal and early taste experiences are critical in shaping taste preferences, possibly throughout the life span. Thus, taste preferences feature a substantial genetic and ontogenetically old basis.

Although the experience of taste is conceptually different from the preference for tastes, the psychological effects of taste experience may provide information about the co-development of taste preferences and personality. [Ventura and Worobey \(2013\)](#) reviewed a host of findings showing that prenatal and early childhood taste experiences are a crucial determinant of taste preferences. Due to this empirical relationship between taste experience and preference, it seems important to consider research that addresses the psychological consequences of taste experiences. Specifically, taste experiences as induced in laboratory studies yield a first hint as to the immediate causal effects of oral intake.

Most notably, sweet taste experiences increased self-reported agreeableness and the intention to help ([Meier et al., 2012](#), Studies 4 and 5) and decreased death anxiety ([Hirschberger & Ein-Dor, 2005](#)), whereas bitter taste experiences were shown to elicit harsher moral judgments ([Eskine, Kacirik, & Prinz, 2011](#)) and interpersonal hostility ([Sagioglou & Greitemeyer, 2014](#)). If a onetime, minor taste experience—even of a palatable, good-tasting stimulus (see [Sagioglou & Greitemeyer, 2014](#); Study 2)—increases hostility, it is readily conceivable that this association becomes chronic in people with more pronounced preferences for bitter substances. Moreover, hostile and aggressive behaviors are manifestations of various malevolent personality traits, such as the Dark Triad (e.g., [Furnham, Richards, & Paulhus, 2013](#); [Reidy, Zeichner, & Seibert, 2011](#)). The Dark Triad is a personality construct that comprises subclinical levels of Machiavellianism, psychoticism, and narcissism ([Paulhus & Williams, 2002](#)). Importantly, a recent meta-analysis ([O'Boyle, Forsyth, Banks, Story, & White, 2014](#)) confirmed that hostility is an important factor underlying the Dark Triad traits. Thus, if increased liking of bitter substances is indeed linked to a more hostile personality, this is likely to be expressed in a variety of “interpersonally toxic behaviors” ([Furnham et al., 2013](#), p. 210). Originally, this included the three traits of Machiavellianism, psychopathy and narcissism, but studies by [Chabrol](#) and colleagues provided first evidence that sadism constitutes a fourth unique component of noxious personality traits ([Chabrol, Van Leeuwen, Rodgers, & Séjourné, 2009](#)). Borrowing the term from [Paulhus and Williams \(2002\)](#), they called this extension of the Dark Triad “the Dark Tetrad” ([Chabrol et al., 2009](#), p. 738). Recently, studies by [Buckels et al.](#) confirmed the unique power of everyday sadistic tendencies to predict specific forms of aggressive behavior ([Buckels, Jones, & Paulhus, 2013](#)), which further supports the usefulness of the Dark Tetrad concept.

Taken together, general taste preferences—unlike preferences for specific food items—develop very early in life (e.g., [Mennella & Castor, 2012](#)). Moreover, these early taste experiences are likely to influence taste preferences throughout the life span ([Mennella, Griffin, & Beauchamp, 2004](#)). Experiencing bitter tastes thus simultaneously contributes to the development of a preference for bitter substances and evokes hostile reactions towards the stimulus, even when perceived as palatable. Based on this reasoning, an increased preference for bitter taste should be related to a more hostile personality. The present studies were conducted to test this notion—that a liking of bitter tastes is associated with an increased presence of antisocial personality traits.

## 4. Study 1

Study 1 examined the relation between bitter taste preferences and antisocial psychological propensities in a cross-sectional design. In the literature, taste and food preferences are often measured differently and thus refer to different phenomena ([Drewnowski, 1997](#)). Sometimes it is specific food items that are tasted by participants and subsequently rated, while at other times

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