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Is there an association between consumers' personality traits and the sensory characteristics they look for in wine?

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ABSTRACT

This study investigates the link between the personality profiles and socio-demographic characteristics of wine consumers and the sensory characteristics of the wines they prefer. This was measured in terms of a self-reported list of the wines they like and buy. The 1176 Italian adults who participated were asked to complete an online form. Information was collected regarding certain socio-demographic details and the participants' personality profile (established by means of the Big Five Inventory 2 by Soto & John, 2017). The participants were then asked to specify their favorite types of wines (open response: "Which wines do you like the most? Please list the wines that you like and buy"). The sensory profiles of the 258 wines in total listed by the participants were described by four of the experimenters (based on official reviews) in terms of eight variables: the degree of Alcohol, Acidity, Sweetness, Body, Tannicity, Sapidity, Persistence and Complexity of bouquet.

Various associations were found between the sensory characteristics of the wines listed and the socio-demographic characteristics analyzed (gender, age and wine expertise), and between the sensory characteristics of the wines and the participants' personality traits. For example, we found that extroverts prefer more acidic wines, sociable people like wines characterized by a high alcohol content and with a more complex bouquet, people with high emotional stability prefer tannic, persistent, full-bodied wines and open-minded people favor wines with a persistent flavor and high levels of tannicity while they don't like sapidity. Almost all of these associations were consistent across gender. The study contributes to academic research on the relationships between consumers' characteristics and their wine preferences, and it provides insights which are interesting for the wine industry and other wine distribution channels in terms of market orientation.

1. Introduction

Are the wines that we appreciate somehow related to our personality? For instance, do introverted people prefer wines with certain sensory characteristics? Are these characteristics different from those appreciated by extroverts? These are the kinds of questions that prompted the research presented in this paper.

In order to describe consumers' personality traits, we referred to the Big Five Model, which is one of the most popular structures used over the last 30 years to define differences between personalities (Digman, 1990). It includes five traits (see Fig. 1). *Extraversion* refers to an individual's inclination to be sociable, enthusiastic and action-oriented, talkative and assertive. *Agreeableness* assesses the tendency of an individual to show general concern for other people and be cooperative, sympathetic, trusting and valuing social harmony. *Conscientiousness* refers to an individual's aptitude for self-discipline, duty and planned behavior. *Neuroticism* includes the propensity to be emotionally unstable, experience negative emotions, with a low tolerance for aversive stimuli and stress. Finally, *Openness* to experiences relates to whether a person is open to novelty, that is, willing to try new things, and open to new ideas and emotions or skeptical with regard to new experiences.

Our research follows on from a wide range of previous studies on the relationship between consumers' personalities and their attitudes, preferences or consumption behaviors in relation to food products. For

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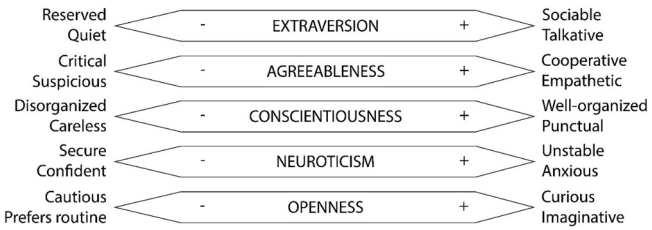

Fig. 1. The five factors defining personality according to the Big Five model: Extraversion (E), Agreeableness (A), Conscientiousness (C), Neuroticism (N), Openness (O).

instance, it has been found that there is an association between openness and a willingness to try new foods (Steptoe et al., 1995) and between Extraversion and Openness and healthy eating (Brummett et al., 2008; Keller & Siegrist, 2015). Another study found that Conscientiousness is negatively associated with unhealthy eating (Bogg & Roberts, 2004). A study of coffee preferences showed that consumers exhibiting Extraversion and Conscientiousness (on the Midlife Development Inventory Personality scale) were willing to pay more than average for specialty coffee (Ufer, Lin & Ortega, 2019). Furthermore, a significant association was found between a greater consumption of fruit and vegetables in young adults and the Extroversion and Openness traits, but no significant relationship was found between the consumption of these foods and either Neuroticism or Agreeableness (see Conner et al., 2017; Keller and Siegrist, 2015; Kessler et al. 2016; Mõttus et al., 2013; Pfeiler and Egloff, 2018a, 2018b).

Wine has only been marginally focused on in previous research. Mora, Urdaneta and Chaya (2019) found that Neuroticism and Extraversion had an effect on the emotional responses elicited by wine. In their study, the "emotional responses elicited by wine" were defined by a generic lexicon (e.g. active, adventurous, aggressive, joyful etc.) rather than a specific lexicon for wine (e.g. Silva et al., 2016) and the authors themselves observed that this may be a limitation to the study since using a specific lexicon might have led to a more refined picture of the differences between consumers. An attempt to directly link personality traits and specific preferences for certain sensorial characteristics related to wine was addressed in two other studies, which were inspired by a previous finding (see Kikuchi & Watanabe, 2000) that there is an association between preferences for either sweet or savory flavors in food and high scores for the Neuroticism trait. Saliba et al. (2009) showed that a preference for sweet wines was associated with a higher level of impulsiveness but a lower level of Openness. Extroversion was found to predict a preference for sweetness in red wines, but only for the maximum concentration of sugar (i.e. 32 g/l) and specifically for women and non-expert wine drinkers rather than for men or expert wine drinkers (Sena-Esteves, Mota, & Malfeito-Ferreira, 2018).

The main aim of this study is to contribute towards a better understanding of the relationship between consumers' personalities and the sensorial characteristics they look for in a wine. We also explored the association between sensorial characteristics of wine and the socio-demographic factors and individual characteristics, such as gender and age, which we know from previous literature to be associated with certain preferences relating to drinks (e.g. Atkin, Nowak, & Garcia, 2007; Barber, Almanza, & Donovan, 2006; Barber, Dodd, & Ghiselli, 2008; Bruwer, 2004, 2007; Bruwer, Saliba, & Miller, 2011; Gustavsen & Rickertsen, 2018; Miller & Bruwer, 2006; Mora et al., 2021) and wine expertise (e.g. Blackman, Saliba, & Schmidtke, 2010; Lanseng & Sivertsen, 2019; Oyinseye, et al. 2022; Perry et al., 2019).

We approached these issues by means of a methodology which is not standard in the literature on the subject, that is, we did not use either a tasting condition or a preference matching task. Instead, we asked participants to tell us which types of wines they like and buy in an open response task, and then the sensorial profile of the wines selected by the participants were described by the experimenters based on official reviews in terms of eight sensorial characteristics. In the introduction to the study, we explain the reasons supporting these choices.

2. The study

The study investigates whether there is an association between consumers' personality traits - defined according to the Big Five Inventory 2 (Soto & John, 2017), that is, Extraversion, Agreeableness, Consciousness, Neuroticism, Openness, and the sensory profile of the wines they report that they like and buy. Additionally, we explored any associations between the wines chosen by the participants and individual factors such as gender and level of wine expertise.

Producers are aware that it is more important to assess wine not only from an expert or professional standpoint, but also to take into account the consumers' point of view (e.g. Pretorius & Høj, 2005). Characterizing the sensory qualities of wine based on consumer descriptions has become more popular (e.g. Cardello, 2005; Jaeger et al., 2013; Lazaeta, Bordeu, Næs, & Varela, 2017; Varela & Ares, 2012). However, the gap between naïve and expert interpretations is still a topic of debate (e.g. Bastian, Bruwer, Li, & Alant, 2005; Torri et al., 2013; Moussaoui & Varela, 2010; Vidal, Giménez, Medina, Boido & Ares, 2015). Recent studies have discussed the inconsistencies in the meanings that non-expert wine drinkers assign to the same basic wine terms (e.g. Bianchi et al., 2021, 2022; Truong et al., 2021) and even among experts, it is still difficult to define certain qualities pertaining to wine (see for example the controversial definition of what is typical in wines - Maitre, Symoneaux, Jourjon & Mehinagic, 2010, or of the minerality of a wine - Rodrigues, Ballester, Saenz-Navajas & Valentin, 2015, or of the complexity of a wine - Wang, & Spence, 2018). For these reasons, and in order to avoid problems relating to an inconsistent use of the same terms, we did not ask the participants in our study to report which characteristics they appreciate in wine. They were simply asked to list the wines they usually buy. A classification of the wines listed in terms of eight target characteristics (Degree of Alcohol, Acidity, Sweetness, Body, Tannicity, Sapidity, Persistence, Complexity of Bouquet) was subsequently compiled by four of the experimenters, two of whom are sommeliers. This was based on descriptions in official reviews of the types of wines listed and inter-rater agreement tests were carried out to measure the consistency of the classifications (see procedure and supplementary material 1). For the purposes of our study, general categories were sufficient since the aim was to discover, for instance, whether extroverts tend to like wines with *no* tannicity, *low* tannicity, *medium* tannicity or *high* tannicity.

3. Method

3.1. Participants

1176 Italian adults volunteered to take part in the study (811 females, 365 males). Their ages ranged from 18 to 87 years (mean age = 34.6; DS = 14.38). The participants were recruited at the University of Verona and from among their families and friends. Additional recruiting was also done via social media. The study conforms to the ethical principles of the declaration of Helsinki (World Medical Association, 2013) and ethical approval for the study was obtained from the universities involved.

3.2. Material

An online questionnaire (in Italian) was used (Appendix 1). The questionnaire was created using LimeSurvey CE (stable version 3.4.2) and the responses were automatically stored into a MySQL database. The HTTPS protocol and Secure Sockets Layer (SSL) were used to encrypt all traffic. The first part of the questionnaire informed participants about the aims of the study, gave instructions regarding the procedure and asked for their informed consent. The participants who accepted the

invitation to take part in the study were then shown the next part of the questionnaire in which they were asked to provide information about their age, gender and wine expertise/consumption. For the latter, the participants had to tick one of four possible answers: "I never drink wine"; "I sometimes drink/buy wine"; "I often drink/buy wine"; "I am a wine expert/sommelier/oenologist". Information was also requested regarding their current place of residence in order to have a map of the geographical distribution of those taking part in the study, and they were asked about their occupation in order to have a picture of the composition of the sample. The third part of the questionnaire enquired about which types of wines they liked ("Which wines do you like the most? Please list the wines that you like and buy"). The final part of the questionnaire presented an Italian version of the Big Five Inventory 2 questionnaire (the 60-item version, to be answered according to a 5-point scale, from 1 = strongly disagree to 5 = strongly agree).

3.3. Procedure

The participants compiled the questionnaire anonymously online. No time limits were set. It took them on average 10 min to complete the task. After finishing, each participant received automatic feedback about their personality profile in the form of a simple diagram that showed the rating for each of the 5 factors in the Big Five Inventory 2.

Each of the wines listed by the participants was categorized by four of the experimenters (two of whom are sommeliers) according to eight sensorial characteristics: the degree of alcohol content, the levels of acidity, sweetness, body, tannicity, sapidity and persistence; and complexity of bouquet. Complexity of bouquet was operationalized in terms of the number of macro-categories of flavors present – fruity, floral, spicy, herbaceous (balsamic), animal, mineral, toasted, dairy and other. The degree of alcohol content, acidity, sweetness, body, tannicity, sapidity and persistence were described in terms of a 0–3 rating scale (0 = absent; 1 = low; 2 = moderate; 3 = high). In cases where the participants had also reported the winemaker (e.g. Amarone Sartori), the categorization was based on the description of the product as provided by that specific winemaker. When participants simply referred to the type of wine (e.g. Amarone), the categorization was based on the sensory characteristics listed in the Italian Product Specification for that type of wine and in five different reviews given by winemakers.

3.4. Data analysis

In order to determine the structure of the internal factors relating to the Italian version of the Big Five Inventory 2, we ran a Confirmatory Factor Analysis (CFA) on all sixty items in the questionnaire and the five factors (i.e. the personality traits). The CFA was carried out using the Diagonally Weighted Least Squares estimator (DWLS, a method of estimating the parameters specifically designed for ordinal data). As recommended in the literature (Marsh et al. 2005; Schumacker & Lomax, 2004; Fan et al. 1999), we tested the adequacy of the confirmatory solutions by means of six fit-indexes, namely the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root-Mean-Square Error of Approximation (RMSEA), the Standardized Root Mean Residual (SRMR), the Goodness of Fit Index (GFI) and the Adjusted Goodness of Fit Index (AGFI).

The threshold values to assess the goodness of fit were: $\leq$0.08 for RMSEA and SRMR, $\geq$0.90 for CFI, TLI, GFI, and AGFI (Hu & Bentler, 1999). We also estimated the internal consistency reliability of the Italian Big Five dimensions using McDonald's omega indexes (Zhang & Yuan, 2016). The threshold values to assess the indexes are as follows: $\geq$0.90 excellent; between 0.80 and 0.89 good; between 0.70 and 0.79 acceptable; between 0.60 and 0.69 questionable and $<$ 0.60 bad.

The software used was R, version 4.2.0 (R core Team, 2022). The R-package for the CFA was lavaan (Rosseel, 2012). The R-package for McDonald's omega was psych (Revelle, 2022). Linear Mixed Models for continuous data (LMMs; Gaussian family, identity link function) and Generalized Linear Mixed Models for count data (GLMMs, Poisson family, Log link function) were used to model the effect of the individual variables (age, gender, wine expertise and the ratings for each of the five personality traits, all as Fixed factors) as predictors of the sensorial properties of the wines indicated by the participants according to their preferences. The participants were random factors in the model. The Analysis of Variance Table with Satterthwaite's method for LMMs and the Analysis of Deviance Table for GLMMs (Wald chi square tests) were then used to analyze the results. Bonferroni corrections were applied to the post-hoc comparison.

The inter-rater agreement in the description of the wines listed by participants, according to the eight target sensory categories (level of alcohol content, acidity, sweetness, body, tannicity, sapidity, persistence and complexity of bouquet) was tested using Cohen's K (irr R-package, Gamer & Lemon, 2019).

4. Results

4.1. Preliminary analyses

To start with, we performed the CFA (using structural equation modeling) on the data of the Italian version of the Big Five Inventory 2. The fit indexes, CFI = 0.911, TLI = 0.902, RMSEA = 0.081, SRMR = 0.079, GFI = 0.950, and AGFI = 0.930 indicated that there was a relatively adequate fit between the model hypothesized and the data observed. The McDonald's omega indexes were 0.802, 0.806, 0.848, 0.880 and 0.848, respectively, for Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness, suggesting that the dimensions of the Italian version of the Big Five Inventory 2 were acceptably reliable.

We then checked that none of the questionnaires had been completed by people with no experience of wine at all (i.e. those who indicated "I do not drink and buy wine"), but there were no cases. The subsequent analyses were carried out on 985 out of the complete sample of 1176 questionnaires, since we had to eliminate from the analysis those participants who had simply indicated a generic preference for "red wine" or "white wine" without further specifying the type of wine. In these cases, there was not enough information to profile the sensory identity of the wine. The participants who were excluded were 76 % females and 24 % males, reflecting the gender imbalance of the overall sample.

We tested for the inter-rater agreement in the descriptions of the sensory profiles of the wines (Appendix 2). Cohen's K Inter-rater agreement was good for all of the eight sensory qualities considered in the study: Alcoholicity: 0.82; Acidity: 0.88; Sweetness: 0.79; Body: 0.78; Tannicity: 0.91; Sapidity: 0.89; Persistence: 0.82; Complexity of Bouquet: 0.80. In fact, Cohen (1960) suggested interpreting the Kappa result as follows: values $\leq$ 0 no agreement; 0.01–0.20 none to slight agreement, 0.21–0.40 fair agreement, 0.41– 0.60 moderate agreement, 0.61–0.80 substantial agreement and 0.81–1.00 almost perfect agreement. Our results range from substantial to almost perfect agreement. We analyzed the demographics of our sample of participants whose places of origin included 16 Italian regions (80 % of the total). 34 % of them were students, 57 % were employees or freelance, 5 % were retired and 4 % were unemployed adults. Females represented 65 % of the total sample. Occasional consumers of wine were 54 %, those consumers that drink wine frequently were 41 %, and the remaining 5 % were wine experts.

4.2. The associations between personality traits and the sensory features of the types of wines listed

Table 1 shows a summary of the analysis of the associations between the independent variables relating to the participants' personality traits (see the first five rows in the table) and individual characteristics (see the three last rows in the table) and the eight sensorial descriptors for the wines. The majority of the cells have a colored background (i.e. there is a

Table 1
The association between personality traits and individual characteristics (independent variables) and the eight sensorial wine descriptors. Significant effects and the direction of the associations are indicated by the + or - signs (i.e. + indicate a direct association and - indicate a inverse association). The tendency to significance is indicated by the square brackets.

	Sweetness	Acidity	Alcoholicity	Body	Tannicity	Sapidity	Persistence	Complexity of Bouquet
Extraversion		+			+	[-]		
Agreeableness		-	+					+
Conscientiousness		[+]	[+]					
Neuroticism			-	-	-	+	-	-
Openness				[+]	+	-	+	
Gender (F, M)			F < M	F < M	F < M	F > M	F < M	F < M
Wine expertise	-		+	+	+	-	+	+
Age	-	-	+	+	+	-	+	+

significant association between the variables studied or at least a trend towards an association), thus making it evident that the pattern of associations is rich and not limited to a few cases. In the description below Table 1, we restrict our comments to the statistically significant association, thus leaving aside the trait of Consciousness for which only a trend toward significance emerged and discussing the associations relating to the other four personality traits.

Fig. 2 shows the direction of all of the significant associations between personality traits and sensorial factors. The most prominent results concern four of the five traits:

(i) Extraversion: extroverts prefer wines which are more acidic and more tannic;
(ii) Agreeableness: sociable people prefer wines characterized by a high alcohol content and a complex bouquet, and are averse to acid a wines;
(iii) Neuroticism: emotionally stable people (with a low level of neuroticism) prefer tannic, persistent, full-bodied wines with a complex bouquet and a high alcohol content and favor wines with less sapidity and finally,
(iv) Openness: open-minded people favor wines with persistent flavors and high levels of tannicity but are averse to sapid wines.

4.3. The associations between gender, age and expertise and the sensory features of the types of wines listed

LMMs and one GLMM (to study the Complexity of Bouquet variable) were conducted to study the association between gender and the sensory characteristics of the wines listed by the participants. As shown in Fig. 3, there was an effect of gender for six out of the eight sensory characteristics analyzed. The male participants appreciated wines with a high alcoholic content, body, tannicity, persistence and a complex bouquet significantly more than the female participants. In contrast, sapidity was the characteristic which was most appreciated by the women.

Age also predicted differences in wine preferences. As shown in Fig. 4, sweetness, acidity and sapidity were more appreciated by the younger participants, while a preference for high alcohol content, body, tannicity, persistence and complexity of bouquet appears to increase with age.

Significant effects also emerged when we studied the association between the three levels of experience with wine (i.e. level 1: “I sometimes drink/buy wine”; level 2: “I often drink/buy wine” and level 3: “I am a wine expert/sommelier/oenologist”) and the sensorial characteristics of the wines. The association found was significant for seven out of the eight characteristics analyzed in the study (see Fig. 5). As revealed by post-hoc tests, all the significant differences concerned the preferences of those participants who reported drinking wine only on certain occasions, as compared to those who drink wine more often and (in some cases) to those participants who claimed to be wine experts. For the latter group the responses varied widely, which may be due to the fact that the number of participants in this sample was limited. This was an expected consequence of the method of recruitment used and consistent with our objective to reach a sample of standard consumers rather than expert consumers. Therefore, we will only comment on the significant differences between the occasional consumers of wine (level 1) and those consumers who drink wine more frequently (level 2). In any case, the differences related to the experts (i.e. level 3), when significant, went in the same direction, as can be seen in Fig. 5. With regard to the occasional as compared to the more regular wine consumers, the results indicate that the occasional consumers prefer sweetness (EST = 0.066, SE = 0.022 df = 878, *t*-ratio = 3.027, p = 0.007) and sapidity (EST = 0.255, SE = 0.045 df = 892, *t*-ratio = 5.678, p = 0.001) and dislike both a high alcohol content (EST = -0.100, SE = 0.027 df = 884, *t*-ratio = -3.677, p = 0.000), body (EST = 0.162, SE = 0.041, df = 882, *t*-ratio = -3.869, p = 0.004) and tannicity (EST = -0.281, SE = 0.045, df = 905, *t*-ratio = -6.118, p < 0.001).

4.4. The interaction between personality traits and gender in predicting the sensory characteristics preferred.

Since there was an imbalance in the sample of participants in the study between the number of males and females, and since various significant effects of gender on the preferred characteristics of wine had emerged (see Fig. 3), we tested whether the results shown in Fig. 2 were affected by gender. For all of the significant associations between personality traits and wine characteristics described in Fig. 2, LMMs and GLMMs were performed in order to analyze the interaction with gender. The males and females only differed significantly in the association between Agreeableness and acidity. Specifically, we found a significant inversely proportional relationship between Agreeableness and acidity for males, but not for females (see Fig. 6).

5. Final discussion

The main goal of the present study was to verify whether there are any significant associations between consumers’ preferences for specific sensorial characteristics relating to wine and their personality traits. We also investigated whether there are any associations between the sensorial characteristics and the gender, age, and wine expertise of the consumers. At a general level, and in line with the previous studies on food and wine preferences briefly described in the Introduction, our results indicate that there are significant associations between the characteristics of the participants (wine consumers) and their preferences. The specific associations which emerged in the results can be summarized with reference to two main areas.

Firstly, we found that a preference for higher alcohol content, tannicity, body, complexity of bouquet and a persistent flavor increases with the individual’s level of expertise (Fig. 5) and their age (Fig. 4) and was also more frequently associated with the male participants in the study (Fig. 3). We also found that a greater appreciation of sweetness and sapidity in wine is associated with younger consumers (Fig. 4) and those with less experience in the consumption of wine (Fig. 5). We did not find any significant associations between sweetness and gender, while we found that greater appreciation of sapidity is associated with female consumers (Fig. 3).

Many of these findings are in agreement with the results of previous

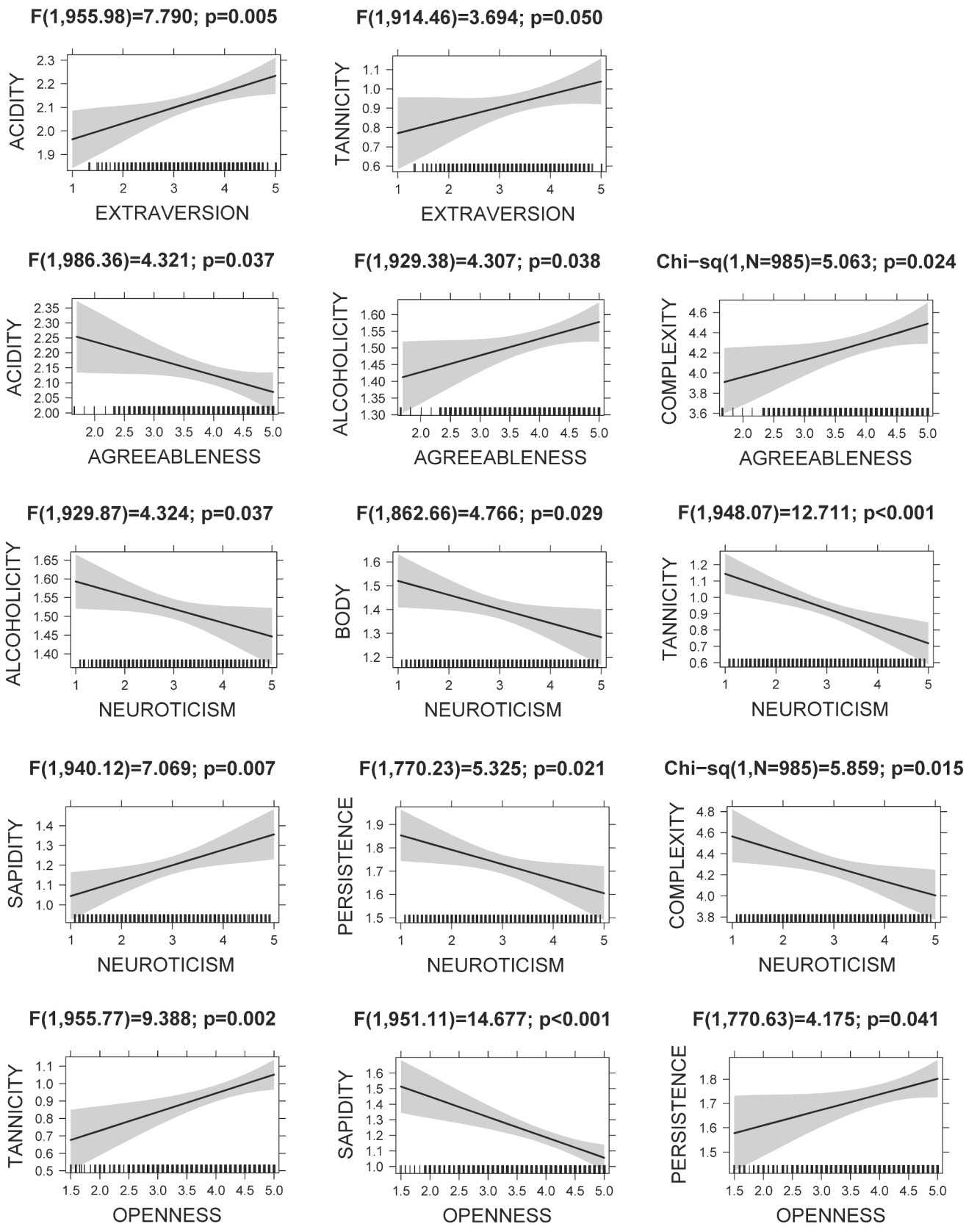

Fig. 2. Effect plot of all the significant associations which emerged from the LMMs and GLMMs, between personality traits (Extroversion, Agreeableness, Neuroticism, Openness; no significant association emerged for Conscientiousness) and the sensorial descriptors of the wines listed. The grey band represents the 95% CI.

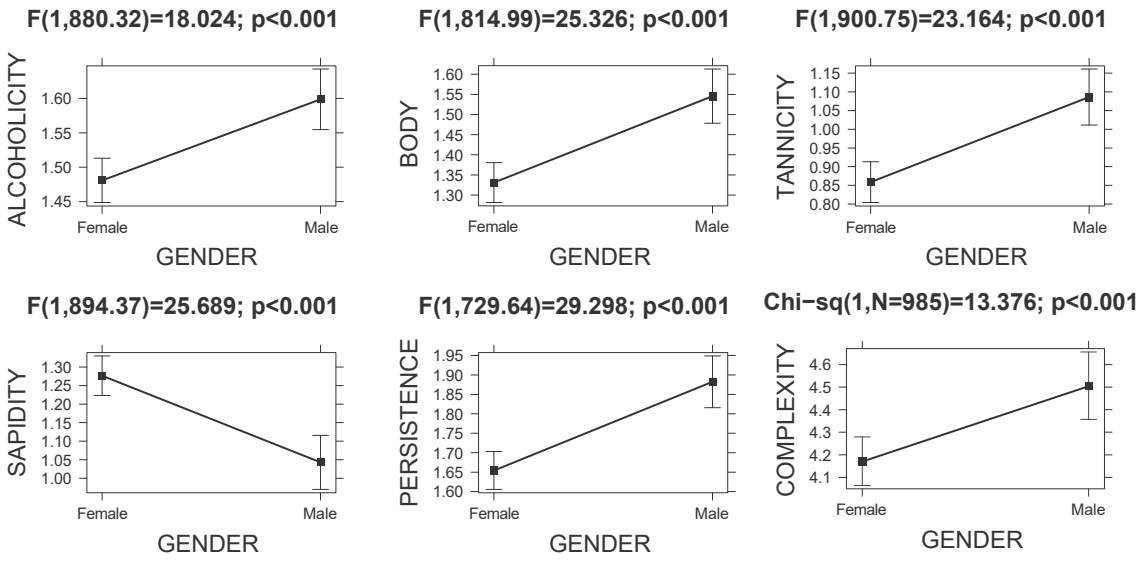

Fig. 3. Effect plot of all the significant differences found between the male and female participants in relation to the descriptors of the sensorial features of the wines listed. Error bars represent the 95% CI.

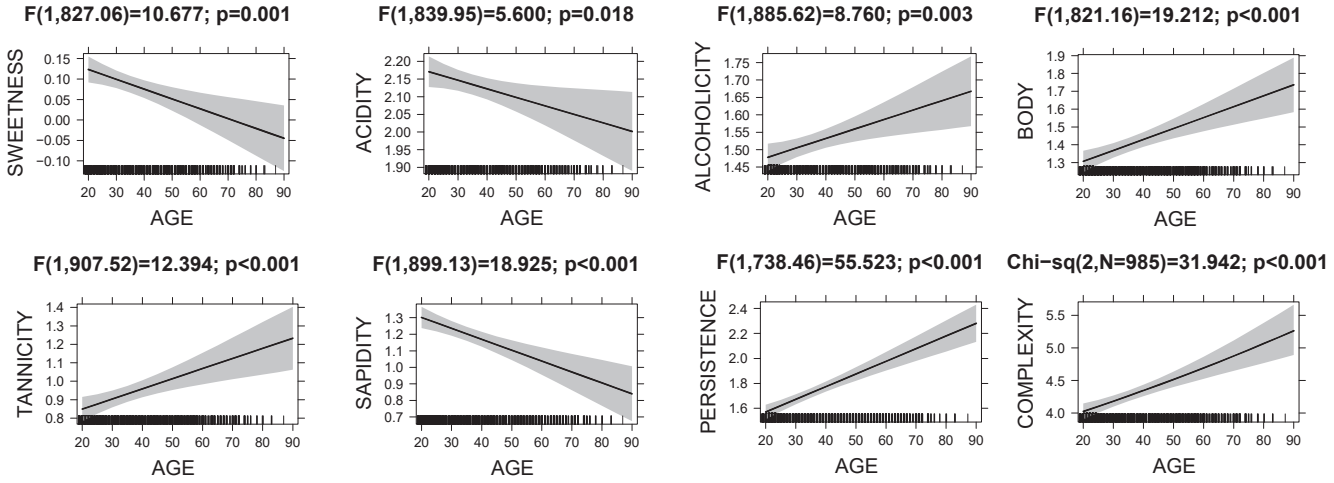

Fig. 4. Effect plots of all of the significant differences found between age and a preference for certain sensorial characteristics. The grey band represents the 95% CI.

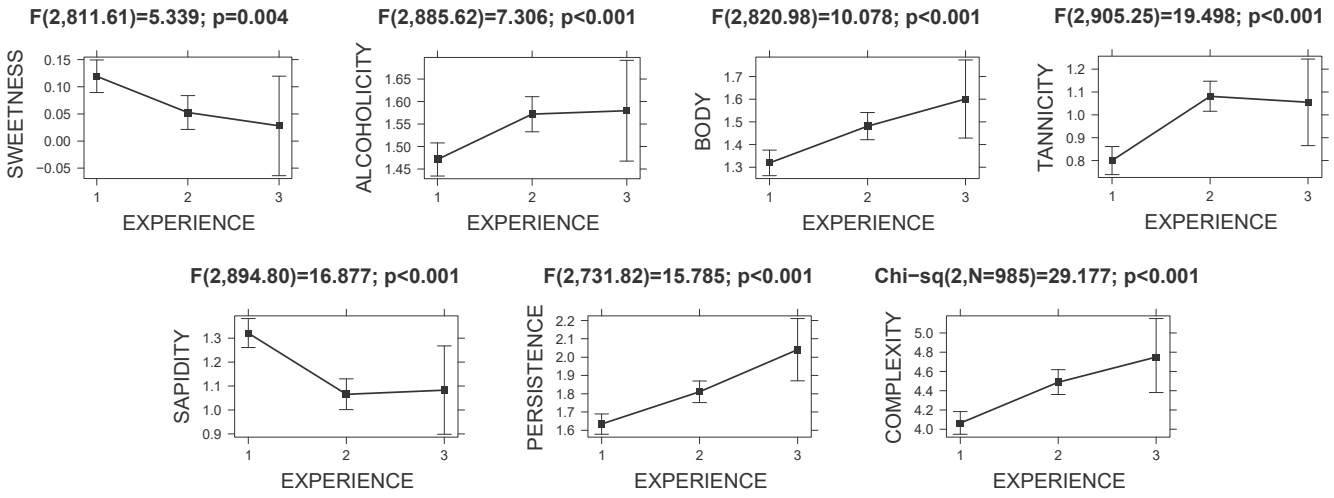

Fig. 5. Effect plot of all the significant differences in relation to the level of wine expertise and the preferences given for certain sensorial characteristics. Error bars represent the 95% CI.

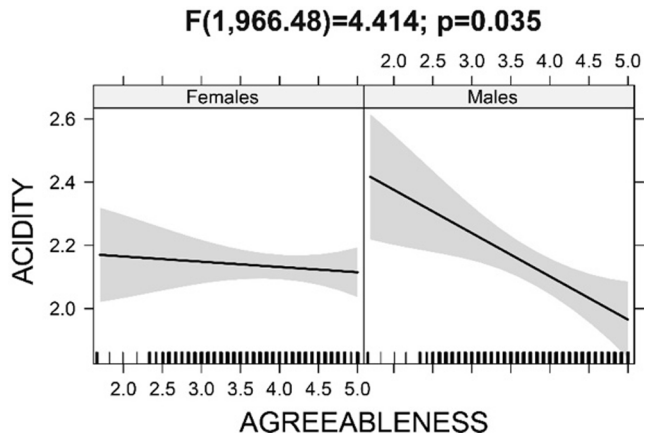

Fig. 6. Effect plots of the interaction between Agreeableness, Acidity and gender. The grey band represents the 95% CI.

studies. For instance, a difference between males and females with regard to their preferences relating to whether a wine is full bodied or not was also found by Bruwer et al. (2011), with women preferring medium-bodied wine and men preferring fuller-bodied wines. The findings in our study consolidate this result and provide new information relating to alcohol content, the complexity of the bouquet, persistent flavors and tannicity, that is, the sensory features that often (but not always) covary with body. The results of the present study indicate a greater preference for wine with these characteristics in males as compared to females. A preference for sweeter wines was linked in our study to non-experts (novice consumers) as compared to experts (i.e. experienced consumers and wine producers) which was also found by Blackman, Saliba, and Schmidtke (2010), and similarly a preference for sweetness in younger drinkers was identified by Bruwer, Saliba and Miller (2011).

In contrast, we did not find an association between a preference for sweetness in wine and female consumers as reported in some previous studies (e.g. Bruwer, et al., 2011; Sena-Esteves et al., 2018), even though other studies have suggested that this association may be related more to common stereotypical beliefs (Miller & Bruwer, 2006) or selectively related to younger women (Bruwer et al., 2011). It is however difficult to make direct comparisons between our data and those of previous literature since in the latter case a preference for sweet wine was based on a tasting task with the sample of wines used for pair comparisons consisting of standard wines and wines enriched with sugar (Blackman, et al., 2010; Sena-Esteves et al., 2018). Moreover, in our study, all findings are based on the self-reports given by the participants concerning the wines they like and purchase. This methodological difference may account for the differences in the results. At the same time, in light of this difference, the points which are in agreement become particularly interesting since they suggest a robustness of these associations across tasks.

A second area concerns the association between the participants' wine preferences and their personality traits. This is the area in which the present paper makes a more substantial contribution since it addresses a broad-spectrum investigation of five personality traits and eight sensorial characteristics of wine. Significant associations were found for four of the five personality traits. Neuroticism, in particular, had the greatest number of associations. Emotionally stable individuals (i.e. with a low level of neuroticism) tended to prefer wines with high alcohol content, high tannicity, persistent flavor, which were full-bodied, with a complex bouquet and a low level of sapidity. Some of these sensorial characteristics were also associated with Agreeableness, Openness and Extraversion: an appreciation for a high alcohol content and a complex bouquet turned out to be positively associated with Agreeableness, but in contrast, these individuals were averse to acidic wines. A preference for a persistent flavor and high tannicity and a dislike of sapidity were associated with Openness. Tannic wines were appreciated by the extrovert participants, who however also indicated a preference for greater acidity in wines.

5.1. *Strengths, limitations and possible future developments*

The findings of the study support the hypothesis that there is indeed a robust relationship between consumer characteristics and their wine preferences. This result is not only of interest from the point of view of basic research in that it contributes to previous literature on the subject (mainly regarding food preferences but also in a few cases specifically focusing on wine). There is also clear potential for applications in the fields of wine production and marketing in order to orientate strategies and advertising campaigns. If the wine industry wishes to adopt an approach in which consumers' preferences drive production, a thorough understanding of customers' needs and desires is essential. The results of this study provide new insights into what customers look for in a wine, and this will help producers to link specific wines to specific types of consumers. This might be based not only on sociodemographic factors such as age, gender and expertise, but also on the psychological characteristics of the consumer.

A limitation of the study concerns the imbalance between males and females in the sample. However, there was a lack of significant interactions with gender for all of the significant associations found between personality traits and sensory characteristics, with only one exception, namely the association between acidity and agreeableness. This is promising in terms of the generalizability of the findings.

Another limitation of the study is that we did not measure the participants' preferences by means of a wine tasting task; the participants were recruited online and were asked to list the wines *they like and buy*. The study was exploratory in nature: the aim was to provide a first indication of whether a consumer's personality orients them towards certain characteristics in wines as opposed to others. However, many studies have shown that wine purchasing behavior may be different to sensory preferences - purchases may be influenced by variables such as price, availability, region, label, expert recommendations and awards received (e.g. Hoffman, 2004; Jaeger, Danaher, & Brodie, 2009; Mueller, Osidacz, Francis, & Lockshin, 2010; Mueller, & Szolnoki, 2010). Future studies might investigate the association between consumers' personality and wine choices separately in relation to consumers' purchasing choices and/or their preferences (and, in the latter case go from reported preferences as in the present study to sensory preferences emerging from wine tasting tasks).

Finally, the study was carried out with Italian participants and the wines listed were for the most part Italian. Furthermore, despite the fact that the sample was quite large, and the participants were distributed among 16 Italian regions, they were not balanced across regions. This means that there is a risk that the participants might choose local wines at the expense of other Italian wines, and thus these other wines would potentially be underrepresented in the sample of wines listed by the participants in the study. It would be ideal to design new studies with a view to balancing the geographical distribution of the participants and weighting the impact that a preference for local wines might have on the results of the research.

Similarly, a cross-cultural study would be interesting in order to assess the consistency or variability of these results based on cultural differences relating to wine. For instance, would the same associations emerge with French consumers, that is, participants with a similar wine culture to that in Italy? And what about other places with a more recent but well-established wine culture, such as Australia or California? The effect of participants from other countries and cultures and a different sample of wines is likely to add interesting aspects to our findings of the association between consumer factors and types of wines. An experimental design that might make it easier to ascertain whether it is possible to generalize the associations found in the study presented in this article (at the same time checking for effects related to the specific

wine cultures in question) would necessitate inverting the sequence, which would mean first selecting the participants who purchase (or prefer) wines with certain sensorial characteristics and then assessing the personal characteristics and personality traits of these consumers.

CRediT authorship contribution statement

Roberto Burro: Conceptualization, Data curation, Formal analysis, Methodology, Software, Visualization, Validation, Writing - review & editing. **Erika Branchini:** Investigation, Resources, Conceptualization. **Elena Capitani:** Investigation, Resources, Conceptualization. **Veronica Barnaba:** Investigation, Resources, Conceptualization. **Arianna Fermani:** Investigation, Resources, Conceptualization. **Carita Paradis:** Supervision, Validation, Conceptualization. **Ivana Bianchi:** Conceptualization, Methodology, Visualization, Validation, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodqual.2022.104767.

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