Dias, R., Sáenz-Navajas, M.-P., & Malfeito-Ferreira, M. (2026). Sensory characterisation and consumer preference segmentation to meet the demand of changing trends in wine appreciation using minority grape varieties. *OENO One*, *60*(1).
https://doi.org/10.20870/oeno-one.2026.60.1.9625

SUPPLEMENTARY DATA

Table S1. Ranking of the most planted grape varieties in Portugal 2

Table S2. List of the ten items used to evaluate the level of consumer's wine involvement..... 3

Table S3. Demographic characterization of consumers according to involvement level 3

Table S4. Frequency of citation of attributes by cluster of white and red wines 4

Table S5. Consumer demographic characterisation of each cluster style liking..... 4

Table S6. Average liking and sensory scores according to consumer segmentation based on white wine preference 5

Table S7. Average liking and sensory scores according to consumer segmentation based on red wine preference 6

Figure S1. Consensual GPA maps derived from the PM task 7

Figure S2. Distribution of liking scores 7

Figure S3. Cluster dendrogram of the liking scores for white wines..... 8

Figure S4. Biplot from PCA showing consumer preference distribution for white wines 9

Figure S5. HCA dendrogram for red wine analysis..... 10

Figure S6. PCA biplots illustrating the distribution of red wine consumer preferences..... 11

Table S1. Ranking of the most planted grape varieties in Portugal (https://www.ivv.gov.pt/np4/35?newsId=7501&fileName=Ranking_Castas_2017.xls, assessed 19th September 2025).

Variety	Colour (T, red; B, white)	Area (h)	Percentage
Aragonez/Tinta Roriz/Tempranillo	T	20,884.00	11 %
Touriga Franca	T	13,445.00	7 %
Touriga Nacional	T	13,032.00	7 %
Fernão Pires/Maria Gomes	B	12,052.00	6 %
Castelão/João de Santarém/Periquita	T	9,130.00	5 %
Trincadeira/Tinta Amarela/Trincadeira Preta	T	8,413.00	4 %
Baga	T	8,258.00	4 %
Loureiro	B	5,851.00	3 %
Arinto/Pedernã	B	5,778.00	3 %
Syrah/Shiraz	T	5,674.00	3 %
Síria/Roupeiro/Códega	B	5,431.00	3 %
Alicante Bouschet	B	4,888.00	3 %
Vinhão/Sousão	T	3,894.00	2 %
Tinta Barroca	T	3,790.00	2 %
Jaen/Mencia	T	3,789.00	2 %
Rufete/Tinta Pinheira	T	3,422.00	2 %
Alvarinho	B	3,187.00	2 %
Caladoc	T	2,667.00	1 %
Malvasia Fina/Boal	B	2,605.00	1 %
Marufo/Mourisco Roxo	T	2,122.00	1 %
Cabernet-Sauvignon	T	1,752.00	1 %
Rabigato	B	1,592.00	1 %
Malvasia Rei	B	1,584.00	1 %
Trajadura/Treixadura	B	1,564.00	1 %
Malvasia	B	1,488.00	1 %
Azal	B	1,443.00	1 %
Bical/Borrado das Moscas	B	1,377.00	1 %
Antão Vaz	B	1,343.00	1 %
Alfrocheiro/Tinta Bastardinha	T	1,324.00	1 %
Tinta Gorda	T	1,296.00	1 %
Malvasia Branca	B	1,094.00	1 %
Gouveio	B	1,067.00	1 %
Viosinho	B	1,038.00	1 %
Mourisco	T	974.00	1 %

Table S2. List of the ten items used to evaluate the level of consumer's wine involvement. These items come from Bruwer and Buller (2013) and adapted to Spanish consumers by Oyinseye *et al.* (2022). The eight correlated items employed for the evaluation of level of involvement are marked with an asterisk.

Item	Question
1*	I'm interested in the world of wine and wine tasting is part of my lifestyle
2*	I try to increase my knowledge of the world of wine (*e.g.*, reading magazines, looking at publications…)
3*	Drinking wine creates pleasure
4*	I like visiting wineries
5*	I love tasting different wines
6*	I regularly take part in wine tastings
7*	I usually choose a wine according to the food and I take the task of choosing a wine seriously
8*	It's important for me to use special glasses when I drink wine
9	I usually buy wine in wine cellars
10	I drink more bottled wine than from a bag in box

Bruwer, J., & Buller, C. (2013). Product involvement, brand loyalty, and country-of-origin brand preferences of Japanese wine consumers. *Journal of Wine Research*, *24*, 38–58. https://doi.org/10.1080/09571264.2012.717221

Oyinseye, P., Suárez, A., Saldaña, E., Fernández-Zurbano, P., Valentin, D., & Sáenz-Navajas, M.-P. (2022). Multidimensional representation of wine drinking experience: Effects of the level of consumers' expertise and involvement. *Food Quality and Preference*, *98*, 104536. https://doi.org/10.1016/j.foodqual.2022.104536

Table S3. Demographic characterization of consumers according to involvement level.

	Demographic features	All	High involvement	Low involvement
Sex	Female	42	22	20
	Male	42	22	20
Age range	20–39	26	14	12
	40–59	44	26	18
	>60	14	4	10
Consumption frequency	More than once a week	36	27	9
	Once a week	26	10	16
	At least once a month	22	7	15
Education	Basic education	6	5	1
	Secondary education	14	9	5
	Higher education (degree)	35	16	19
	Postgraduation (master/PhD)	29	14	15

Table S4. Frequency of citation of attributes by cluster of white and red wines. Percentage of tasters who used each descriptor in at least one sample.

Wine colour	Descriptors	X^2	*p*	Frequency of citation				
				Cluster I	Cluster II	Cluster III	Cluster IV	All clusters (%)
White	Fruity	7.42	*	8 ab	9 ab	15 b	7 a	71.4
	Intense	7.60	*	1 a	2 ab	7 b	3 ab	24.6
	Woody/spicy	5.37	ns	2	6	1	4	21.4
	Neutral	3.01	ns	6	3	2	5	20.6
	Yellow/white fruit	3.53	ns	4	5	9	5	19.8
	Citrus/tropical fruit	2.47	ns	4	4	6	2	16.7
	Acid	1.21	ns	5	5	7	4	15.9
	Structured	2.00	ns	4	3	1	3	15.9
	Fine	5.43	ns	0	2	4	1	15.1
	Reduced	3.36	ns	1	3	1	4	14.3
Red	Animal	15.43	***	9 b	2 a	3 ab	0 a	40.5
	Woody/spicy	3.00	ns	6	7	5	10	23.0
	Dry fruit	1.99	ns	1	3	3	4	16.7
	Complex	2.82	ns	1	4	2	4	14.3
	Red/black fruit	0.75	ns	4	4	6	5	11.9
	Oxidation	1.71	ns	3	1	2	1	11.9
	Neutral	1.71	ns	5	3	4	2	11.9
	Fresh fruit	1.15	ns	2	2	4	3	10.3

Chi-square and significance (ns: not significant; *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$) for the citation of each.

Table S5. Consumer demographic characterisation of each cluster style liking.

	Sex		Age			Frequency of consumption[a]			Involvement level	
	Women	Men	20–39	40–59	>60	1	2	3	Low	High
All wines	42 (50)[b]	42 (50)	26 (31)	44 (52)	14 (17)	36 (43)	26 (31)	22 (26)	40 (48)	44 (52)
White wines										
Cluster I	14 (41)	20 (59)	**8 (24)**[c]	**16 (47)**	**10 (29)**	**20 (59)**	**10 (29)**	**4 (12)**	**12 (35)**	**22 (65)**
Cluster II	6 (50)	6 (50)	5 (42)	5 (42)	2 (16)	**2 (17)**	**3 (25)**	**7 (58)**	7 (58)	5 (42)
Cluster III	22 (58)	16 (42)	**13 (34)**	**23 (61)**	**2 (5)**	14 (37)	13 (34)	11 (29)	21 (55)	17 (45)
Red wines										
Cluster I	11 (44)	14 (56)	9 (36)	12 (48)	4 (16)	10 (40)	8 (32)	7 (28)	13 (52)	12 (48)
Cluster II	**11 (61)**	**7 (39)**	4 (22)	11 (61)	3 (17)	8 (44)	5 (28)	5 (28)	9 (50)	9 (50)
Cluster III	**8 (36)**	**14 (64)**	6 (27)	11 (50)	5 (23)	7 (32)	9 (41)	6 (27)	12 (55)	10 (45)
Cluster IV	**12 (63)**	**7 (37)**	7 (37)	10 (52)	2 (11)	**11 (58)**	**4 (21)**	**4 (21)**	**6 (32)**	**13 (68)**

[a] 1, more than once a week; 2, once a week; 3, at least once a month.

[b] Percentage of consumers within the group is indicated between brackets.

[c] Bold values indicate different distributions compared to the distribution of all wines, according to chi-square test ($p < 0.05$).

Table S6. Average liking and sensory scores according to consumer segmentation based on white wine preference.

Clusters	Samples	Score[a]	Liking	Acid	Citrus/tropical fruit	Dried fruit	Neutral	Oxidation	Reduced
I	Blend_T_21	X	6.65 abc[b]	3.91 a	2.65 a	1.12 ab	0.91 a	1.00 a	0.53 b
		Sd	2.12	1.86	2.25	1.89	1.83	1.94	1.21
	Donzel_D_18	X	4.79 de	3.50 a	1.44 a	1.44 ab	1.26 a	1.82 a	0.53 b
		Sd	1.61	2.33	2.16	2.09	1.96	2.50	1.28
	Callum_BI_22	X	5.85 bcd	2.88 a	1.74 a	0.94 ab	1.62 a	1.09 a	0.44 b
		Sd	1.26	1.97	2.27	1.50	2.27	1.86	1.28
	RabOve_A_23	X	7.03 ab	3.29 a	2.32 a	1.03 ab	0.97 a	0.91 a	0.62 b
		Sd	1.31	1.68	2.38	1.78	1.95	1.60	0.95
II	Blend_T_21	X	4.71 abc	3.19 a	2.05 a	0.67 ab	1.62 a	0.76 a	0.29 b
		Sd	2.31	2.38	2.29	1.56	2.18	1.81	0.78
	Donzel_D_18	X	**6.10 a**	2.29 a	1.57 a	**1.95 a**	1.14 a	1.71 a	0.29 b
		Sd	2.98	1.98	2.29	2.13	1.96	2.47	0.72
	Callum_BI_22	X	**5.67 a**	1.90 a	0.95 a	0.71 ab	0.81 a	0.95 a	0.81 b
		Sd	2.58	1.92	1.50	1.35	1.50	1.63	1.99
	RabOve_A_23	X	2.48 f	2.52 a	0.71 a	0.67 b	0.33 a	1.14 a	**2.62 a**
		Sd	1.94	2.69	1.42	1.35	0.73	1.96	2.69
III	Blend_T_21	X	6.28 cde	3.38 a	2.76 a	0.41 b	1.62 a	0.76 a	0.14 b
		Sd	0.92	1.95	2.25	1.27	2.29	1.68	0.35
	Donzel_D_18	X	4.62 e	3.21 a	0.97 a	1.66 ab	0.83 a	1.93 a	0.45 b
		Sd	1.97	2.06	1.78	2.38	1.58	2.49	1.02
	Callum_BI_22	X	2.97 f	2.86 a	1.28 a	1.10 ab	0.93 a	1.76 a	1.66 ab
		Sd	1.50	2.08	1.81	1.90	1.85	2.18	2.27
	RabOve_A_23	X	2.93 f	3.21 a	2.69 a	0.72 b	0.59 a	1.48 a	1.03 ab
		Sd	2.09	2.30	2.45	1.49	1.24	2.08	1.94

[a] X, mean, Sd, standard deviation.

[b] Different letters indicate significant differences in the column ($p < 0.05$). When there is a gradation, highest scores with single are highlighted in bold.

Table S7. Average liking and sensory scores according to consumer segmentation based on red wine preference.

Clusters	Samples	Score[a]	Liking	Red/black fruit	Woody/ spicy	Animal	Neutral	Astringency	Complex
I	Blend_D_19	X	**6.08 a**[b]	1.44 abc	2.16 abc	0.32 a	0.44 b	2.28 ab	1.96 b
		Sd	1.50	2.42	2.49	1.14	1.19	2.42	2.26
	Moret_A_22	X	3.56 bcd	0.64 c	1.36 abc	1.16 a	0.76 ab	2.28 ab	1.20 b
		Sd	2.04	1.78	2.29	1.80	1.81	2.30	1.80
	TintFran_D_22	X	3.24 bcd	0.96 bc	0.84 c	0.40 a	1.88 ab	1.36 b	1.32 b
		Sd	1.45	1.67	1.62	1.29	2.11	2.02	2.34
	NegMol_Al_22	X	2.52 cde	0.76 c	0.84 c	1.20 a	0.48 b	1.00 b	0.72 b
		Sd	1.92	1.48	1.55	2.36	1.26	1.47	1.37
II	Blend_D_19	X	2.11 de	1.28 bc	2.78 abc	0.56 a	0.78 ab	**3.83 a**	2.44 ab
		Sd	1.88	2.11	2.65	1.50	1.59	2.50	2.59
	Moret_A_22	X	1.67 e	1.33 abc	1.22 bc	1.67 a	1.22 ab	3.33 ab	1.50 b
		Sd	1.41	2.00	1.86	2.33	2.21	2.33	2.01
	TintFran_D_22	X	2.22 de	1.17 bc	1.78 abc	0.67 a	1.50 ab	3.06 ab	2.00 b
		Sd	1.99	1.79	1.99	1.19	2.18	2.53	2.52
	NegMol_Al_22	X	3.33 bcd	1.33 abc	1.89 abc	0.61 a	1.44 ab	2.00 ab	1.28 b
		Sd	2.17	1.78	2.47	1.14	2.06	2.43	1.93
III	Blend_D_19	X	**6.95 a**	2.95 ab	3.27 ab	1.09 a	1.36 ab	3.27 ab	**4.23 a**
		Sd	1.56	2.72	2.66	1.82	2.17	2.49	2.54
	Moret_A_22	X	**6.27 a**	2.36 abc	2.27 abc	1.55 a	1.77 ab	2.68 ab	2.50 ab
		Sd	1.45	2.36	2.23	1.95	2.14	2.28	2.54
	TintFran_D_22	X	**6.36 a**	2.91 ab	1.91 abc	0.95 a	**2.55 a**	2.73 ab	2.86 ab
		Sd	1.26	2.45	2.31	1.36	2.46	2.37	2.44
	NegMol_Al_22	X	3.77 bc	1.86 abc	1.27 bc	1.23 a	1.95 ab	2.05 ab	2.14 ab
		Sd	2.05	1.81	1.67	1.66	2.10	2.06	2.27
IV	Blend_D_19	X	**5.79 a**	**3.37 a**	**3.53 a**	0.74 a	0.37 b	3.05 ab	2.37 ab
		Sd	1.65	2.31	2.29	1.76	1.16	2.12	2.69
	Moret_A_22	X	4.42 b	1.79 abc	2.21 abc	1.63 a	0.53 b	2.95 ab	2.32 ab
		Sd	1.43	2.04	1.87	2.48	1.07	2.22	2.29
	TintFran_D_22	X	4.63 b	1.68 abc	1.84 abc	0.68 a	1.11 ab	2.95 ab	1.58 b
		Sd	1.46	2.14	1.89	1.49	1.88	1.81	2.17
	NegMol_Al_22	X	**7.05 a**	2.32 abc	1.79 abc	1.26 a	0.63 b	1.95 ab	2.58 ab
		Sd	0.97	2.24	1.78	2.33	1.16	1.87	2.19

[a] X, mean, Sd, standard deviation.

[b] Different letters indicate significant differences in the column ($p < 0.05$). When there is a gradation, highest scores with single letter are highlighted in bold.

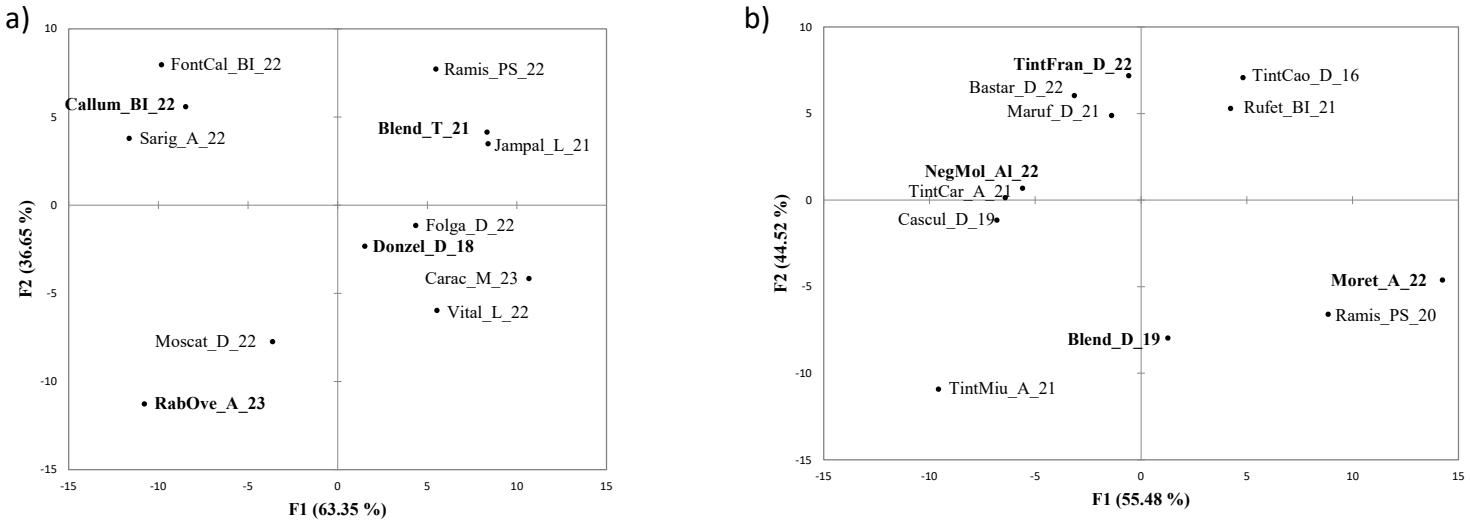


Figure S1. Consensual GPA maps derived from the PM task carried out with the a) white and b) red wine samples. Samples marked in bold were evaluated by the panel of consumers.

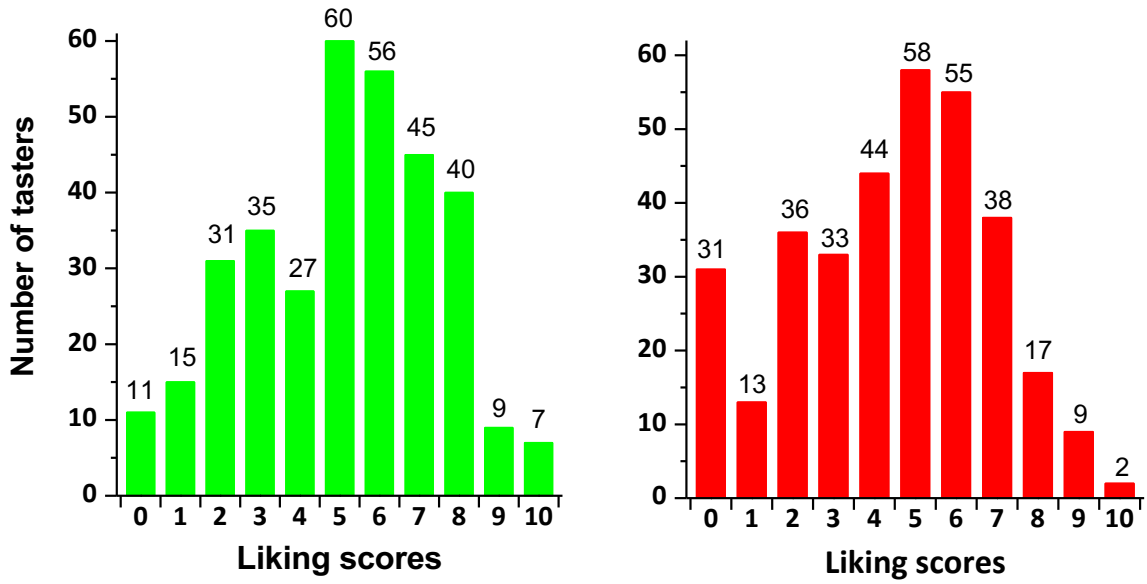


Figure S2. Distribution of liking scores of white (left panel) and red wines (right panel). Numbers on the columns indicate the responses of each score.

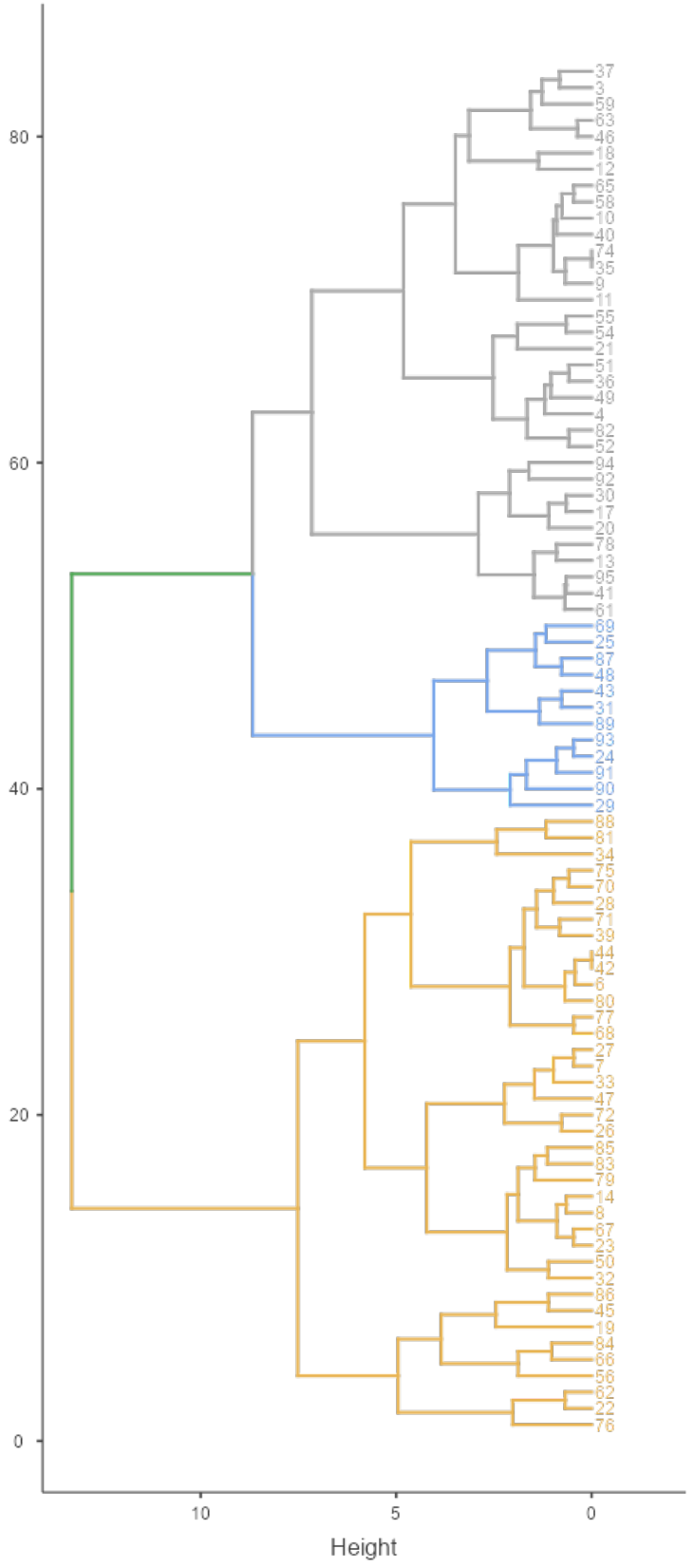


Figure S3. Cluster dendrogram of the liking scores for white wines obtained through AHCA. The numbers in the dendrogram represent the different tasters. Cluster I in grey, Cluster II in blue and Cluster III in yellow.

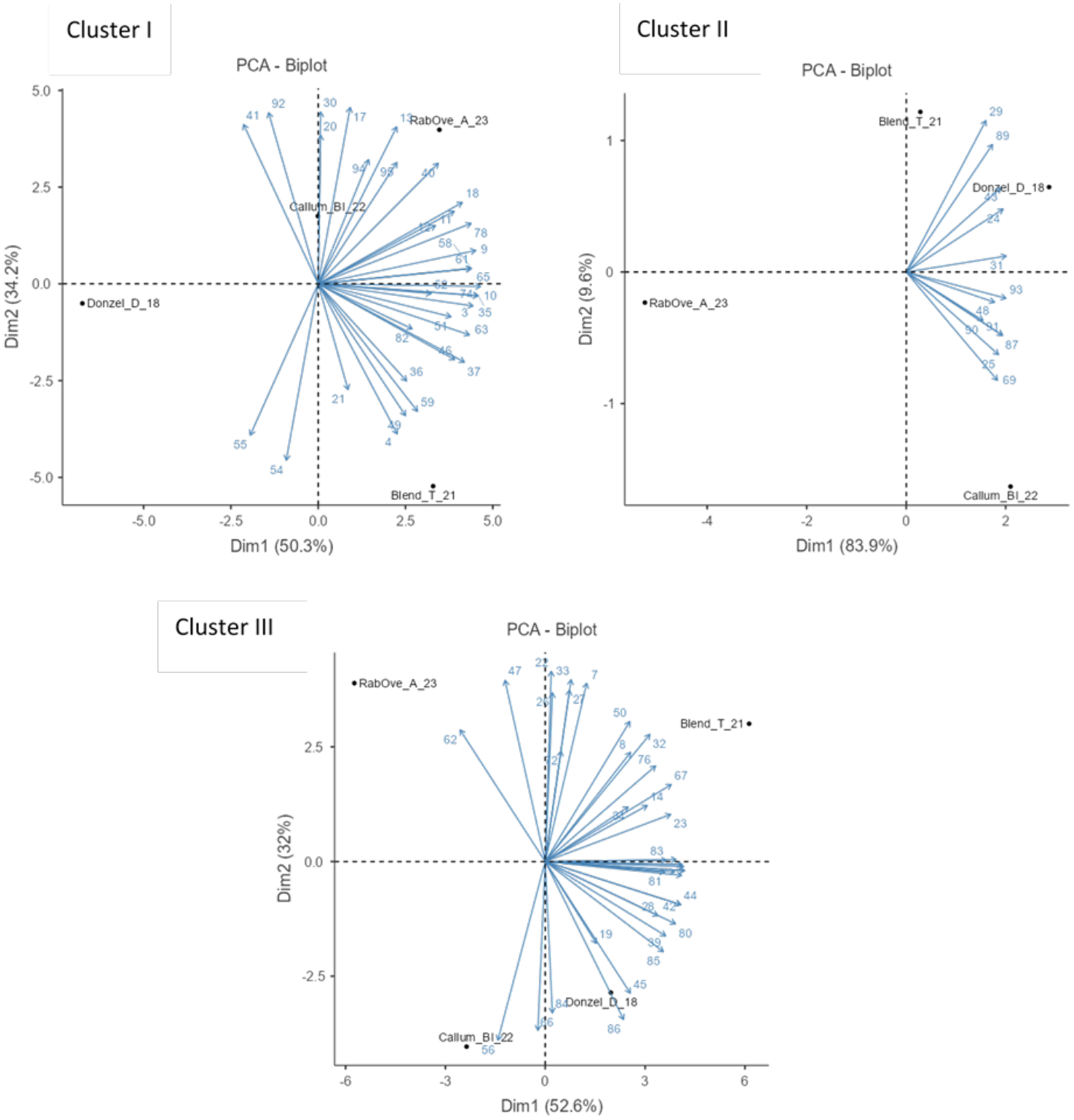


Figure S4. Biplot from PCA showing consumer preference distribution for white wines.

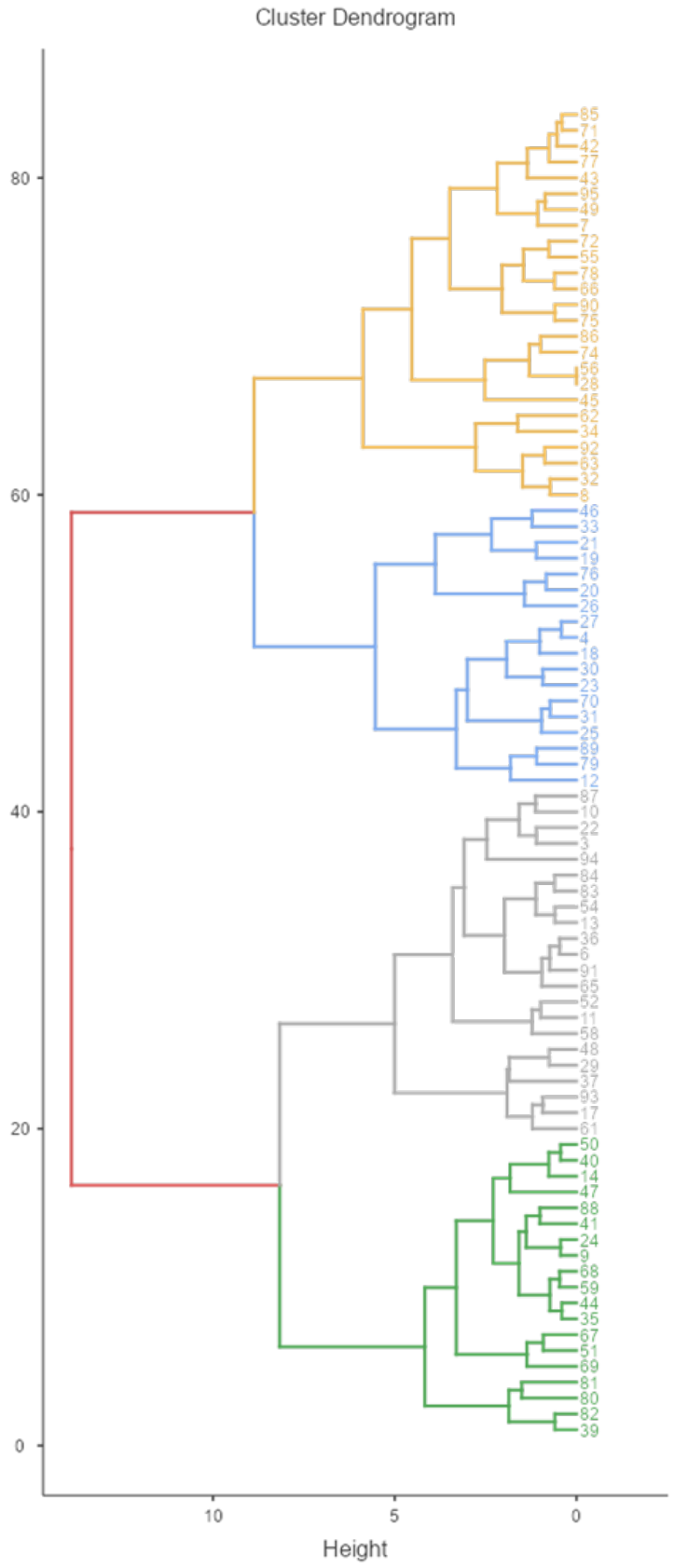


Figure S5. HCA dendrogram for red wine analysis. The numbers in the dendrogram represent the different tasters. Cluster I in yellow, Cluster II in blue, Cluster III in grey, and Cluster IV in green.

Dias, R., Sáenz-Navajas, M.-P., & Malfeito-Ferreira, M. (2026). Sensory characterisation and consumer preference segmentation to meet the demand of changing trends in wine appreciation using minority grape varieties. *OENO One*, *60*(1).
https://doi.org/10.20870/oeno-one.2026.60.1.9625

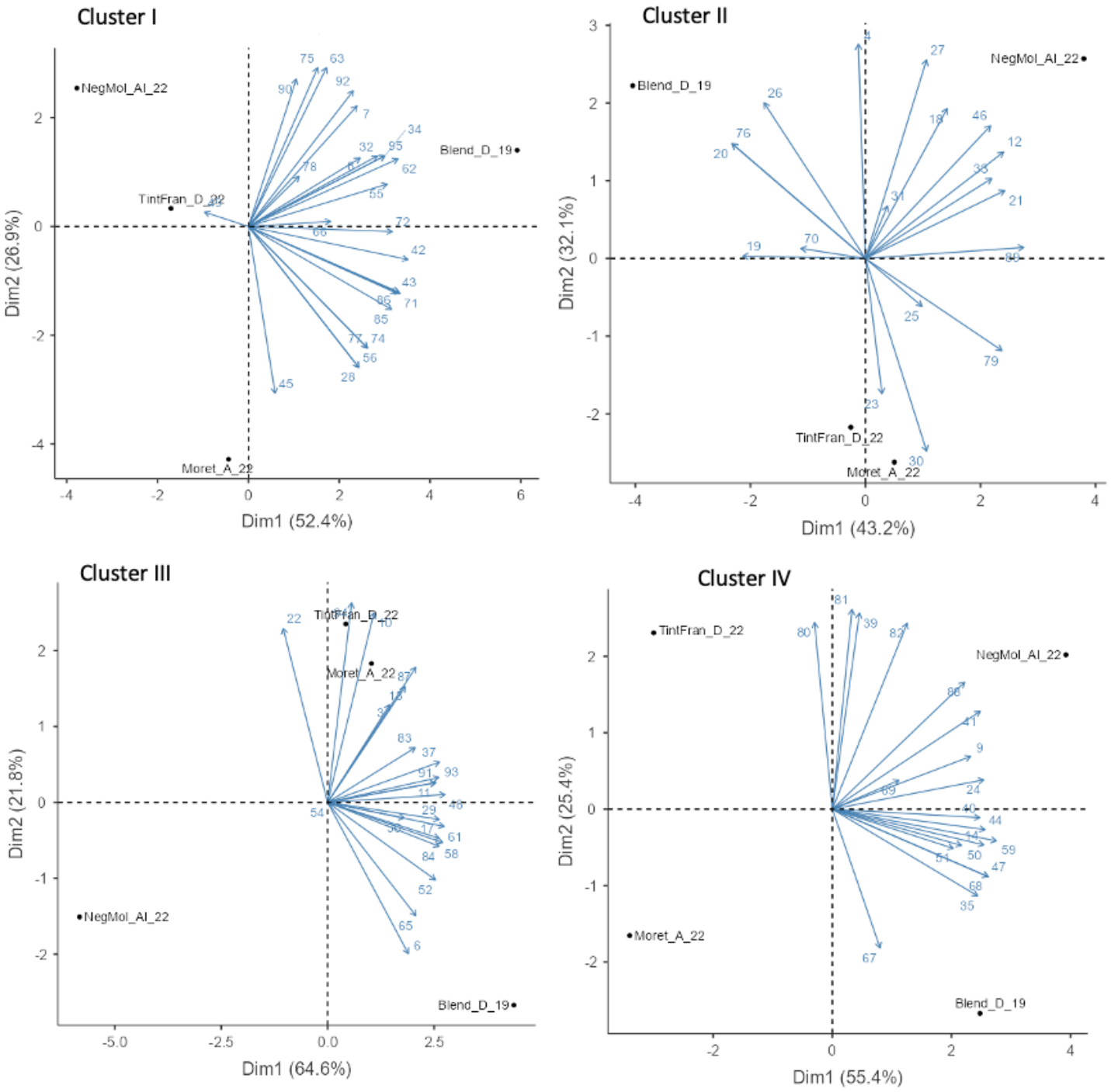


Figure S6. PCA biplots illustrating the distribution of red wine consumer preferences according to clustering.