ISSN 2359-6562 (ONLINE) 2359-6562 (CD-ROM)

ANÁLISE SENSORIAL E ACEITAÇÃO DE HIDROMÉIS SECO, MEIO SECO, SUAVE E BOUCHET

FÁBIO MARTINS JUNQUEIRA[1]; PAULO RENATO MATOS LOPES[2]; YARA MARTINS MOLINA FERRAZ[3]; MARCELA PAGOTI BERGAMINI-LOPES[4] E DANIEL NICODEMO[5]*

[1] Departamento de Produção Animal, Faculdade de Ciências Agrárias e Tecnológicas, Universidade Estadual Paulista, Rodovia Comandante João Ribeiro de Barros, km 651, Bairro das Antas, CEP 17915-899, Dracena-SP, Brasil, fabio.junqueira@unesp.br.
[2] Departamento de Produção Vegetal, Faculdade de Ciências Agrárias e Tecnológicas, Universidade Estadual Paulista, Rodovia Comandante João Ribeiro de Barros, km 651, Bairro das Antas, CEP 17915-899, Dracena-SP, Brasil, prm.lopes@unesp.br.
[3] Programa de Pós-Graduação em Ciência Animal, Faculdade de Ciências Agrárias e Veterinárias, Universidade Estadual Paulista, Via de Acesso Prof.Paulo Donato Castellane s/n, CEP 14884-900, Jaboticabal-SP, Brasil, yara.martins@unesp.br.
[4] Departamento de Produção Vegetal, Faculdade de Ciências Agrárias e Tecnológicas, Universidade Estadual Paulista, Rodovia Comandante João Ribeiro de Barros, km 651, Bairro das Antas, CEP 17915-899, Dracena-SP, Brasil, marcela.pagoti@unesp.br.
[5] Departamento de Produção Animal, Faculdade de Ciências Agrárias e Tecnológicas, Universidade Estadual Paulista, Rodovia Comandante João Ribeiro de Barros, km 651, Bairro das Antas, CEP 17915-899, Dracena-SP, Brasil, daniel.nicodemo@unesp.br.

RESUMO: Embora seja muito antigo, o hidromel ainda é pouco conhecido comercialmente. A fim de tornar esta bebida mais competitiva e popular no mercado, o objetivo desta pesquisa foi investigar a aceitação por análise sensorial de hidroméis seco, meio seco, suave e bouchet entre os potenciais consumidores de Dracena-SP. O mel foi adquirido de produtores de abelhas africanizadas (*Apis mellifera* L.) do tipo silvestre e utilizou-se cepas da levedura *Saccharomyces cerevisiae* para a produção da bebida. No processo de fermentação, foram elaborados mostos com três diferentes níveis de dulçor, visando obter hidroméis seco, meio seco e suave. O mosto para a produção de hidromel bouchet foi semelhante ao dulçor da versão meio seco, diferindo-se pelo aquecimento do mel em fogo baixo por 30 minutos. As diferentes amostras foram degustadas por 110 avaliadores não treinados, visando verificar a impressão global e aceitação das amostras com relação aos atributos dulçor, teor alcoólico, gostar/desgostar e intenção de compra. A maior concentração de mel utilizada no preparo dos hidroméis se mostrou mais aceita pelos provadores, indicando em preferência por bebidas mais doces. De modo geral, todos os hidroméis tiveram boa aceitação pelos provadores.

Palavras-chaves: bebida alcoólica, Brix, degustação, fermentação, mel.

SENSORY ANALYSIS AND ACCEPTANCE OF DRY, SEMI-DRY, SWEET AND BOUCHET MEADS

ABSTRACT: Although it is very ancient, mead is still relatively unknow commercially. In order to make this beverage more competitive and popular, the aim of this research was to investigate the sensory acceptance of dry, semi-dry, sweet and bouchet meads among potential consumers in Dracena, São Paulo State, Brazil. The wildflower honey was obtained from producers of Africanized bees (*Apis mellifera* L.), and yeast strains of the *Saccharomyces cerevisiae* were used to produce the beverage. In the fermentation process, musts with three different sweetness levels were elaborated, aiming to obtain dry, semi-dry and sweet meads. The must for bouchet mead was similar in sweetness to the semi-dry version, differing by heating the honey over low heat for 30 minutes. The different samples were tasted by 110 untrained evaluators to assess the overall impression and acceptance of the samples regarding sweetness, alcohol content, liking/disliking, and purchase intention. The higher concentration of honey used in the preparation of meads was more accepted by tasters, indicating a preference for sweeter beverages. Overall, all meads were well accepted by evaluators.

Recebido em 05/06/2022 e aprovado para publicação em 15/07/2022
DOI: http://dx.doi.org/10.17224/EnergAgric.2023v37n3p23-38

Keywords: alcoholic beverage, Brix, fermentation, honey, tasting.

1 INTRODUCTION

Beekeeping is considered one of the oldest and most important practices for the world economy due to its numerous benefits, as it is possible to obtain honey, propolis, wax, pollen, bee venom, and royal jelly from beehives, in addition to their ecosystem services of pollination (ALMEIDA; OLIVEIRA; SILVA, 2021). Among all bee products, the best known and most commonly used by humanity is honey, which can be described as a substance produced from the nectar of different flowers with a naturally sweet sensory character (ALJOHAR *et al.*, 2018; ARAÚJO *et al.*, 2020). In addition to diverse derived products, mead is an alcoholic beverage prepared from the fermentation of honey diluted in water by yeasts (PEREIRA *et al.*, 2019).

There are several recipes available for formulating beverages, and although recommendations can be made, there are no guarantees that the mead produced will be of excellent quality. The problem arises from the variation in ingredients and preparation methods. Honey, the main ingredient of the product, has a variable composition, containing a supersaturated solution of sugars and, in smaller quantities, proteins, minerals, vitamins, organic acids, enzymes, pollen, and various phenolic compounds. The type of nectar used in its production, the species of bee that produces it, the production method, the region, and the climate, among other factors, determine the formulation of the honey (SIME; ATLABACHEW; ABSHIRO, 2015).

During the mead production process, there are other challenges that can also impact its quality. The fermentation process of transforming the must into the beverage is a step that must be systematically monitored, as unpleasant flavors may be generated by the yeast. Other fundamental parameters, including pH, ethanol concentration, acidity, and sugar and organic acid contents, also need to be monitored during mead production (RAMALHOSA *et al.*, 2011).

Although determining the physicochemical parameters of mead is important, sensory analysis is a tool that helps to establish whether some samples have particular characteristics that make them superior to others and to detect flaws (unpleasant odors, undesirable flavors, and others) that make their commercialization impossible (HERNÁNDEZ, SERRATOA; QUICAZANB, 2015).

Thus, despite being an ancient beverage, mead is still poorly understood and explored nationally, making it necessary to survey consumer acceptance to increase the likelihood of success in the production of this honey derivative, with a greater likelihood of these products being well received by consumers. Therefore, this research aimed to investigate the acceptance of different meads (dry, semidry, sweet, and bouchet) among potential consumers in the city of Dracena. Furthermore, we sought to understand the preferences of potential consumers of mead with different levels of sweetness on the basis of sex, age, income bracket, and education level.

2 MATERIALS AND METHODS

The experiment was conducted at the Laboratory of Ecology and Useful Insects, Department of Animal Production, Faculty of Agricultural and Technological Sciences, Unesp, Dracena-SP Campus.

For the production of beverages, Mangrove Jacks - M05 yeast with *Saccharomyces cerevisiae* yeast was used. According to the manufacturer, this strain promotes fresh and floral aromas through high ester production, exhibits high alcohol tolerance, and ferments well over a wide temperature range.

The wild honey used to produce the meads was obtained from a beekeeper whose apiary is located in Osvaldo Cruz, São Paulo. Additionally, mineral water was used in the preparation of the meads.

Initially, the laboratory environment where the mead was made was cleaned, with all

equipment to be used being sterilized with 70% alcohol. For the fermentation process, musts with three different levels of sweetness were prepared, aiming to obtain dry, semidry, and sweet meads. The must for the production of bouchet mead was similar in sweetness to that of semidry mead, differing only in that the honey was heated in a water bath for 30 minutes to caramelize it.

For each recipe, 10 L of must was prepared from wild honey, mineral water, or yeast. For the dry, semidry, and boiled samples, 0.5 g of yeast per liter of must was used. For sweet mead, twice the amount of yeast was used ($1.0\ g\ L^{-1)}$.

The preparation of the musts used measurements from a manual refractometer (Atago). The initial °Brix parameter of each must was established on the basis of the desired residual sugar content (Table 1). Thus, the alcohol content was calculated via the BrixCalc application.

Table 1. Sugar concentrations at the beginning and end of fermentation and alcohol contents in the different musts.

Features	Dry	Medium dry	Smooth	*Bouchet*
Initial ° Brix	22.2%	29.1%	38.1%	28.6%
Final Brix	9.9%	13.3%	26.2%	14.6%
Alcohol content	11 °GL	14.4 °GL	8 °GL	14.5 °GL

Source: the authors.
The results were obtained by averaging three repetitions. One degree Brix (1°Bx) is equal to 1 gram of sugar per 100 grams of solution or 1% sugar.

The fermentation and maturation process took place over seven months, with shaking once a month for the first three months. During racking, the musts were transferred to other properly sanitized containers to facilitate clarification. After this period, the samples were bottled in sanitized 50 mL plastic containers with lids. The samples were identified and kept refrigerated at 4°C until they were tasted by the interviewees.

The color of the beverage was determined via the Konica Minolta colorimeter methodology (Model Chroma Meter CR-400), which considers the CIELAB system, through light reflectance readings in 3 dimensions: L* (luminosity), a* (red), b* (yellow), presenting a clear appearance with a more translucent color than honey, with different levels and alcoholic contents, as previously mentioned, obtaining the following average values: A1 (L 20.70; A 3.43 and B 5.77); A2 (L 20.19, A 3.43 and B 4.92); A3 (L 19.21, A 2.27 and B 2.97); and A4 (L 18.80, A 0.17 and B 2.00). The color analysis was performed at the Meat Science and Technology Laboratory, Department of Animal Production, Faculty of Agricultural and Technological Sciences, Unesp, Dracena-SP campus.

The sensory analysis of the four meads produced (dry, semidry, sweet, and bouchet) was carried out by 110 untrained evaluators, aiming to verify the overall impressions and acceptance of the samples in relation to the attributes of sweetness, alcohol content, liking/disliking, and purchase intentions. The evaluators were 18 years of age or older; therefore, they did not have any legal restrictions on the consumption of alcoholic beverages and were eligible and accepted for this study.

Considering the provision of an experimental beverage to humans, the project was previously submitted to the Research Ethics Committee for review through the Plataforma Brazil platform. A favorable opinion was obtained for the execution of the project through opinion number 5,536,752. After approval, the meads were tasted by the interviewees.

Before participating, the evaluators, from a diverse audience, read and signed a free and informed consent form. They then evaluated samples in disposable cups containing approximately 25 mL, coded with random single-digit numbers, without obtaining any information about the beverage (DUTCOSKY, 2011). The analyses were performed with individual tastings of the samples at approximately 13 °C. They were

served monadically (one at a time), sequentially (one after the other), and randomly.

The evaluation form was completed anonymously, indicating gender, age, income bracket, and education level. For each sample, the respondents were asked to rate their sweetness (very dry, dry, ideal, sweet, very sweet), alcohol content (very weak, weak, ideal, strong, very strong), liking/dislike (like very much, liked, found bland, bad, very bad) according to an adapted five-point hedonic scale, and finally, their acceptance of the product, stating their actual interest in purchasing it (yes, definitely; yes, probably; probably; not; not at all). In addition, evaluators answered questions about their frequency of wine consumption (daily; once a week; once a month; once a year; never).

The chi-square test, with a significance level of 5% probability, considers the responses given by the interviewees to the research questions.

To determine the ranking of the samples compared to each other, 4, 3, 2, and 1 points were assigned to the samples ranked first, second, third, and fourth, respectively. The points for each mead were added together to allow for comparisons between the meads.

3 RESULTS

The participants were aged between 18 and 73 years, with 53.64% being male and 46.36% being female. According to 65.45% of the respondents, regardless of sex, age, education level, and salary range, dry mead was indeed considered dry. The remaining evaluators, in similar proportions, considered the sweetness level of this product to be very dry (16.36%) or ideal (18.18%). No respondent considered this mead to be sweet or very sweet (Table 2).

For the evaluation of the sweetness of the samples with semidry mead, the "dry" response was the most representative (52.73%), but there was no significant difference in the stratification according to sex, age or income bracket ($p>0.05$) (Table 3). For the other respondents, the sweetness level of this product was considered ideal (30.91%), very dry (12.73%) or sweet (3.64%). No respondent considered this mead to be very sweet. However, considering the level of education, the responses differed across strata ($p<0.05$). For respondents with primary and secondary education, the second most representative response was "very dry" (25%), whereas for the group with higher education, it was "ideal" (39.02%). Most tasters classified this mead as sweet (58.18%), ideal (30.91%), very sweet (9.09%) or dry (1.82%). None of the respondents considered the mead to be too dry (Table 4).

The sweetness level of mead bouchet significantly differed according to sex and salary range ($p<0.05$) (Table 5). The most representative response based on sex was for the dry sweetness level (52.73%), followed by the very dry (23.64%), ideal (16.36%), and sweet (7.27%) levels. This same pattern of responses was followed by the salary range strata, with the dry sweetness level prevailing. No respondent considered the mead very sweet.

Table 2. Relative frequency, total number of people, and p value of the chi-square test for preference for dry mead with respect to sweetness level, according to sex, age, income bracket, and education level of the respondents.

Features		Sweet					Total	P
		Very dry	Dry	Ideal	Sweet	Very sweet		
Sex	Female	19.61	62.75	17.65	-	-	51	0.693
	Male	13.56	67.80	18.64	-	-	59	
Age	18-35	8.82	70.59	20.59	-	-	34	0.491
	36-53	22.73	63.64	13.64	-	-	44	
	54-75	16,13	61.29	22.58	-	-	31	
Education	Fund	25.00	62.50	12.50	-	-	8	0.752
	Average	15.00	75.00	10.00	-	-	20	
	Superior	15.85	63.41	20.73	-	-	82	
Salary range (minimum wage)	>3	16.33	59.18	24.49	-	-	49	0.482
	4-9	15.22	73.91	10.87	-	-	46	
	10+	20.00	60.00	20.00	-	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; sal. mín. : minimum wages.

Table 3. Relative frequency, total number of people, and P value of the chi-square test for preference for semidry mead with respect to sweetness level, according to sex, age, income bracket, and education level of the respondents.

Features		Sweet					Total	P
		Very dry	Dry	Ideal	Sweet	Very sweet		
Sex	Female	9.80	52.94	35.29	1.96	-	51	0.580
	Male	15.25	52.54	27.12	5.08	-	59	
Age	18-35	11.76	58.82	29.41	-	-	34	0.800
	36-53	11.36	52.27	29.55	6.82	-	44	
	54-75	12.90	48.39	35.48	3.23	-	31	
Education	Fund	25.00	62.50	-	12.50	-	8	0.028
	Average	25.00	60.00	10.00	5.00		20	
	Superior	8.54	50.00	39.02	2.44		82	
Salary Range (minimum wage)	>3	14.29	55.10	28.57	2.04		49	0.804
	4-9	13.04	47.83	32.61	6.52		46	
	10+	6.67	60.00	33.33	0.00		15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

Table 4. Relative frequency, total number of people, and p value of the chi-square test for preference for sweet mead with respect to sweetness level, according to sex, age, income bracket, and education level of the respondents.

Features		Sweet					Total number of people	P
		Very dry	Dry	Ideal	Sweet	Very sweet		
Sex	Female	-	-	33.33	60.78	5.88	51	0.377
	Male	-	3.39	28.81	55.93	11.86	59	
Age	18-35	-	-	26.47	67.65	5.88	34	0.121
	36-53	-	-	31.82	52.27	15.91	44	
	54-75	-	6.45	35.48	54.84	3.23	31	
Education	Fund	-	-	37.50	62.50	-	8	0.418
	Average	-	-	50.00	45.00	5.00	20	
	Superior	-	2.44	25.61	60.98	10.98	82	
Salary range (minimum wage)	>3	-	-	28.57	69.39	2.04	49	0.112
	4-9	-	4.35	32.61	50.00	13.04	46	
	10+	-	-	33.33	46.67	20.00	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

Table 5. Relative frequency, total number of people, and P value of the chi-square test for preference for bouchet mead regarding sweetness level, according to sex, age, income bracket, and education level of the respondents.

Features		Sweet					Total	P
		Very dry	Dry	Ideal	Sweet	Very sweet		
Sex	Female	35.29	52.94	5.88	5.88	-	51	0.007
	Male	13.56	52.54	25.42	8.47	-	59	
Age	18-35	35.29	47.06	11.76	5.88	-	34	0.656
	36-53	20.45	54.55	18,18	6.82	-	44	
	54-75	16,13	54.84	19.35	9.68	-	31	
Education	Fund	-	87.50	-	12.50	-	8	0.168
	Average	40.00	45.00	10.00	5.00	-	20	
	Superior	21.95	51.22	19.51	7.32	-	82	
Salary range (minimum wage)	>3	26.53	61.22	8.16	4.08	-	49	0.037
	4-9	19.57	50.00	17.39	13.04	-	46	
	10+	26.67	33.33	40.00	-	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

Information regarding the alcohol content of dry mead is presented in Table 6. No difference ($p>0.05$) was observed in relation to the perception of alcohol content on the basis of the characteristics reported by the respondents.

However, for females, 41.18% classified the alcohol content as weak, and only 1.96% classified it as very strong. For male respondents, 35.59% classified alcohol content as weak, and none classified it as very strong. With respect to age, those aged 18--35 years (47.06%) classified the alcohol content as weak, as did those aged 36--53 years (45.45%). On the other hand, people aged 54--75 years (38.71%) categorized the alcohol content as ideal and 35.48% as strong.

Table 6. Relative frequency, total number of people, and P value of the chi-square test for preference for dry mead with respect to alcohol content level as a function of sex, age, income bracket, and education level.

Features		Alcohol content					Total	P
		Very weak	Weak	Ideal	Strong	Very strong		
Sex	Female	1.96	41.18	27.45	27.45	1.96	51	0.553
	Male	6.78	35.59	32.20	25.42	-	59	
Age	18-35	5.88	47.06	32.35	11.76	2.94	34	0.119
	36-53	2.27	45.45	22.73	29.55	-	44	
	54-75	6.45	19.35	38.71	35.48	-	31	
Education	Fund	-	12.50	37.50	50.00	-	8	0.256
	Average	-	40.00	25.00	30.00	5.00	20	
	Superior	6.10	40.24	30.49	23.17	-	82	
Salary range (minimum wage)	>3	2.04	45.94	32.65	16.33	2.04	49	0.269
	4-9	8.70	30.43	26.09	34.78	-	46	
	10+	-	33.33	33.33	33.33	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

Table 7 shows that there was a difference only as a function of education level ($p<0.05$), and in general, the evaluators classified dry mead as ideal (40.91%). However, depending on each stratum, evaluators with elementary education considered the alcohol content weak (37.50%), whereas those with secondary education considered it strong (50%) and those with higher education ideal (45.12%).

Table 7. Relative frequency, total number of people, and p value of the chi-square test for preference for semidry mead with respect to alcohol content level, according to sex, age, income bracket, and education level of the respondents.

Features		Alcohol Content					Total	P
		Very weak	Weak	Ideal	Strong	Very strong		
Sex	Female	-	15.69	33.33	49.02	1.96	51	0.181
	Male	1.69	20.34	47.46	27.12	3.39	59	
Age	18-35	-	20.59	41.18	35.29	2.94	34	0.566
	36-53	-	11.36	40.91	45.45	2.27	44	
	54-75	3.23	25.81	41.94	25.81	3.23	31	
Education	Fund	12.50	37.50	12.50	25.00	12.50	8	0.004
	Average	-	10.00	35.00	50.00	5.00	20	
	Superior	-	18.29	45.12	35.37	1.22	82	
Salary range (minimum wage)	>3	2.04	18.37	44.90	30.61	4.08	49	0.669
	4-9	-	16.39	41.30	41.30	-	46	
	10+	-	20.00	26.67	46.67	6.67	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

Table 8 shows that both females (74.51%) and males (61.02%) rated their blood alcohol content as ideal. With respect to age, people aged 36--53 years and 54--75 years also rated their blood alcohol content as ideal. The ideal blood alcohol content also prevails in relation to education level and salary range.

For males, there was a higher classification regarding the ideal type of alcohol content, whereas for females, there was a higher

classification for strong alcohol content (Table 9). The patients aged 18--35 years and 54--75 years were more likely to be ideal, whereas those aged 36--53 years were more likely to be strong. With respect to education, people with primary and secondary education are categorized as strong, unlike people with higher education, where a higher classification for ideal education prevails. For the salary range, people characterized by earning up to three minimum wages defined bouchet as strong; however, people who earn from four to nine minimum wages, ten or more, defined it as ideal.

Table 8. Relative frequency, total number of people, and p value of the chi-square test for preference for sweet mead with respect to alcohol content level as a function of sex, age, income bracket, and education level of the respondents.

Features		Alcohol content					Total	P
		Very weak	Weak	Ideal	Strong	Very strong		
Sex	Female	3.92	13.73	74.51	5.88	1.96	51	0.351
	Male	3.39	23.73	61.02	11.86	-	59	
Age	18-35	2.94	23.53	6.71	8.82	-	34	0.619
	36-53	6.82	20.45	63.64	9.09	-	44	
	54-75	-	12.90	74.19	9.68	3.23	31	
Education	Fund	-	12.50	75.00	12.50	-	8	0.950
	Average	-	15.00	80.00	5.00	-	20	
	Superior	4.88	20.73	63.41	9.76	1.22	82	
Salary range (minimum wage)	>3	-	16.33	69.39	12.24	2.04	49	0.622
	4-9	6.52	19.57	67.39	6.52	-	46	
	10+	6.67	26.67	60.00	6.67	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

Table 9. Relative frequency, total number of people, and P value of the chi-square test for preference for boiled mead with respect to alcohol content level, according to sex, age, income bracket, and education level of the respondents.

Features		Alcohol content					Total	P
		Very weak	Weak	Ideal	Strong	Very strong		
Sex	Female	3.92	13.73	29.41	35.29	17.65	51	0.234
	Male	1.69	18.64	44.07	28.81	6.78	59	
Age	18-35	2.94	26.47	32.35	26.47	11.76	34	0.651
	36-53	2.27	11.36	34.09	38.64	13.64	44	
	54-75	3.23	12.90	48.39	25.81	9.68	31	
Education	Fund	-	25.00	12.50	37.50	25.00	8	0.099
	Average	5.00	10.00	25.00	30.00	30.00	20	
	Superior	2.44	17.07	42.68	31.71	6.10	82	
Salary range (minimum wage)	>3	2.04	22.45	26.53	32.65	16.33	49	0.052
	4-9	4.35	10.87	45.65	30.43	8.70	46	
	10+	-	13.33	46.67	33.33	6.67	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

The overall perceptions of dry mead are presented in Table 10. There was a difference only as a function of education level ($p<0.05$), which generally responded "I liked it"

(44.55%). According to each educational stratum, most people with elementary educations described dry mead as "bad" (50%), unlike the evaluators with secondary educations, who classified it as "I liked it" (45%) and "I found it bland" (45%). For the higher education stratum, the majority rated dry mead as "I liked it" (46.34%) and "I found it bland" (32.93%).

On the basis of the data in Table 10, it can be inferred that the highest rating for dry mead was "I liked it," while the relative frequencies for gender, age, and income bracket were 64.55%, 44.04%, and 44.55%, respectively.

Table 10. Relative frequency, total number of people, and p value of the chi-square test for preference for dry mead with respect to general perceptions as a function of sex, age, salary range, and education level.

Features		**I liked it/I disliked it.**					**Total**	**P**
		I truly liked it.	**I liked**	**I thought it was lame.**	**Bad**	**Very bad**		
Sex	Female	5.88	47.06	25.49	21.57	-	51	0.221
	Male	5.08	42.37	38.98	10.17	3.39	59	
Age	18-35	5.88	52.94	23.53	17.65	-	34	0.695
	36-53	2.27	43.18	36.36	15.91	2.27	44	
	54-75	9.68	35.48	38.71	12.90	3.23	31	
Education	Fund	12.50	25.00	-	50.00	12.50	8	0.019
	Average	5.00	45.00	45.00	5.00	-	20	
	Superior	4.88	46.34	32.93	14.63	1.22	82	
Salary range (minimum wage)	>3	2.04	48.98	26.53	18.37	4.08	49	0.453
	4-9	8.70	36.96	41.30	13.04	-	46	
	10+	6.67	53.33	26.67	13.33	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

The overall perception of the liking/disliking of semidry mead is presented in Table 11. There was no difference in the characteristics of the respondents ($p>0.05$).

Table 11. Relative frequency, total number of people, and P value of the chi-square test for preference for semidry mead regarding general perceptions as a function of sex, age, salary range, and education level of the respondents.

Features		I liked it/I disliked it.					Total	P
		I truly liked it.	I liked	I thought it was lame.	Bad	Very bad		
Sex	Female	9.80	56.86	13.73	17.65	1.96	51	0.064
	Male	-	71.19	18.64	8.47	1.69	59	
Age	18-35	8.82	64.71	8.82	14.71	2.94	34	0.501
	36-53	4.55	63.64	18,18	13.64	-	44	
	54-75	-	67.74	22.58	6.45	3.23	31	
Education	Fund	-	37.50	12.50	37.50	12.50	8	0.054
	Average	-	60.00	20.00	15.00	5.00	20	
	Superior	6.10	68.29	15.85	9.76	-	82	
Salary range (minimum wage)	>3	10.20	59.18	14.29	14.29	2.04	49	0.400
	4-9	-	65.22	19.57	13.04	2.17	46	
	10+	-	80.00	13.33	6.67	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

With respect to mild mead, no differences were observed in overall perception on the basis of the totality of the respondents' characteristics (p>0.05) (Table 12).

Table 12. Relative frequency, total number of people, and P value of the chi-square test for preference for sweet mead with respect to general perceptions as a function of sex, age, income bracket, and education level.

Features		I liked it/I disliked it.					Total	P
		I truly liked it.	I liked	I thought it was lame.	Bad	Very bad		
Sex	Female	64.71	35.29	-	-	-	51	0.056
	Male	42.37	50.85	1.69	5.08	-	59	
Age	18-35	67.65	32.35	-	-	-	34	0.256
	36-53	45.45	50.00	-	4.55	-	44	
	54-75	45.16	48.39	3.23	3.23	-	31	
Education	Fund	75.00	25.00	-	-	-	8	0.847
	Average	55.00	40.00	-	5.00	-	20	
	Superior	50.00	46.34	1.22	2.44	-	82	
Salary range (minimum wage)	>3	59.18	38.78	-	2.04	-	49	0.112
	4-9	50.00	47.83	2.17	-	-	46	
	10+	40.00	46.67	-	13.33	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

An analysis of the data in Table 13 reveals that the interviewed public appreciated the mead bouchet, since the response rates for gender, age, and income bracket were predominantly "liked".

The only difference was based on the respondents' level of education (p<0.05), with

those at the primary school level showing a dislike for the beverage, as the highest response rate was "bad" (62.50%), as did those interviewed at the secondary school level (35%). In contrast, those interviewed at the higher education level showed an appreciation for the beverage, since the highest response rate was "I liked it".

Table 13. Relative frequency, total number of people, and P value of the chi-square test for the preference for bouchet mead regarding general perceptions as a function of sex, age, salary range, and education level of the respondents.

Features		I liked it/I disliked it.					Total	P
		I truly liked it.	I liked	I thought it was lame.	Bad	Very bad		
Sex	Female	7.84	47.06	9.80	31.37	3.92	51	0.062
	Male	18.64	40.68	20.34	13.56	6.78	59	
Age	18-35	14.71	47.06	11.76	26.47	-	34	0.543
	36-53	13.64	45.45	11.36	20.45	9.09	44	
	54-75	12.90	35.48	25.81	19.35	6.45	31	
Education	Fund	12.50	12.50	-	62.50	12.50	8	0.026
	Average	15.00	25.00	15.00	35.00	10.00	20	
	Superior	13.41	51.22	17.07	14.63	3.66	82	
Salary range (minimum wage)	>3	14.29	34.69	14.29	28.57	8.16	49	0.130
	4-9	6.52	52.17	19.57	17.39	4.35	46	
	10+	33.33	46.67	6.67	13.33	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages.

There was a significant difference based on the respondents' education level in terms of their interest in purchasing dry mead ($p<0.05$) (Table 14), where 62.5% of the respondents with elementary educations said that they would not buy it "at all". For the high school level, the highest percentage of responses was divided between 30% "Yes, probably" and 35% "probably not". For higher education, the responses ranged between "probably not" (31.71%) and "maybe" (26.83%).

The overall perception regarding purchase intent also reveals that the female audience chose "yes, probably" (31.37%) as their purchase intent, unlike the male audience, who responded "probably not" (33.90%). With respect to age, tasters aged 18--35 years responded that they would buy "yes, probably," whereas those aged 36--53 years and 54--75 years said that their purchase intention would be "probably not." Purchase intent in relation to the income bracket also showed a divergence of opinions, where the audience earning up to three minimum wages said "yes, probably" (26.53%) that they would buy dry mead, as did those earning 10 or more. The audience earning between 4–9 minimum wages said that they would "probably not" buy it. No further developments were observed.

Table 14. Relative frequency, total number of people, and P value of the chi-square test for interest in purchasing dry mead in terms of purchase intentions as a function of the sex, age, income bracket, and education level of the respondents.

Features		Interest in buying					Total	P
		THE	B	W	D	AND		
Sex	Female	7.84	31.37	21.57	25.49	13.73	51	0.354
	Male	15.25	16.95	22.03	33.90	11.86	59	
Age	18-35	2.94	35.29	26.47	23.53	11.76	34	0.237
	36-53	11.36	22.73	20.45	31.82	13.64	44	
	54-75	22.58	12.90	16.13	35.48	12.90	31	
Education	Fund	37.50	-	-	-	62.50	8	0.001
	Average	10.00	30.00	10.00	35.00	15.00	20	
	Superior	9.76	24.39	26.83	31.71	7.32	82	
Salary range (minimum wage)	>3	10.20	26.53	22.45	24.49	16.33	49	0.599
	4-9	10.87	17.39	23.91	34.78	13.04	46	
	10+	20.00	33.33	13.33	33.33	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages. A: yes, definitely; B: yes, probably; C: maybe; D: probably not; E: not at all; sal mín. : minimum wages.

There was a statistically significant difference only for education level with respect to the intention to purchase semidry mead ($p<0.05$, Table 15). A total of 87.5% of the evaluators at the elementary school level indicated that they would "not buy" semidry mead "at all." However, evaluators at the high school and university levels said "yes," "probably," and "maybe." A salary bracket of 10 or more indicated a probable intention to purchase semidry mead (53.33%). In summary, evaluators across different strata demonstrated their interest in purchasing semidry mead with "yes," "probably," or "maybe."

Table 15. Relative frequency, total number of people, and P value of the chi-square test for interest in purchasing semidry mead in terms of purchase intentions, according to the sex, age, income bracket, and education level of the respondents.

Features		Interest in buying					Total	P
		THE	B	W	D	AND		
Sex	Female	9.80	33.33	17.65	23.53	15.69	51	0.512
	Male	8.47	27.12	32.20	16.95	15.25	59	
Age	18-35	5.88	35.29	32.35	11.76	14.71	34	0.708
	36-53	9.09	31.82	25.00	18,18	15.91	44	
	54-75	12.90	22.58	19.35	29.03	16,13	31	
Education	Fund	-	12.50	-	-	87.50	8	<0001
	Average	10.00	35.00	15.00	30.00	10.00	20	
	Superior	9.76	30.49	30.49	19.51	9.76	82	
Salary range (minimum wage)	>3	12.24	28.57	24.49	18.37	16.33	49	0.323
	4-9	4.35	23.91	28,26	23.91	19.57	46	
	10+	13.33	53.33	20.00	13.33	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages. A: yes, definitely; B: yes, probably; C: maybe; D: probably not; E: not at all; sal mín. : minimum wages.

There was a statistically significant difference in the relative frequency of interest in sweet mead based on sex and education level ($p<0.05$, Table 16). Both female and male participants indicated a "yes, definitely" level of interest in the purchase of sweet mead. In terms of education level, the different strata also demonstrated a "yes, definitely" level of purchase interest. These same results also prevailed for the income bracket and age strata.

Table 17 shows that women responded that they "maybe" would buy Bouchet mead, whereas men said that they "probably" would. With respect to the age of the evaluators, those aged 18--35 years and 54--75 years responded that they "maybe" would buy Bouchet; however, those aged 36--53 years responded that they "definitely" would not buy it. The responses according to different educational levels were divided, with those with primary education responding that they "maybe" would buy it, those with secondary education "maybe," and those with higher education "probably." Similar results were also observed for the salary range, where up to 3 minimum wages, the interest in buying was "definitely," from 4--9 minimum wages "maybe," and 10 or more minimum wages "probably."

Table 16. Relative frequency, total number of people, and P value of the chi-square test for interest in purchasing sweet mead in terms of purchase intentions as a function of the sex, age, income bracket, and education level of the respondents.

Features		**Interest in buying**					**Total**	**P**
		THE	**B**	**W**	**D**	**AND**		
Sex	Female	62.75	27.45	5.88	1.96	1.96	51	0.029
	Male	37.29	30.51	20.34	10.17	1.69	59	
Age	18-35	50.00	32.35	14.71	-	2.94	34	0.315
	36-53	47.73	22.73	15.91	13.64	-	44	
	54-75	48.39	35.48	9.68	3.23	3.23	31	
Education	Fund	87.50	12.50	-	-	-	8	0.029
	Average	55.00	25.00	10.00	-	10.00	20	
	Superior	43.90	31.71	15.85	8.54	-	82	
Salary range (minimum wage)	>3	59.18	26.53	10.20	-	4.08	49	0.067
	4-9	41.30	30.43	19.57	8.70	-	46	
	10+	40.00	33.33	6.67	20.00	-	15	

Source: the authors.

Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages. A: yes, definitely; B: yes, probably; C: maybe; D: probably not; E: not at all; sal mín. : minimum wages.

Table 17. Relative frequency, total number of people, and P value of the chi-square test for interest in purchasing Bouchet mead in terms of purchase intentions, according to the sex, age, income bracket, and education level of the respondents.

Features		Interest in buying					Total	P
		THE	B	W	D	AND		
Sex	Female	5.88	21.57	15.69	33.33	23.53	51	0.237
	Male	18.64	25.42	13.56	20.34	22.03	59	
Age	18-35	14.71	20.59	17.65	26.47	20.59	34	0.564
	36-53	9.09	20.45	20.45	22.73	27,27	44	
	54-75	16,13	29.03	3.23	32.26	19.35	31	
Education	Fund	12.50	12.50	-	12.50	62.50	8	0.084
	Average	10.00	10.00	10.00	40.00	30.00	20	
	Superior	13.41	28.05	17.07	24.39	17.07	82	
Salary range (minimum wage)	>3	14.29	18.37	10.20	24.49	32.65	49	0.050
	4-9	10.87	19.57	21.74	28,26	19.57	46	
	10+	13.33	53.33	6.67	26.67	-	15	

Source: the authors.
Notice: Fem: feminine; Masc: masculine; Fund: fundamental; Sal. mín. : minimum wages. A: yes, definitely; B: yes, probably; C: maybe; D: probably not; E: not at all; sal mín. : minimum wages.

Considering the scores given by the responses, the preferred mead was the sweet one, with 393 points. Next were the semidry (269 points), bouchet (223 points), and dry (215 points) meads.

The frequency of wine consumption was measured to understand the profile of the judges regarding the consumption of this beverage, which is similar to mead (Table 18). Most people say that they consume wine monthly (38.18%), followed by weekly (31.82%), annual (15.45%), and daily (6.36%). Of those interviewed, 8.18% did not consume wine.

4 DISCUSSION

Currently, many researchers are seeking to develop methods in which fruits and pulps are added (AMORIM *et al.*, 2018; MATOS; OLIVEIRA; BANDEIRA, 2020; OUROS *et al.*, 2021). For this purpose, sensory analysis is an essential tool in judging the quality of food (SCHIANO; HARWOOD; DRAKE, 2017) because if consumers do not like the appearance, taste, or texture of a particular food product and do not meet their desires and needs, they will not buy it (SIRAGENGELO, 2019). Regardless of the items chosen to compose the mead recipe, the sweetness level of the beverage can be preponderant for the acceptability of the product.

Meads of the dry, semidry, sweet, and bouchet types are distinguished according to the residual sugar and/or heating of the honey. In the present study, the sensory analysis demonstrated that the evaluators classified dry and semidry mead as truly dry. The sweet version was mostly classified as sweet, and regarding the bouchet, most men classified the mead as dry or ideal and women as dry or very dry. This indicates compliance with the classification of Brazilian legislation, in which the beverage is classified as dry when it has a sugar content below 3.0 g L^{-1} and sweet when the values are above this value (BRASIL, 2012).

In general, sweet meads possess sensory properties that make them more appreciated and, consequently, more accepted by consumers, regardless of their alcohol content (GOMES *et al.*, 2015). This can be confirmed by the "liked/disliked" preference scale, with a preference for sweet mead.

The alcohol content is directly related to the ability of yeast to transform the sugars present in must into alcohol and carbon dioxide (DEMAN *et al.*, 2018). The yeast selected for fermentation is an appropriate strain because of its high tolerance. Although dry meads have a stronger, more astringent flavor and little residual sugar, the alcohol content of dry meads

is considered weak, which may be related to the final alcohol content of 11° GL (Table 1). With respect to the semidry version, the value of 14.4° GL influenced the decisions of the majority, who rated it as ideal or strong. However, sweet mead seemed to have greater acceptability in terms of alcohol content, since most evaluators rated it as ideal. In fact, the result of 8° GL for the sweet version provided more residual sugar than the other types of media did. Finally, the bouquet was classified as strong or ideal, consistent with an alcohol content of 14.5° GL.

Mead can have a wide range of alcohol contents, generally ranging from 8 to 18% (v/v) (PEREIRA *et al.*, 2015). Therefore, standardization throughout its production chain becomes a challenge, as it depends on the proportions of honey and water used in the must, the addition of ingredients, and the fermentation time. These variables contribute to obtaining products with different sensory characteristics, mainly reflecting the parameters of sweetness and alcohol perception, characteristics that are of paramount importance for consumer acceptability (GOMES *et al.*, 2015; KAWA-RYGIELSKA *et al.*, 2019).

In terms of purchase preference, a greater preference was found for sweet mead, followed by the semidry, bouquet, and dry versions. This confirms once again that consumers, regardless of gender, have a greater preference for sweeter beverages.

5 CONCLUSION

The mild mead was the most accepted by the evaluators, indicating a greater chance of success in commercialization. This result allows for the expansion of new, higher value-added bee products, which can increase and diversify producers' income sources.

6 REFERENCES

ALJOHAR, HI; MAHER, HM; ALBAQAMI, J.; AL-MEHAIZIE, M.; ORFALI, R.; ORFALI, R.; ALRUBIA, S. Physical and chemical screening of honey samples available in the Saudi market: An important aspect in the authentication process and quality assessment. **Saudi Pharmaceutical Journal** , Amsterdam, vol. 26, no. 7, p. 932-942, 2018.

ALMEIDA, JM; OLIVEIRA, FC; SILVA, RR Monitoring of fermentation in mead production using *Saccharomyces cerevisiae* and *Saccharomyces boulardii* . **Brazilian Journal of Sustainable Agriculture** , Viçosa, v. 11, n. 1, p. 22-28, 2020.

AMORIM, TS; LOPES, SB; BISPO, JAC; BONAFE, CFS; CARVALHO, GBM; MARTÍNEZ, EA Influence of acerola pulp concentration on mead production by *Saccharomyces cerevisiae* AWRI 796. **LWT** , London, v. 97, p. 561-569, 2018.

ARAÚJO, GS; GUTIÉRREZ, MP; SAMPAIO, K., F.; SOUZA, SMA; RODRIGUES, RCLB; MARTÍNEZ, EA Mead Production by *Saccharomyces cerevisiae* Safbrew T-58 and *Saccharomyces bayanus* (Premier Blanc and Premier Cuvée): Effect of Cowpea (*Vigna unguiculata* L. Walp) Extract Concentration. **Applied Biochemistry and Biotechnology** , Heidelberg, vol. 191, no. 1, p. 212-225, 2020.

BRAZIL. Ministry of Agriculture, Livestock and Supply. Normative Instruction No. 34, of November 29, 2012. Technical Regulation of Identity and Quality of fermented beverages: fruit ferment; liqueur fruit ferment; compound fruit ferment; cider; mead; sugarcane ferment; sake . Official **Gazette of the Union** : section 1, Brasília, DF, year 2012, no. 34, Nov. 23, 2012.

DEMAN, JM ; FINLEY, JW; HURST, WJ; LEE, CY **Principles of Food Chemistry.** 4. ed. Cham : Springer Nature , 2018.

DUTCOSKY, SD **Sensory Analysis of Food** . 3rd ed. Curitiba: Champagnat University, 2011.

GOMES, T.; DIAS, T.; CADAVEZ, V.; VERDIAL, J.; MORAIS, JS; RAMALHOSA, E.; ESTEVINHO, LM Influence of sweetness and ethanol content on mead acceptability .

Polish Journal of Food and Nutrition Sciences , Olsztyn, v. 65, no. 2, p. 137-142, 2015.

HERNÁNDEZ, CY; SERRATOA, JC; QUICAZANB, MC Evaluation of physicochemical and sensory aspects of mead, produced by different nitrogen sources and commercial yeast. **Chemical Engineering** , Rockville, vol. 43, p. 1-6, 2015.

KAWA-RYGIELSKA, J.; ADAMENKO, K.; KUCHARSKA, AZ; SZATKOWSKA, K. Fruit and herbal meads - Chemical composition and antioxidant properties. **Food Chemistry** , Amsterdam, vol. 283, p. 19-27, 2019.

MATOS, PA; OLIVEIRA, HLM; BANDEIRA, SF Production of mead flavored with black garlic. **Research, Society and Development** , Itabira , v. 9, n. 8, p. e485985738, 2020.

OLIVEIRA, J.; KRISTBERGSSON, K. (ed.). **Traditional Foods** : General and Consumer Aspects. Cham : Springer Nature , 2016.

OUROS, LF; FIGUEIRA, R.; ANDRADES, TLL; SARTORI, MMP; VENTURINI FILHO, WG. Production, physicochemical and sensory analysis of meads with orange, tangerine and lime. **Energia na Agricultura** , Botucatu, v. 36, n. 4, p. 504-511, 2021.

PEREIRA, A. P; MENDES-FERREIRA, A.; ESTEVINHO, LM; MENDES-FAIA, A. Improvement of mead fermentation by honey - must supplementation . **Journal of the Institute of Brewing** , Hoboken, vol. 121, no. 3, p. 405-410, 2015.

PEREIRA, AP; MENDES-FERREIRA, A.; DIAS, L.; OLIVEIRA, JM; ESTEVINHO, LM; MENDES-FAIA, A. Volatile composition and sensory properties of mead . **Microorganisms** , Basel, vol. 7, no. 10, p. 404-419, 2019.

RAMALHOSA, E.; GOMES, T.; PEREIRA, AP; DIAS, T.; ESTEVINHO, LM Mead production : Tradition versus modernity . **Advances in Food and Nutrition Research** , San Diego, vol. 63, p. 101-118, 2011.

SCHIANO, AN; HARWOOD, W.S.; DRAKE, MA A 100-year review: Sensory analysis of milk. **Journal of Dairy Science** , New York, vol. 100, no. 12, p. 9966-9986, 2017.

SIME, D.; ATLABACHEW, M.; ABSHIRO, MR Total phenols and antioxidant activities of natural honeys and propolis collected from different geographical regions of Ethiopia. **Bulletin of the Chemical Society of Ethiopia** , Addis Ababa, vol. 29, no. 2, p. 163-172, 2015.