horticulturae

Article

# 'Hass' Avocados Cultivated in the Canary Islands: Sensory Attributes Related to Fatty Acid Profiles

**Eva Dorta [1,*], José Ignacio Alonso-Esteban [2,3], Carlos Álvarez-Acosta [1] and M. Gloria Lobo [1]**

1 Departamento de Producción Vegetal en Zonas Tropicales y Subtropicales, Instituto Canario de Investigaciones Agrarias, 38270 Tenerife, Spain; calvarez@icia.es (C.Á.-A.); globo@icia.es (M.G.L.)
2 Departamento de Nutrición y Cienciade los Alimentos, Facultad de Farmacia, Universidad Complutense de Madrid, Plaza Ramón y Cajal s/n, 28040 Madrid, Spain; joseigal@ucm.es
3 CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal
* Correspondence: edorta@icia.es

**Abstract**

Dry matter (DM) is a critical parameter for avocado quality and commercialization, particularly in the 'Hass' cultivar, where it is closely associated with the oil content and flavor. This study evaluated the fatty acid composition and sensory attributes of 'Hass' avocados with varying DM levels (19%, 21%, 24%, and 27%) cultivated in the Canary Islands. Additionally, the impact of dehydration methods (oven and microwave) and sample preparation techniques on the oil content and lipid profiles were assessed. Six main fatty acids were identified, with oleic acid (38–43%) and palmitic acid (30–36%) being predominant. Higher DM levels were associated with increased concentrations of palmitoleic and linoleic acids. Drying methods did not significantly alter the fatty acid profile, supporting the crushed microwave-dried (CMW) method as a practical, low-cost approach for preserving lipid integrity. Consumer panelists showed a clear preference for avocados with higher DM contents (24–27%), associating the flavor (86.2%) and texture (59.6%) with the purchase intent. The high monounsaturated fatty acid content, particularly oleic acid, qualifies these avocados for the European nutritional claim 'high in monounsaturated fat.' This is the first study to characterize these parameters in 'Hass' avocados from the Canary Islands, contributing to both quality assessments and potential marketing strategies based on nutritional and sensory attributes.

**Keywords:** quality; postharvest; near-infrared spectroscopy; dehydration method; palatability



Academic Editor: Xueren Yin

Received: 27 May 2025
Revised: 24 June 2025
Accepted: 25 June 2025
Published: 2 July 2025

**Citation:** Dorta, E.; Alonso-Esteban, J.I.; Álvarez-Acosta, C.; Lobo, M.G. 'Hass' Avocados Cultivated in the Canary Islands: Sensory Attributes Related to Fatty Acid Profiles. *Horticulturae* **2025**, *11*, 763. https://doi.org/10.3390/horticulturae11070763



## 1. Introduction

The growing consumer awareness of nutrition and health has led to an increased demand for fruits rich in bioactive compounds, such as vitamin E, vitamin B6, ascorbic acid, β-carotene, and tocopherols [1,2]. Among these, the avocado (*Persea americana*) has received particular attention due to its unique lipid profile and associated health benefits. Avocados are notable for their high content of monounsaturated fatty acids, particularly oleic acid, and are also rich in essential micronutrients and bioactive compounds. These include β-carotene, tocopherols (vitamin E), ascorbic acid (vitamin C), and phytosterols, all of which contribute to a range of health-promoting effects, including antioxidant, anti-inflammatory, and cardiovascular benefits [1–3].

In the Canary Islands, the avocado is the second most important subtropical crop after the banana, with a total production of 14,615 tons recorded in 2023 [4]. While most of this production is consumed locally within the archipelago, a smaller proportion is exported to mainland Spain and various European countries. The recent increase in production has led to a renewed interest in expanding exports to both national and European markets. This interest is further supported by current European Union policies that promote the consumption of locally produced foods with lower carbon footprints [5]. As a result, there has been a growing demand for tropical products from the Canary Islands, encouraging the development of research initiatives in this field (CAIA 2024-002-04-04). Notably, the 'Avocado from the Canary Islands' was recently registered as a Protected Geographical Indication (PGI) in the European Union's register of geographical indications, in accordance with Regulation (EU) 2024/1143 of the European Parliament and of the Council [6].

The determination of the optimum harvest maturity is critical to the postharvest quality of the avocado fruit [7]. Maturation involves a gradual decrease in the mesocarp moisture and a corresponding increase in the dry matter (DM) content. As such, the minimum DM has become a globally accepted parameter for avocado marketing, with the 'Hass' cultivar typically requiring at least 21% DM [7]. DM correlates closely with the oil content, with higher DM values indicating higher oil percentages [8,9]. Furthermore, research has demonstrated a direct correlation between the oil content and flavor, with higher oil percentages leading to more favorable consumer ratings [9]. Given this, it is essential to evaluate the acceptability and preference of 'Hass' avocados produced in the Canary Islands based on their %DM, as this is critical for effective marketing.

In this study, 'Hass' avocados with different %DM levels (19%, 21%, 24%, and 27%) were analyzed and evaluated by a consumer panel. Given the recent PGI recognition of 'Hass' avocados from the Canary Islands, investigating changes in their fatty acid profile over time is of particular interest. To date, no studies have correlated the fatty acid composition with the organoleptic evaluation by Canarian consumers; nor have evaluations been conducted on fruits with varying DM contents.

The FFV-42 Standard, which governs the commercialization of avocados worldwide, mandates that fruits must meet a minimum %DM, determined by drying to a constant weight [7]. However, the standard does not specify the drying procedure, leading to the use of various destructive methods for dehydrating avocado pulp and determining DM. The *Codex Alimentarius* [7] recommends drying 1.5–2 mm thick slices of avocado pulp at 60 °C in an oven or using a microwave (MW) at 800 W until a constant weight is achieved. Arpaia et al. [8] developed and standardized a sampling method for DM determination using microwave drying, although it did not consider the potential impact of dehydration on the oil content, such as inadvertent oil loss.

Several studies have investigated the effects of dehydration methods on the extraction of avocado pulp oil [9,10], but they have not specifically addressed how these methods may influence the DM determination. When dehydration conditions are too intense (e.g., prolonged exposure to microwave or oven drying, or excessive power or temperature), oil may be removed along with water, potentially skewing the results. Guzmán-Gerónimo et al. [11] investigated the impact of microwave processing on the release of volatile compounds and the sensory profile of avocado fruits, underscoring the broader influence on the fruit quality. This highlights the importance of optimizing dehydration conditions to ensure an accurate DM assessment.

Harvesting 'Hass' avocados with insufficient DM has been associated with suboptimal ripening, resulting in a watery texture, bland or grassy flavor, and reduced consumer acceptance [12,13]. Therefore, the accurate determination of DM not only supports an optimal postharvest quality but also ensures that the fruit meets both sensory expectations and market standards. In this context, the DM analysis can also provide insights into consumer preferences, including likes, dislikes, and specific fruit attributes that influence purchasing decisions [13,14].

This study aims to (1) evaluate the fatty acid profile of 'Hass' avocados from the Canary Islands across different DM levels, (2) determine how dehydration methods and the sample preparation influence the oil yield and fatty acid composition, and (3) assess consumer preferences in relation to the DM content.

## 2. Materials and Methods

### 2.1. Harvest of Fruits

'Hass' avocado fruits cultivated in the Canary Islands were obtained from three different locations on the island of Tenerife: Güímar (28°17′46.94″ N, 16°23′39.56″ W), La Orotava (28°24′45.51″ N, 16°30′41.62″ W), and La Laguna (28°23′13.75″ N, 16°23′13.75″ W), in order to obtain fruits with varying dry matter content. The fruits from the different locations were pooled and subsequently classified according to their %DM. A total of 100 fruits were collected during September and October 2020, and 25 fruits were selected for each dry matter (DM) level evaluated. Additionally, 10 more fruits were used for each dehydration system evaluated to assess the effect of the dehydration method. The fruits were harvested following the recommended procedures described in [7].

### 2.2. Plant Material Preparation

All analytical determinations were performed in triplicate. The preparation of plant material for dry matter percentage (%DM) followed two procedures previously described by the California Avocado Society [8]:

**Opposite eighths method:**

Sampling for %DM determination was conducted by cutting the fruit longitudinally, then dividing each half again lengthwise to obtain four quarters. Two opposite quarters were selected, peeled, and had the seed and seed coat removed. The resulting pulp was then either sliced or homogenized using an electric grinder [15].

**Equatorial core method:**

Pulp was extracted using a small manual coring cylinder inserted from the equator of the fruit to the seed. The cylinder was then rotated to loosen and extract the pulp [8]. The extracted pulp was used to determine dry matter content via the rapid microwave dehydration method [15]. The hole created by coring was sealed with parafilm, and the fruit was allowed to ripen for subsequent analysis.

#### 2.2.1. Dry Matter Determination

Two distinct methods were used to determine the dry matter (%DM) content of the harvested avocado fruits:

Near-Infrared Spectroscopy (NIRS)

Initially, %DM was assessed in situ before harvesting using a near-infrared spectroscopy (NIRS) device [16]. NIRS facilitated the selection of fruits with the desired DM content, which were subsequently validated in the laboratory through dehydration (see Dehydration Methods section).

Dehydration Methods

Three dehydration procedures were employed:

- *Method A:* Here, 2 mm thick slices of avocado pulp were dried at 60 °C in a conventional oven until constant weight was achieved (approximately 72 h) [7].

- *Method B:* Pulp was homogenized using an electric grinder to produce a uniform mass (approximately 5 min). Six watch glasses were placed in a microwave oven, and time and power cycles were applied according to the protocol of Dorta et al. (2021) [15].

In both cases, approximately 5 g of avocado pulp was placed in pre-weighed watch glasses (60 mm diameter), and the final weight (glass + dried sample) was recorded. Each measurement was performed in triplicate for each avocado. Dry matter percentage was calculated using Equation (1):

$$\mathbf{\%DM} = \left(\frac{\mathbf{P_d}}{\mathbf{P_f}}\right) \times \mathbf{100} \quad (1)$$

where $P_f$ is the weight of the fresh sample, and $P_d$ the weight after drying.

- *Method C:* The avocado pulp was prepared similarly to *method B*, but the dehydration was carried out in an oven at 60 °C under the same conditions as *method A*.

### *2.3. Oil Extraction and Fatty Acid Analysis*

Samples dried using the three methodologies described in Dehydration Methods section were used for oil extraction. The extraction was performed using a Soxhlet apparatus and petroleum ether as the solvent, following established procedures [17]. Results were expressed as g/100 g of fresh matter, calculated using the dry matter values of each sample.

Fatty acids were analyzed by gas chromatography with flame ionization detection (GC-FID) using a capillary column, as described in previous studies [18,19]. The first step involved transesterification of fatty acids into fatty acid methyl esters (FAMEs). This was achieved by adding 5 mL of a methanol/sulfuric acid/toluene mixture (2:1:1, *v*/*v*/*v*) and incubating for 12 h in a shaking water bath at 50 °C and 160 rpm. Deionized water was then added to separate the phases, and FAMEs were extracted using 3 mL of diethyl ether after vortex mixing. The upper phase was dehydrated with anhydrous sodium sulfate and filtered through 0.22 μm nylon filters for subsequent injection [18].

GC-FID analysis was performed using a DANI GC 1000 instrument (Cologno Monzese, Italy) equipped with a split/splitless injector, an FID detector set at 260 °C, and a Macherey-Nagel capillary column (30 m × 0.32 mm ID × 0.25 μm df). The oven temperature program followed the method described by Pereira et al. [20]. Fatty acids were identified by comparing the relative chromatographic retention times of FAME peaks in the samples with those of standard compounds. Data were recorded and processed using CSW 1.7 software (DataApex 1.7) and expressed as the relative percentage of each fatty acid [19].

In addition, absolute fatty acid content (g/100 g) was derived by multiplying the relative fatty acid abundance by the total oil content and a conversion factor of 0.956, as recommended for avocado oil by Greenfield and Southgate [21]. Final results were expressed in g/100 g.

### *2.4. Fruit Ripening Conditions*

The puncture hole created during the drying process using the equatorial core method was securely sealed with parafilm. The fruits were then placed in ripening chambers maintained at 80% relative humidity and a temperature of 25 °C. Avocados were stored under these conditions until they reached the desired level of ripeness suitable for consumption. Once optimal ripeness was achieved, the fruits were subjected to evaluation by a panel of tasters (see Section 2.5).

### *2.5. Analysis of Acceptance and Preference*

All evaluations were conducted under controlled conditions in a white room at approximately 21 °C with natural lighting. No prior training or information about the samples was provided to the panelists to ensure unbiased responses. An untrained consumer panel consisting of 50 participants (25 women and 25 men), aged between 20 and 60 years, was recruited. Inclusion criteria included regular avocado consumption and residency in Tenerife (Canary Islands). The panel was composed of ICIA staff, university students, and members of the general public.

Panelists participated in two types of tests: (i) a preference acceptance test and (ii) a descriptive analysis [22], following the triangular test protocol outlined in ISO 4120:2021 [23]. Avocado samples were labeled A, B, C, and D, corresponding to their dry matter (DM) content: A = 19%, B = 21%, C = 24%, and D = 27% [24]. Slices of avocado (≈1 cm thick) were served on white plates at room temperature (≈21 °C) [25]. The slices were prepared immediately before consumption to prevent oxidation and preserve the characteristic color of the avocado pulp. Fruits were cut vertically from stem to distal end, halved, and the seed removed, following the method described by Pisani et al. [25]. The sensory panel was conducted under blinded conditions to ensure unbiased evaluations.

In the acceptance preference analysis, panelists evaluated the four avocado samples by assigning scores based on perceived quality in terms of color, odor, texture, and flavor. A 9-point hedonic scale was used, where 1 indicated 'extremely dislike' and 9 indicated 'extremely like' [25]. Additionally, the same samples were subjected to a descriptive analysis using a structured questionnaire, in which participants selected predefined descriptors to characterize each sample.

The evaluated attributes and corresponding descriptors were as follows:

- **Color**: greenish, pale yellow, golden yellow, brownish yellow;
- **Odor**: no scent, slightly intense, intense, very intense;
- **Texture**: chewy, watery, oily, creamy;
- **Flavor**: green, avocado, oily–fatty, rancid.

These descriptors were selected based on prior experience from ICIA research and other published studies [13]. Panelists were instructed to cleanse their palate between samples by eating a piece of bread and drinking water.

*2.6. Statistical Analysis*

All samples were analyzed in triplicate, and results were expressed as mean ± standard error (SE). Data analysis was conducted using the R programming language (R Development Core Team, 2022), version 4.1.3. A one-way analysis of variance (ANOVA) was performed using the agricolae package [26] to assess the significance of differences among dry matter (DM) processing methods for each fatty acid studied, as well as to compare the concentrations of each fatty acid across DM levels (19%, 21%, 24%, and 27%). Post hoc pairwise comparisons were carried out using Tukey's Honestly Significant Difference (HSD) test to identify specific group differences. A Student's *t*-test was used to evaluate statistical differences in the concentrations of palmitic and oleic acids.

Differences in sensory scores across dry matter levels by the 50 panelists were evaluated using the Kruskal–Wallis test, followed by Dunn's post hoc test with Bonferroni adjustment for multiple comparisons. The assumption of normality was assessed using the Shapiro–Wilk test. Results are presented as medians with interquartile ranges (IQRs), and significant differences between groups are indicated with letters.

To investigate the relationship between panelists' purchasing intentions and the sensory attributes of color, texture, odor, and flavor, a Generalized Linear Model (GLM) was applied. Given the binary nature of the response variable ('willingness to buy,' where 1 indicates a positive inclination to purchase and 0 indicates otherwise), the model was fitted with a binomial distribution and a logit link function. The Hosmer–Lemeshow goodness-of-fit test was performed to assess the adequacy of the model.

## 3. Results

In general, six fatty acids were consistently detected across all avocado samples evaluated. In some cases, additional minor fatty acids were identified, but only six were present in all samples. Figure 1 shows the fatty acid profile obtained from a representative 'Hass' avocado sample, along with their chromatographic retention times. The predominant fatty acid in 'Hass' avocados cultivated in the Canary Islands was oleic acid (18:1n9, OA), with a relative abundance of 38–43%, followed by palmitic acid (16:0, PA), ranging from 30 to 36%. Palmitoleic acid (16:1n7, POA) and linoleic acid (18:2n6, LA) were present in lower amounts, with POA ranging from 11 to 17% and LA from 9 to 13%. Stearic acid (18:0, SA) and α-linolenic acid (18:3n3, ALA) showed the lowest relative abundance, typically below 1% in most of the analyzed samples.

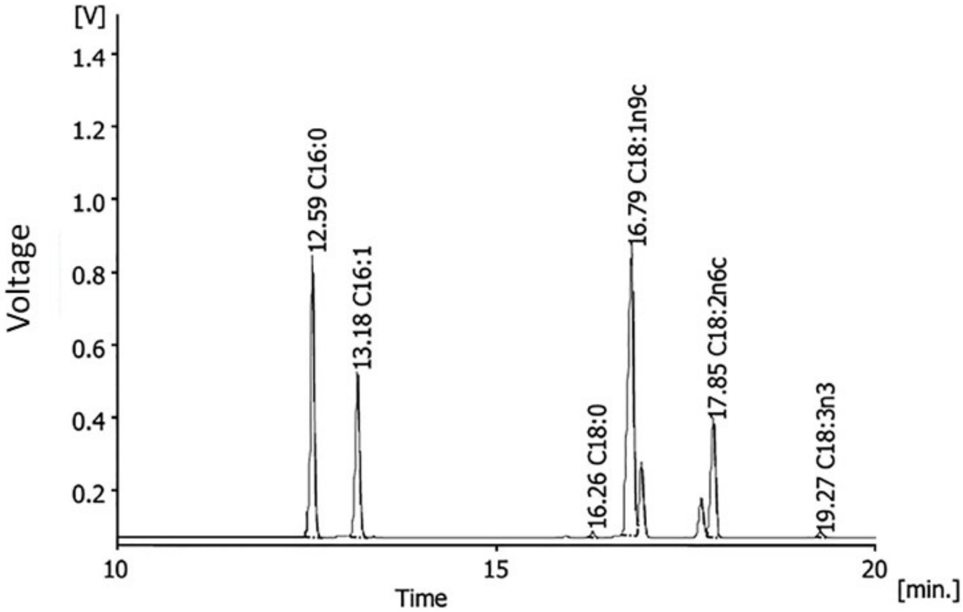


**Figure 1.** The chromatogram of the fatty acid profile in 'Hass' avocadoes cultivated in the Canary Islands. ALA, α-linolenic acid; LA, linoleic acid; OA, oleic acid; PA, palmitic acid; POA, palmitoleic acid; and SA, stearic acid.

### *3.1. Method of Stabilization of Avocado Pulp cv. 'Hass'*

No significant differences were observed among the three methods used to stabilize the avocado pulp—SO (sliced oven-dried), CO (crushed oven-dried), and CMW (crushed microwave-dried). Specifically, there were no significant differences in the concentrations of palmitic acid (16:0), stearic acid (18:0), palmitoleic acid (16:1n7), oleic acid (18:1n9), linoleic acid (18:2n6), or α-linolenic acid (18:3n3) across the drying methods (Figure 2). However, stearic acid (18:0) was significantly higher in CO samples compared to CMW samples ($F = 5.281$; d.f. = 2; $p = 0.01$).

### *3.2. Evolution of Fatty Acid Profiles*

Significant differences ($p < 0.001$) were observed in the evolution of the fatty acid content (g/100 g DM) of 'Hass' avocados harvested at varying dry matter (DM) levels (Figure 3). The concentrations of palmitic acid (16:0), palmitoleic acid (16:1n7), oleic acid (18:1n9), and linoleic acid (18:2n6) were significantly higher at 27% DM compared to 24% DM, at 24% DM compared to 21% DM, and at 21% DM compared to 19% DM. The statistical results for these comparisons are in Appendix A.

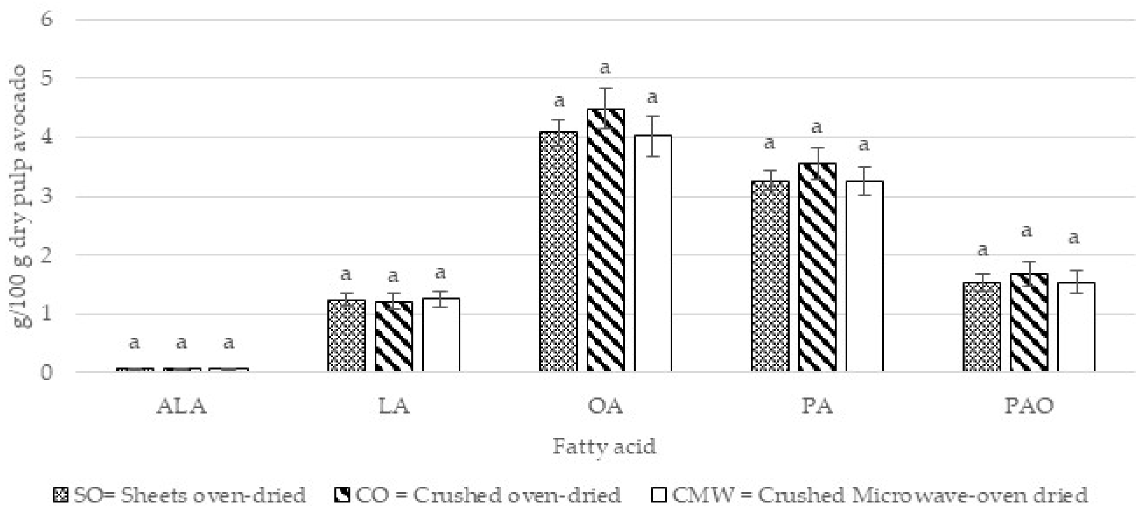


**Figure 2.** The fatty acid content (g/100 g) in avocado samples stabilized using three different drying methods. Bars represent mean values, and error bars indicate the standard error of the mean. Different letters denote statistically significant differences between samples ($p < 0.05$) according to Tukey's HSD test. ALA, α-linolenic acid; LA, linoleic acid; OA, oleic acid; PA, palmitic acid; POA, palmitoleic acid; and SA, stearic acid.

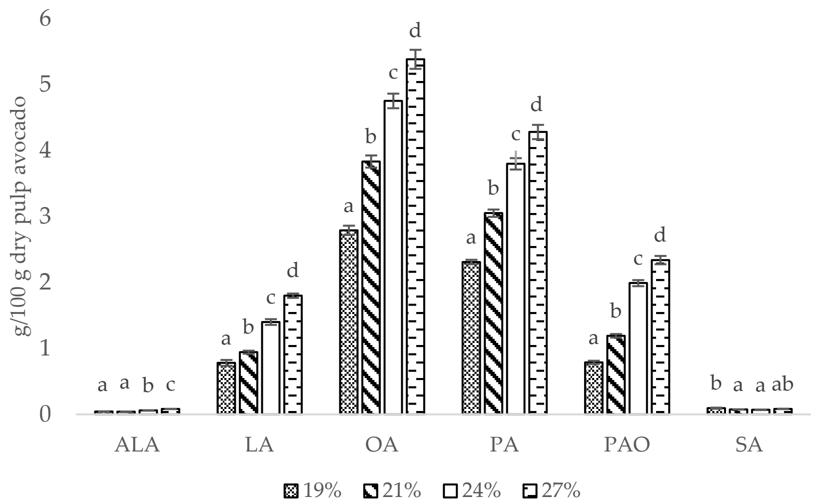


**Figure 3.** The fatty acid content (g/100 g) in 'Hass' avocados harvested at 19%, 21%, 24%, and 27% dry matter (%DM). Bars represent mean values, and error bars indicate the standard error of the mean. Different letters denote statistically significant differences between samples ($p < 0.05$) according to Tukey's HSD test. ALA, α-linolenic acid; LA, linoleic acid; OA, oleic acid; PA, palmitic acid; POA, palmitoleic acid; and SA, stearic acid.

Regarding minor fatty acids, stearic acid (18:0) levels were higher in the 19% DM samples than in those with 21% or 24% DM but were similar to those with 27% DM ($F = 4.62$; d.f. = 3; $p < 0.001$). The concentration of α-linolenic acid (18:3n3) was highest in the 27% DM samples, followed by 24%, both of which were significantly higher than in the 21% and 19% DM samples ($F = 74.68$; d.f. = 3; $p < 0.001$) (Figure 3). The n-6/n-3 ratio was higher in avocados with 21% and 24% DM compared to those with 27% DM, and all three were significantly higher than the 19% DM group ($F = 40.25$; d.f. = 3; $p < 0.001$).

### *3.3. Sensory Evaluation*

Table 1 presents the median scores obtained in the evaluation conducted by 50 panelists for four avocado samples with different dry matter contents: A = 19%, B = 21%, C = 24%, and D = 27%. As the data did not meet normality assumptions, a non-parametric method was applied. The statistical analysis of this initial acceptance/preference test revealed significant differences ($p \leq 0.05$) for all evaluated attributes, except odor. The lowest scores were assigned to fruits with 19% and 21% DM, particularly in the attributes of texture and flavor, with values ranging from 5 to 6, respectively.

**Table 1.** Sensory attributes by dry matter contents: median [IQR] with significance letters within the same row for a given attribute, from Dunn's test (Bonferroni) and Kruskal–Wallis *p*-values ($p < 0.05$).

| Dry Matter (%DM). | 19 | 21 | 24 | 27 | *p*-Value |
|---|---|---|---|---|---|
| Color | 6 (4–7)a | 6 (5–7) ab | 6 (6–8) bc | 7 (6–8) c | 0.001 |
| Odor | 5 (4–7)a | 6 (5–7) a | 6 (5–7) a | 6 (5–7) a | 0.819 |
| Texture | 5 (3–6)a | 5 (4–7) ab | 6 (5–7) b | 6 (5–8) b | 0.001 |
| Flavor | 5 (3–6)a | 6 (4–7) ab | 7 (6–8) b | 7 (5–8) b | 0.000 |

The radar chart (Figure 4) summarizes the results of the sensory characterization, providing an overall view of the attributes evaluated by the tasting panel. In general, approximately 60% of responses indicated that the odor intensity was low across all four avocado samples with different dry matter contents (19%, 21%, 24%, and 27% DM). Regarding color, the majority of panelists (31–51%) described the samples as pale yellow, particularly those with 21% DM. Avocados with 24% and 27% DM were most frequently described as having a creamy texture and a characteristic avocado flavor.

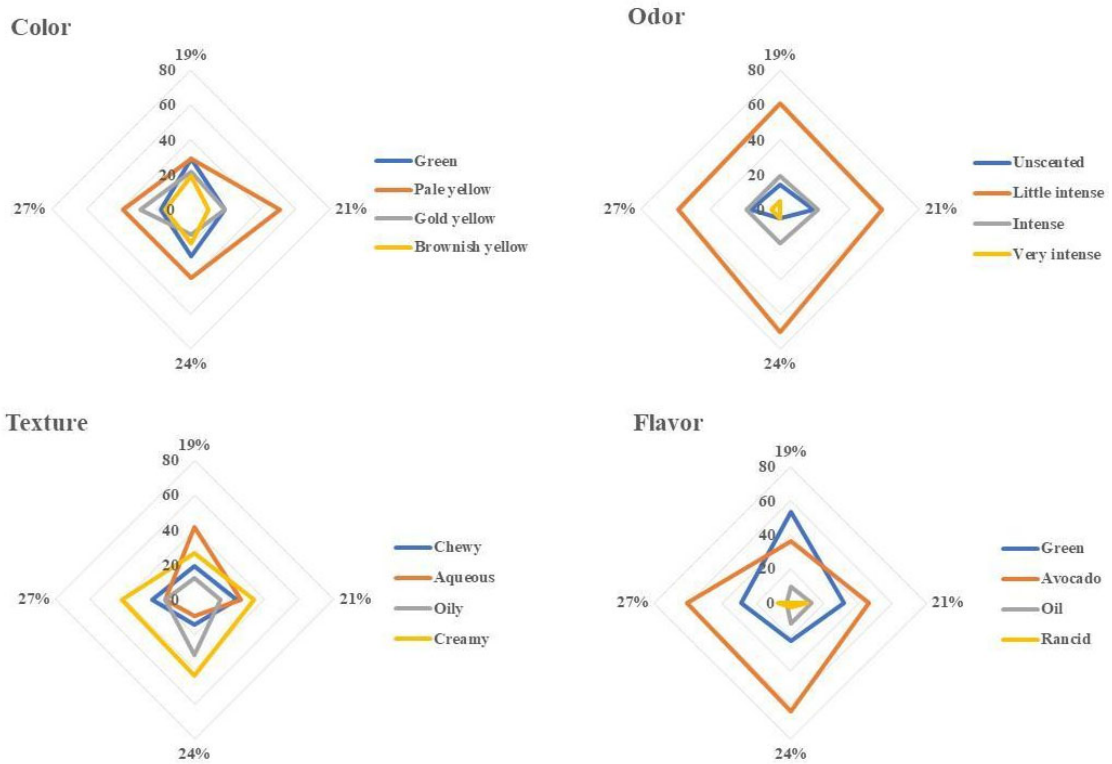


**Figure 4.** Percentage of panelists who selected each descriptive attribute for color, odor, texture, and flavor in four samples of 'Hass' avocado pulp with different dry matter contents (%DM).

In general, all panelists indicated that they would be willing to purchase the avocado samples. However, when asked to rank their preferences, 80% of the participants favored the fruits with 24% and 27% dry matter contents over those with a lower %DM.

### 3.4. Generalized Linear Model

A Generalized Linear Model (GLM) was applied to identify the variables influencing consumers' willingness to purchase avocados. Fifty panelists evaluated four samples with different dry matter contents (19%, 21%, 24%, and 27% DM). Given that the willingness to buy was a dichotomous variable, a binomial distribution with a logit link function was used. The best-fitting model, as indicated by the Bayesian Information Criterion (BIC = 156.52), identified the texture and flavor as the two variables significantly influencing purchase decisions ($p < 0.001$). No multicollinearity was detected, as the Variance Inflation Factor (VIF) was 1.06. The Hosmer–Lemeshow goodness-of-fit test indicated no significant lack of fit ($\chi^2 = 6.65$; d.f. = 8; $p = 0.57$), suggesting that the model's predicted values aligned well with the observed outcomes.

As expected, the regression coefficients were positively associated with the likelihood of purchase: the higher the evaluation of the texture and flavor by the panelists, the greater the probability of buying the avocado. The odds ratio for the texture was 1.596, and for flavor it was 1.862. This means that for each one-unit increase in the evaluation of the texture, the odds of purchasing the avocado increased by approximately 1.596 times compared to those who rated the texture one unit lower. Similarly, a one-unit increase in the flavor score resulted in approximately 1.862 times greater odds of purchase.

In relative terms, each one-point increase in the texture rating raised the likelihood of purchase by approximately 59.6%, while a one-point increase in flavor increased it by approximately 86.2%, after adjusting for other variables in the model.

## 4. Discussion

Water removal plays a critical role in postharvest preservation. Although traditional dehydration methods, such as freeze-drying or pulsed electric fields, are effective, their high cost limits their large-scale application [27]. In contrast, microwave (MW) drying offers a more accessible alternative, as it enables internal heating and efficient moisture removal. Given these advantages, assessing the impact of MW drying on the fatty acid profile of avocado pulp is particularly relevant for the food industry. Similar findings were recently reported by Marović et al. [28], who examined the effects of three drying methods—hot air drying (HAD), vacuum drying (VD), and hot-air microwave drying (HAMD)—on the fatty acid composition of the avocado peel, seed, and pulp. Among the methods tested, HAMD was the most efficient due to its shorter drying time.

The avocado pulp analyzed in this study exhibited a high content of monounsaturated fatty acids, which is consistent with reports from other regions where the same cultivar is grown. However, the fatty acid profile of 'Hass' avocados can vary significantly depending on growing conditions. Table 2 compares data from several Latin American countries [3,29–31] and Portugal (Madeira) [32], which, like the Canary Islands, belongs to the Macaronesia region. In all cases, oleic acid was the predominant fatty acid, followed by palmitic, palmitoleic, and α-linolenic acids. Notably, avocados from Portugal exhibited a higher linoleic acid content and a fatty acid profile more similar to that of Latin American avocados, despite their geographical proximity to the Canary Islands.

A recent study evaluated the fatty acid profile of 31 'Hass' avocado samples collected in Tenerife with a mean dry matter content of 26.8 ± 3.48%. Oleic acid was the principal fatty acid, followed by palmitic, palmitoleic, linoleic, and α-linolenic acids [33]. In general, Méndez-Hernández et al. [33] observed an increase in the oleic acid concentration with a higher %DM: from 50.9 ± 3.74% to 57.1 ± 4.10% in samples from the northern part of the island as the dry matter increased from 26.8 ± 3.48% to 31.4 ± 2.91%, respectively.

**Table 2.** Fatty acids profile (%) of 'Hass' avocados produced in different countries.

| Fatty Acids | Countries Producing Avocados | | | | |
|---|---|---|---|---|---|
| | Ecuador | Mexico | Colombia | Chile | Portugal |
| PA (16:0) | 18.45–20.04 | 12.08–17.01 | 17.34–26.13 | 13.2–14.1 | 8.52–9.09 |
| PAO (16:1) | 8.63–9.21 | 6.13–10.73 | 7.04–12.01 | 3.4–3.5 | |
| SA (18:0) | 0.49–0.56 | 0.24–0.40 | 0.60–0.87 | | |
| OA (18:1) | 50.20–51.24 | 70.13–78.31 | 44.88–64.16 | 66.4–67.6 | 42.05–43.47 |
| LA (18:2n6) | 11.83–12.45 | 2.22–3.53 | 9.18–14.37 | 14.7–14.9 | 41.76–61.93 |
| ALA (18:3n3) | 0.83–0.95 | 0.11–0.27 | 0.71–1.04 | 1.1 | |
| Other | 7.14–7.53 | 0.04–0.07 | 0.29–0.37 | | 7.10–10.23 |

ALA, Alpha-linoleic acid; LA, Linoleic acid; OA, Oleic acid; PA, Palmitic Acid; and PAO, Palmitoleic acid.

The comparative analysis of the fatty acid profiles of Canarian avocados and olive fruits (*Olea europaea*) reveals notable similarities, particularly in the predominance of monounsaturated fatty acids (MUFAs). Oleic acid (C18:1) is the most abundant fatty acid in both fruits [34–36], though typically present at higher concentrations in olive oil (≈55–77%) [34] compared to the Canarian avocado. However, varietal differences, environmental conditions, and agronomic practices—including the cultivar, soil composition, climate, and harvest timing—can significantly influence the fatty acid composition in both crops [35,37]. In the case of avocados, the dry matter content (%DM) at harvest is closely correlated with the lipid accumulation and modifications in the fatty acid profile [9,38], as demonstrated in the present study.

Conversely, the palmitic acid (C16:0) content is generally lower in olives (≈10–16%) than in avocados, reflecting species-specific differences in lipid metabolism and biosynthesis pathways [9]. As a saturated fatty acid, palmitic acid plays a complex role in human health, and its higher proportion in avocados may have distinct nutritional implications compared to olive oil [39]. Meanwhile, the relatively similar contents of linoleic (C18:2), stearic (C18:0), and $\alpha$-linolenic acids (C18:3) in both fruits further support their comparable nutritional value, especially considering the essential role of these polyunsaturated fatty acids (PUFAs) in human diets [40].

In 2004, Özdemir and Topuz [9] studied the evolution of the fatty acid composition of avocados during ripening, with samples analyzed at 21%, 24%, and 31% DM. Their results showed an increase in oleic acid with a higher DM content, reaching a peak of 59.5% $\pm$ 0.31 at 31% DM—comparable to the 39.53% $\pm$ 0.37 measured in 'Hass' avocados from the Canary Islands at 27% DM in the present study. Recently, Rodríguez et al. [30] developed multivariate models (principal component analysis and partial least squares discriminant analysis) to explore the relationships between the internal fruit quality, chemical composition, and sensory attributes in avocado. While the study did not use direct correlation coefficients or a regression analysis for individual variables, the multivariate grouping of samples revealed that those with higher concentrations of unsaturated fatty acids—particularly oleic, linoleic, $\alpha$-linolenic, and palmitoleic acids—were consistently associated with superior sensory profiles, including their creaminess, flux texture, and flavor notes of hazelnut and coconut. Rodríguez et al. [30] developed a multivariate model linking the internal fruit quality with the ripening patterns, chemical composition, and sensory attributes in avocados. Their findings showed that samples with higher concentrations of unsaturated fatty acids (oleic, linoleic, $\alpha$-linolenic, and palmitoleic acids) also exhibited superior sensory properties, such as creaminess, a fluid texture, and flavor notes reminiscent of hazelnut and coconut.

Similarly, in the present study, avocado samples with the highest content of unsaturated fatty acids—those with 24% and 27% DM—received the highest scores for texture and flavor (Table 1). In fact, 40% of the panelists described these samples as having a creamy texture, and 60% associated them with the characteristic 'avocado' flavor.

Although previous studies [13,41] have examined the relationship between sensory attributes and consumer preferences, they employed different methodological approaches. Martín-Obispo et al. [41] applied a continuous preference mapping strategy for an exploratory analysis, while Hausch et al. [13] used mixed-effects models to analyze consumer preference data. In contrast, the present study adopts an inferential and explanatory approach using a binomial decision model to assess how specific sensory attributes—particularly the texture and flavor—influence the likelihood of purchase. This constitutes a novel contribution by quantifying purchasing behavior rather than merely identifying preference trends.

The fatty acid profile of 'Hass' avocados cultivated in the Canary Islands exhibited a general increase in most fatty acids with higher dry matter contents, with the exception of stearic acid and α-linolenic acid. According to the European Food Safety Authority (EFSA) [42], adequate intake (AI) values for essential fatty acids are set at 4% of the total energy intake for linoleic acid and 0.5% for α-linolenic acid. Based on the U.S. Food and Drug Administration (FDA) [43] reference serving size of 30 g, the contribution of Canarian 'Hass' avocados to the AI of these essential fatty acids is modest but nutritionally relevant—providing up to 6.1% and 2.2% of the AI, respectively, at higher %DM levels. This aligns with Canarian consumer preferences observed in this study.

In addition, avocados are notably rich in oleic acid, the predominant fatty acid in the samples analyzed. Monounsaturated fatty acids accounted for more than 45% of total lipids and provided over 20% of the fruit's energy content, supporting the nutritional claim of being 'high in monounsaturated fat' at all stages of ripeness.

## 5. Conclusions

The fatty acid profile and content of avocados were found to be unaffected by the drying method employed. This study highlights the potential of microwave drying (CMW) as an efficient and sustainable method for dehydrating avocado pulp while preserving its fatty acid composition. These findings support the application of CMW in the food industry, particularly in avocado processing aligned with green economy principles.

Notably, the major fatty acids—oleic and palmitic acids—showed higher relative abundances at early stages of dry matter accumulation (19% and 21% DM), while the relative abundances of palmitoleic and linoleic acids were more pronounced at later stages (24% and 27% DM). Nonetheless, the absolute content of all fatty acids increased with ripening, which is consistent with the rise in the oil content. Oleic acid consistently emerged as the predominant fatty acid across all dry matter levels, followed by palmitic, palmitoleic, linoleic, stearic, and α-linolenic acids. Remarkably, the 'Hass' avocado cultivated in the Canary Islands contributes meaningfully to the adequate intake of essential fatty acids and is distinguished by its high monounsaturated fatty acid content, particularly oleic acid. These characteristics qualify it for the use of the nutritional claim 'high in monounsaturated fat' under current European Union regulations. To our knowledge, this is the first study to characterize these attributes in avocados grown in the Canary Islands.

Furthermore, the binomial decision model applied in this study revealed that the flavor (86.2%) and texture (59.6%) had a significant and positive influence on consumers' willingness to purchase, offering important insights into the sensory drivers of consumer preference. These findings contribute to a better understanding of the compositional quality and sensory acceptance of avocados and have potential applications in both nutritional labeling and product development.

Additionally, this study provides valuable insight into the distinctive qualities and added value of Canarian-grown avocados, which are now protected under a registered Protected Geographical Indication (PGI). To consolidate these findings, further research across different regions of the Canary Islands and over multiple harvest seasons is recommended. Future studies would also benefit from the inclusion of sensory evaluations conducted by trained expert panels, which could provide a more detailed characterization of the organoleptic quality and consumer acceptability.

**Author Contributions:** Conceptualization, E.D. and G.L.R.; methodology, E.D. and G.L.R.; software, validation and formal analysis, C.Á.-A. and E.D.; investigation, E.D. and J.I.A.-E.; resources, E.D. and G.L.R.; data curation, C.Á.-A.; writing—original draft preparation, E.D. and J.I.A.-E.; writing—review and editing, visualization and supervision, E.D., J.I.A.-E., and C.Á.-A.; project administration and funding acquisition E.D. and G.L.R. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by the 'CAIA 2024-002-04-04 Calidad del Aguacate Hass producido en Canarias' project. The fatty acid analysis was financially supported by national funds through FCT/MCTES (PIDDAC), CIMO, UIDB/00690/2020 (DOI: 10.54499/UIDB/00690/2020) and SusTEC, LA/P/0007/2020 (DOI: 10.54499/LA/P/0007/2020).

**Data Availability Statement:** The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding authors.

**Conflicts of Interest:** The authors declare no conflicts of interest.

## Abbreviations

The following abbreviations are used in this manuscript:

| | |
|---|---|
| PGI | Protected Geographical Indication |
| DM | Dry Matter |
| MW | Microwave |
| $P_f$ | Weight of fresh avocado |
| $P_d$ | Weight of dry avocado |
| SO | Sheets oven-dried |
| CO | Crushing oven-dried |
| CMW | Crushing microwave-oven-dried |
| GC-FID | Gas chromatography with flame ionization detection |
| FAME | Fatty acid methyl esters |
| SE | Standard error |
| ANOVA | Analysis of variance |
| HSD | Tukey's Honestly Significant Difference |
| GLM | Generalized Linear Model |
| OA | Oleic Acid |
| PA | Palmitic Acid |
| POA | Palmitoleic Acid |
| LA | Linoleic Acid |
| SA | Stearic Acid |
| ALA | $\alpha$-linolenic acid |
| BIC | Bayesian information criterion |
| GOF | Hosmer-Lemeshow Goodness of Fit |
| EFSA | European Food Safety Authority |
| AI | Adequate intake |
| EU | European Union |
| RI | Reference Intake |
| FDA | Food and Drug Administration |

## Appendix A

**Table A1.** The statistical results for comparisons related to the evolution of the fatty acid content expressed in g/100 g of 'Hass' avocados harvested with a varying dry matter (DM) levels (Figure 3).

| FATTY ACIDS | F | DF | *p*-Value |
|---|---|---|---|
| Palmitic acid (PA) | 127,771 | 3 | 0.000 |
| Palmitoleic acid (PAO) | 272,900 | 3 | 0.000 |
| Stearic acid (SA) | 4621 | 3 | 0.009 |
| Oleic acid (PAO) | 34,466 | 3 | 0.000 |
| Linoleic acid (LA) | 152,420 | 3 | 0.000 |
| Alph-linoleic acid (ALA) | 74,682 | 3 | 0.000 |

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