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Effects of Acidification and Blanching Pretreatments on Nutraceutical Properties, and Consumer Acceptability of Cherry Laurel (*Prunus laurocerasus* L.) Nectar-type Beverages

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HIGHLIGHTS

- Acidification to pH 3.0 doubled monomeric anthocyanin retention in cherry laurel nectar.
- Blanching at 90°C/2 min enhanced total phenolics and antioxidant capacity.
- Acidification was the dominant factor for anthocyanin stability and color preservation immediately after processing.
- Combined treatments produced the highest bioactive content and consumer acceptability.

Abstract

Cherry laurel (*Prunus laurocerasus* L.) is an underutilized regional fruit rich in anthocyanins and phenolic compounds native to the Eastern Black Sea of Turkey with potential for functional food development and regional gastronomy. This study investigated the effects of acidification (citric acid to pH 3.0) and blanching (90°C, 2 min) on anthocyanin retention, antioxidant properties, and consumer acceptability of cherry laurel nectar-type beverages. A 2×2 factorial design (acidification × blanching) yielded four products (P1–P4). Acidification was the dominant factor for anthocyanin retention ($P < 0.05$), approximately doubling monomeric anthocyanin content relative to the non-acidified samples. Both pretreatments improved anthocyanin retention, with acidification exerting a stronger effect on polymeric color reduction. Blanching significantly improved TPC and antioxidant capacity (CUPRAC and DPPH) by approximately 20% ($P < 0.05$). The acidified and blanched product (P4) received the highest mean sensory scores for appearance (5.43 ± 0.22), taste (4.78 ± 0.24), and overall acceptability (4.86 ± 0.21). In conclusion, acidification is critical for anthocyanin retention and color preservation during processing, while blanching effectively enhances antioxidant properties. The combination of both treatments produced a nectar-type beverage with the highest bioactive content and consumer acceptability, providing a scientific basis for optimizing cherry laurel beverage production.

Keywords: Cherry Laurel; Nectar Processing; Antioxidants; Consumer Liking

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1. Introduction

Regional potentials of agro-materials in food innovation are one of the key factors to improve gastronomic tourism. The attractiveness of the local food variety could be decisive for tourists to choose a destination, and beneficial economic impacts on local food producers and HORECA businesses are possible (Cavicchi and Stancova, 2016). Traditional fruit-based beverages already serve as cultural and touristic attractions in various regions, for example, Ottoman-style sherbets in Turkey demonstrate how region-specific beverages can be integrated into gastronomy tourism to create added socio-economic value (Alkan et al. 2024). Recently, food innovation practices mostly focused on functional, healthy products with highly palatable results. Various regions have their unique variety of raw plants that are rich in nutraceutical bioactive compounds. Therefore, the development of new functional foods from regionally unique raw plants offers opportunities to enhance gastronomic appeal.

Nowadays, beverages are expected to contain health-promoting bioactive compounds in addition to their taste perception (Corbo *et al.*, 2014). The color of juices is another quality characteristic of sensory perception. This perception is especially pronounced in juices made from red fruits. Phenolic compounds and anthocyanins found in red fruits are the main contributors to the antioxidant properties and health benefits of their juices, and they should be highly preserved during juice production (Vilela and Cosme, 2016). Anthocyanins are red to blue-purple colored phenolic pigments, and they are highly sensitive to many factors such as pH, enzymes, heat, and light. An acidic environment with a pH < 3 increases the stability of anthocyanins. Their colors are bright red due to flavylium cations formed in low pH conditions. Colorless structures of anthocyanins are predominant between pH 4 and 5 (Khoo *et al.*, 2017). Red fruit juices, such as sour cherry, pomegranate, strawberry, and cranberry, have naturally low pH values (Vilela and Cosme, 2016). Highly acidic conditions (pH < 4.5) can contribute to the microbiological stability of fruit juices by inhibiting the growth of many spoilage microorganisms. Combined with a moderate heat treatment such as pasteurization, acidified fruit juices can achieve extended shelf life (Petruzzi *et al.*, 2017). Moreover, the blanching process applied during juice production inactivates the browning enzymes (polyphenol oxidase and peroxidase) and glycosidases naturally found in fruits. Oxidation products of polyphenol oxidase accelerate the formation of brown products from anthocyanins based on a condensation reaction with quinones. Glycosidases are the most common enzymes for the effective degradation of anthocyanins (Weber and Larsen, 2017). The blanching process also has an increasing effect on anthocyanin retention from fruits' red skin. Jiang *et al.* (2020) reported that the blanching process increased the anthocyanin content of the blueberry pulp ~56 times. Blueberry skin cells were disrupted by the blanching process, and the anthocyanin pigments in the skin cells were easily transferred to the pulp. Therefore, the blanching step has a versatile function in fruit juice processing.

Cherry laurel berries (*Prunus laurocerasus* L.) are grown in the Black Sea region of Turkey. The berries have dark, red-pigmented skin and light, yellow-colored fruit flesh around a central stone. Locally, they are consumed fresh or processed into various products such as pickles, jam, and dried fruit. Existing literature on this fruit is largely confined to the compositional characterization of the raw berries (Kolaylı et al., 2003; Karahalil & Şahin, 2011; Bayrambaş et al., 2019; Başar et al., 2024; Kesen and Uzun Karka, 2025) and proccessing studies limited to their mollasses (Başar et al., 2024) and juice drying (Güldane and Bozkır, 2024). However, these berries also have potential for a gastronomy-oriented boutique beverage. In the present study, acidification and blanching were selected as accessible, cost-effective pretreatments suited for small-scale and artisanal production. We hypothesized that acidification to pH 3.0 and blanching at 90°C would each independently improve anthocyanin retention and antioxidant properties of cherry laurel juice relative to untreated controls and that their combination would yield a nectar-type beverage with both the highest bioactive content and the best consumer acceptability. Accordingly, the major purpose of this study was optimization of nectar production from cherry laurel berries to (a) monitor the highest level of bioactive recovery, especially anthocyanins, from fruits by applying combined effects of acidification and blanching processes and (b) demonstrate consumer acceptability of end products. To our knowledge, this is the first study to systematically evaluate the individual and combined effects of pretreatments on anthocyanin

retention, antioxidant capacity, and consumer acceptability of cherry laurel nectar, thereby providing concrete processing guidance for the valorization of this underutilized regional fruit.

2. Materials and Methods

2.1. Material and Chemicals

Fully ripened cherry laurel berries were harvested from the Dereli village of Giresun, Turkey. Fruits were manually extracted from their branches, washed, and stored at -20°C. Folin–Ciocalteu's phenol reagent, gallic acid, trifluoroacetic acid (for HPLC, ≥99.9%), neocuproine, 2,2-Diphenyl-1-picryl-hydrazyl (DPPH), Trolox, cyanidin-3*O*-glucoside (cyn-3-glu), and cyanidin-3*O*-rutinoside (cyn-3-rut) were provided by Sigma-Aldrich (Germany).

2.2. Nectar Production

The flesh of the cherry laurel berry samples was very firm, and extraction of their juice was not as easy as with sour cherries. Additionally, the juice gelled quickly after extraction. This is thought to be due to their pectin content. However, the pectin content of cherry laurel berries was reported as 3.2% by Kolaylı *et al.* (2003), which is a high level when compared to sour cherry pectin content, reported as 0.39% (mean of 33 cultivars) by Wojdyło *et al.* (2014). Due to the high pectin content of these fruits, two sets of the pectinase concentrations (200 and 2500 ppm) were found to be effective in increasing the extractability of juice, based on pre-research data (unpublished). After the enzyme treatment, two types of juices were obtained: (1) natural cloudy juice formed with the 200 ppm enzyme treatment and (2) clear juice formed with the 2500 ppm enzyme treatment. Pectic compounds were highly interesting health-related bioactives due to their nutraceutical potentials, such as dietary fiber, cholesterol-lowering effect, and cancer prevention (Naqash *et al.*, 2017). Their availability has the potential to increase the functionality of cherry laurel juice. Therefore, natural cloudy nectar production was preferred primarily in this study.

The production flow roughly includes the pre-treatments applied to the fruit (seed removal and preparation of fruit paste with water at a ratio of 1:1 (w/w)), acidification, enzyme treatment, blanching, filtration, setting SS (soluble solids) content, and pasteurization. The acidification step was added to the process before the enzyme application to see the effects of acidification on the end product. The final SS (soluble solid) value of the product after the centrifugation step was adjusted to 12.5°Bx using standard table sugar (sucrose) to standardize and sweeten the water-soluble dry matter of the product. Pasteurization was applied at 90°C for two minutes to ensure enzymatic and microbial stabilization as the last step of the process. Four end products (P1-4) were obtained depending on the presence of acidification and blanching processes: P1 (NA&NB), not acidified (NA) and not blanched (NB) product; P2 (NA&B), only blanched product; P3 (A&NB), only acidified product; and P4 (A&B), acidified and blanched product. Nectar productions were made as a triple, and the samples were taken at two different stages: after filtration and after pasteurization, respectively. Monomeric anthocyanin, polymeric color, anthocyanin profile, antioxidant capacity (TPC, CUPRAC, DPPH), and SS (°Bx) analyses were carried out using the samples. A consumer test was applied to the end products using a 7-point hedonic scale.

2.3. Analysis

Soluble solids and pH: Atago PAL1 (Pocket Refractometer, Japan) digital refractometer and pH-meter (SevenCompact S210, Mettler Toledo, Inc., US) were used for the determination of soluble solids (^{o}bx) and pH of samples, respectively.

Total phenolics: The Folin-Ciocalteu method was followed (Singleton and Rossi, 1965). The results were expressed as mg gallic acid (GA) per L of the sample.

Total monomeric anthocyanin and polymeric color: The pH-differential method with buffers at pH 1.0 and 4.5 was followed. The total monomeric anthocyanin content of samples was expressed as mg cyn-3-glu L^{-1} (Giusti and Wrolstad, 2001). Color density, polymerized color, percent polymeric color values of the samples and

degradation index of anthocyanins were investigated using the method suggested by Giusti and Wrolstad (2001).

Anthocyanin profile: Samples were diluted (1:5, v: v) with 1% trifluoroacetic acid (TFA) and were filtered through a 0.45 μm PTFE syringe filter. 20 μL of the diluted samples were injected into the HPLC system coupled with a DAD detector and a Phenomenex Gemini C18 (250 mm, 4.6 ID, 5μ) column (Shimadzu, Japan). The mobile phases were 0.1% TFA in water (A) and 0.1% TFA in acetonitrile (B). The HPLC gradient has 1mL min^{-1} flow rate, which started with 95% (A) to reach 82% (A) in 45 min, decreased to 20% (A) in 2 min and then reached 95% (A) in 8 min (Kamiloglu *et al.*, 2013). Pure standards (cyn-3-glu and cyn-3-rut) were used for the identification of anthocyanin peaks in the sample chromatograms by comparing their retention times and spectrum similarities. The external standard method was used for the quantification of anthocyanin peaks in the sample. The results were expressed as mg cyn-3-glu L^{-1} sample.

DPPH antioxidant assay: The method based on spectrophotometrically measuring the decrease in color at 517 nm as a result of the inhibition of antioxidant compounds by DPPH radical was used (Benvenuti *et al.*, 2004). Results were given as EC_{50} value that the sample concentration (μL) causing 50% inhibition of the radical. Smaller EC_{50} values obtained from this analysis indicate that the antioxidant power is high.

Cupric-reducing antioxidant capacity (CUPRAC): CUPRAC values of the samples were determined by utilizing the ability of the Cu (II) -neocuproine complex to be reduced by the antioxidant compounds in the sample to Cu (I) -neocuproine chelate, which gives maximum absorbance at 450 nm (Apak *et al.*, 2004). Calculations were made using the standard calibration curve to be prepared with Trolox (Merck, Germany) and were expressed as mg Trolox L^{-1} sample.

Consumer Test: The sensory acceptability of nectar samples in terms of aroma, flavor, color, and general attributes was investigated using a 7-point hedonic scale. Participants were untrained consumers (n=66, 50 women and 16 men) aged 18-40, recruited on a voluntary basis among university staff and students who regularly consume fruit juices/nectars. The four samples (P1-4), each coded with a random three-digit number were served at room temperature in randomized order, with water provided for palate cleansing between samples (Meilgaard *et al*., 1999). This study was conducted prior to the period when ethics committee approval was institutionally required for minimal-risk food sensory consumer tests and carried out in full accordance with the Declaration of Helsinki. All participants were fully informed about the purpose of the study and provided written consent before participation. No personal identifying information was collected, ensuring confidentiality.

Statistical Test: The experiment followed a 2 × 2× 2 full factorial design with three independent categorical factors: (1) Acidification with two levels (acidified to pH 3.0 and not acidified), (2) Blanching with two levels (blanched at 90 °C for 2 min and not blanched), and (3) Processing stage with two levels (after filtration and after pasteurization). The data from three replicates (production runs) were analyzed using the variance analysis technique by following the MIXED procedure in SAS V8.2 (Statistical Analysis Systems Institute Inc., Cary, NC, USA). The statistical model included acidification, blanching, processing stage and their two-way and three-way interactions as fixed effects, with production run included as a random effect. Pairwise comparisons among the means were performed using Fisher's least significant difference (LSD) test at a significant level of $P < 0.05$. Results are reported as mean ± standard error (SE).

3. Results

3.1. Effects of Juicing Process on Recovery of Colored Pigments in Cherry Laurel Berries

The skin color of the cherry laurel berry was one of the most interesting characteristics due to its richness in anthocyanins. Anthocyanins were selected as the target bioactive component for ensuring the highest level of their transmission to nectar and the desired appearance of end products. The effects of the production steps on the recovery of anthocyanins and anthocyanin degradation were given in Table 1-2.

Table 1. Effects of process conditions on monomeric anthocyanins and degradation index of nectars. (A: Acidified; NA: Not acidified; B: Blanched; NB: Not blanched). Column values with different superscripts (a, b; x, y, and A, B) differ (P< 0.05).

Process	Products	Total Monomeric Anthocyanins (mg cyn-3-glu L^{-1})	Color Density	Polymerized Color	% Polymeric Color
After Filtering	P1 (NA&NB)	60,17^{a}	2,40^{b}	0,93^{ab}	38,63^{ab}
	P2 (NA&B)	124,68^{b}	2,47^{b}	0,95^{ab}	38,35^{ab}
	P3 (A&NB)	128,8^{b}	4,48^{a}	0,66^{a}	15,56^{a}
	P4 (A&B)	127,29^{b}	4,28^{a}	0,89^{ab}	22,86^{ac}
After Pasteurization	P1 (NA&NB)	55,67^{a}	2,51^{b}	1,18^{b}	46,86^{bc}
	P2 (NA&B)	116,84^{b}	2,36^{b}	1,19^{b}	53,11^{b}
	P3 (A&NB)	111,16^{b}	4,09^{ab}	0,75^{ab}	19,36^{a}
	P4 (A&B)	110,08^{b}	4,46^{a}	0,95^{ab}	21,93^{ac}
±SE		17,06	0,61	0,15	8,38
Pre-treatments					
A		119,47^{x}	4,32^{x}	0,81^{x}	19,93^{x}
NA		89,34^{y}	2,43^{y}	1,06^{y}	44,23^{y}
B		119,72^{A}	3,39	0,995	34,06
NB		89,08^{B}	3,37	0,88	30,10
± SE		8,53	0,30	0,08	4,18

In Table 1, changes in total monomeric anthocyanin content and anthocyanin degradation index (color density, polymerized color, and percent polymeric color) of the nectars made by four different methods before and after the pasteurization process were provided. Nectar products without acidification and blanching (P1) have the lowest monomeric anthocyanin contents both before and after pasteurization (P<0.05). In addition, the product acidified to pH 3 and unblanched (P3) recovered approximately twice the monomeric anthocyanin compared to the P1 (NA&NB) sample before and after pasteurization (P<0.05). When the P2 (NA&B) and P4 (A&B) were compared with the P3 (A&NB) in terms of anthocyanin recovery, individually, the differences were not large enough to be significant (P>0.05). From these findings, it can be concluded that the acidification and blanching processes were equally effective factors in the recovery of anthocyanins during the production of cherry laurel nectar. The amount of polymeric color was observed to be less in acidified samples (P<0.05). Moreover, the acidification process increased the color density of the products (P<0.05). The effects of the acidification process on anthocyanin stability were shown by various studies in literature. Howard *et al.* (2015) reported that anthocyanin content of blueberry juices adjusted to pH 2.1 increased the stabilization, and polymeric color values were lower compared to the juices adjusted to pH 2.5 and the control (pH 2.9) group. Giusti and Wrolstad (2001) wrote that if the polymeric color ratio is 30% or more in processed and stored fruit and vegetable juices, it is an indication that the degradation of anthocyanins increases, and the natural color begins to disappear by increasing the brown pigments in the product. The positive effect of the acidification process on the polymeric color ratio of the products (<30%), independent of the blanching process, is seen in Table 1.

The individual effects of acidification and blanching processes on monomeric anthocyanins and polymeric color of nectars are also provided in Table 1. The monomeric anthocyanin and color density values of all acidified products were significantly higher than the non-acidified samples (P<0.05). Inversely, the polymeric color and polymeric color ratio values of the acidified samples were lower than the non-acidified samples (P<0.05). On the other hand, only the monomeric anthocyanin content of blanched products was significantly higher than the non-blanched products (P<0.05). It is clear that the acidification process helps the stability of the anthocyanins and causes the polymeric color ratio to be lower, which is an indicator of freshness.

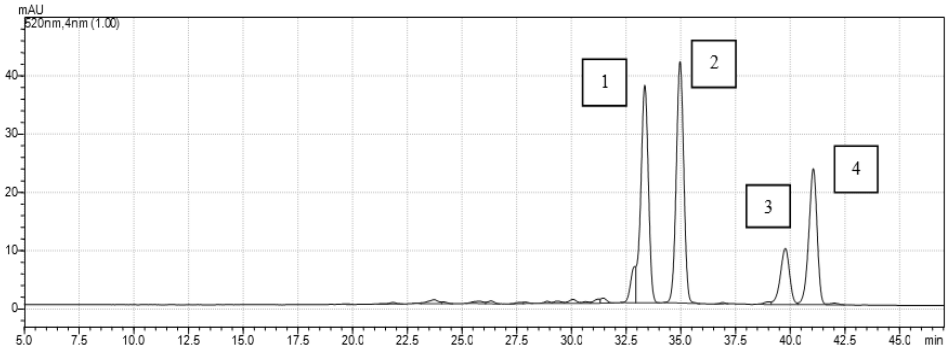

Figure 1. HPLC chromatogram of cherry laurel nectar of P2 at 520 nm: (1) Cyn 3-glu; (2) Cyn 3-rut; (3) and (4) not identified (ni) peaks

Two different anthocyanins were identified in the HPLC chromatograms of the Cherry Laurel nectars as cyanidin 3-glycoside (cyn 3-glu) and cyanidin 3-rutinoside (cyn 3-rut) (Figure 1). Anthocyanins for the other two peaks (peaks 3 and 4) were not identified. Among them, the predominant anthocyanins were cyn 3-rut and cyn 3-glu, respectively. Similar findings were reported by Çapanoğlu *et al.* (2011) as cyn 3-glu and cyn 3-rut were found in extracts of cherry laurel fruit.

Table 2. Effects of process conditions on individual anthocyanins expressed as mg cyn 3-glu L^{-1} of nectars. (A: Acidified; NA: Not acidified; B: Blanched; NB: Not blanched). Column values with different superscripts (a, b) differ (P< 0.05).

Process	Products	Cyn 3-glu	Cyn 3-rut	ni	ni	Total
After Filtering	P1 (NA&NB)	16,74^{b}	17,70^{b}	6,49^{b}	13,49^{b}	54,43^{b}
	P2 (NA&B)	40,42^{a}	41,09^{ab}	11,83^{a}	24,34^{ab}	117,67^{a}
	P3 (A&NB)	43,46^{a}	43,28^{a}	11,93^{a}	25,32^{a}	123,99^{a}
	P4 (A&B)	41,90^{a}	42,10^{ab}	11,29^{a}	23,99^{ab}	119,29^{a}
After Pasteurization	P1 (NA&NB)	14,44^{b}	17,18^{b}	6,57^{b}	14,64^{ab}	52,83^{b}
	P2 (NA&B)	36,12^{ab}	37,43^{ab}	10,62^{ab}	22,22^{ab}	106,37^{ab}
	P3 (A&NB)	37,18^{ab}	38,87^{ab}	10,18^{ab}	22,59^{ab}	108,82^{ab}
	P4 (A&B)	35,03^{ab}	36,83^{ab}	9,38^{ab}	20,73^{ab}	101,97^{ab}
± SE		7,12	7,39	1,36	3,27	19,00

The effects of four different production methods on the anthocyanin profile of the final products (P1-4) before and after pasteurization were provided in Table 2. In parallel with the total monomeric anthocyanin results, P1 (NA&NB) had lower values in terms of anthocyanin profile (P>0.05). In addition to the positive effects of acidification and blanching processes on anthocyanin recovery, it was determined that the pasteurization process (90°C, 2 min) did not have a significantly destructive effect on the content of individual anthocyanins (P>0.05). However, the stability of the anthocyanin profile is affected by heating conditions (temperature, time, and pH) during processing (Patras *et al.*, 2010). For example, the thermal stability of black rice anthocyanins (cyn 3-glu, cyn 3-rut, peonidin 3-glu, and cyn 3,5-diglu) in different pH (1-6) conditions decreased with higher temperature and higher pH values. Cyn 3-glu and cyn 3-rut in black rice extracts were reported to be more stable than the others at 80-90°C (Hou *et al.*, 2011). Also, different sugar types attached to the anthocyanin structure were reported to be affected differently during heating. For example, glucoside forms were more durable than galactosides (White *et al.*, 2011).

3.2. Effects of Juicing Process on Antioxidant Properties of Cherry Laurel Nectars

The effects of four different production methods on the antioxidant properties of the nectars (P1-4) before and after pasteurization can be seen in Table 3. Antioxidant properties of the nectars in terms of TPC, CUPRAC, and DPPH were positively affected by the blanching process (P<0.05). There is a high correlation between phenolic bioactives and the antioxidant capacity of fruits (Gramza-Michałowska *et al.*, 2019). Cherry laurel fruit is an important source of phenolic compounds. Total phenolic contents of fresh cherry laurel fruits were reported to range between 1697.2 and 2210.3 mg kg^{-1} fw^{-} (fresh weight) based on different harvesting times. Phenolic contents significantly increased with fruit maturity (Altuntas *et al.*, 2018). Alaşalvar *et al.* (2005)

reported chlorogenic acid as the major phenolic acid of cherry laurel fruit, followed by *p*-hydroxybenzoic acid, vanillic acid, protocatechuic acid, and *p*-coumaric acid, respectively (Karahalil and Şahin, 2011). Moreover, tannins (catechin, catechin gallate, gallocatechin gallate, epicatechin, epigallocatechin, epigallocatechin gallate) and procyanidin B2 are notably found in methanolic extracts of cherry laurel fruit (Bayrambas *et al.*, 2019).

Application of the blanching process at 90°C for 2 min significantly increased the transition of phenolics as antioxidants from fruit to their juice ($P<0.05$). There are two major benefits of the blanching process, which are inactivation of browning enzymes (polyphenol oxidase and peroxidase) and an increase in the extraction yield of phenolics from the fruit tissues. Adetoro *et al.* (2021) reported that polyphenol oxidase and peroxidase activities of pomegranate arils blanched at 90°C for 30 sec reduced 76% and 88%, respectively, when compared with unblanched arils. Similarly, extraction yields of phenolic compounds from sour cherry (Jia *et al.*, 2012), blueberry (Zang et al., 2019), and kencur (*Kaempferia galanga* L.) rhizome (Kiptiyah *et al.*, 2021) were notably improved by the blanching process. CUPRAC and EC_{50} values of juices as indicators of antioxidant properties were also enhanced by the blanching process in accordance with phenolics in juices ($P<0.05$). CUPRAC, DPPH, and TPC methods are classified as electron transfer (ET)-based assays. CUPRAC shows chromogenic redox reactions with hydrophilic and lipophilic antioxidants without affecting sugars and citric acid found in the foods, while DPPH radicals are mostly scavenged by lipophilic antioxidants. Epicatechin gallate, epigallocatechin gallate, epigallocatechin, catechin, epicatechin, and chlorogenic acid, as well as signature phenolics of cherry laurel fruit, were reported to have the highest antioxidant capacities with the CUPRAC assay (Apak *et al.*, 2007). CUPRAC results also show highly positive correlations with TPC values (Can *et al.*, 2018). The same trend can be viewed from Table 4. Kolaylı *et al.* (2003) reported the DPPH value (EC_{50}) of cherry laurel fruit to be 28.6±2.9 µg as an indicator of the concentration inhibiting 50% of the DPPH radical, which is consistent with the results of this study. Moreover, Kamble *et al.* (2021) revealed that the blanching effect enhanced the antioxidant activity of sugarcane juice in terms of the DPPH method when compared with extracted juice from unblanched cane stalk. On the contrary, the effects of the acidification process on antioxidant properties of nectars were too small to be significant ($P>0.05$), and their preservative effect on anthocyanins is shown in Table 1. Pasteurization did not have significant negative effects on the antioxidant properties of the Cherry laurel nectars (Table 3). Similar results were reported by Tomas *et al*. (2015) the final pasteurization step did not change the antioxidant capacity of black mulberry juice in terms of TPC, CUPRAC, and ABTS (2,2-azinobis 3-ethylbenzothiazoline-6-sulfonic acid diammonium salt) assays when compared with initial pressed juice during black mulberry juice processing ($P>0.05$).

Table 3. Effects of process conditions on antioxidant properties of nectars (A: Acidified; NA: Not acidified; B: Blanched; NB: Not blanched). Column values with different superscripts (a, b and A, B) differ ($P< 0.05$).

Process	Products	Total Phenolics (mg GA L^{-1})	CUPRAC (mg Trolox L^{-1})	DPPH (EC_{50}, µL)
After Filtering	P1 (NA&NB)	1144,78^{ac}	1555,22	21,67^{ab}
	P2 (NA&B)	1370,42^{b}	1941,21	18,37^{bc}
	P3 (A&NB)	1203,15^{ab}	1711,56	23,51^{ac}
	P4 (A&B)	1385,27^{b}	2014,39	19,38^{ab}
After Pasteurization	P1 (NA&NB)	1179,99^{ab}	1667,67	22,17^{ab}
	P2 (NA&B)	1371,77^{b}	1925,94	16,91^{b}
	P3 (A&NB)	1039,13^{a}	1622,44	25,12^{a}
	P4 (A&B)	1333,61^{bc}	1958,08	17,13^{b}
±SE		76,85	185,92	1,85
Pre-treatments				
A		1240,29	1826,62	21,28
NA		1266,74	1772,51	19,78
B		1365,26^{A}	1959,91^{A}	17,95^{A}
NB		1141,76^{B}	1639,22^{B}	23,12^{B}
±SE		38,42	92,96	0,93

3.3. Sensory Acceptability of Cherry Laurel Nectars

Innovative food products are highly profitable if they are developed with a consumer-oriented mindset. A consumer test is vital to the assessment of the product to see whether the product is acceptable to consumers (Grahl *et al.*, 2018). The sensory scores given by the panelists using 7-point hedonic scale were presented in Table 4. The product that received the highest scores in terms of appearance (color) was P4 (A&B) ($P<0.05$). The juice color of a red fruit is a fundamental sensory attribute, and it is a valued trait for practically all consumers. Moreover, the color of a beverage has a great influence on the purchasing behavior of consumers (Vilela and Cosme, 2016). P4 was the most preferred nectar and 44% of the panelists ranked it as their first choice. When the nectar products (P1, 2, 3, and 4) were evaluated in terms of appearance, taste and general acceptability, P4 was the leading beverage (Table 4). These findings also support that the acidification process enhanced consumers' taste perception of juice from cherry laurel berries. Organic acids extend the sourness sensation of juices that could strengthen the taste perceptions of other flavor compounds, mask undesirable aftertastes, or be effective on the sweetness balance of juices (Dziezak, 2016). Halagarda and Suwala (2018) studied the effects of individual quality parameters on the sensory assessment of 14 different apple juices with the participation of 130 evaluators and reported that the most preferred apple juice had a balanced sweet and sour taste. Moreover, Franklin *et al.* (2015) reported the impact of calcium addition to juices on oral pH and taste perception of 100 healthy children ranging from 10 to 14 years old to protect against dental problems based on high-sugar and high-acid beverages. Calcium ion fortification of juices increased the pH of normal juice to 4.03 from 3.4. Interestingly, calcium addition had a slight lowering effect on the oral pH, but the perceived taste was adversely affected compared to normal juice ($P<0.05$).

Table 4. Sensory scores of nectar products (A: Acidified; NA: Not acidified; B: Blanched; NB: Not blanched). Column values shown in different superscripts (a, b) differ from each other ($P<0.05$)

Product	Appearance	Taste	General Acceptability
P1 (NA&NB)	4,24±0,22[a*]	4,31±0,24	4,42±0,21
P2 (NA&B)	4,65±0,22[a]	4,47±0,24	4,55±0,21
P3 (A&NB)	4,69±0,22[a]	4,57±0,24	4,49±0,21
P4 (A&B)	5,43±0,22[b]	4,78±0,24	4,86±0,21

* Results are given as mean ± standard error.

4. Conclusions

In this study, cherry laurel fruits unique to the Eastern Black Sea region in Turkey were used to produce nectar-type beverages, demonstrating that acidification and blanching can improve the bioactive content and sensory quality of this underutilized fruit. The acidification pre-treatment alone approximately doubled monomeric anthocyanin and reduced polymeric color, while the blanching improved antioxidant properties. The combination of both pre-treatments (P4) yielded the highest bioactive content and received the highest consumer acceptability scores for appearance, taste, and overall acceptability. From a practical perspective, both acidification (citric acid addition to pH 3.0) and blanching (90 °C, 2 min) pre-treatments are low-cost unit operations and readily transferable to small- and medium-scale producers as well as artisanal production settings. These findings support the potential of cherry laurel nectar as a regionally distinctive beverage for gastronomy tourism and local markets. However, the anthocyanin and color stability during storage were not evaluated in this study. Future research should include shelf-life stability and techno-economic assessments to evaluate the complete scalability and commercial feasibility. Further investigation in this subject is warranted.

Conflicts of Interest: The authors declare no conflict of interest.

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