Data Article

Data on green Spanish-style Manzanilla table olives fermented in salt mixtures

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A B S T R A C T

This article contains processed data related to the research published in “Fermentation in nutrient salt mixtures affects green Spanish-style Manzanilla table olives” [1]. It displays information on the salt substitution by other nutrient salts (potassium chloride and calcium chloride) during fermentation of green Spanish-style Manzanilla table olives to produce healthier products. Particularly, it studies the relationship between the different colour parameters ($L^*$, $a^*$, $b^*$ and $C_i$), firmness, and sensory attributes (saltiness, bitterness, hardness, and fibrousness), and the composition of the initial brine in NaCl, KCl, and CaCl$_2$. The composition of the brines affected the characteristics of the product. In general, the higher was the proportion of CaCl$_2$ in the initial brines the better was the colour. Also, the presence of this salt mitigated the saltiness perception but increment those of bitterness, hardness, fibrousness, and crunchiness. Besides, most of the sensory attribute scores could successfully be predicted as a function of the Na, K, and Ca concentrations in the fermented olive flesh. The work allows the production of table olives with specific characteristics and pre-determined mineral nutrient composition.

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The information provided present the equations that relate the concentrations of the various salts in the brines prepared with salt mixtures with the most important characteristics of the fermented table olives like colour, firmness sensory attributes, and concentration of the mineral contents in the flesh (Table 1). Also, the relationships of the mineral content in the flesh with the observed sensory scores are presented (Table 1). On the other hand, the graphical presentations (including contour lines) of some of these equations visualize the values of colour, firmness, and sensory values (scores) that could be obtained for the diverse combinations of salt mixtures (Figs. 1, 2 and 3). Finally, the prediction goodness of saltiness, bitterness, and harness is also graphically shown (Fig. 4).

2. Experimental design, materials and methods

The experimental design consisted of 15 independent runs from an enlarged simplex centroid mixture design with three replicates [2]. The measures of colour were obtained using a BYK-Gardner Model 9000 Colour-view spectrophotometer (Columbia, USA). Firmness, using a Kramer Shear compression cell coupled to an Instron Universal Testing Machine (Canton, MA, USA). Mineral concentrations by AA, using a GBC model 932 AA (Victoria, Australia), equipped with three hollow multi-element cathode lamps (Cu and Mn; Ca, Mg, and Zn; or Na and K). Sensory analysis by evaluating the sample by a trained panel.

1. Data

The information provided present the equations that relate the concentrations of the various salts in the brines prepared with salt mixtures with the most important characteristics of the fermented table olives like colour, firmness sensory attributes, and concentration of the mineral contents in the flesh (Table 1). Also, the relationships of the mineral content in the flesh with the observed sensory scores are presented (Table 1). On the other hand, the graphical presentations (including contour lines) of some of these equations visualize the values of colour, firmness, and sensory values (scores) that could be obtained for the diverse combinations of salt mixtures (Figs. 1, 2 and 3). Finally, the prediction goodness of saltiness, bitterness, and harness is also graphically shown (Fig. 4).
Table 1
Fermentation of green Spanish-style Manzanilla table olives in nutrient salt mixtures (NaCl, KCl and CaCl₂). List of equations relating salt concentration on the salt mixtures (brines) with the characteristics of the fermented product.

**Colour**

\[ C_i = +0.266 \cdot [\text{NaCl}] + 0.273 \cdot [\text{KCl}] + 0.360 \cdot \text{CaCl}_2 \]  (1)

\[ L^* = +0.522 \cdot [\text{NaCl}] + 0.543 \cdot [\text{KCl}] + 0.435 \cdot [\text{CaCl}_2] + 0.004 \cdot [\text{NaCl}] \cdot [\text{CaCl}_2] \]  (2)

\[ b^* = +3.784 \cdot [\text{NaCl}] + 4.211 \cdot [\text{KCl}] + 4.582 \cdot [\text{CaCl}_2] \]  (3)

**Firmness**

\[ \text{Firmness (kN/kg pitted olives)} = +0.21 \cdot [\text{NaCl}] + 0.17 \cdot [\text{KCl}] + 0.29 \cdot [\text{CaCl}_2] \\
-0.003 \cdot [\text{NaCl}] \cdot [\text{KCl}] + 0.002 \cdot [\text{NaCl}] \cdot [\text{CaCl}_2] - 0.026 \cdot [\text{KCl}] \cdot [\text{CaCl}_2] \\
+0.0079 \cdot [\text{NaCl}] \cdot [\text{KCl}] \cdot [\text{CaCl}_2] \]  (4)

**Nutrient mineral in flesh (added in the fermentation brine)**

\[ \text{Na (mg/kg flesh)} = 176.741 \cdot [\text{NaCl}] + 7.458 \cdot [\text{KCl}] - 6.009 \cdot [\text{CaCl}_2] \]  (5)

\[ \text{K (mg/kg flesh)} = 7.526 \cdot [\text{NaCl}] + 358.888 \cdot [\text{KCl}] + 4.084 \cdot [\text{CaCl}_2] \\
-1.807 \cdot [\text{NaCl}] \cdot [\text{KCl}] + 0.124 \cdot [\text{NaCl}] \cdot [\text{CaCl}_2] - 1.973 \cdot [\text{KCl}] \cdot [\text{CaCl}_2] \]  (6)

*Note:* The equation for Ca was significant but had a significant lack of fit also.

**Other mineral nutrients (originally found in flesh)**

\[ \text{Zn content in flesh (mg/kg)} = +0.030 \cdot [\text{NaCl}] + 0.027 \cdot [\text{KCl}] + 0.038 \cdot [\text{CaCl}_2] \\
+0.004 \cdot [\text{NaCl}] \cdot [\text{KCl}] - 0.0073 \cdot [\text{NaCl}] \cdot [\text{CaCl}_2] - 0.029 \cdot [\text{KCl}] \cdot [\text{CaCl}_2] \\
+0.001 \cdot [\text{NaCl}] \cdot [\text{KCl}] \cdot [\text{CaCl}_2] \]  (7)

**Sensory characteristics**

\[ \text{Saltiness} = +0.006 \cdot [\text{NaCl}] + 0.007 \cdot [\text{KCl}] - 0.025 \cdot [\text{CaCl}_2] \]  (9)

\[ \text{Bitterness} = -0.0151 \cdot [\text{NaCl}] - 0.0101 \cdot [\text{KCl}] + 0.0529 \cdot [\text{CaCl}_2] \]  (10)

\[ \text{Hardness} = -0.0038 \cdot [\text{NaCl}] - 0.0225 \cdot [\text{KCl}] + 0.0333 \cdot [\text{CaCl}_2] \]  (11)

\[ \text{Fibrousness} = -0.0007 \cdot [\text{NaCl}] - 0.0220 \cdot [\text{KCl}] + 0.0195 \cdot [\text{CaCl}_2] \]  (12)

\[ \text{Crunchiness} = -0.0002 \cdot [\text{NaCl}] - 0.0263 \cdot [\text{KCl}] + 0.0320 \cdot [\text{CaCl}_2] \]  (13)

**Relationship between sensory attributes and Na, K and Ca contents in flesh**

\[ \text{Saltiness} = 1.97 - 6.03E - 05 \cdot [\text{Na}] - 3.43E - 05 \cdot [\text{K}] - 3.33E - 04 \cdot [\text{Ca}] \]  (14)

\[ \text{Bitterness} = 0.33 - 1.20E - 04 \cdot [\text{Na}] - 5.79E - 05 \cdot [\text{K}] + 3.64E - 04 \cdot [\text{Ca}] \]  (15)

\[ \text{Hardness} = 3.54 - 2.18E - 04 \cdot [\text{Na}] - 2.09E - 04 \cdot [\text{K}] - 1.86E - 05 \cdot [\text{Ca}] \]  (16)

\[ \text{Fibrousness} = -1.44 + 6.27E - 05 \cdot [\text{Na}] - 3.11E - 05 \cdot [\text{K}] + 2.55E - 04 \cdot [\text{Ca}] \]  (17)

\[ \text{Crunchiness} = 3.48 - 2.04E - 04 \cdot [\text{Na}] - 2.24E - 04 \cdot [\text{K}] - 1.84E - 05 \cdot [\text{Ca}] \]  (18)
Model 9000 Colour-view spectrophotometer (Columbia, USA) [3]. The firmness was measured by using a Kramer Shear compression cell coupled to an Instron Universal Testing Machine (Canton, MA, USA) [3]. The mineral content in the fresh was analysed by dry ashing the olive pulp, followed by solubilization of the minerals in diluted HCl. Then, the elements were estimated by atomic absorption spectrometry using a GBC model 932 AA (Victoria, Australia), equipped with hollow multi-element cathode lamps (Ca, Mg, and Zn; Na and K) [4]. The sensory analysis was carried out by a trained and experienced panel test, using the descriptors included in the Sensory Analysis for Table Olives issued by the International Olive Oil Council [5]. The data were studied following QDA [6–8] and chemometric techniques [9,10]. The contour lines in the triangular graphs were obtained by plotting the corresponding equations for specific responses.
Fig. 2. Fermentation of green Spanish-style Manzanilla table olives in nutrient salt mixtures (NaCl, KCl and CaCl$_2$). Changes in (A) saltiness and (B) bitterness centred scores, according to the salt concentrations in the initial brines (details of runs in [1], Table 1). Duplicate design points are indicated by a two close to them.
Fig. 3. Fermentation of green Spanish-style Manzanilla tables olives in nutrient salt mixtures (NaCl, KCl and CaCl₂). Contour lines of (A) hardness, and (B) fibrousness centred scores as a function of the salt concentrations in the initial brines (details of runs in [1], Table 1). Duplicate design points are indicated by a two close to them.
Fig. 4. Fermentation of green Spanish-style Manzanilla table olives in nutrient salt mixtures (NaCl, KCl and CaCl₂). Confidence limits for the relationship between saltiness, bitterness, and hardness as a function of their predictions (according to Na, K, and Ca contents in the fermented Manzanilla olive flesh).
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Transparency document. Supplementary material

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