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INFLUENCE OF EDIBLE COATING ENRICHED WITH PREBIOTIC IN MECHANICAL PROPRIETIES OF GRAPE *THOMPSON* VARIETY

Iuri Mira Msc. In Food Science. Federal University of Bahia. Rua Barão de Jeremoabo, 147, Ondina. Salvador – BA. Postal Code: 40170-115.

Celso Duarte Carvalho Filho Post-Doctorate in Molecular Biology of Microorganisms by the State University of Londrina. Federal University of Bahia. Rua Barão de Jeremoabo, 147, Ondina. Salvador – BA. Postal Code: 40170-115.

ABSTRACT The aim of this study was to evaluate the influence of edible coating based carnauba wax enriched with prebiotic to properties of texture in *Thompson* grapes stored under refrigeration. After selection, the fruits were cleaned in a solution of 0.01% sodium hypochlorite for 30 minutes, dried at room temperature, immersed in aqueous solutions of carnauba wax enriched concentrations of fructooligosaccharides 50:20, 25:10, 25: 0 and control (uncovered) for 10 seconds, dried under ventilation, packed in PET plastic perforated and stored at 6 ± 2°C for 31 days. Texture parameters were evaluated in puncture analysis. The texture parameters of *Thompson* grapes were changed during the study period, but no evidence of interference of the coverage applied. The application of edible coatings enriched functional ingredient did not significantly alter the parameters evaluated showing promise for the marketing table grape variety Thompson.

KEYWORDS : *Vitis vinifera,* functional ingredients, texture, post-harvest.

INTRODUCTION

The grape (*Vitis vinifera* L.) is one of the main fruits explored in the São Francisco River Valley - Brazil. The cultivation of seedless grapes has been increasing, and the *Thompson Seedless* variety has induced great interest among the producers. It is a main variety of seedless grapes grown in the world, with excellent acceptance in the foreign market[1].

Several technologies have been applied in the post-harvest area of fruit, seeking to minimize financial losses with physical injuries. Among the applied technologies, we highlight the use of films and coatings, which have the potential to delay degradation reactions and/or synthesis of substances in fruits, providing a longer shelf life, as for example in grapes[2,3], guava[4] and strawberries grapes[5].

Among the various types of materials used as edible coatings, carnauba wax has been used in the coating of various fruits, such as yellow passion fruit and cherry grapes[6,7]. This wax is classified as GRAS (Generaly Recognized As Safe), being considered safe for use in foods and its permitted use in toppings for fresh fruits and vegetables and other types of food[8].

Fructooligosaccharides (FOS) are unconventional sugars not metabolized by the human body and non-caloric, with a flavor similar to that of sucrose, occurring naturally in products of plant origin[9,10].

Texture is one of the most important quality characteristics in edible fruits and vegetables. Texture includes all the physical characteristics felt by the touch, which are related to the deformation of the analyzed body under the action of an applied force and can be measured objectively in terms of force, distance and time[11].

In this context, the objective of this work was to evaluate the influence of prebiotic enriched carnauba wax coatings on the texture parameters of seedless grapes of the *Thompson* variety.

MATERIALS AND METHODS

The grapes were purchased directly from the producer, in a farm located near the township of Juazeiro, estate of Bahia, region of the Sao Francisco River Valley, in the period between August and October 2012.

Carnauba wax emulsion JVC WAX 36 (36% carnauba wax), from Química JVC LTDA and Frutooligosaccharide ORAFTI GR (96.4% oligofructose) from Clariant was used.

After hygienization by immersion in 100 mg/L sodium hypochlorite solution for 10 minutes, the grape bunches were dried at room temperature. The frutooligosaccharide was dissolved in ultrapure water at room temperature, under manual stirring until complete solubilization. The carnauba wax emulsion was poured over this solution and the manual stirring was continued until complete homogenization. The formulations were prepared according to percentages shown in Table 1.

Table 1 - Values of the components used in the preparation of the filmogenic solutions

Formulation components	Treatments			
	B	K	L	X
Carnauba wax emulsion (%)	50	25	25	0
Fructooligosaccharide (%)	20	10	0	0
Water (QS)	500mL	500mL	500mL	500mL

The solutions were placed in 1L beakers and the bunches were immersed one at a time, remaining in contact with their respective solution for 10 seconds. The bunches were raised and the drying occurred in a suspended mode, without contact of the berries with surfaces, at room temperature (25°C), for three hours.

After complete drying, the bunches were removed from the drying rack, the suspension cords were removed and stored under refrigeration (2-8°C) in perforated polyethylene terephthalate (PET) packages, specifically for fruit packaging.

The Packagings containing the bunches were used to evaluate the loss of mass and were weighed and analyzed.

For the analysis of the texture parameters, the Puncture Resistance parameter was used. A Stable Micro Systems model TA-XT2i texturometer was used to determine the texture parameters, using eight berries from each treatment. The samples were positioned with their longitudinal axis in the horizontal position, always maintaining the peduncle to the right. The analyzes occurred at intervals of 5 days. The maximum force until rupture (MFB) and maximum distance until rupture (MDB) were considered. An aluminum cylindrical probe 2 mm in diameter (P/2) was used in a single cycle. The equipment was adjusted to work under the following conditions: initial velocity 1 mm/s, test velocity 1 mm/s, post-test velocity 1 mm/s, distance traveled after contact with sample 6 mm, force 5 g, data acquisition 200 PPS.

The median values were calculated from the values obtained. Data were statistically treated using the Kruskal-Wallis test.

RESULTS

The Table 2 presents the median values for the texture parameters of the puncture analysis: Maximum Force to Breakdown (MFB) and Maximum Distance to Breakdown (MDB).

Table 2 - Median values of the Maximum Force to Breakdown (MFB) and Maximum Distance to Breakdown (MDB) texture parameters of *Thompson* grapes.

Days after coverage application	Treatments			
	B	K	L	X
MFB (N)				
1	351,55^{a}	342,95^{a}	310,60^{a}	342,30^{a}
6	291,80^{a}	274,60^{a}	312,90^{a}	278,40^{a}
11	410,40^{a}	323,60^{a}	351,65^{a}	401,50^{a}
16	387,70^{a}	344,15^{a}	310,90^{a}	359,90^{a}
21	397,75^{b}	433,30^{b}	271,00^{a}	384,00^{a,b}
26	386,85^{a,b}	306,45^{a}	315,20^{a}	548,30^{b}
31	393,40^{a,b}	344,60^{a}	467,50^{b}	296,15^{a}
MDB (mm)				
1	2,80^{a}	3,30^{a}	3,05^{a}	2,90^{a}
6	2,60^{a,b}	3,15^{a,b}	3,70^{b}	2,40^{a}
11	4,25^{b}	3,30^{a,b}	3,85^{a,b}	2,95^{a}
16	4,40^{b}	3,45^{a,b}	3,90^{b}	3,15^{a}
21	5,20^{a}	5,15^{a}	3,80^{a}	4,85^{a}
26	4,50^{a,b}	3,80^{a}	4,15^{a}	6,00^{b}
31	4,60^{a,b}	4,20^{a}	5,35^{b}	3,50^{a}
Medians followed by equal letters in the same line correspond to treatments that do not differ from each other at the level of $p \leq 0.05$.				

Simple linear regression models were calculated, considering the day of analysis as independent variable to evaluate the effect of time on the MFB and MDB, being the equations and p-value presented in Table 3.

Table 3 - Simple Linear Regression Models for Maximum Force to Breakdown (MFB) and Maximum Distance to Breakdown (MDB) in Thompson grapes.

Treatments	MFB		MDB	
	equation	p-value	equation	p-value
B	MFBB=331,079+2,585Day	0,1105	MDBB=2,8706+0,0705Day	0,0199
K	MFBK=310,893+1,891Day	0,3582	MDBK=3,0123+0,0424Day	0,0667
L	MFBL=294,573+3,719Day	0,3046	MDBL=3,1849+0,0530Day	0,0125
X	MFBx=322,723+2,649Day	0,4266	MDBX=2,4471+0,0777Day	0,0788

DISCUSSION

From the observed p-values, it is noticed that there is no effect of the time on the MFB for the treatments at the level of 5% of significance. However, when the p-values of MDB are observed, there is an effect of the time on MDB for treatments B and L (p-value <0.05), while treatments K and X have p-values very close of the rejection zone (0.0667 and 0.0788, respectively). This demonstrates that time interferes with the MDB of these berries.

The mechanical resistance of the epidermis decreases with the advancement of maturation[12], however, all treatments evidenced an increase in these values. This fact can be attributed to the loss of mass of the samples due to fruit respiration during storage, which causes a decrease in the turgor of the berries. When applying the forces to puncture, the fruit epidermis offers more resistance because it is more flexible and has greater deformation capacity before the rupture[2,12]. This phenomenon was noted in previous work, when an increase in the mechanical resistance was perceived, being attributed to the loss of water in the fruits[13].

After 31 days of experiment, the samples presented accumulated loss of mass around 14%, as shown in Table 4, thus registering a mean mass loss rate around 0.5% per day. This rate of weight loss is lower than that observed in a previous study, when samples of *Italy* grape stored for 9 days at room temperature (21,2°C) presented a percentage loss of mass equal to 0.7333%/day[14].

Table 4 - Loss of accumulated mass of *Thompson* grapes after 31 days of refrigerated storage

Treatments	Accumulated loss (%)
B	18,14
K	14,04
L	14,64
X	13,86

Treatment B=50:20; K=25:10; L=25:0; X=0:0

The results obtained corroborate with those obtained in a other previous study, when performed compression tests (MFB and MDB) on *Muscatel* table grapes coated with hydroxypropylmethyl cellulose containing propolis extract stored under refrigeration (1-2°C) did not identify any significant differences between the treated berries and the controls for the mechanical responses resulting from the coating or storage time[2].

CONCLUSION

No significant changes were observed in the texture analysis of the grapes after the application of prebiotic enriched carnauba wax coatings, showing a promising technique for the incorporation of active ingredients in *Thompson* variety table grapes.

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