

# Supplementary Materials: The Effect of Whey Protein-Based Edible Coatings Incorporated with Lemon and Lemongrass Essential Oils on the Quality Attributes of Fresh-Cut Pears during Storage

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**Table S1.**  $L^*$ ,  $a^*$ ,  $b^*$  colour parameters and browning index (BI) of fresh-cut pears coated with whey 1protein isolate coatings (WPI) incorporated with lemon (WPI+LEO) and lemongrass (WPI+LgEO) essential oils or uncoated samples during storage.

Storage (days)	Uncoated	Coating		
		WPI	WPI+LEO	WPI+LgEO
$L^*$				
0	79.06 ± 1.81 <sup>b,B</sup>	78.36 ± 1.56 <sup>a,AB</sup>	79.41 ± 1.31 <sup>a,B</sup>	77.06 ± 1.77 <sup>d,A</sup>
7	77.21 ± 1.75 <sup>b,C</sup>	78.10 ± 1.87 <sup>a,C</sup>	70.10 ± 1.11 <sup>ab,A</sup>	74.53 ± 1.68 <sup>c,B</sup>
14	77.78 ± 1.83 <sup>b,B</sup>	77.58 ± 1.69 <sup>a,B</sup>	71.72 ± 1.72 <sup>ab,A</sup>	72.11 ± 1.35 <sup>b,A</sup>
21	74.48 ± 1.94 <sup>a,B</sup>	76.76 ± 1.44 <sup>a,C</sup>	72.10 ± 1.82 <sup>b,A</sup>	71.37 ± 1.86 <sup>ab,A</sup>
28	74.19 ± 1.15 <sup>a,B</sup>	76.68 ± 1.19 <sup>a,C</sup>	69.83 ± 1.76 <sup>c,A</sup>	69.66 ± 1.32 <sup>a,A</sup>
$a^*$				
0	-0.69 ± 0.64 <sup>ab,B</sup>	-1.03 ± 0.66 <sup>a,B</sup>	-0.93 ± 0.71 <sup>b,B</sup>	-4.39 ± 0.72 <sup>a,A</sup>
7	-0.19 ± 0.35 <sup>b,C</sup>	-1.28 ± 0.69 <sup>a,B</sup>	-0.93 ± 0.58 <sup>b,B</sup>	-3.31 ± 0.73 <sup>b,A</sup>
14	-0.45 ± 0.37 <sup>ab,C</sup>	-1.13 ± 0.41 <sup>a,B</sup>	-1.00 ± 0.40 <sup>b,BC</sup>	-3.20 ± 0.74 <sup>b,A</sup>
21	-0.58 ± 0.36 <sup>ab,C</sup>	-1.44 ± 0.63 <sup>a,B</sup>	-1.02 ± 0.45 <sup>b,BC</sup>	-3.31 ± 0.78 <sup>b,A</sup>
28	-0.78 ± 0.23 <sup>a,C</sup>	-1.55 ± 0.52 <sup>a,B</sup>	-1.74 ± 0.48 <sup>a,B</sup>	-4.07 ± 0.67 <sup>ab,A</sup>
$b^*$				
0	10.15 ± 1.25 <sup>a,A</sup>	10.46 ± 1.15 <sup>a,A</sup>	9.94 ± 0.91 <sup>a,A</sup>	23.93 ± 1.03 <sup>a,B</sup>
7	13.90 ± 0.85 <sup>b,A</sup>	12.01 ± 1.07 <sup>ab,A</sup>	12.27 ± 1.38 <sup>bc,A</sup>	21.38 ± 2.83 <sup>b,B</sup>
14	13.43 ± 0.55 <sup>b,A</sup>	12.07 ± 0.98 <sup>ab,A</sup>	12.26 ± 1.32 <sup>bc,A</sup>	20.69 ± 1.03 <sup>b,B</sup>
21	13.12 ± 1.05 <sup>b,A</sup>	12.24 ± 1.26 <sup>b,A</sup>	13.42 ± 0.78 <sup>c,A</sup>	20.69 ± 1.36 <sup>b,B</sup>
28	13.83 ± 1.05 <sup>b,B</sup>	11.36 ± 0.87 <sup>ab,A</sup>	11.25 ± 0.65 <sup>ab,A</sup>	20.19 ± 1.46 <sup>b,C</sup>
$BI$				
0	12.92 ± 1.69 <sup>a,A</sup>	12.90 ± 2.08 <sup>a,A</sup>	12.07 ± 1.65 <sup>a,A</sup>	31.37 ± 2.69 <sup>a,B</sup>
7	19.05 ± 2.59 <sup>b,B</sup>	14.95 ± 1.94 <sup>a,A</sup>	17.60 ± 3.00 <sup>b,c,AB</sup>	29.17 ± 3.94 <sup>a,C</sup>
14	17.89 ± 1.35 <sup>b,A</sup>	15.27 ± 1.82 <sup>a,A</sup>	17.08 ± 2.13 <sup>bc,A</sup>	29.19 ± 2.54 <sup>a,B</sup>
21	18.15 ± 2.14 <sup>b,AB</sup>	15.37 ± 2.31 <sup>a,A</sup>	18.33 ± 2.86 <sup>c,AB</sup>	29.50 ± 3.43 <sup>a,C</sup>
28	19.17 ± 1.82 <sup>b,B</sup>	13.99 ± 1.68 <sup>a,A</sup>	15.10 ± 1.65 <sup>b,A</sup>	28.43 ± 2.43 <sup>a,C</sup>

Mean values with standard deviations in brackets. Different superscripts letters (a–c) within the same column or (A–C) within the same lines indicate significant differences between the values ( $p < 0.05$ ).

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**Table S2.** Firmness of fresh-cut pears coated with whey protein isolate coatings (WPI) incorporated with lemon (WPI+LEO) and lemongrass (WPI+LgEO) essential oils or uncoated samples during storage.

Storage (days)	Uncoated	Coating		
		WPI	WPI+LEO	WPI+LgEO
0	21.66 ± 1.1 <sup>a,A</sup>	22.14 ± 1.2 <sup>b,A</sup>	21.83 ± 1.2 <sup>b,A</sup>	21.67 ± 1.3 <sup>b,A</sup>
7	21.05 ± 1.0 <sup>a,A</sup>	20.56 ± 0.6 <sup>ab,A</sup>	19.67 ± 0.9 <sup>a,A</sup>	21.45 ± 1.3 <sup>b,A</sup>
14	20.49 ± 0.7 <sup>a,B</sup>	20.24 ± 1.1 <sup>a,B</sup>	16.21 ± 1.1 <sup>a,A</sup>	20.53 ± 1.4 <sup>b,B</sup>
21	20.15 ± 1.2 <sup>a,B</sup>	19.68 ± 1.4 <sup>a,B</sup>	15.35 ± 0.9 <sup>a,A</sup>	20.70 ± 0.6 <sup>b,B</sup>
28	20.10 ± 0.9 <sup>a,C</sup>	19.27 ± 1.1 <sup>a,BC</sup>	14.67 ± 0.9 <sup>a,A</sup>	17.68 ± 1.3 <sup>a,B</sup>

Mean values with standard deviations in brackets. Different superscripts letters (<sup>a-b</sup>) within the same column or (<sup>A-C</sup>) within the same lines indicate significant differences between the values ( $p < 0.05$ ).

**Table S3.** Polyphenol content of fresh-cut pears coated with whey protein isolate coatings (WPI) incorporated with lemon (WPI+LEO) and lemongrass (WPI+LgEO) essential oils or uncoated samples during storage.

Storage (days)	Uncoated	Coating		
		WPI	WPI+LEO	WPI+LgEO
0	4.05 ± 0.10 <sup>c,B</sup>	3.56 ± 0.19 <sup>bc,A</sup>	5.99 ± 0.07 <sup>bc,C</sup>	5.68 ± 0.11 <sup>c,C</sup>
7	4.23 ± 0.18 <sup>c,A</sup>	3.87 ± 0.23 <sup>c,A</sup>	6.22 ± 0.44 <sup>c,C</sup>	5.16 ± 0.19 <sup>c,B</sup>
14	4.00 ± 0.12 <sup>c,A</sup>	3.88 ± 0.29 <sup>c,A</sup>	5.25 ± 0.53 <sup>b,B</sup>	4.28 ± 0.55 <sup>b,AB</sup>
21	2.93 ± 0.12 <sup>b,A</sup>	2.97 ± 0.27 <sup>ab,A</sup>	4.27 ± 0.11 <sup>a,C</sup>	3.44 ± 0.13 <sup>a,B</sup>
28	1.53 ± 0.09 <sup>a,A</sup>	2.39 ± 0.32 <sup>a,B</sup>	3.89 ± 0.04 <sup>a,C</sup>	3.19 ± 0.11 <sup>a,D</sup>

Mean values with standard deviations in brackets. Different superscripts letters (<sup>a-c</sup>) within the same column or (<sup>A-D</sup>) within the same lines indicate significant differences between the values ( $p < 0.05$ ).

**Table S4.** Flavonoid content of fresh-cut pears coated with whey protein isolate coatings (WPI) incorporated with lemon (WPI+LEO) and lemongrass (WPI+LgEO) essential oils or uncoated samples during storage.

Storage (days)	Uncoated	Coating		
		WPI	WPI+LEO	WPI+LgEO
0	5.38 ± 0.08 <sup>d,A</sup>	3.93 ± 0.31 <sup>d,A</sup>	4.59 ± 1.27 <sup>d,A</sup>	3.99 ± 0.11 <sup>b,A</sup>
7	4.00 ± 0.15 <sup>c,B</sup>	3.11 ± 0.13 <sup>c,A</sup>	3.53 ± 0.27 <sup>bc,AB</sup>	3.47 ± 0.47 <sup>b,AB</sup>
14	2.86 ± 0.10 <sup>b,B</sup>	1.98 ± 0.13 <sup>b,A</sup>	2.54 ± 0.09 <sup>ab,B</sup>	3.62 ± 0.19 <sup>b,C</sup>
21	2.91 ± 0.14 <sup>b,B</sup>	1.59 ± 0.11 <sup>ab,A</sup>	2.05 ± 0.14 <sup>ab,A</sup>	3.27 ± 0.34 <sup>ab,B</sup>
28	2.13 ± 0.13 <sup>a,B</sup>	1.39 ± 0.11 <sup>a,A</sup>	1.88 ± 0.15 <sup>a,B</sup>	2.55 ± 0.17 <sup>a,C</sup>

Mean values with standard deviations in brackets. Different superscripts letters (<sup>a-d</sup>) within the same column or (<sup>A-C</sup>) within the same lines indicate significant differences between the values ( $p < 0.05$ ).

**Table S5.** Carbon dioxide content in packaging of fresh-cut pears coated with whey protein isolate coatings (WPI) incorporated with lemon (WPI+LEO) and lemongrass (WPI+LgEO) essential oils or uncoated samples during storage.

Storage (days)	Uncoated	Coating		
		WPI	WPI+LEO	WPI+LgEO
0	32.7 ± 5.4 <sup>a,AB</sup>	39.1 ± 0.7 <sup>a,C</sup>	28.1 ± 0.2 <sup>a,A</sup>	35.4 ± 1.6 <sup>a,AB</sup>
7	52.4 ± 1.1 <sup>b,C</sup>	45.6 ± 1.8 <sup>b,A</sup>	46.9 ± 2.0 <sup>b,AB</sup>	51.6 ± 2.5 <sup>b,BC</sup>
14	61.7 ± 0.8 <sup>c,A</sup>	61.4 ± 1.8 <sup>c,A</sup>	64.5 ± 3.1 <sup>c,A</sup>	70.5 ± 1.6 <sup>c,B</sup>
21	75.9 ± 2.2 <sup>d,B</sup>	77.7 ± 1.2 <sup>d,B</sup>	66.0 ± 1.9 <sup>c,A</sup>	77.0 ± 3.5 <sup>d,B</sup>
28	76.7 ± 1.5 <sup>d,AB</sup>	80.5 ± 2.4 <sup>d,B</sup>	73.1 ± 0.3 <sup>d,A</sup>	78.7 ± 1.6 <sup>c,B</sup>

Mean values with standard deviations in brackets. Different superscripts letters (<sup>a-d</sup>) within the same column or (<sup>A-C</sup>) within the same lines indicate significant differences between the values ( $p < 0.05$ ).

**Table S6.** Sensory attributes of fresh-cut pears coated with whey protein isolate coatings (WPI) incorporated with lemon (WPI+LEO) and lemongrass (WPI+LgEO) essential oils or uncoated samples during storage.

Coating	Sensory Attribute				
	Colour	Odour	Firmness	Taste	Acceptability
<b>Day 0</b>					
Uncoated	5.90±1.97 <sup>a,A</sup>	7.97±1.17 <sup>c,C</sup>	6.23±1.98 <sup>a,AB</sup>	8.00±1.03 <sup>c,C</sup>	7.10±1.54 <sup>b,BC</sup>
WPI	7.71±1.24 <sup>b,B</sup>	7.23±1.67 <sup>c,AB</sup>	6.65±1.98 <sup>a,A</sup>	8.06±0.77 <sup>c,B</sup>	7.39±1.31 <sup>b,AB</sup>
WPI+LEO	5.94±1.65 <sup>a,B</sup>	3.77±2.16 <sup>b,A</sup>	5.61±1.56 <sup>a,B</sup>	4.00±1.75 <sup>b,A</sup>	4.77±1.87 <sup>a,AB</sup>
WPI+LgEO	5.87±1.52 <sup>a,C</sup>	1.74±0.96 <sup>a,A</sup>	5.77±2.22 <sup>a,C</sup>	2.19±1.54 <sup>a,A</sup>	3.74±2.37 <sup>a,B</sup>
<b>Day 7</b>					
Uncoated	3.77±0.96 <sup>a,A</sup>	7.23±1.18 <sup>c,D</sup>	4.84±1.21 <sup>a,B</sup>	7.06±1.59 <sup>c,D</sup>	5.94±1.36 <sup>c,C</sup>
WPI	7.52±1.09 <sup>c,B</sup>	7.65±1.38 <sup>c,B</sup>	6.32±1.22 <sup>c,A</sup>	8.03±0.75 <sup>d,B</sup>	7.52±1.03 <sup>d,B</sup>
WPI+LEO	5.52±1.59 <sup>b,B</sup>	4.29±1.62 <sup>b,A</sup>	5.58±1.34 <sup>ab,B</sup>	4.32±1.42 <sup>b,A</sup>	4.81±1.45 <sup>b,AB</sup>
WPI+LgEO	5.06±1.65 <sup>b,C</sup>	2.32±1.35 <sup>a,AB</sup>	5.65±1.68 <sup>ab,C</sup>	1.90±1.01 <sup>a,A</sup>	3.23±1.73 <sup>a,B</sup>
<b>Day 14</b>					
Uncoated	3.58±1.41 <sup>a,A</sup>	6.29±1.35 <sup>d,B</sup>	4.26±1.32 <sup>a,A</sup>	5.94±1.67 <sup>b,B</sup>	5.61±1.09 <sup>b,B</sup>
WPI	7.90±0.87 <sup>c,B</sup>	7.32±0.98 <sup>c,AB</sup>	7.19±0.98 <sup>c,A</sup>	7.42±1.12 <sup>c,AB</sup>	7.94±0.81 <sup>c,B</sup>
WPI+LEO	5.16±0.82 <sup>b,B</sup>	4.77±0.99 <sup>b,AB</sup>	5.26±1.03 <sup>b,B</sup>	4.32±1.28 <sup>a,A</sup>	5.42±1.12 <sup>b,B</sup>
WPI+LgEO	4.94±1.24 <sup>b,C</sup>	2.97±1.38 <sup>a,A</sup>	4.81±1.58 <sup>ab,C</sup>	3.74±1.09 <sup>a,AB</sup>	4.35±1.17 <sup>a,BC</sup>

Mean values with standard deviations in brackets. Different superscripts letters (<sup>a-b</sup>) within the same column or (<sup>A-C</sup>) within the same lines indicate significant differences between the values ( $p < 0.05$ ).