

**Supplementary Table S1.** Mean populations (in log<sub>10</sub> cfu/gr) of Total Mesophilic Counts, Total Psychrophilic Counts, *Brochothrix thermosphacta* and Lactic Acid Bacteria in meat pieces from shoulder region (standard deviation in parenthesis).

Value	Storage (Days)	Treatment											Sig.
		Co	Ch	Ch + or	Ch + va	Ch + or + va	Va	Al	Al + or	Al + va	Al + or + va	Al + ol + va	
TMC	0	5.74 (0.19) <sup>Aa</sup>	5.74 (0.19) <sup>Aab</sup>	5.74 (0.19) <sup>Aab</sup>	5.74 (0.19) <sup>Aabc</sup>	5.74 (0.19) <sup>Aa</sup>	5.74 (0.19) <sup>Aab</sup>	5.74 (0.19) <sup>Aa</sup>	5.74 (0.19) <sup>Aa</sup>	5.74 (0.19) <sup>Aa</sup>	5.74 (0.19) <sup>Aa</sup>	5.74 (0.19) <sup>Aa</sup>	NS
	1	5.72 (0.17) <sup>Aa</sup>	4.50 (0.28) <sup>Aa</sup>	4.50 (0.7) <sup>Aa</sup>	5.53 (0.08) <sup>Aab</sup>	5.88 (0.15) <sup>Aa</sup>	5.30 (0.42) <sup>Aa</sup>	6.58 (1.25) <sup>Aab</sup>	6.08 (1.53) <sup>Aa</sup>	5.43 (0.36) <sup>Aa</sup>	7.30 (0.42) <sup>Aab</sup>	6.40 (0.7) <sup>Aab</sup>	NS
	3	7.25 (0.49) <sup>Cb</sup>	4.58 (0.15) <sup>Aa</sup>	5.45 (0.77) <sup>ABab</sup>	5.03 (0.61) <sup>Aa</sup>	5.00 (0.01) <sup>Aa</sup>	6.80 (0.7) <sup>BCbc</sup>	7.23 (0.08) <sup>Cab</sup>	7.23 (0.08) <sup>Ca</sup>	7.54 (0.21) <sup>Cb</sup>	8.00 (0.01) <sup>Cb</sup>	7.73 (0.05) <sup>Cbc</sup>	***
	7	7.38 (0.55) <sup>BCb</sup>	4.81 (0.04) <sup>Aa</sup>	6.80 (0.28) <sup>BCb</sup>	6.53 (0.08) <sup>ABCbc</sup>	5.65 (0.91) <sup>ABa</sup>	6.90 (0.01) <sup>BCbc</sup>	7.66 (0.26) <sup>Cab</sup>	7.69 (0.12) <sup>Ca</sup>	7.60 (0.01) <sup>Cb</sup>	7.40 (0.70) <sup>BCb</sup>	8.34 (0.70) <sup>Cc</sup>	***
	14	7.84 (0.21) <sup>CDb</sup>	6.37 (0.66) <sup>ABb</sup>	6.40 (0.70) <sup>ABCab</sup>	6.72 (0.17) <sup>ABCDc</sup>	5.65 (0.49) <sup>Aa</sup>	7.47 (0.01) <sup>BCDc</sup>	7.65 (0.06) <sup>BCDab</sup>	7.90 (0.01) <sup>Da</sup>	7.30 (0.42) <sup>BCDb</sup>	7.15 (0.21) <sup>BCDab</sup>	7.12 (0.06) <sup>BCDabc</sup>	**
	21	8.00 (0.01) <sup>Db</sup>	6.50 (0.28) <sup>ABCb</sup>	7.15 (0.21) <sup>BCDb</sup>	6.15 (0.21) <sup>ABabc</sup>	5.84 (0.21) <sup>Aa</sup>	7.15 (0.21) <sup>BCDbc</sup>	7.95 (0.06) <sup>Db</sup>	8.00 (0.42) <sup>Da</sup>	8.06 (0.15) <sup>Db</sup>	7.30 (0.42) <sup>CDab</sup>	7.8 (0.28) <sup>Dbc</sup>	***
	Sig.	***	**	**	*	NS	***	***	NS	***	***	***	
TPC	0	5.75 (0.02) <sup>Aa</sup>	5.75 (0.02) <sup>Aabc</sup>	5.75 (0.02) <sup>Aab</sup>	5.75 (0.02) <sup>Aa</sup>	5.75 (0.02) <sup>Aa</sup>	5.75 (0.02) <sup>Aa</sup>	5.75 (0.02) <sup>Aa</sup>	5.75 (0.02) <sup>Aa</sup>	5.75 (0.02) <sup>Aa</sup>	5.75 (0.02) <sup>Aa</sup>	5.75 (0.02) <sup>Aa</sup>	NS
	1	5.50 (0.70) <sup>ABa</sup>	4.65 (0.91) <sup>Aa</sup>	4.65 (0.91) <sup>Aa</sup>	5.88 (0.15) <sup>ABab</sup>	5.34 (0.49) <sup>ABa</sup>	5.73 (0.36) <sup>ABa</sup>	6.84 (1.50) <sup>ABab</sup>	6.50 (1.13) <sup>ABab</sup>	5.93 (0.33) <sup>ABa</sup>	7.75 (0.21) <sup>Bb</sup>	6.45 (0.21) <sup>ABa</sup>	*
	3	8.30 (0.56) <sup>Cb</sup>	5.32 (0.21) <sup>Aab</sup>	5.73 (0.61) <sup>Aab</sup>	6.43 (0.36) <sup>ABabc</sup>	5.82 (0.91) <sup>Aa</sup>	7.87 (0.04) <sup>BCb</sup>	8.77 (0.10) <sup>Cb</sup>	8.30 (0.56) <sup>Cbc</sup>	8.10 (0.28) <sup>BCb</sup>	8.23 (0.33) <sup>Cbc</sup>	8.00 (0.01) <sup>BCb</sup>	***
	7	8.45 (0.63) <sup>BCb</sup>	5.84 (0.21) <sup>Aabc</sup>	7.34 (0.49) <sup>ABCbc</sup>	7.53 (0.33) <sup>ABCc</sup>	6.84 (1.20) <sup>ABa</sup>	7.82 (0.18) <sup>BCb</sup>	8.53 (0.33) <sup>BCb</sup>	8.66 (0.26) <sup>BCbc</sup>	8.73 (0.05) <sup>BCb</sup>	8.45 (0.21) <sup>BCbc</sup>	8.80 (0.28) <sup>Cb</sup>	**
	14	8.69 (0.12) <sup>Cb</sup>	7.38 (0.55) <sup>ABc</sup>	7.15 (0.21) <sup>Abc</sup>	7.38 (0.55) <sup>ABbc</sup>	7.19 (0.28) <sup>Aa</sup>	8.45 (0.21) <sup>BCb</sup>	8.3 (0.01) <sup>BCab</sup>	8.95 (0.06) <sup>Cbc</sup>	8.17 (0.01) <sup>ABCb</sup>	8.6 (0.01) <sup>Cbc</sup>	8.47 (0.01) <sup>Cb</sup>	**
	21	8.84 (0.21) <sup>BCb</sup>	7.15 (0.21) <sup>ABbc</sup>	8.58 (0.15) <sup>BCc</sup>	7.42 (0.59) <sup>ABbc</sup>	6.65 (0.06) <sup>Aa</sup>	8.12 (0.24) <sup>ABCb</sup>	9.50 (0.70) <sup>Cb</sup>	9.38 (0.86) <sup>Cc</sup>	8.73 (0.36) <sup>BCb</sup>	8.73 (0.36) <sup>BCc</sup>	8.73 (0.36) <sup>BCb</sup>	**
	Sig.	***	***	***	***	NS	***	***	***	***	***	***	

<b>B. thermo-sphacta</b>	0	4.55 (0.26) <sup>Aa</sup>	4.55 (0.26) <sup>Aa</sup>	4.55 (0.26) <sup>Aab</sup>	4.55 (0.26) <sup>Aa</sup>	4.55 (0.26) <sup>Aa</sup>	4.55 (0.26) <sup>Aa</sup>	4.55 (0.26) <sup>Aa</sup>	4.55 (0.26) <sup>Aa</sup>	4.55 (0.26) <sup>Aab</sup>	4.55 (0.26) <sup>Aa</sup>	4.55 (0.26) <sup>Aa</sup>	NS
	1	4.50 (0.70) <sup>Aa</sup>	4.00 (0.98) <sup>Aa</sup>	3.95 (0.06) <sup>Aa</sup>	5.15 (0.63) <sup>Aab</sup>	5.03 (0.19) <sup>Aa</sup>	4.42 (0.59) <sup>Aa</sup>	4.50 (0.70) <sup>Aa</sup>	4.58 (0.15) <sup>Aa</sup>	4.50 (0.28) <sup>Aa</sup>	4.99 (0.12) <sup>Aab</sup>	4.53 (0.33) <sup>Aa</sup>	NS
	3	5.77 (0.32) <sup>BCab</sup>	4.60 (0.42) <sup>ABa</sup>	5.27 (0.38) <sup>ABCab</sup>	4.88 (0.58) <sup>ABab</sup>	4.47 (0.01) <sup>Aa</sup>	4.97 (0.28) <sup>ABa</sup>	5.73 (0.36) <sup>ABCab</sup>	6.50 (0.14) <sup>Cb</sup>	5.50 (0.28) <sup>ABCabc</sup>	5.62 (0.21) <sup>ABCbc</sup>	5.30 (0.01) <sup>ABCab</sup>	**
	7	6.50 (0.70) <sup>Cbc</sup>	4.38 (0.30) <sup>Aa</sup>	6.38 (0.12) <sup>BCb</sup>	5.47 (0.10) <sup>ABCab</sup>	4.80 (0.70) <sup>ABa</sup>	5.60 (0.01) <sup>ABCab</sup>	6.30 (0.42) <sup>BCbc</sup>	7.00 (0.01) <sup>Cbc</sup>	5.92 (0.10) <sup>ABCbc</sup>	6.53 (0.33) <sup>Cd</sup>	6.19 (0.70) <sup>BCb</sup>	**
	14	7.00 (0.01) <sup>BCbc</sup>	5.58 (0.58) <sup>ABa</sup>	5.38 (1.11) <sup>ABab</sup>	6.57 (0.38) <sup>BCb</sup>	4.77 (0.10) <sup>Aa</sup>	5.60 (0.01) <sup>ABab</sup>	7.30 (0.01) <sup>Cbc</sup>	6.69 (0.30) <sup>BCb</sup>	6.03 (0.36) <sup>ABCc</sup>	5.69 (0.12) <sup>ABCbc</sup>	5.47 (0.01) <sup>ABab</sup>	**
	21	7.77 (0.01) <sup>DEc</sup>	5.60 (0.91) <sup>ABCa</sup>	6.65 (0.49) <sup>BCDEb</sup>	5.50 (0.70) <sup>ABab</sup>	4.30 (0.42) <sup>Aa</sup>	6.32 (0.21) <sup>BCDEb</sup>	7.84 (0.21) <sup>Ec</sup>	7.47 (0.01) <sup>CDEc</sup>	6.50 (0.58) <sup>BCDEc</sup>	5.90 (0.10) <sup>ABCDcd</sup>	5.58 (0.58) <sup>ABCab</sup>	***
<b>Sig.</b>		***	NS	***	**	NS	*	***	***	**	**	*	
<b>LAB</b>	0	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	NS
	1	2.50 (0.70) <sup>ABab</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	2.69 (0.98) <sup>ABab</sup>	4.19 (0.15) <sup>Bb</sup>	3.23 (0.33) <sup>ABb</sup>	3.08 (0.86) <sup>ABab</sup>	3.30 (0.98) <sup>ABab</sup>	4.12 (0.06) <sup>ABb</sup>	*
	3	4.19 (0.58) <sup>BCabc</sup>	2.00 (0.01) <sup>Aa</sup>	2.70 (1.04) <sup>ABab</sup>	2.00 (0.01) <sup>Aa</sup>	2.00 (0.01) <sup>Aa</sup>	3.65 (0.49) <sup>ABCabc</sup>	4.67 (0.7) <sup>Cb</sup>	3.95 (0.06) <sup>BCb</sup>	4.32 (0.21) <sup>BCbc</sup>	4.23 (0.08) <sup>BCbc</sup>	4.23 (0.33) <sup>BCb</sup>	**
	7	3.97 (0.7) <sup>Aabc</sup>	3.45 (0.77) <sup>Aab</sup>	4.38 (0.12) <sup>Abc</sup>	3.38 (1.28) <sup>Aab</sup>	3.53 (1.75) <sup>Aab</sup>	3.8 (0.14) <sup>Aabc</sup>	4.9 (0.01) <sup>Ab</sup>	3.15 (0.21) <sup>Ab</sup>	4.95 (0.06) <sup>Ac</sup>	4.73 (0.05) <sup>Abc</sup>	5.15 (0.21) <sup>Ab</sup>	NS
	14	4.40 (0.70) <sup>ABCbc</sup>	4.80 (0.70) <sup>ABCb</sup>	4.86 (0.44) <sup>ABCc</sup>	5.15 (0.21) <sup>ABCb</sup>	5.38 (0.55) <sup>BCb</sup>	4.05 (0.08) <sup>ABbc</sup>	5.11 (0.01) <sup>ABCb</sup>	3.77 (0.10) <sup>Ab</sup>	5.40 (0.41) <sup>BCc</sup>	5.02 (0.02) <sup>ABCc</sup>	5.77 (0.10) <sup>Cb</sup>	*
	21	5.00 (0.01) <sup>Ac</sup>	4.77 (0.32) <sup>Ab</sup>	5.45 (0.21) <sup>Ac</sup>	5.34 (0.49) <sup>Ab</sup>	5.69 (0.12) <sup>Ab</sup>	5.15 (0.21) <sup>Ac</sup>	5.00 (0.01) <sup>Ab</sup>	5.53 (0.33) <sup>Ac</sup>	5.08 (0.55) <sup>Ac</sup>	5.32 (0.21) <sup>Ac</sup>	4.57 (1.79) <sup>Ab</sup>	NS
<b>Sig.</b>		***	***	***	***	***	***	***	***	***	***	***	

Treatment: Co: Control; Ch: Chitosan; Ch + or: Chitosan + oregano; Ch + va: Chitosan + vacuum; Ch + or + va: Chitosan + oregano + vacuum; Va: Vacuum; Al: Alginate; Al + or: Alginate + oregano; Al + va: Alginate + vacuum; Al + or + va: Alginate + oregano + vacuum; Al + ol + va: Alginate + olive + vacuum.

A-E Mean values in the same row (corresponding to the same days of storage) not followed by a common uppercase letter differ significantly (p-value < 0.05).

a-d Mean values in the same column (corresponding to the same treatment) not followed by a common lowercase letter differ significantly (p-value < 0.05).

\* p-value < 0.05; \*\* p-value < 0.01; \*\*\* p-value < 0.001; NS no significance (p-value > 0.05)