Assessing the use of chitosan and alginate based membranes with oregano essential oil and olive oil on quality of beef following packaging

Anestis Tsitsos [1] , Eirini Chouliara [2] , Alexandros Theodoridis [3] , Georgios Arsenos [4] , Ioannis Amvrosiadis [2] , Vangelis Economou [1]

[1]Laboratory of Hygiene of Food of Animal Origin – Veterinary Public Health
[2]Laboratory of Technology of Food of Animal Origin
[3]Laboratory of Animal Production Economics
[4]Laboratory of Animal Husbandry
School of Veterinary Medicine, Aristotle University of Thessaloniki

ΕΠΑνΕΚ 2014-2020 ΕΠΙΧΕΙΡΗΣΙΑΚΟ ΠΡΟΓΡΑΜΜΑ ΑΝΤΑΓΩΝΙΣΤΙΚΟΤΗΤΑ•ΕΠΙΧΕΙΡΗΜΑΤΙΚΟΤΗΤΑ•ΚΑΙΝΟΤΟΜΙΑ
Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης
ΕΣΠΑ 2014-2020
Τ1ΕΔΚ-05479

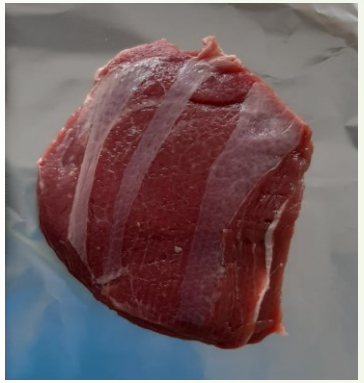
Background

- Edible membranes
  - Chitosan
  - Sodium alginate
  - Emulsions with essential oils

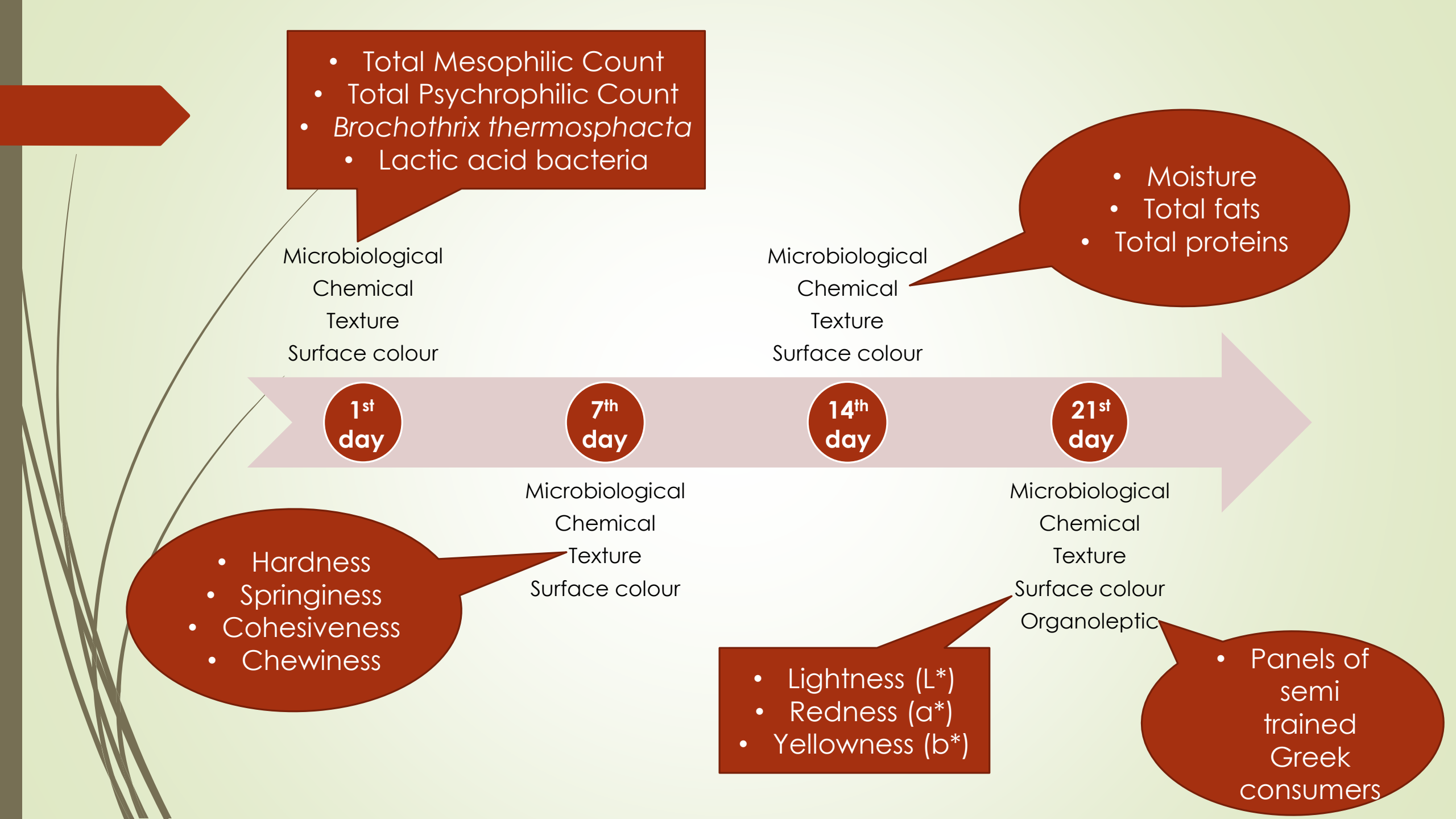
- Objective of the study
  - To evaluate the microbiological, chemical, and organoleptic properties of beef products, coated with chitosan and alginate-based emulsions with oregano or olive oil and stored with vacuum packaging.

Materials and methods

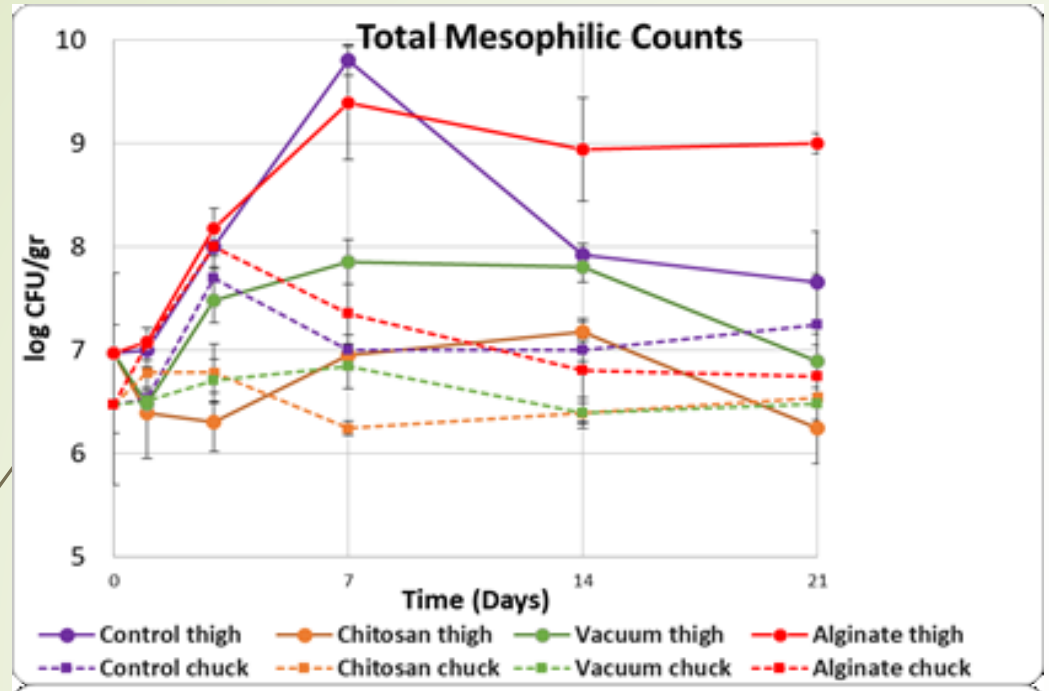
- Beef chuck and thigh
  - 1.5% alginate or 1% chitosan
  - Oregano oil or olive oil
  - Aerobically or under vacuum

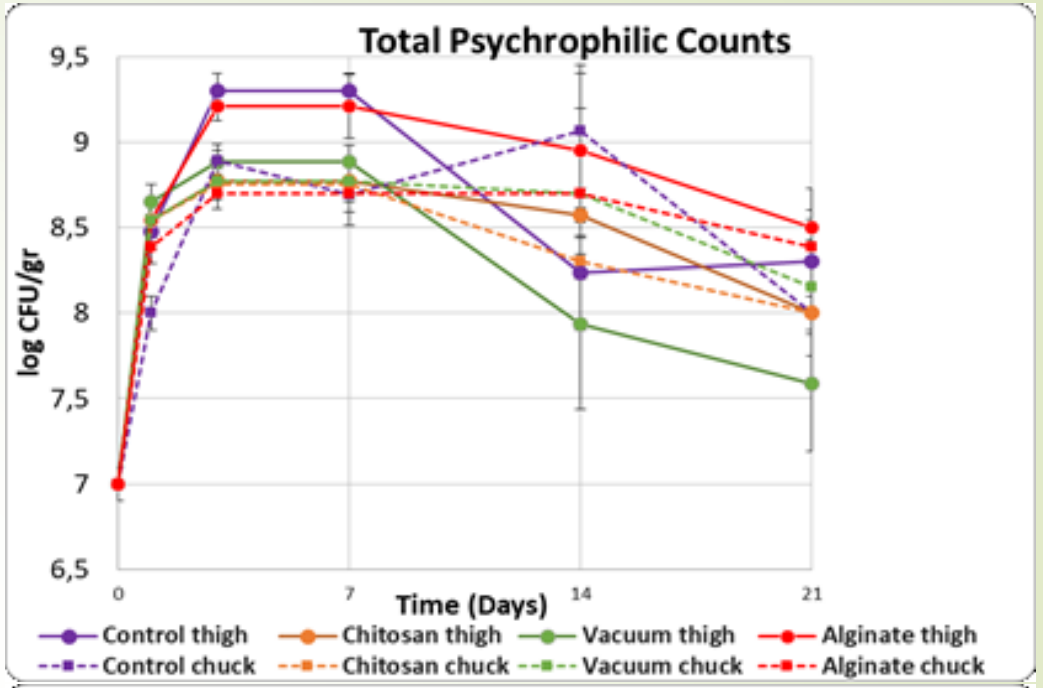


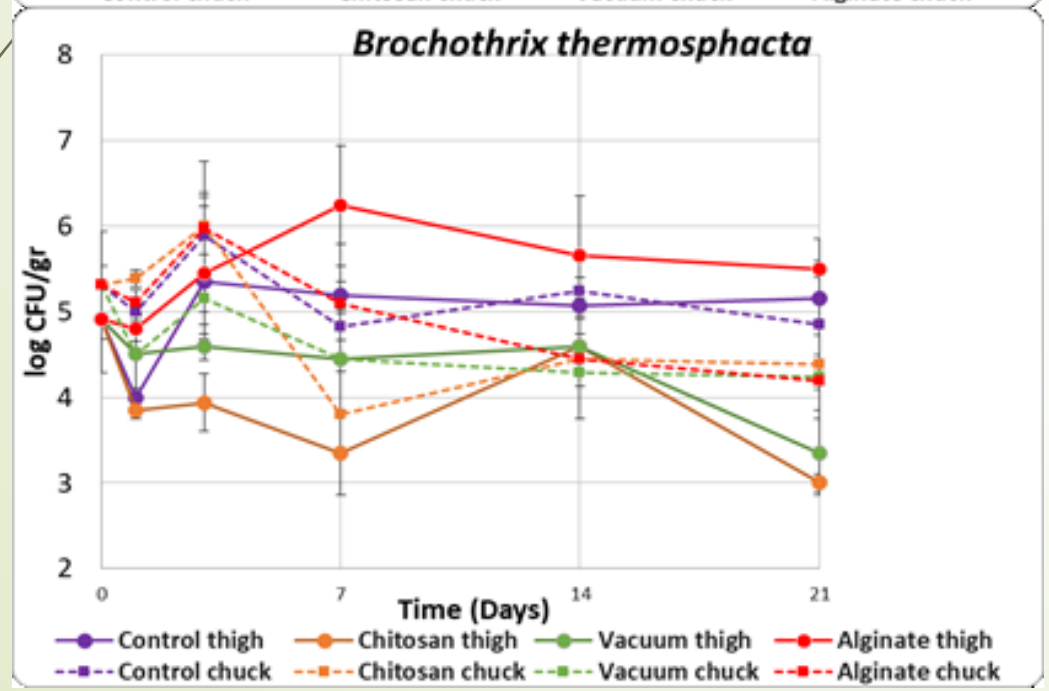
Control	Vacuum	Chitosan	Chitosan + vacuum	Chitosan + oregano	Chitosan + oregano + vacuum
Alginate	Alginate + vacuum	Alginate + oregano	Alginate + oregano + vacuum	Alginate + olive oil	Alginate + olive oil + vacuum

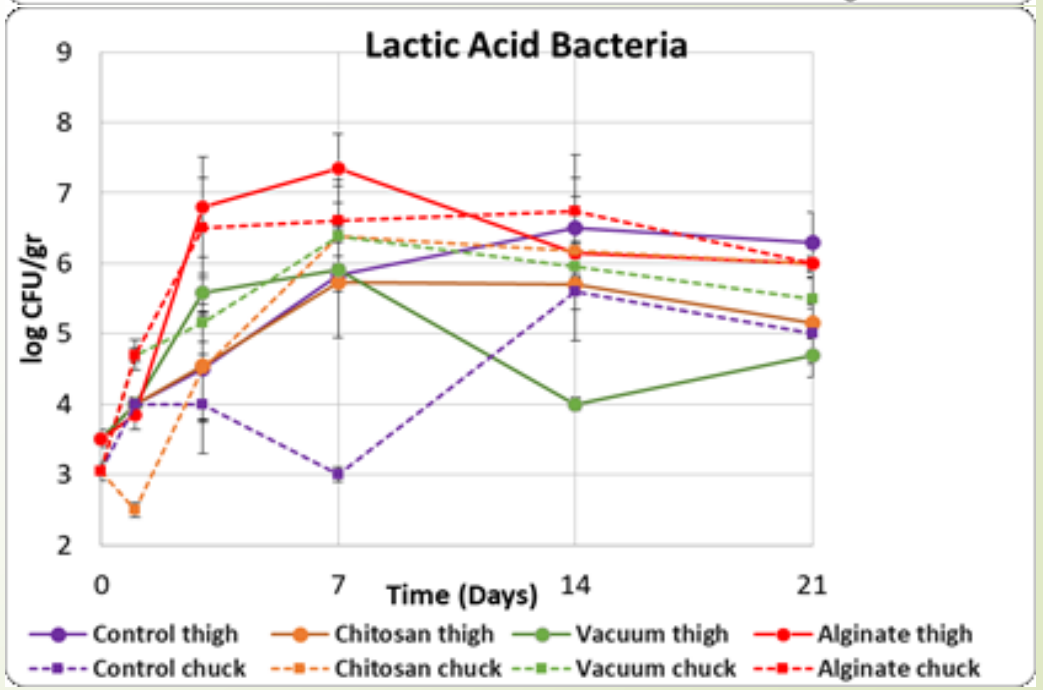

• Total Mesophilic Count
• Total Psychrophilic Count
• *Brochothrix thermosphacta*
• Lactic acid bacteria
Microbiological
Chemical
Texture
Surface colour
1st day
7th day
Microbiological
Chemical
Texture
Surface colour
• Hardness
• Springiness
• Cohesiveness
• Chewiness
14th day
Microbiological
Chemical
Texture
Surface colour
• Moisture
• Total fats
• Total proteins
21st day
Microbiological
Chemical
Texture
Surface colour
Organoleptic
• Lightness (L*)
• Redness (a*)
• Yellowness (b*)
• Panels of semi trained Greek consumers

Results

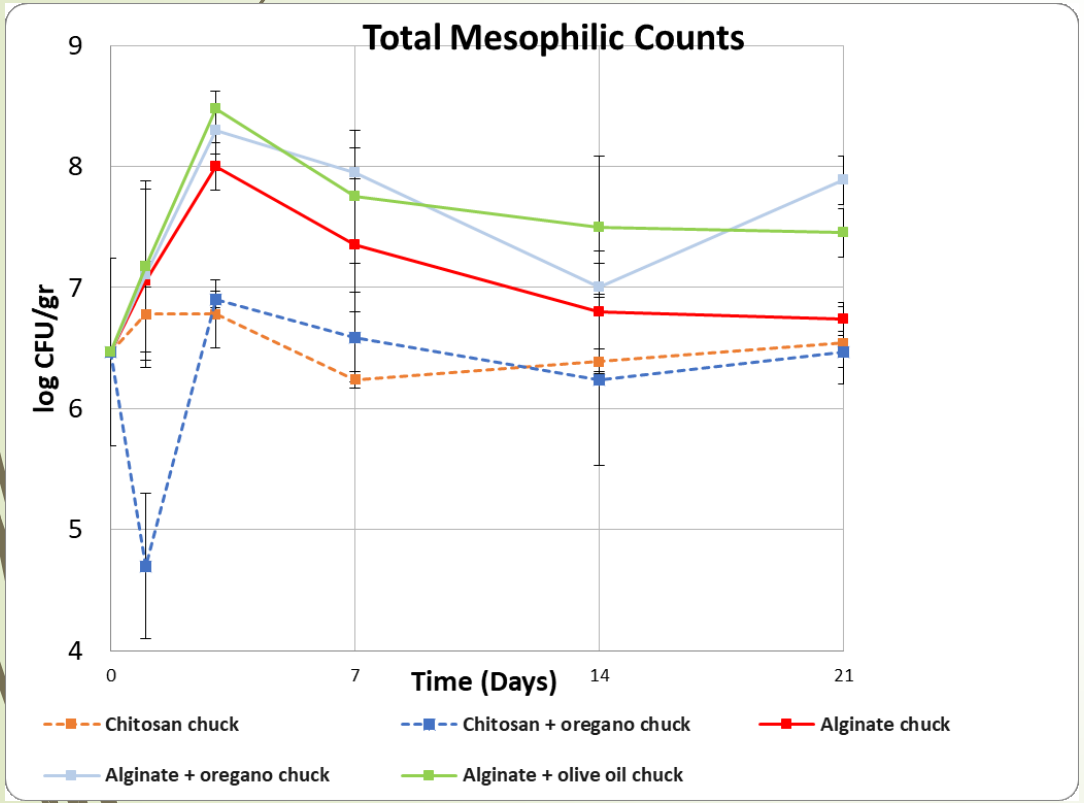

Total Mesophilic Counts
log CFU/gr
Time (Days)
Control thigh
Chitosan thigh
Vacuum thigh
Alginate thigh
Control chuck
Chitosan chuck
Vacuum chuck
Alginate chuck

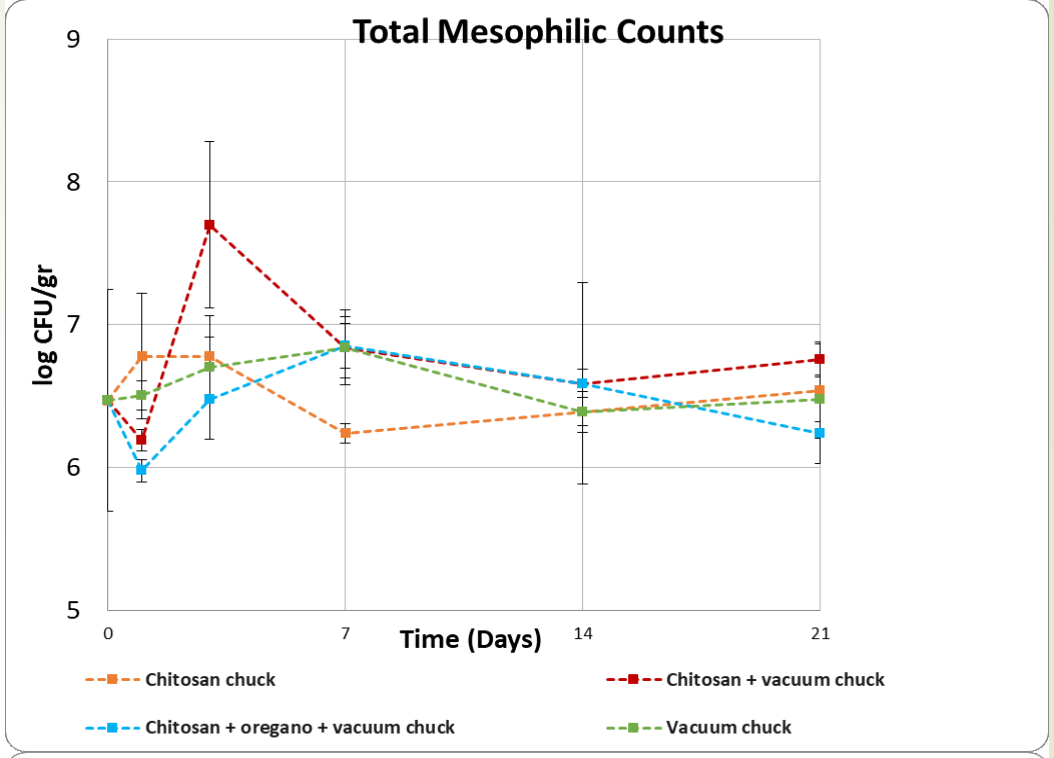

Total Psychrophilic Counts
log CFU/gr
Time (Days)
Control thigh
Chitosan thigh
Vacuum thigh
Alginate thigh
Control chuck
Chitosan chuck
Vacuum chuck
Alginate chuck

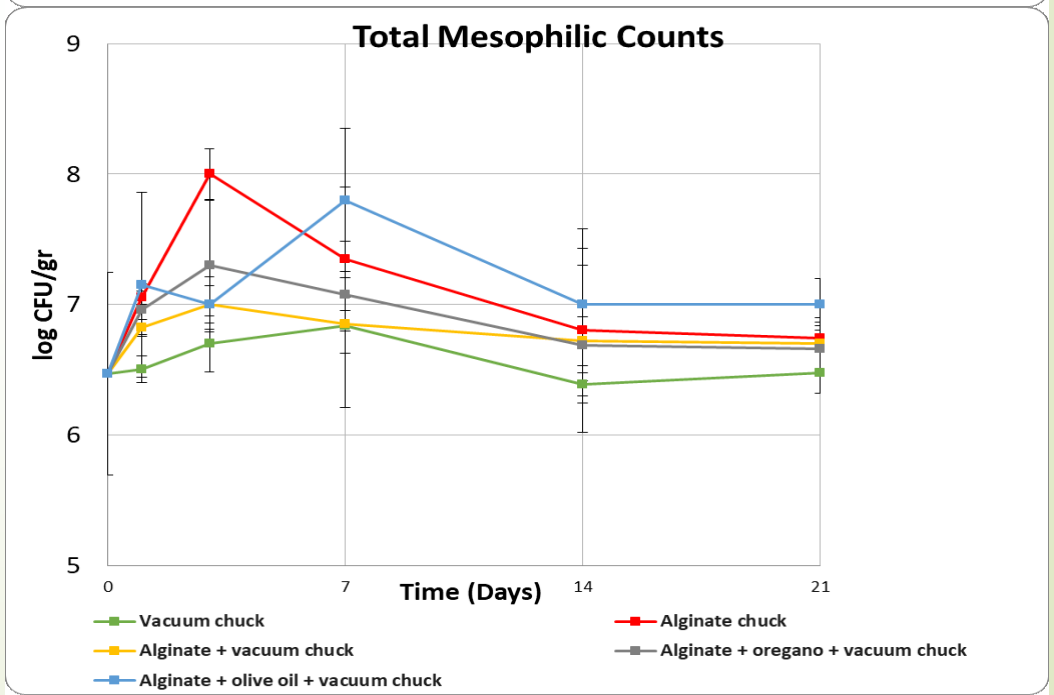

Brochothrix thermosphacta
log CFU/gr
Time (Days)
Control thigh
Chitosan thigh
Vacuum thigh
Alginate thigh
Control chuck
Chitosan chuck
Vacuum chuck
Alginate chuck


Lactic Acid Bacteria
log CFU/gr
Time (Days)
Control thigh
Chitosan thigh
Vacuum thigh
Alginate thigh
Control chuck
Chitosan chuck
Vacuum chuck
Alginate chuck

Experimental groups of oregano or olive oil films

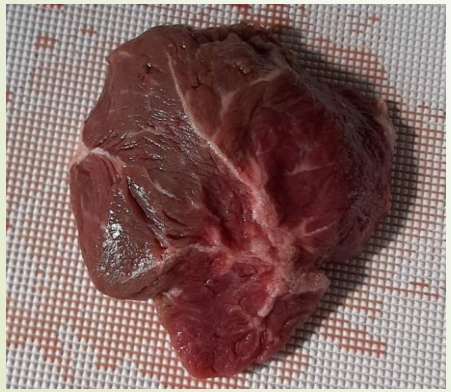






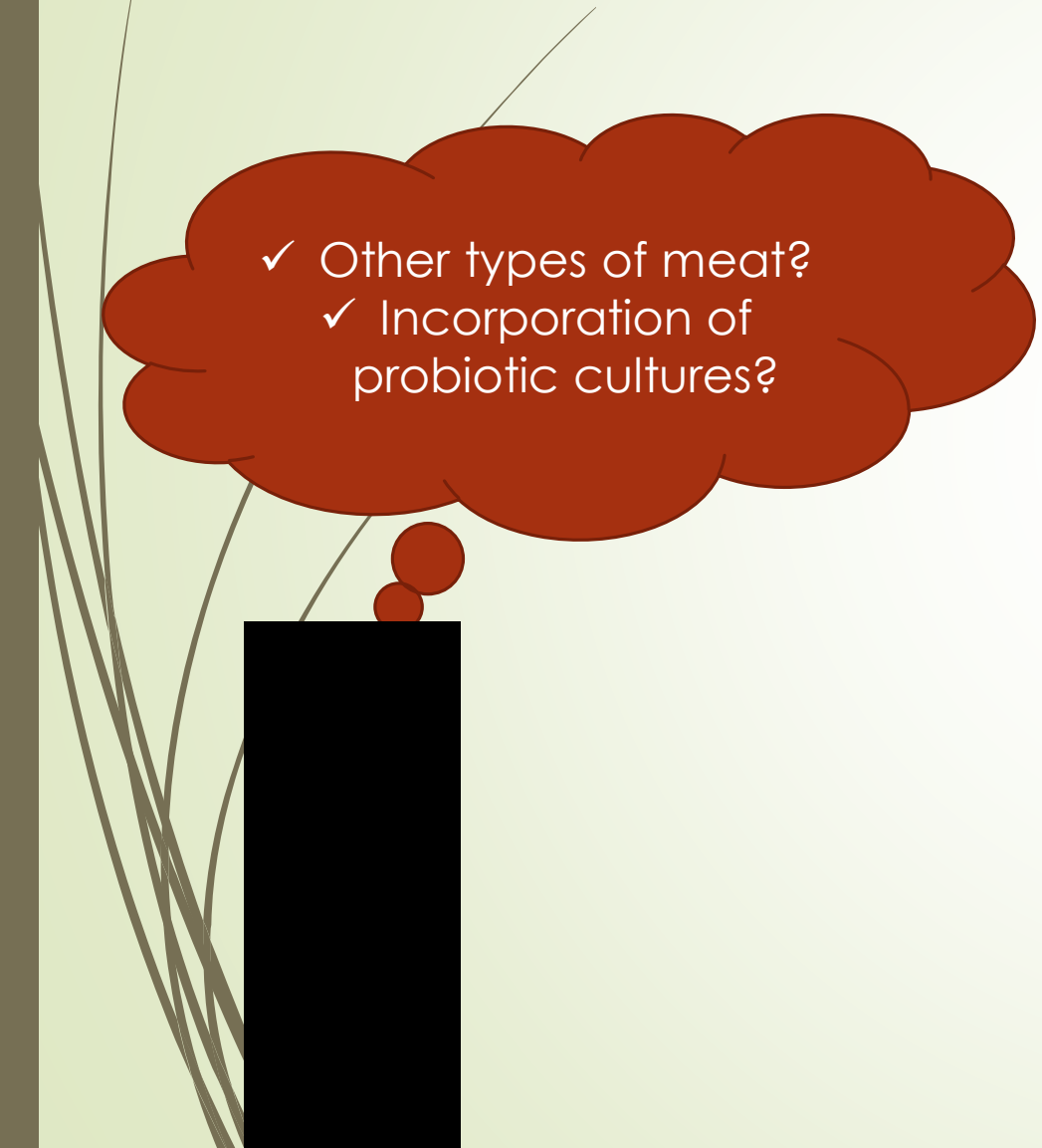
Sample	Day 1			Day 21		
	Moisture	Total Proteins	Total Fat	Moisture	Total Proteins	Total Fat
Control	77.4%	21.7%	2%	74%	21.2%	3.8%
Chitosan	77.7%	21.2%	1.1%	71.7%	20.8%	2.7%
Alginate	74%	19.7%	4.1%	75.5%	22.4%	1.7%
Vacuum	76.7%	21.6%	1.5%	75.7%	23%	1.1%
Chitosan + oregano	75.3%	21.9%	2.1%	76.5%	21.7%	1.6%
Chitosan + vacuum	74.4%	20.9%	3.2%	76.5%	21.4%	1.2%
Chitosan + oregano + vacuum	77.4%	19.9%	1.9%	74.3%	21.6%	1.2%
Alginate + oregano	78.8%	20.3%	1.9%	75.9%	21.1%	2.2%
Alginate + olive oil	75.6%	21.1%	1.5%	76.3%	20.2%	3%
Alginate + vacuum	75.7%	20.7%	3.3%	76.3%	21.3%	1.9%
Alginate + oregano + vacuum	71.2%	20.7%	6.8%	74.8%	21.1%	2.8%
Alginate + olive oil + vacuum	79.4%	21.1%	1.7%	76.8%	20.2%	1.1%

Sample	Hardness	Springiness	Cohesiveness	Chewiness	L*	a*	b*
Control	2817.906	0.611	0.460	792.558	40.97	21.12	7.23
Chitosan	1023.669	0.819	0.459	384.690	42.45	18.91	6.88
Chitosan + oregano	2433.042	0.743	0.532	961.142	40.37	20.34	7.43
Chitosan + vacuum	2029.371	0.688	0.508	709.756	41.92	21.85	8.1
Chitosan + oregano + vacuum	1461.358	0.735	0.464	498.761	41.26	21.64	6.49
Vacuum	1355.110	0.713	0.537	518.799	41.1	21.79	7.34
Alginate	1336.544	0.708	0.418	395.818	49.72	20.2	7.22
Alginate + oregano	1694.816	0.658	0.308	344.005	46.28	19.49	5.94
Alginate + vacuum	1118.298	0.614	0.233	159.617	41.83	21.81	8.23
Alginate + oregano + vacuum	2696.445	0.646	0.461	803.347	45.99	21.77	6.75
Alginate + olive oil	2624.935	0.738	0.491	951.521	46.79	24.09	8.03
Alginate + olive oil + vacuum	1532.270	0.649	0.459	456.502	45.2	22.27	7.72



- Sensory evaluation
  - Oregano oil

Discussion and Conclusion



- Chitosan edible coatings in combination with oregano essential oil and vacuum packaging are effective in enhancing beef quality and shelf life
  - significantly affected the growth of bacterial populations
- Sodium alginate edible coatings had non-significant effect on beef quality
  - low antimicrobial activity of the coating
- No differences in texture and chemical properties of products
- Oregano essential oil positively affected the organoleptic properties of the products

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[4]Laboratory of Animal Husbandry, School of Veterinary Medicine, Aristotle University of Thessaloniki

Background

Edible coatings are used in food packaging to enhance quality and shelf life. Sodium alginate, chitosan and their emulsions with essential oils have the ability to form strong coatings in beef products, positively affecting their quality traits. The objective of the study is to evaluate the microbiological, chemical, and organoleptic properties of beef products, coated with chitosan and alginate-based emulsions with oregano or olive oil and stored with vacuum packaging.

Materials and Methods

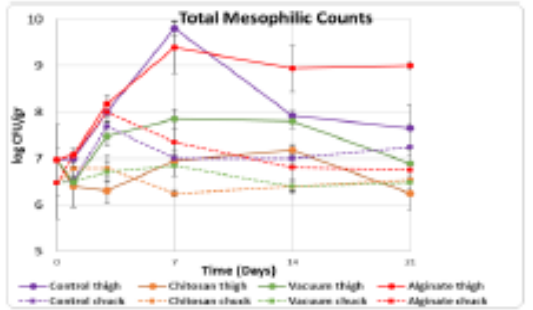
Beef chuck and thigh pieces were coated with 1.5% alginate or 1% chitosan films combined with oregano essential oil or olive oil and stored aerobically or under vacuum at 4°C. Microbiological (total mesophilic counts, total psychrophilic counts, lactic acid bacteria, *Brochothrix thermosphacta*), chemical (moisture, total fats, total proteins), texture and surface color evaluation were performed weekly for 21 days; evaluation of organoleptic properties was performed on the 21st day of storage. A two-way repeated measures ANOVA was performed to analyze the data.

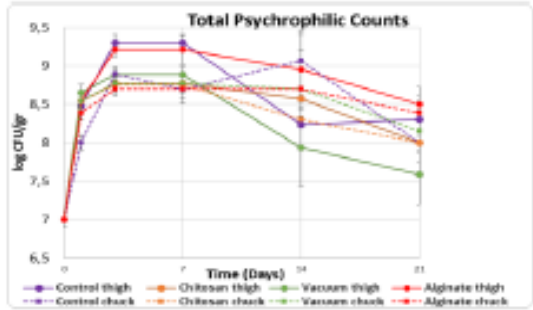
Results

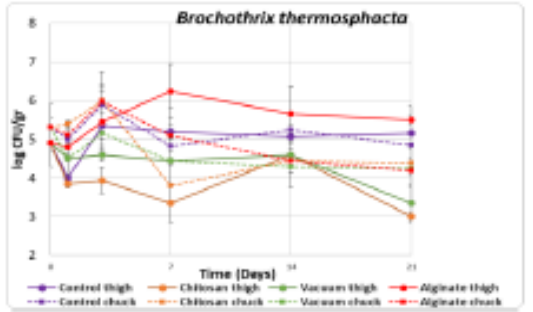
Chitosan and vacuum packaging significantly affected the total mesophilic and psychrophilic counts. Alginate-based emulsions positively affected the growth of bacterial populations. Chemical composition of the meat pieces varied from 69%-79.4% in moisture, 0.5%-8.4% in total fats and 19.1%-22.5% in total proteins. The surface colour of meat pieces coated with oregano oil film was darker compared to other treatments. Oregano essential oil positively affected the organoleptic properties of the products.

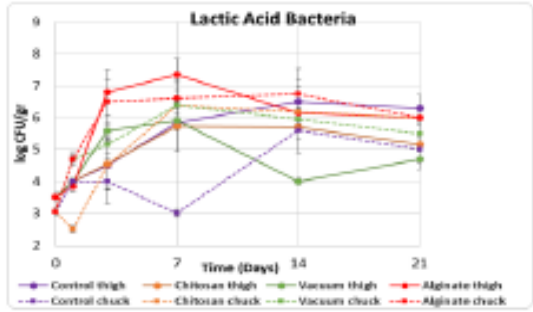
Discussion and Conclusion

Chitosan edible coatings in combination with oregano essential oil and vacuum packaging are effective in enhancing beef quality and shelf life. Sodium alginate edible coatings had non-significant effect on beef quality, possibly because of low antimicrobial activity of the coating. Chitosan coatings can be used on other types of meat. Incorporation of probiotic cultures, especially in the alginate films, could further enhance the storage potential.









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Thank you for your attention!!!

GReQuM
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ΑΝΤΑΓΩΝΙΣΤΙΚΟΤΗΤΑ•ΕΠΙΧΕΙΡΗΜΑΤΙΚΟΤΗΤΑ•ΚΑΙΝΟΤΟΜΙΑ
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