

Oxidative stability of meat fats by isothermal calorimetry

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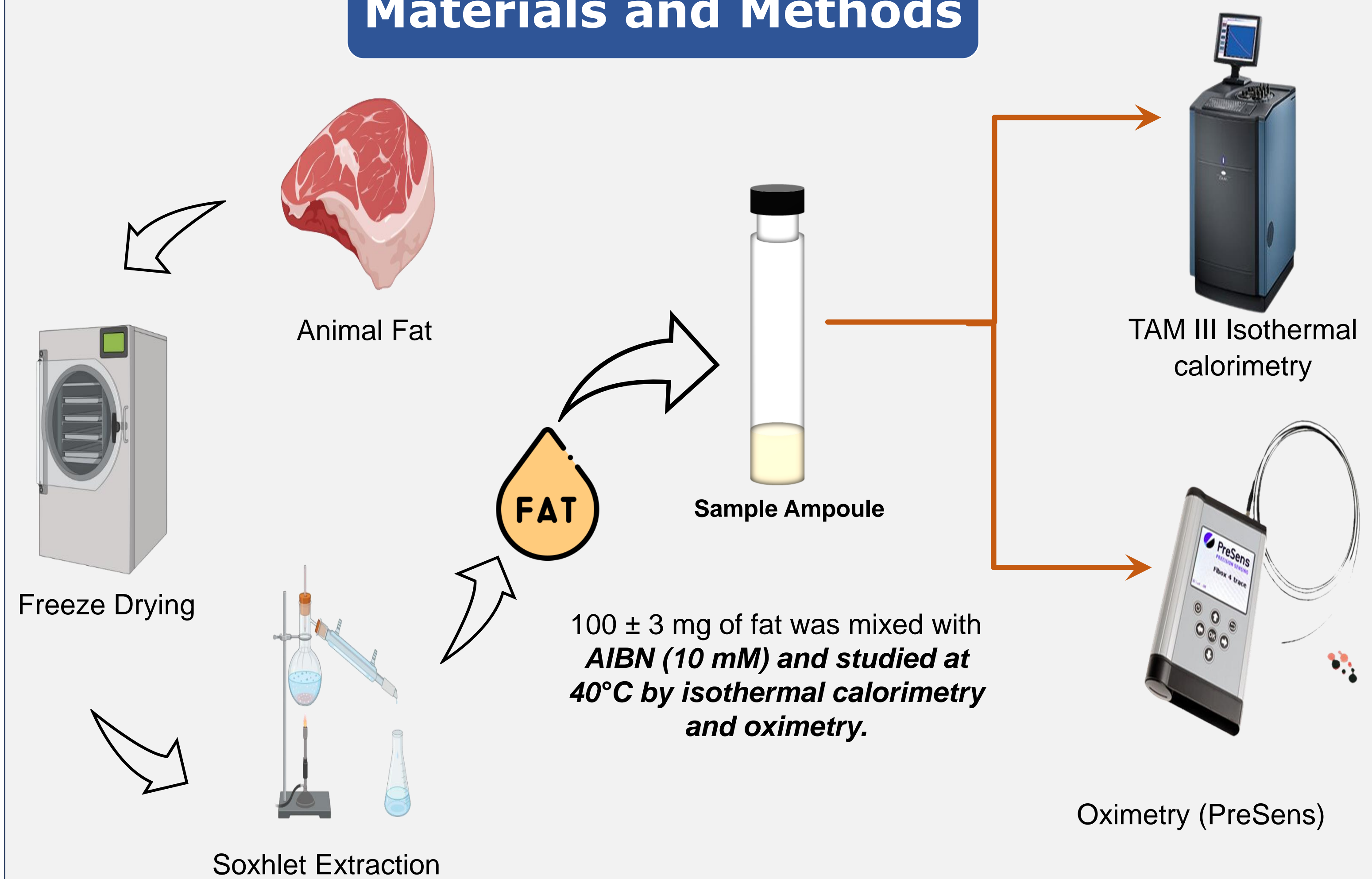
Introduction

The oxidation of fats in meat products leads to rancidity, and off-flavors posing significant challenges for the meat industry.

This research focuses on studying the oxidative stability of **4 different animal fats (lamb, pork, speck, and chicken)**, by using **isothermal calorimetry** at 40°C.

The findings of this study extend the potential of isothermal calorimetry as a fast and direct method for elucidating the complex mechanism behind the lipid oxidation of meat fat.

Materials and Methods



Results and Discussion

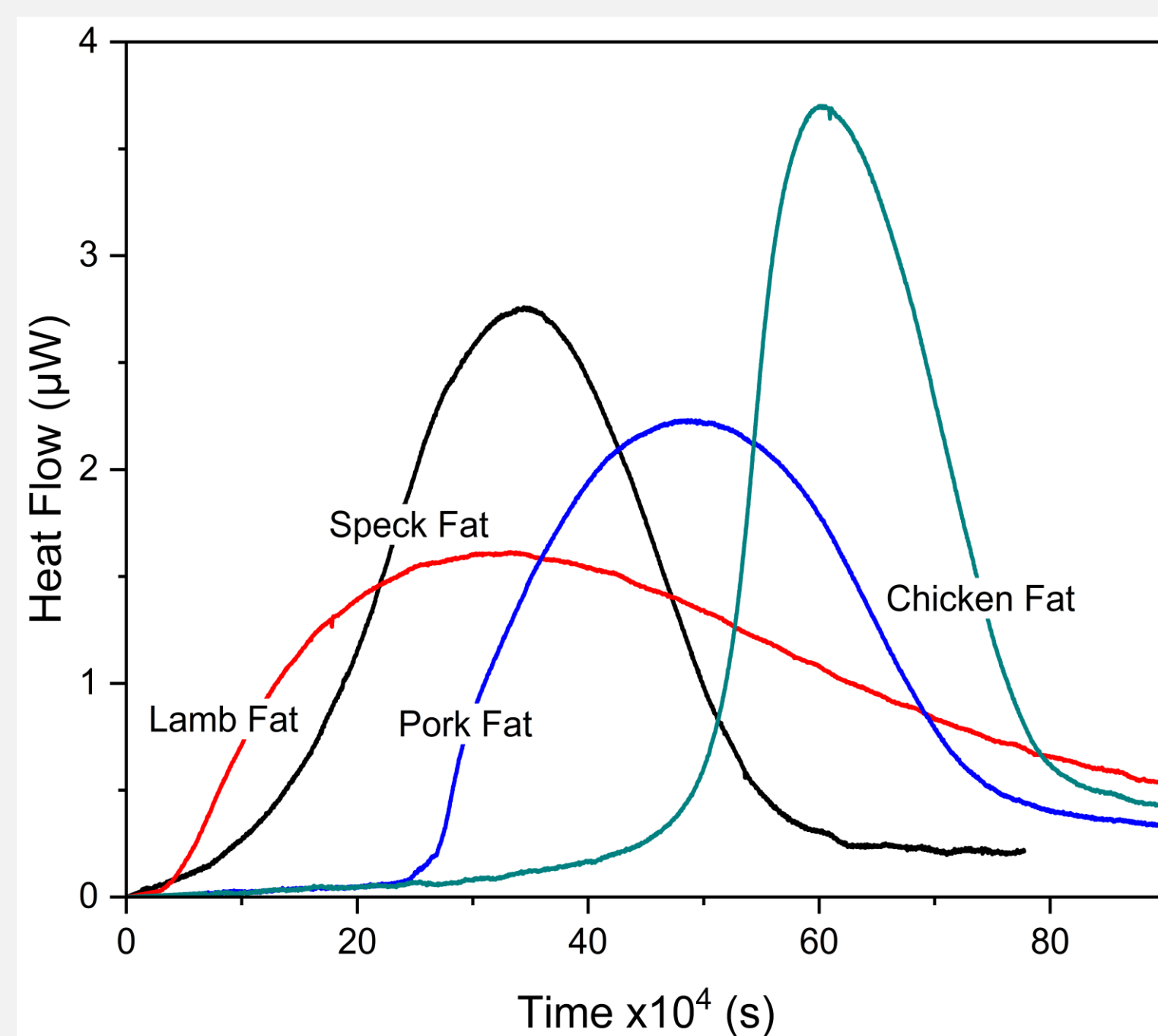


Figure (A) shows the calorimetric traces derived from the analysis of four different animal fats.

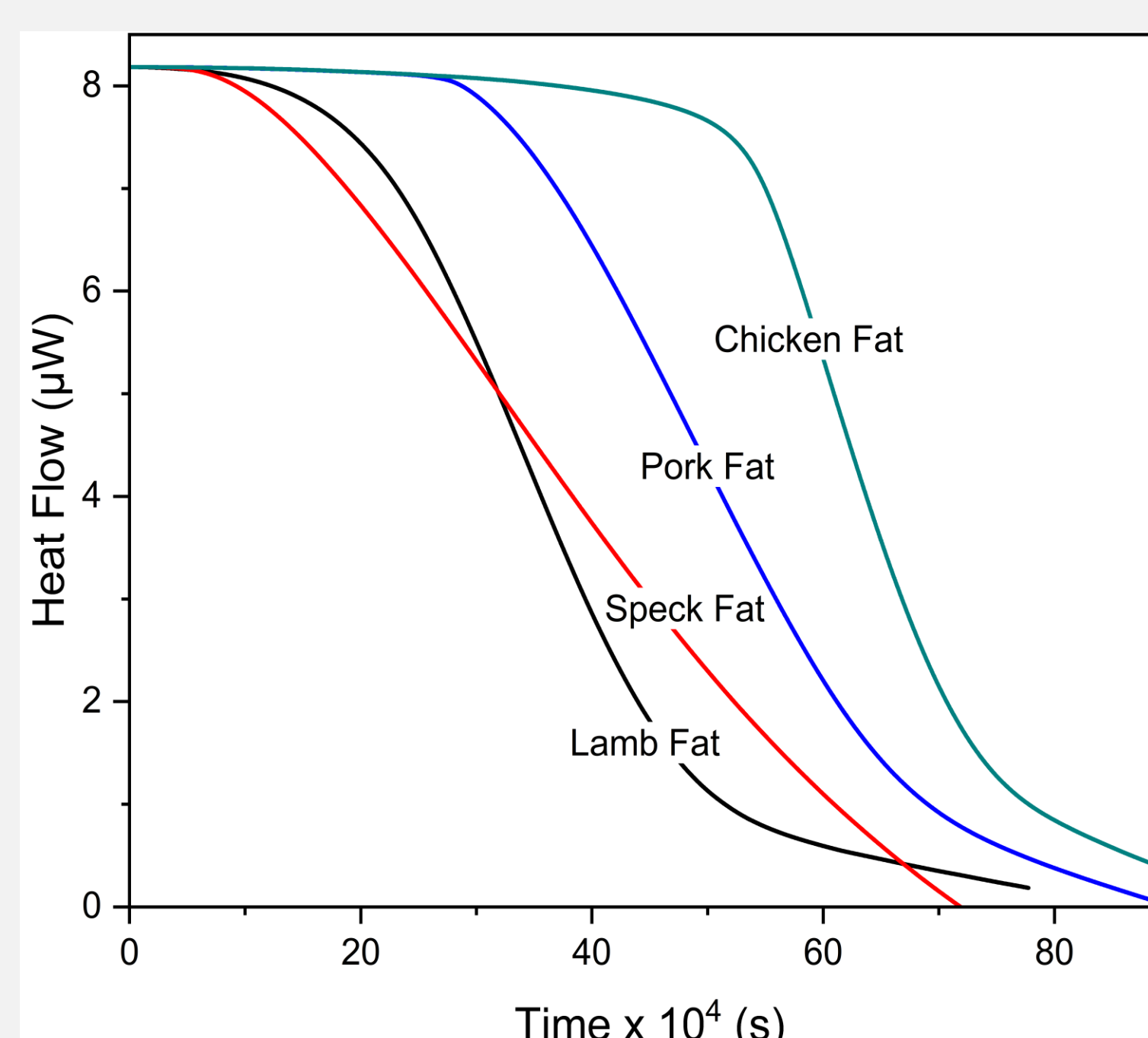


Figure (B) shows the conversion of the heat flow in oxygen consumption data. (Suhag et al. 2024).

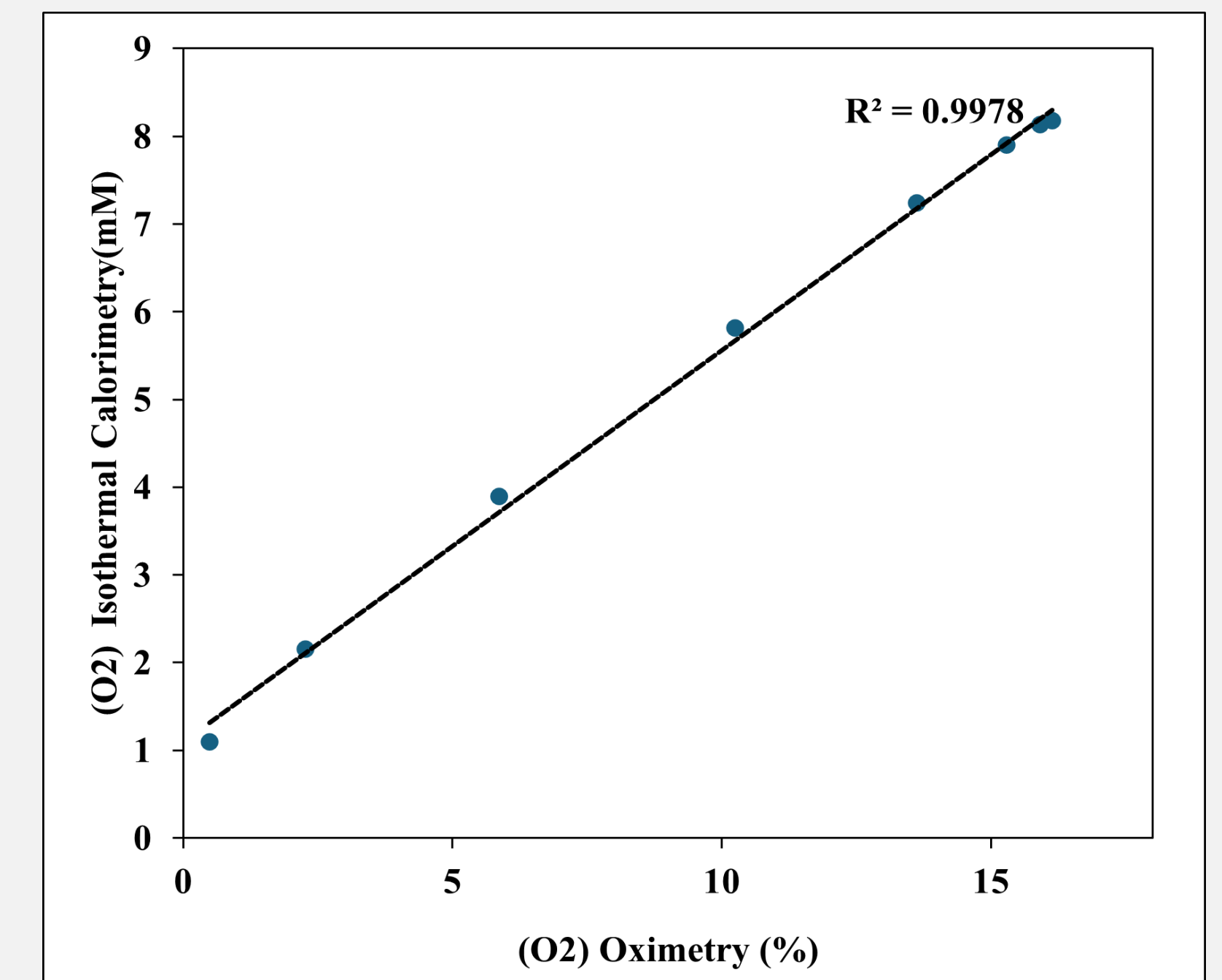


Figure (C) shows the relationship between oxygen concentration obtained from IC and oximetry.

Kinetic parameters and antioxidant efficiency

The concept of “antioxidant efficiency” provides a beneficial and practical approach to quantitatively describe the effects of antioxidants in inhibiting lipid peroxidation (Bravo-Díaz, 2022).

Table 1: Kinetic parameters derived from isothermal calorimetry traces.

Sample	R _{inh}	R _{uni}	O.I	τ	A.E.
	10 ⁻⁸ M/s	10 ⁻⁷ M/s	(mol/L) ^{-1/2} s ^{-1/2}	10 ⁵ s	-
Lamb	2.1±0.2a	6.8±0.2d	4.8±0.1c	1.3±0.1d	454.75
Speck	1.9±0.3a	8.8±0.2b	7.0±0.3b	2.0±0.2c	504.19
Pork	1.1±0.2b	7.4±0.1c	6.5±0.4b	3.2±0.4b	546.4
Chicken	1.1±0.1b	9.5±0.3a	12.3±0.2a	5.1±0.3a	411.80

Table 2: Bioactive compounds detected in meat fats by HPLC-MS analysis.

Sample	β/γ tocopherol	α-tocopherol	β-carotene
	mM	mM	mM
Lamb	1.18±0.05a	0.04±0.01b	Nd
Speck	1.00±0.05a	0.08±0.01b	Nd
Pork	1.45±0.4a	0.63±0.04a	0.73±0.01a
Chicken	5.24±0.2b	0.79±0.05a	63.17±4.7b

Conclusion

Isothermal calorimetry was applied for the first time to determine the oxidative stability of meat fats.

The chicken fat sample exhibited the highest oxidative stability, while speck fat showed maximum antioxidant efficiency.

References

- Suhag, Rajat, Giovanna Ferrentino, Ksenia Morozova, Daniele Zatelli, Matteo Scampicchio, and Riccardo Amorati. 2024. “Antioxidant Efficiency and Oxidizability of Mayonnaise by Oximetry and Isothermal Calorimetry.” Food Chemistry 433. doi:10.1016/j.foodchem.2023.137274.
- Bravo-Díaz, C. (2022) Advances in the control of lipid peroxidation in oil-in-water emulsions: kinetic approaches †. Critical Reviews in Food Science and Nutrition, 1–33.