Citrus Fiber Alters Dynamic Rheology, Texture, and Water Holding Capacity of Chicken Wooden Breast Breakfast Sausage Batter

Meat Science and Technology Center
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Introduction

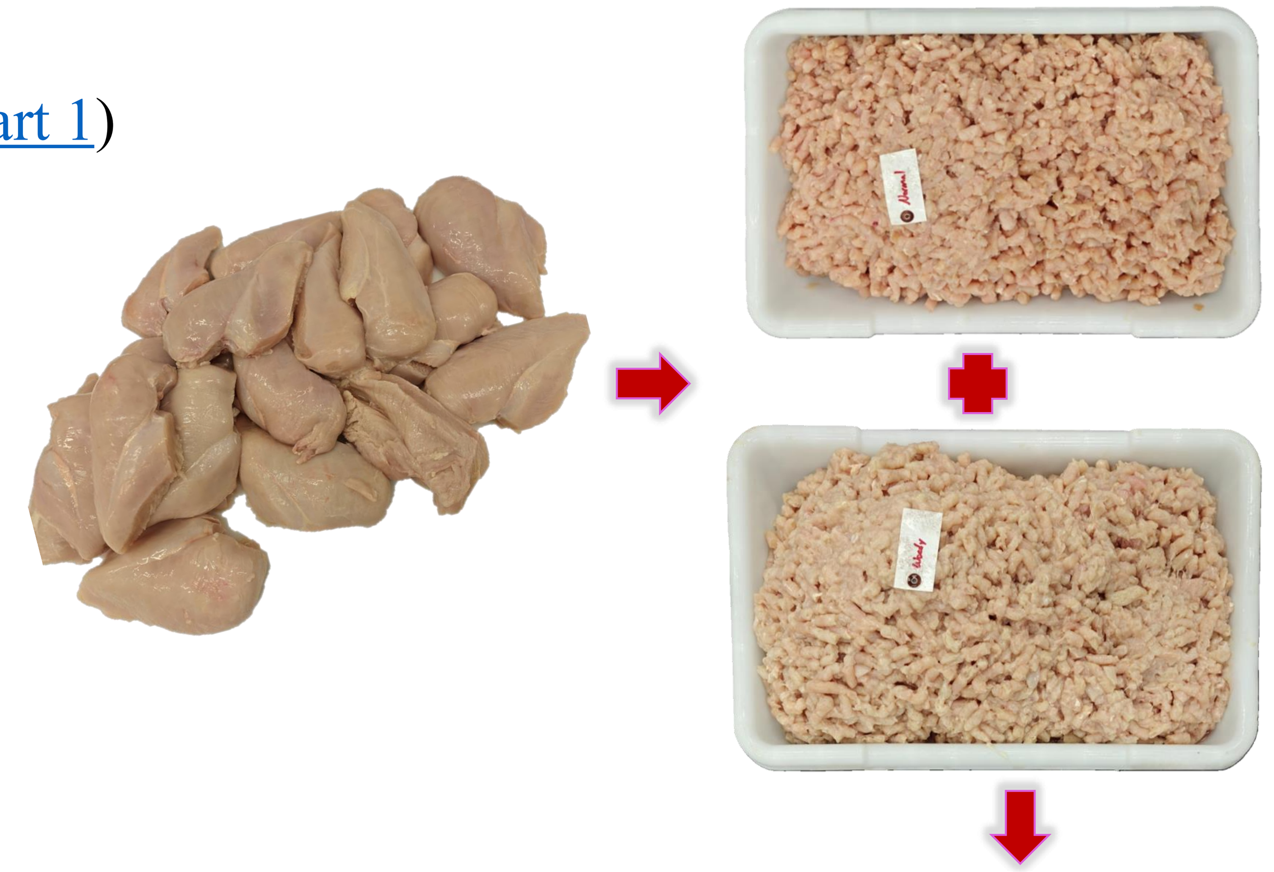
- Wooden breast (**WB**) is characterized by altered protein structure and function resulting in hardness and diminished water-holding capacity (**WHC**)
- Wooden breast posts significant revenue loss due to frequent rejections or undervaluation
- Integrating WB in further processed products can add value, However, WB integration results in mushy and watery batter formation
- Citrus fiber (**FIB**) was reported to reduce water losses and ameliorate rheological and texture properties of meat batters

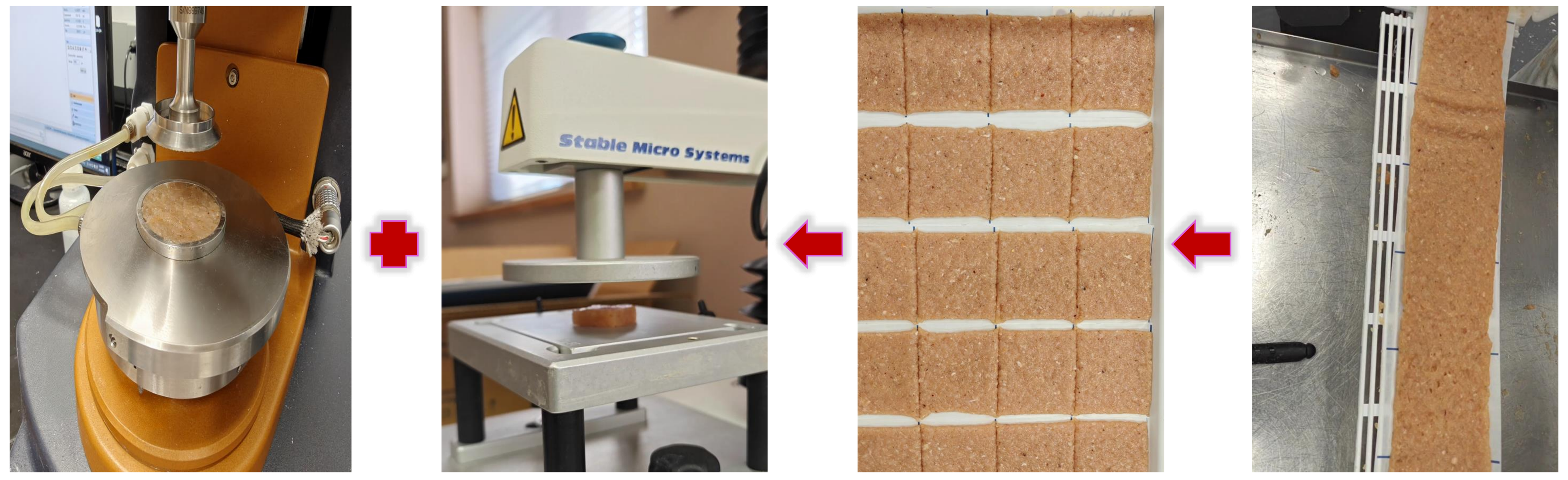
Objective:

- To evaluate citrus fibers' influence on rheological, textural and water holding properties of WB meat batter to improve processability

Methods

- Across 3 reps 227 kg Normal and Severe WB fillets were collected (Flow Chart 1)
- Ground:
  - Coarse = 1.27 cm
  - Fine = 0.48 cm
- Treatments:
  - [0% WB (**NF-WB0**)]
  - [50%WB (**NF-WB50**)]
  - [100%WB (**NF-WB100**)]
  - Fiber × [0% WB (**FIB-WB0**)]
  - Fiber × [50%WB (**FIB-WB50**)]
  - Fiber × [100%WB (**FIB-WB100**)]
- Spice mix:
  - Breakfast sausage blend, Water = 3%, Citrus fiber = ±1%
- Vacuum stuffer breakfast patty extrusion:
  - Single-slot Colosimo die (3/8")
- Further analyses:
  - Dynamic Rheology
  - Cook loss
  - TPA (raw batter)
- Data were analyzed as **RCBD**
  - 2×3 factorial arrangement
  - Fixed effects = Fiber inclusion & WB %
  - Random term = Replication





Results

Cook Loss:

- Fiber inclusion improved ($P < 0.05$) cook yield by 1.92% irrespective of the WB percentage, whereas WB50 had 1.77% and WB100 had 3.45% greater ($P < 0.01$) cook loss than WB0, irrespective of the fiber inclusion (Figure 1)

Dynamic Rheology:

- There were WB×FIB interactions ($P < 0.01$) for the damping factor (tan δ), NF-WB0 had a smaller ($P < 0.01$) tan δ than NF-WB100, and F-WB0 had a smaller ($P < 0.05$) tan δ than F-WB100, indicating their stronger internal structure and more elastic (solid-like) behavior
- The Fiber incorporation made breakfast sausage batters less elastic ($P < 0.01$; Figure 2)
- There were no WB×FIB interactions ($P > 0.05$) for the complex modulus (G*), storage modulus (G'), and loss modulus (G")
- Irrespective of fiber inclusion, WB100 had the smallest ($P < 0.01$) G* value, followed by WB50 and WB0, explaining the decreased total resistance to deformation with increased WB level
- Fiber-added breakfast sausage batters demonstrated enhanced ($P < 0.01$) total resistance to deformation (greater G*), irrespective of the WB level
- Increased WB percentage in breakfast sausage batters resulted in decreased ($P < 0.01$) G', illustrating weaker and softer batter, while fiber addition increased G' of batters
- Reduced G" values were shown by increased WB content in batters, depicting decreased spreadability; fiber addition increased G" irrespective of WB level (Figure 3)

Texture Profile Analysis:

- Raw breakfast sausage batters had WB×FIB interactions ($P < 0.01$) for adhesiveness but not ($P > 0.05$) for hardness, resilience, springiness, and gumminess
- The adhesiveness exhibited by F-WB50 was not different ($P < 0.01$) from NF (Table 1)

Conclusion

Overall, fiber addition to breakfast sausage formulations made with wooden breast meat resulted in a meat batter with increased resistance to deformation (greater G*), increased firmness (greater G') and decreased elastic behavior (greater tan δ). As a result of these changes to the batter, breakfast sausages that included citrus fiber in the formulation were more adhesive and springier, less resilient and had an improved cooking yield.

Acknowledgments

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Flow Chart 1.

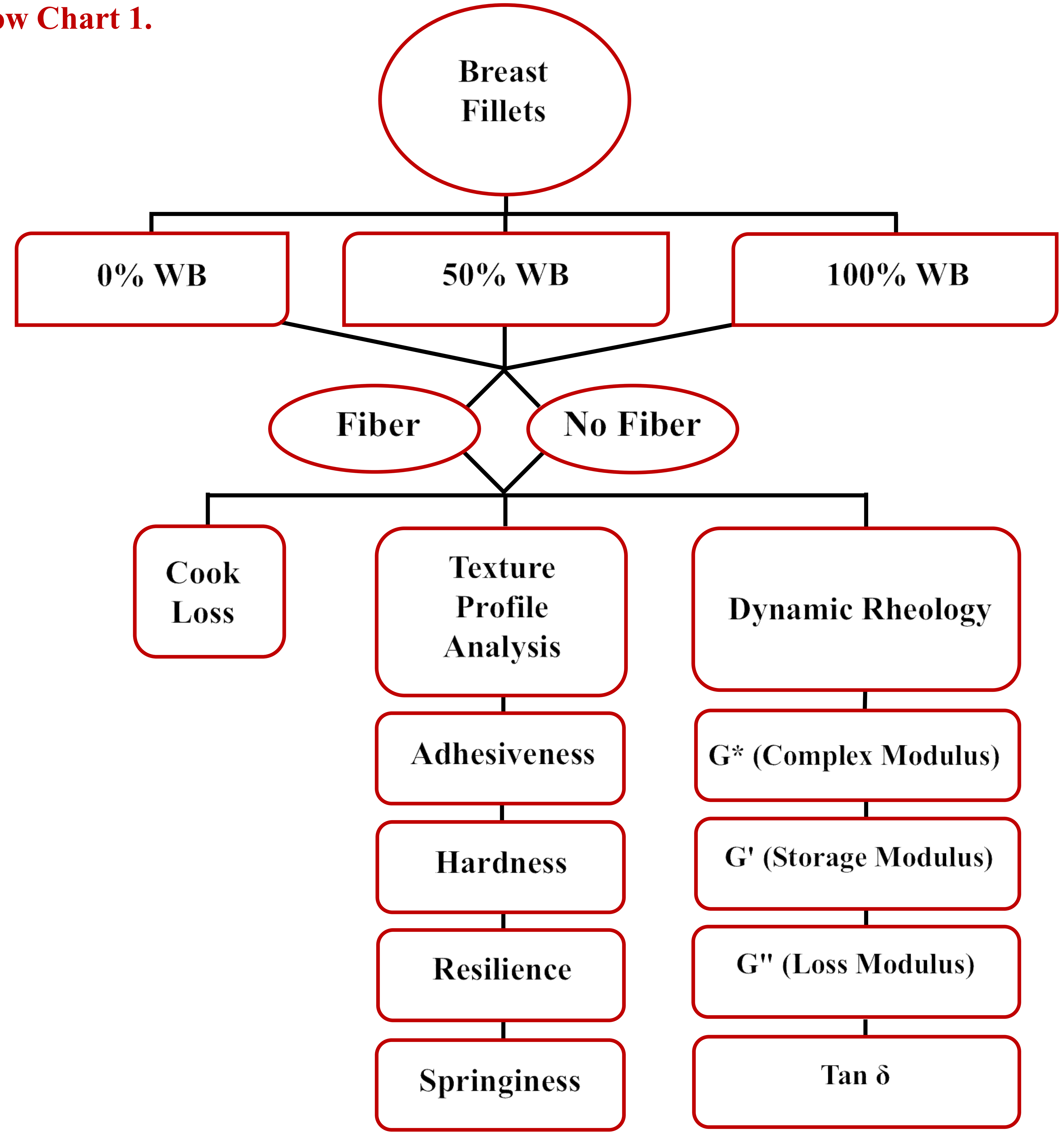

Figure 1.

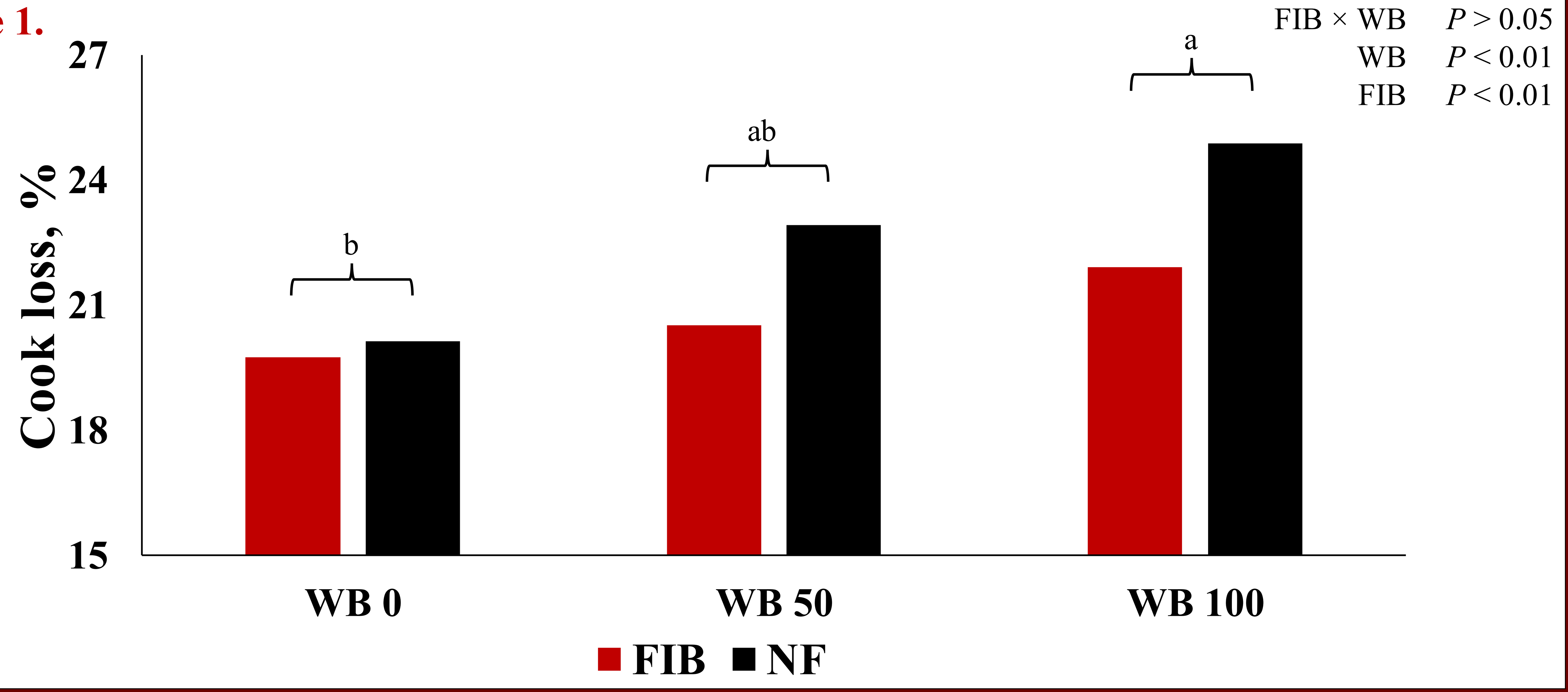

Figure 2.

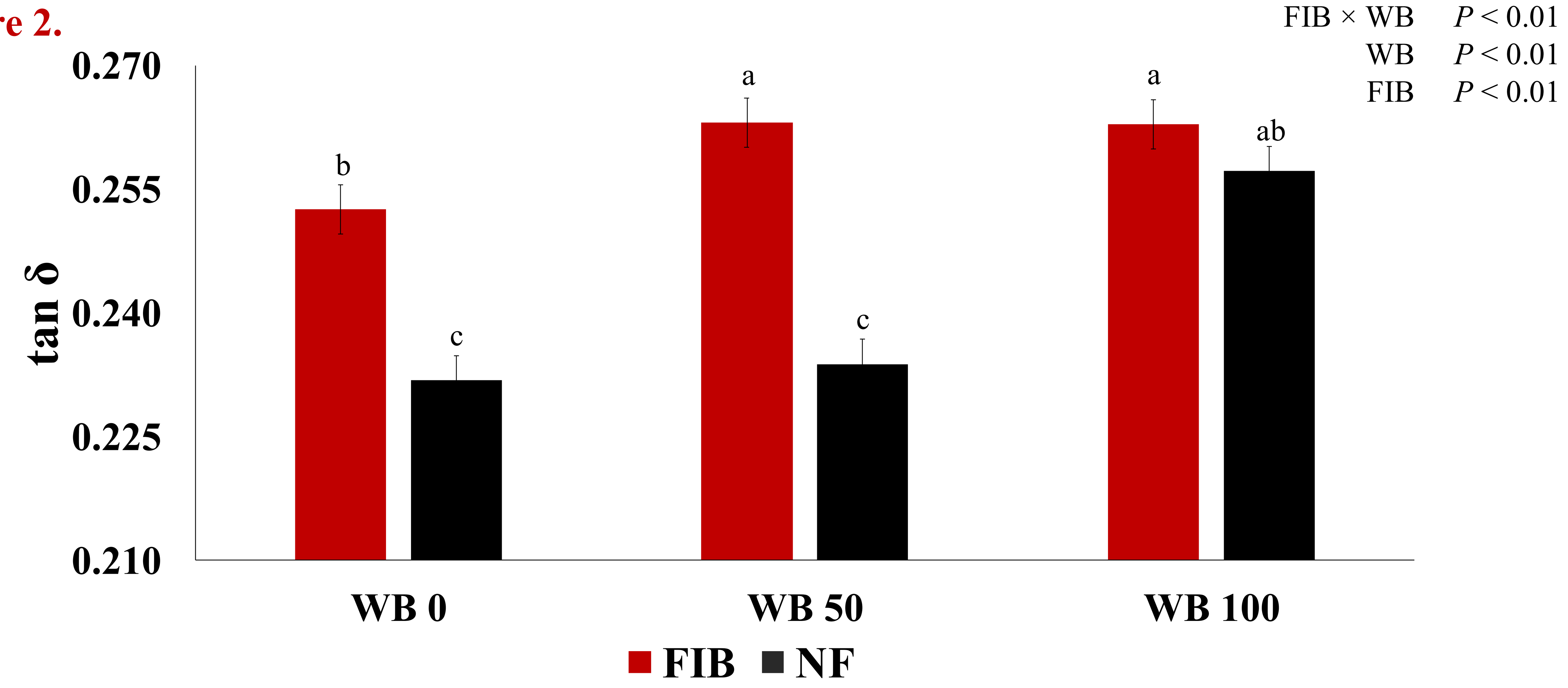

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Figure 3.

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Table 1. Texture Profile Analysis least square mean values of raw chicken breakfast sausage batter with different severe wooden breast (**WB**) percentages (**0, 50, 100**), and with (**FIB**) or without (**NF**) citrus fiber

	FIB			NF				*P* value		
Trait	WB 0	WB 50	WB 100	WB 0	WB 50	WB 100	SEM	FIB	WB	FIB × WB
Texture										
Adhesiveness, g.sec	-426.19[a]	-338.40[b]	-274.84[c]	-330.11[b]	-336.50[b]	-250.04[c]	15.79	< 0.01	< 0.01	< 0.01
Hardness, g	801.75	520.99	349.71	767.00	504.77	310.26	32.73	0.07	< 0.01	0.83
Resilience, %	8.17	6.66	5.85	8.85	7.26	6.43	0.21	< 0.01	< 0.01	0.92
Gumminess	41369.0	27548.0	19905.0	38024.0	28080.0	18586.0	1682.7	0.06	< 0.01	0.11
Springiness, %	95.20	95.36	95.42	94.06	94.33	94.19	0.19	< 0.01	0.24	0.69

[abc]Means in the same row with different superscripts differ (**FIB × WB**).