Effect of mulberry leaf powder content on plant-based simulated meat under different moisture

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Key words: Mulberry leaf powder; Simulated meat; Texture; Moisture.
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Plant-based simulated meat is a good choice to replace the traditional animal protein, which has some problems such as relatively low production efficiency, unfavorable to human health, environmental pressure, animal welfare and so on (Sanchez-Sabate et al., 2019). In recent years, plant-based simulated meat has a good market prospect. The market of plant-based simulated meat is expected to grow from $4.6 billion in 2018 to $30.9 billion in 2026, showing strong growth momentum and good market potential (Sha et al., 2020). Therefore, it is of positive significance to develop a variety of plant-based simulated meat products with rich functions.

Soybean protein isolate is one of the commonly used raw materials for preparing plant-based simulated meat. As plant protein, soybean protein isolate has rich nutrition and is comparable to animal derived products (Huang et al., 2018). At the same time, soy protein isolate is often used in combination with wheat gluten to enhance the apparent properties of plant-based simulated meat, mainly because gluten improves the fiber network structure of the protein (Chiang et al., 2019). Wheat gluten utilizes protein-protein interactions to improve the apparent properties of plant-based simulated meat, but has limited effect on increasing the variety of nutrients.

The influence of other components on the apparent properties and nutritional value of plant-based simulated meat is also worth studying. As a kind of traditional Chinese medicine, mulberry leaves not only have unique fiber structure and pigment, but also are rich in various nutrients (Ma et al., 2022). Plant-based simulated meaty 2020, China's mulberry planting area had exceeded 760,000 hm^2. Mulberry leaf is the main product of mulberry, the output is about 30,000 Kg /hm^2, mainly used for rearing silkworm, and a large number of mulberry leaves have not been developed and utilized, resulting in a waste of resources (Tu et al., 2022).

Therefore, in this study, mulberry leaf powder was used as an additive to co-extrude with soybean protein isolate and wheat gluten to explore the effects of mulberry leaf powder content on the apparent properties and structural characteristics of plant-based simulated meat. At the same time, raw materials containing different moisture were used to explore the related effects of extrusion under different moisture. Finally, the material, extruded product and cooling area product were used for texture analysis.

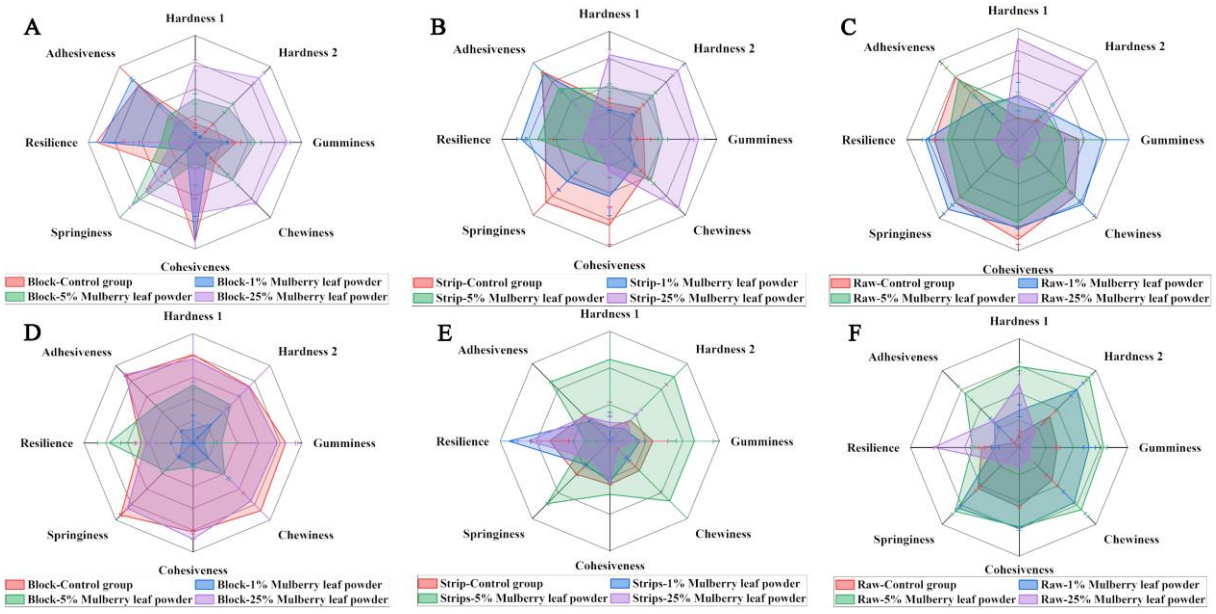

Figure.1 The textures of different plant-based simulated meat products prepared with different formulas (A) Block products with different mulberry leaf powder additions under 60% water content. (B) Strip products with different mulberry leaf powder additions under 60% water content. (C) Raw products with different mulberry leaf powder additions under 60% water content. (D) Block products with different mulberry leaf powder additions under 50% water content. (E) Strip products with different mulberry leaf powder additions under 50% water content. (F) Raw products with different mulberry leaf powder additions under 50% water content.

The results showed that with the addition of mulberry leaf powder at 60% water content, the hardness, adhesiveness and chewability of strip plant-based simulated meat increased, while the adhesion, resilience, elasticity and cohesiveness decreased. With the addition of mulberry leaf powder, the hardness, adhesiveness and chewability of block shaped products were improved, while the adhesion and resilience were decreased, and the changes of elasticity and cohesiveness were not significant. After adding mulberry leaf powder, the adhesive and chewability of raw materials decreased, but after high moisture extrusion, the adhesive and chewability were greatly improved. The products with 1-5% mulberry leaf powder had little effect on adhesion and recovery, while improving other properties.

At 50% water content, with the addition of mulberry leaf powder, the indexes of strip products increased first and then decreased, and the indexes of 5% mulberry leaf powder were better. The addition of 1% mulberry leaf powder has the best recovery. With the addition of mulberry leaf powder, the indexes of block products increased gradually. After adding mulberry leaf powder, the indexes rose first and then decreased, and the indexes of 5% mulberry leaf powder were better. The addition of 1% mulberry leaf powder has the best recovery.

Under 60% water content, the hardness, adhesiveness and chewability of the products added with 25% mulberry leaf powder increased the most before and after extrusion. At 50% water content, the bulk products with 5% mulberry leaf powder decreased significantly before and after extrusion except for the recovery. Different water conditions played a key role in the addition of mulberry leaf powder.

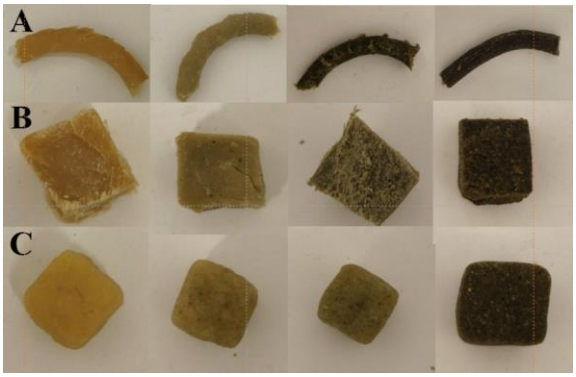

Figure.2 The apparent form of different plant-based simulated meat products prepared with 50% water content formulas. Mulberry leaf addition (from left to right): 0, 1%, 5%, 25%. (A) Block products with different mulberry leaf powder additions. (B) Strip products with different mulberry leaf powder additions. (C) Raw products with different mulberry leaf powder additions.

In summary, the addition of mulberry leaf powder has a positive effect on the texture characteristics of plant-based simulated meat, so that a variety of plant-based simulated meat products with different functions can be developed. Further studies are needed to evaluate the nutritivity of mulberry leaf powder.

Acknowledgements: This work was supported by the Jiangsu Agricultural Science and Technology Innovation Fund (CX (20) 2029).

References

[1] Sanchez-Sabate R., Sabate J., 2019. 'Consumer Attitudes Towards Environmental Concerns of Meat Consumption: A Systematic Review'. *INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH*, 16: 12207.

[2] Sha L., Xiong Y.L., 2020. 'Plant protein-based alternatives of reconstructed meat: Science, technology, and challenges'. *TRENDS IN FOOD SCIENCE & TECHNOLOGY*, 102: 51-61.

[3] Huang, S., Wang, L.M., Sivendiran, T., Bohrer, B.M., 2018. 'Review: Amino acid concentration of high protein food products and an overview of the current methods used to determine protein quality'. *CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION*, 58 (15): 2673-2678.

[4] Chiang, J.H., Loveday, S.M., Hardacre, A.K., Parker, M.E., 2019. 'Effects of soy protein to wheat gluten ratio on the physicochemical properties of extruded meat analogues'. *FOOD STRUCTURE-NETHERLANDS*, 19 (100102).

[5] Ma, G., Chai, X., Hou, G., Zhao, F., Meng, Q., 2022. 'Phytochemistry, bioactivities and future prospects of mulberry leaves: A review'. *FOOD CHEMISTRY*, 372: 131335.

[6] Tu, J., Liu, G., Jin, Y., Tang, C., Yao, T., Zhuo, J., Li, Q., Liu, L., Wang, J., 2022. 'Enrichment of gamma-aminobutyric acid in mulberry leaves and the inhibitory effects of the water extract on ACE and alpha-glucosidase activity'. *INDUSTRIAL CROPS AND PRODUCTS*, 177: 114485.