

Research on the Chinese Consumers' Perceptions of Imperfect "Ugly" Produce

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Abstract: Despite the nutritional value of imperfect or 'ugly' produce, these items are often left unharvested or discarded, contributing to increasing farm-to-fork food waste issues worldwide, and China is no exception. This paper aims to explore Chinese consumers' perceptions of imperfect produce and their willingness to purchase these foods in their households. Six online focus group sessions were conducted, each involving five voluntary participants. The structured interviews generated a total of eleven themes related to consumer perceptions of imperfect produce, including food safety, freshness confusion, price sensitivity, the channel of sale, product presentation, intended use, goodwill, family influence, consumer education, smart integration and food waste. This study provides initial insights into consumer perceptions of imperfect "ugly" fruits and vegetables from a research perspective, and the conclusions provide strategies for sustainable food management. This helps stakeholders in the food supply chain to save on production costs while helping governments to alleviate the paradox of hunger and food waste.

Keywords: Sustainability, farm-to-fork, food waste reduction, imperfect produce, "Ugly" fruits and vegetables

1. Introduction

Food waste is defined as any food and inedible parts of food that are removed from the food supply chain to be recovered or disposed of [1]. Imperfect or "ugly" produce exacerbated the global farm-to-fork food waste problem. Despite the nutritional value of imperfect or "ugly" produce, these items are often left unharvested or discarded. The 2023 China Report on Food and Nutrition reveals that China experiences a combined food loss and waste rate of about 22.7%, with total food waste reaching 460 million tons in 2021. Vegetables and fruits account for a significant portion of this waste, contributing to substantial economic losses. The introduction of the "Anti-Food Waste Law" in April 2021 marked a significant step towards addressing this issue, though challenges remain in curbing consumer-driven waste due to gaps in the law's enforcement.

Most of the food waste in household food consumption can be avoided as most of the food that is discarded is within the range of what is safe to eat [2]. According to earlier research, imperfect food waste is avoidable food waste brought on by false beliefs that devalue edible food and are the result of a lack of familiarity with and understanding of food, food systems, and food sources [3].

This paper explores Chinese consumers' perceptions of imperfect produce and their willingness to purchase and consume these foods in their households. Through six online focus group sessions with participants from large cities, the study aims to identify the major themes related to consumer

perceptions. These findings offer valuable insights for developing strategies to reduce food waste and promote sustainable food management in China.

2. Literature Review

To date, studies on consumers' perceptions of imperfect foods are mainly carried out in the US and Europe, such as Yuan et al. looked into how imperfect or "ugly" produce was perceived by US customers and whether or not they were willing to buy and eat it. In contrast, relatively little attention has been paid to food waste in Chinese households, and relevant academic research is limited [4]. Current literature linking the food waste problem to Chinese consumers' perceptions of sub-optimal food argues that refusing to consume food because of its imperfect appearance can result in serious food waste [5]. They contend that raising consumer concerns about the environment and social trust may lead people to buy food that is atypically formed. This may lessen the strain on China's food supply network.

In addition, the study by Bai et al. identified influencers that could minimize sub-optimal food waste in Chinese households [6]. They classified four categories and ten subcategories of motivations and obstructions. The categories are sub-optimal context (type of sub-optimal food, sub-optimal levels), product characteristics (characteristics of sub-optimal food), psychological consciousness (face concepts, cognition of sub-optimal food, values, negative mood), norms (special customs, social norms, religious beliefs) [6].

3. Methodology

3.1. Data Collection

This study used synchronized online focus groups to investigate how Chinese consumers perceive, recognize, and interpret aesthetically imperfect "ugly" produce [7]. The focus group methodology has been widely used to explore the issue of food waste, as it effectively captures authentic and reliable insights from participants [8-10]. Synchronized online focus groups are close to traditional face-to-face focus groups [11].

Six online group discussions took place in June and July 2024. 30 volunteers took part in the interviews. Participants were recruited through WeChat circles of friends, were over 21 years old, and came from three major Chinese cities: Shanghai, Tianjin, and Beijing. All 30 participants were the main individuals responsible for grocery shopping in their families. Participants used online nicknames to ensure anonymity. Focus group participants ranged in age from 21 to 65 years old. There were 11 males and 19 females.

The discussions were held via a Microsoft online platform over six sessions, each involving five participants. The same facilitator led every session.

The questions for the group discussions were categorized into three primary themes: perceptions, knowledge, and factors influencing consumption [4]. The discussions followed a predefined structure: the facilitator outlined the purpose of the meeting, gathered information about participants' household details and shopping behaviors, and inquired about their views on aesthetically imperfect produce and consumption intentions, and explored perceptions of imperfect "ugly" food waste caused by produce, and each participant's suggestions for encouraging the consumption of ugly produce. The list of questionnaires is shown in Table 1.

Discussion materials were not sent to participants prior to the focus group sessions. This was done to ensure spontaneity and authenticity of responses. During the focus group sessions, the facilitator offered definitions only after participants had articulated their knowledge and perceptions of imperfect "ugly" produce. Throughout the process, the moderator asked probing questions to develop

deeper perspectives and ideas. All participants volunteered to participate in the focus groups and were not paid.

3.2. Table 1. The questionnaire list

Table 1: The questionnaire list.

| | | |
|------------------|---|---|
| | Focus Group Questions | |
| Descriptive info | nickname | |
| | family size | |
| | grocery purchase cycle | wet market |
| | | online grocery store |
| | | grocery store |
| | | street vendor |
| | | other |
| | frequency of grocery shopping | |
| Key questions | your understanding of imperfect produce (give examples) | |
| | Do you know that imperfection in produce does not necessarily affect its nutritional value? | worm holes Curled Scars Uneven colors Irregular appearance Odd shapes |
| | Will you accept imperfect fruits and vegetables in your household? | |
| | If not acceptable, what are the reasons? | |
| | If there are imperfect produce sold separately in stores, would you buy them? Why or why not? | |
| | If imperfect produce is used as ingredients, would you resist it? Why or why not? | |
| | Would you buy imperfect produce as an act of good will? | |
| | How should we incorporate imperfect produce into our daily lives? | |
| | How should we educate people to accept imperfect produce? | |
| | Do you have any awareness of the food waste caused by imperfect produce? Would you change your actions if you had more awareness? | |
| Ending questions | Anything to add? | |

3.3. Results

The main objective of this research was to initially uncover the attitudes, including concerns, misinformation, and misunderstandings, that Chinese consumers have regarding imperfect "ugly" fruits and vegetables. Subsequently, the aim was to identify potential solutions that could increase people's awareness and promote positive acceptance of imperfect "ugly" produce. In order to achieve these objectives, eleven dominant themes were identified as the dominant themes of the study, as shown in Table 2.

Table 2: Eleven dominant themes.

| Theme | Defining questions | Theme intensity | Supporting examples of quotes |
|----------------------|--|-----------------|--|
| Food safety | Does imperfect “ugly” produce have the same nutritional value as the “perfect” ones? Are they safe to eat? | 29 | When given a chance, I would definitely buy the good-looking ones. (Jiuma) I wouldn’t buy ugly produce because I am concerned about health issues. (Yue) |
| Freshness confusion | Is the imperfect produce not fresh or near expiration? | 14 | If bananas turn black, can they still be eaten? Are they rotten? (ZhuDR) I’m worried imperfect produce might be not fresh or near expiration. (Cailiang) |
| Price sensitivity | Is “ugly” produce cheaper than normal produce? How much discount is needed to incentivize purchasing? | 15 | If perfect and imperfect produce were sold at the same price, I buy the one that is perfect (Erjie). Maybe if it were at least 20% off and they could prove to me that it is fresh and good then I might try it (Mutong) |
| Channel of sale | wet market online grocery store grocery store street vendor other | 8 | I would buy imperfect produce only at the trustworthy chain stores so that I don’t have to get into the trouble of testing them. (Wang Yingqian) If the process from farm to store could be broadcasted online, I would buy it because I can trust the source. (Jiuma) |
| Product presentation | Where is the imperfect produce displayed within the retail setting? How should they be displayed? | 16 | 'Product information should be clearly displayed to educate customers. (Xu Zihan) Imperfect produce should be picked out and displayed separately, with clear reasons for imperfection to help consumers make a choice. (Boris) |
| Intended use | How will the produce be used by consumers? How can more frequent use be encouraged? | 25 | I would feel uncomfortable if I knew the product I have bought contains imperfect ingredients. (Yi Pianyun) This is even worse than imperfection in the final products. I would only buy things with imperfect ingredients if the discount is 50% off and more.' (Mutong) |
| Good will | Would you be willing to purchase imperfect produce simply out of good will? | 30 | I would only buy imperfect produce occasionally out of good will. But it has to be discounted and I will have to be assured of its safety. (Erjie) I won’t buy it for good will even. (Daniel) |
| Family influence | How are your perceptions of imperfect produce influenced by other family members? | 6 | I am told by the elderlies in the family imperfect produce are more natural and more delicious. (Vincy) My friends have a farm and I find vegetables with worm holes more precious. (Wang Yingqian) |

| | | | |
|---------------------|---|----|--|
| Consumer education | How can we educate consumers? | 22 | Consumers need to be educated to know what kind of imperfect produce are safe to eat. (KK) Education would change my opinion (Yang Jiaqi) |
| Smart Incorporation | How can we incorporate imperfect fruits and vegetables into our daily life? | 8 | Juice, Jams, Seeds (Zhang Cuicui) Pre-cut fruits, or animal food. (Ada) |
| Food waste | Do you know the amount of food wasted by people discarding imperfect produce? How can grocery sellers change consumer perceptions to reduce food waste? | 20 | I didn't know there was so much food waste caused by imperfect produce. Had I known this I would have changed my attitude immediately. (Nancy) Imperfect fruits and vegetables are edible as long as they are safe. (Vincy) |
| Note | The number of times this theme emerged during the focus groups | | |

In terms of Food Safety, Chinese consumers are highly concerned about food safety. The predominant discussion theme revolved around helping them distinguish imperfect "ugly" produce from unsafe products. Consumer education emerged as a key recommendation from all focus groups. **On freshness confusion**, feedback from focus group participants revealed that Chinese consumers tend to associate imperfect "ugly" produce with low freshness or nearing expiration. This perception posed a significant barrier for the acceptance of ugly produce. **In terms of price sensitivity**, most focus group participants exhibited high price sensitivity. Significant discounts were deemed necessary to stimulate their purchase of imperfect "ugly" produce. Participants' discount threshold ranged between 30% to 60% off regular prices. Even those with positive perceptions of ugly produce required price reductions for purchasing significant quantities of sub-optimal foods. **In terms of channel of sale**, many focus group participants expressed concerns about the source of imperfect produce. They indicated trust in major grocery store chains or farms they had personally visited. Transparency regarding the origin of the produce emerged as an important factor in driving the adoption of imperfect fruits and vegetables.

In terms of product presentation, discussions were held among focus group participants regarding the presentation of "ugly" produce. The consensus seemed to be that imperfect produce should be displayed separately from regular products, with detailed explanations given regarding the reasons for imperfection. It was also suggested that consumers need to be explicitly told that such produce is safe to eat. **In terms of intended use**, participants' responses were polarized when considering foods that are not seen as a whole at the time of serving or eating, such as canned foods or pre-cut fruits. "Some individuals are indifferent to the use of imperfect produce as ingredients that are not visible, while others strongly oppose this idea due to concerns about food safety". **In terms of good will**, when discussing whether they would buy imperfect produce as an act of goodwill, some participants said no. Even those who said "yes," indicated that they would only do so occasionally. People consistently preferred perfect foods over imperfect ones when given a choice. **In terms of family influence**, a few focus group participants were more tolerant of imperfect "ugly" produce because their parents or themselves grew up near farms. For them, fruits and vegetables with scars or wormholes meant fresh and healthful.

In terms of consumer education, most group participants suggested that education would be necessary to assure consumers that imperfect "ugly" fruits and vegetables could have the same nutritional value as those perfect-looking ones. **In terms of smart incorporation**, some participants suggested smart ways to incorporate imperfect "ugly" produce into our daily lives. Recommendations

included juices, jams, pre-cut vegetables, and even animal food. **In terms of food waste**, one important finding from the focus groups is that a great majority of the participants had no prior knowledge of the quantity of food waste caused by imperfect produce. Many people expressed willingness to purchase and consume more ugly produce if they had known about the severity of food waste.

4. Discussion

This research study confirmed that price is a significant factor influencing the purchase of "ugly" produce. Lower prices may motivate increased buying of fruits and vegetables, particularly among consumers with limited budgets who often avoid these items due to high costs. Additionally, price-sensitive shoppers across all income levels may see these options as a way to rationalize purchasing more fresh produce. Both restaurants and home cooks can increase the amount of fresh produce they buy each week by including reduced-price "ugly" fruits and vegetables into their shopping lists. More studies are needed to identify the optimal pricing that would draw a greater number of consumers to these offerings.

An important outcome of this research revealed that many buyers were highly opposed to using the term "ugly" to describe fruits and vegetables, preferring expressions such as "imperfectly shaped produce" as a more suitable designation. Consequently, it is crucial to position these misshapen fruits and vegetables in a way that emphasizes their typical quality and safety through language. Consistent labeling, potentially supported by industry bodies or government agencies, could effectively reduce consumer concerns about safety. Retailers might also market "ugly" produce as eco-friendly, appealing to environmentally conscious consumers.

The study also highlighted the need for informal educational strategies to shift how people view and choose to buy aesthetically imperfect produce. These initiatives should prioritize aspects such as safety for consumption, general quality, and cost benefits, while also highlighting the positive environmental impact and potential to combat food insecurity through minimizing waste. Given the urgency of addressing both hunger and ecological sustainability, it's essential to raise awareness about the environmental consequences of food waste and the hunger that could be alleviated by reducing waste. Educational programs should also emphasize the nutritional equivalence, food safety, and cost advantages of these previously discarded products to encourage broader acceptance.

The findings suggest that awareness initiatives are likely to have the greatest impact when incorporating authentic testimonials, images, or recordings from individuals who have had positive experiences with imperfect produce. Such authentic narratives, rather than those from actors or industry spokespeople, have the potential to exert a more immediate impact on consumer attitudes and purchasing decisions. Additionally, portraying these unique-looking products as fun to serve and eat could help attract attention and shift consumer behavior.

5. Conclusion

This study explored the Chinese public's understanding, attitudes, and buying behavior related to aesthetically "ugly" fruits and vegetables. Key themes gathered from focus group participants revealed that price is a factor that influences consumers' readiness to buy and use these items at home. Additionally, insights gained from the analysis can guide the development of integrated strategies, such as adjustments in distribution networks and promotional initiatives, to bring "ugly" produce back into the regular shopping habits of consumers. Contrary to retailers' assumptions, people are open to purchasing "ugly" produce if they have greater exposure to it and recognize its edibility. Any stakeholder in the local food chain can start a farm-to-table campaign to raise awareness of aberrant produce and educate individuals on its culinary uses. This study reveals the priorities of Chinese

consumers regarding “ugly” produce, which offers valuable insights on how businesses may develop future strategies to solve such issue. Further research from the business perspective may consider evaluating the cost-effectiveness of various strategies suggested in this study, including price adjustment, educational marketing campaigns, transparency in supply chain, etc. Though this study provides preliminary insights into consumer perceptions of imperfect produce, the limited sample size of 30 participants from six focus groups affects the generalizability of the findings. Future research may conduct online surveys of greater sample size to gather more comprehensive data. Demographic differences were recorded not examined in this study, but future quantitative research may analyze these aspects to provide more specific insights.

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