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Culture-based metaphorical temperature affects food choices: Chinese consumers choose foods based on their hot-cold nature

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The effects of both food temperature and ambient temperature have recently been studied in the context of food marketing and decision-making. However, despite the dominant role of culture-based metaphorical temperature, a characteristic rooted in traditional food culture, in shaping food preferences in many regions (e.g., Southeast Asia), its impact has been overlooked in previous research. Across three studies, this research investigated the effect of metaphorical food temperature on people's food choices. The results revealed that participants chose hot-natured (vs. cold-natured) foods when imagining themselves as experiencing 'bodily cold' (vs. 'bodily hot'; Study 1), as these foods were perceived to be healthier under those conditions (Studies 2 and 3). These findings highlight the influence of culture-based metaphorical temperature on how people perceive the nutritional properties of foods.

Food is typically far more than just a matter of taste and nutrition for individuals. For instance, consider only how people purchase food to celebrate holidays, prepare birthday parties, and welcome friends, because food conveys unique cultural values. Alongside foods' physical temperature, many food cultures attribute to foods a metaphorical "hot" or "cold" nature[1–4]. In China, this classificatory scheme is rooted in Traditional Chinese Medicine (TCM), which treats the human body as a dynamic system in which health depends on a delicate, continually shifting balance between opposing yet complementary *Yin–Yang* forces.

According to this belief, hot-natured foods are thought to help maintain body warmth and alleviate cold-related symptoms, whereas cold-natured foods are commonly believed to relieve discomfort in hot weather and reduce the risk of heat-related conditions[5–8]. These classifications of culture-based metaphorical temperature persist regardless of a food's actual temperature or energy density. For example, both lychee fruit (low-calorie, cold-served) and mutton soup (high-calorie, served warm) are considered hot-natured. Conversely, cucumber salad (low-calorie, cold-served) and roasted duck (high-calorie, hot-served) are both categorized as cold-natured, despite their differing physical properties. The culture-based metaphorical temperature associated with specific foods has been recorded in various regions and continues to influence daily diets even today. For example, in Persian food culture, individuals balance their dishes with hot-natured and cold-natured ingredients, such as fish with yogurt[1]. Similarly, in China, a famous beverage brand uses the classic advertising slogan, "A can of Wong Lo Kat a day keeps the heat away." Despite the observation of food's culture-based metaphorical temperature, it remains unclear why and when it influences people's food choices. Thus, this research proposes a hot-cold complementary thinking framework to understand the impact of the culture-based metaphorical temperature of food on food choices.

Culture-based metaphorical temperature refers to the belief that foods can be classified by their thermal nature and that these classifications guide dietary choices aimed at maintaining internal balance[3,5]. Thermal nature is treated as independent of a food's physical serving temperature and energy content, but is considered to reflect the food's perceived physiological effects after consumption and digestion.

Across many cultural contexts, foods are categorized as hot- or cold-natured[1–4]. In China, this classificatory scheme is closely associated with TCM, which conceptualizes the body as a dynamic system in which health depends on maintaining a continually shifting balance between opposing yet complementary *Yin–Yang* forces (Fig. 1). Hot-natured foods are believed to "warm" the body and alleviate symptoms interpreted as cold-related, whereas cold-natured foods are believed to "cool" the body and relieve symptoms interpreted as heat-related[5–8]. Importantly, these categories do not map neatly onto physical temperature or

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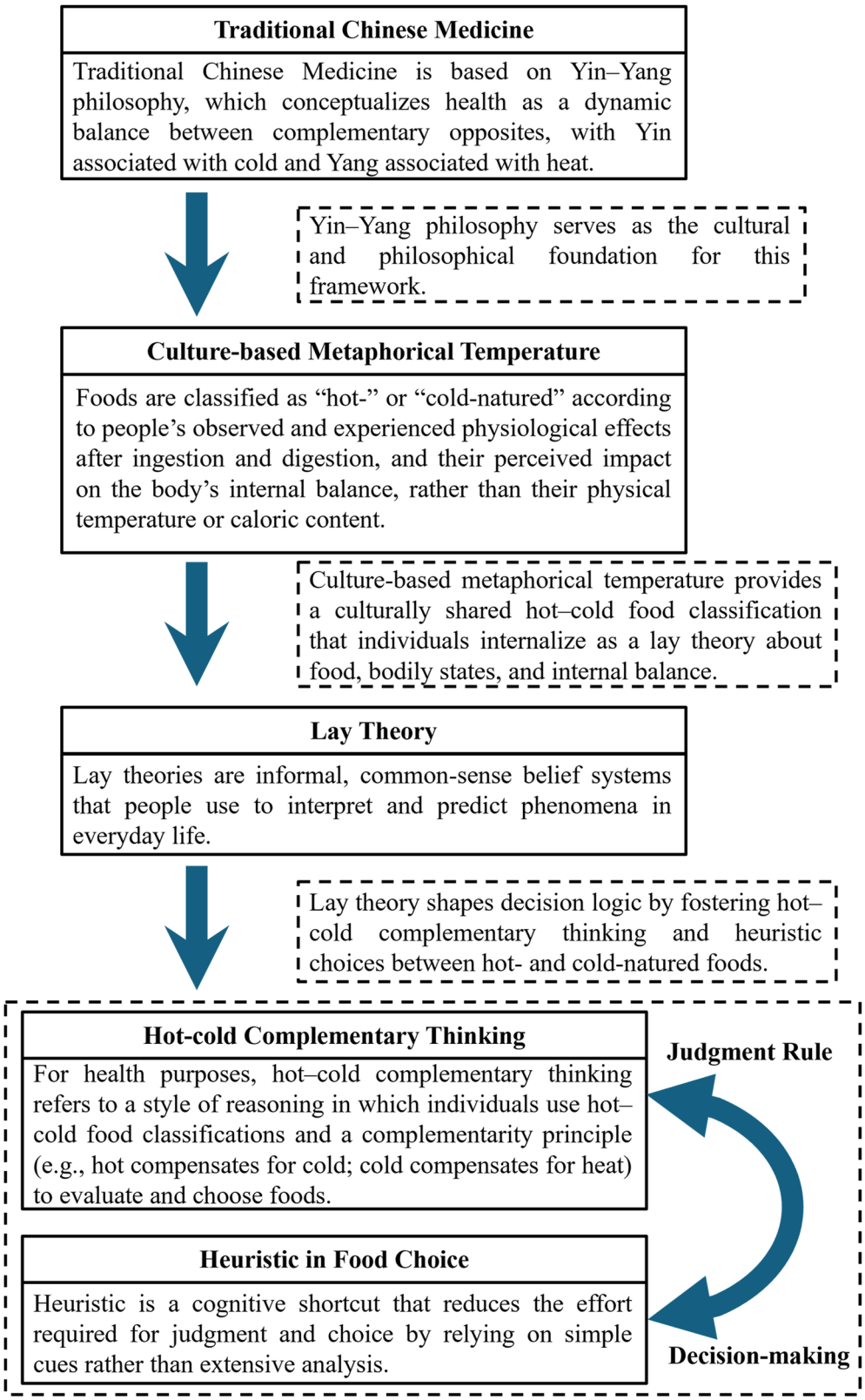

Fig. 1 | The theoretical framework of culture-based metaphorical temperature in food choice.

energy density. Foods considered hot-natured may be served cold or hot and may be relatively low or high in calories (e.g., lychee versus stewed lamb). Likewise, foods considered cold-natured may be served cold or hot and may vary widely in energy content (e.g., cucumber versus roasted duck). Overconsumption of either category is believed to disrupt internal balance, producing "heat" or "cold" syndromes and related discomforts[6,8,9].

This belief aligns with lay theory, individuals develop understandings of food "nature" through common sense, personal observation, bodily sensations, and lived experience[10–12]. Since food consumption is often a form

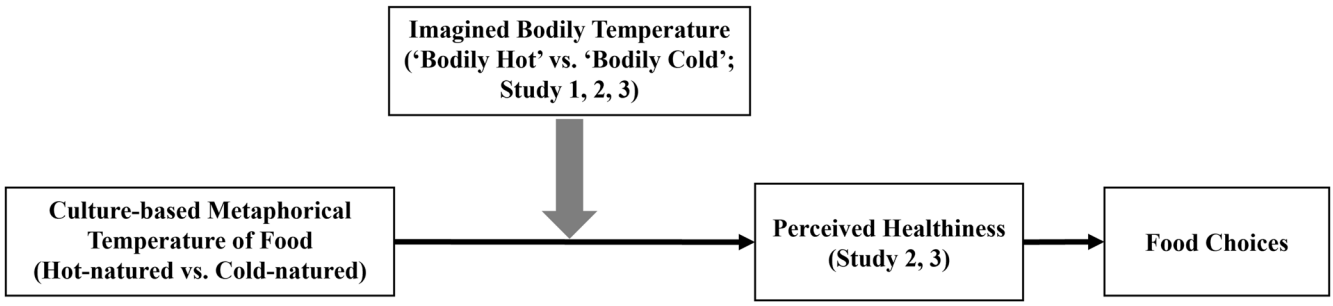

Fig. 2 | The conceptual framework.

of state-dependent self-regulation, individuals who experience (or anticipate) a cold-related internal state may view hot-natured foods as more appropriate, whereas those who experience a heat-related state may prefer cold-natured foods[13]. According to TCM, cold-natured foods are associated with Yin-related properties, and hot-natured foods with Yang-related properties[7,14,15]. *Yin–Yang* philosophy emphasizes complementarity and dynamic adjustment rather than fixed opposition[6,7]. Since health is framed as the outcome of balancing Yin and Yang[7,16–18], people may increase hot-natured foods after consuming many cold-natured foods or when they perceive themselves as "cold," and vice versa. In this sense, culture-based metaphorical temperature may function as a practical heuristic, rather than evaluating nutrient profiles or calorie content. Individuals may rely on the classification as a mental shortcut for restoring internal balance, especially under uncertainty or when bodily cues are salient[5,7,14]. Therefore, the following hypothesis is proposed:

H1: When individuals imagine being 'bodily cold' (vs. 'bodily hot'), they will prefer hot-natured (vs. cold-natured) foods.

Moreover, perceived healthiness functions as an important internal mechanism underlying food-related decision-making. People are strongly motivated to protect and improve their health, and this motivation has become increasingly central in both industrial practice and academic research[19,20]. While advanced technologies have been used to enhance the quality of people's health[21], food culture remains a significant factor in the regulation of people's health, profoundly influencing food-related decision-making[2,3]. Thus, for many individuals, the choice problem is not only "What do I like?" but also "What should I eat to promote my health?"

Perceived healthiness, the extent to which individuals expect a product to be healthy, plays a pivotal role in shaping food preferences[22]. This construct is increasingly important in health marketing due to its significant influence on people's food preferences[23,24]. While many factors, such as visual cues and price, are found to impact perceived healthiness[25–27], cultural factors have surprisingly been largely overlooked in previous studies.

According to lay theory, individuals learn and validate these beliefs through bodily feedback and socially shared narratives[10–12,28], culture-based metaphorical temperature links foods to expected bodily outcomes (warming/cooling) and may serve as a means of restoring internal balance[2,3]. Accordingly, when people experience cold-related symptoms, hot-natured foods are viewed as functionally beneficial because they "warm" the body; when people experience heat-related symptoms, cold-natured foods are viewed as beneficial because they "cool" the body[7,18]. These hot-cold balance beliefs have been widely observed in everyday practices. For example, Chinese people often report choosing hot-natured foods (e.g., ginger, onion) in winter and cold-natured foods (e.g., cucumber, tomato) in summer[29], and similar balancing practices have been documented in other cultures (e.g., pairing cold-natured pomegranate with hot-natured walnuts in Iranian cuisine)[13]. Thus, food-choice self-regulation may depend on the fit between an individual's internal state ('bodily hot' vs. 'bodily cold') and a food's metaphorical temperature. When this fit is high, individuals should perceive the food as healthier in that context, which in turn guides preference. Thus, perceived healthiness may function as a psychological mechanism linking bodily temperature to preferences for hot- versus cold-natured foods, leading to the following hypothesis:

H2: Perceived healthiness mediates the effect of imagined bodily coldness (vs. hotness) on preference for hot-natured (vs. cold-natured) foods.

This present research examined whether and when culture-based metaphorical temperature (hot-natured vs. cold-natured) shapes individuals' food choices. In Study 1, we tested whether these beliefs guide preferences when people imagine different bodily temperature states ('bodily hot' vs. 'bodily cold'). In Studies 2 and 3, we replicated the Study 1 pattern and tested perceived healthiness as the mediator underlying food choice (Fig. 2).

Results

Study 1

Study 1 was designed to investigate the effect of a food's culture-based metaphorical temperature on people's food choices based on imagined bodily temperature. Using a between-subjects design (imagined bodily temperature: 'bodily hot' vs. 'bodily cold'), 149 healthy Chinese participants (63.1% females; M_{age} = 26.43 ± 8.43 years) were randomly assigned to imagine being either 'bodily hot' or 'bodily cold,' and then to select one main dish and one soup from the options of two hot-natured foods (lamb stew and red bean soup) and two cold-natured foods (crab stew and mung bean soup). The experimental manipulation was successfully implemented (see details in the Methods).

As shown in Fig. 3, food choices aligned with our hypothesis, with hot-natured foods more likely to be chosen by those participants who imagined themselves to be 'bodily cold' and cold-natured foods chosen by those who imagined themselves to be 'bodily hot' instead (lamb stew vs. crab stew: $\chi^2_{(1)} = 56.27$, Cramer's $V = 0.61$, $p < 0.001$; red bean soup vs. mung bean soup: $\chi^2_{(1)} = 68.80$, Cramer's $V = 0.68$, $p < 0.001$). As such, H1 was supported.

Study 2

Study 2 was designed to replicate the effect of culture-based metaphorical temperature on people's food choices when these foods are served cold, and to further examine the mediating role of healthiness. A between-subjects design (body temperature: 'bodily hot' vs. 'bodily cold') was used (see details in the Methods). 150 healthy Chinese participants (61.3% females; M_{age} = 30.57 ± 8.40 years) were randomly assigned to imagine either 'bodily hot' or 'bodily cold' while in a normal temperature environment, and were then instructed to choose a physically cold dish (lamb meat jelly or crab meat jelly) and a dessert (red bean pudding or mung bean pudding) for their dinner, taking their imagined body temperature into account. The perceived healthiness of the four foods was then rated (see details in the Methods).

The results consistently demonstrate that the culture-based metaphorical temperature associated with the food affected people's food choices based on their imagined body temperature (lamb meat jelly vs. crab meat jelly: $\chi^2_{(1)} = 47.34$, Cramer's $V = 0.56$, $p < 0.001$; red bean pudding vs. mung bean pudding: $\chi^2_{(1)} = 67.87$, Cramer's $V = 0.67$, $p < 0.001$).

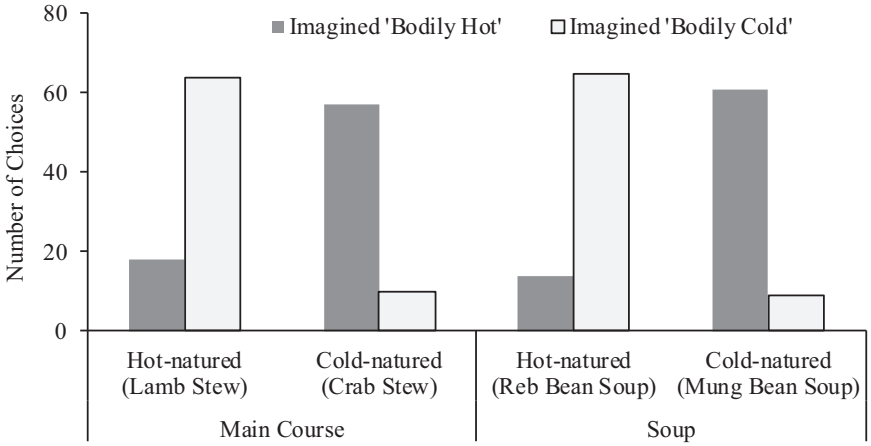

Fig. 3 | The effect of food culture-based metaphorical temperature and imagined body temperature on participants' food choices in Study 1.

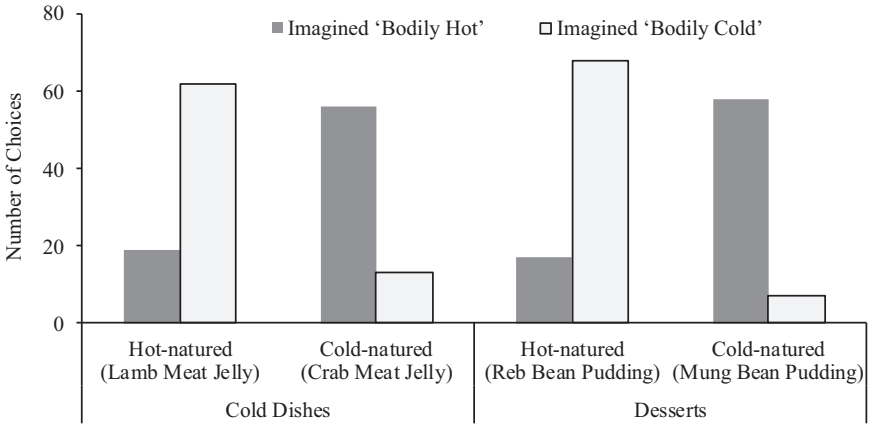

Fig. 4 | Food choice under food culture-based metaphorical temperature and imagined bodily temperature in Study 2.

Those foods were further categorized as metaphorically hot- or cold-natured to conduct the multilevel logistic regression analysis using *lme4* in R. The results showed a significant interaction effect of culture-based metaphorical temperature (hot-natured = 1, cold-natured = 0) and imagined bodily temperature ('bodily hot' = 1, 'bodily cold' = 0) on food choices ($B = 6.05$, $SE = 0.31$, Wald $\chi^2 = 388.23$, $p < 0.001$; Fig. 4). In the imagined 'bodily hot' condition, the participants were less likely to choose hot-natured foods (24%) as compared to cold-natured foods (76%; $B_{(\text{hot - cold})} = 2.31$, $SE = 0.19$, Wald $\chi^2 = 145.41$, $p < 0.001$). Conversely, those participants in the imagined 'bodily cold' condition tended to choose hot-natured foods (87%) rather than cold-natured foods (13%; $B_{(\text{hot - cold})} = -3.74$, $SE = 0.24$, Wald $\chi^2 = 242.92$, $p < 0.001$).

Next, perceived healthiness was included in the model as a mediator. Based on the Monte Carlo approach (20,000 simulations), the research detected a significant moderating effect of imagined bodily temperature on the mediating effect of perceived healthiness (*Effect size* = -3.20, 95%CI [−3.72, −2.72]). Specifically, those participants in the imagined 'bodily hot' condition considered hot-natured foods as being less healthy and were consequently less likely to choose them (*Effect size* = −0.97, 95%CI [−1.28, −0.70]). However, the participants in the imagined 'bodily cold' condition considered the foods with a hot nature as being healthier and were more likely to select them (*Effect size* = 1.68, 95% CI [1.27, 2.13]). As hypothesized in H2, this study showed that perceived healthiness mediates the effect of culture-based metaphorical temperature on food choices. Specifically, those participants who were instructed to imagine being 'bodily hot' tended to choose cold-natured foods, while those participants who imagined themselves as being cold tended to favor hot-natured foods instead, perceiving them as being healthier. This suggests that health considerations influence people's food choices under different imagined bodily temperatures.

Study 3

Study 2 investigated the influence of culture-based metaphorical temperature on food choices among young adults, exploring the role of perceived healthiness. Study 3 extended this investigation to an elderly sample to determine whether these effects generalize across age groups. 363 healthy elderly adults (45.5% females; $M_{age} = 62.03 \pm 5.75$ years) were randomly assigned to either hot or cold bodily temperature conditions. The procedure was identical to that of Study 1 (see details in the Methods).

The results consistently showed that the culture-based metaphorical temperature of foods affected people's food choices based on their imagined bodily temperature (red vs. mung bean soup: $\chi^2_{(1)} = 68.80$, Cramer's $V = 0.68$, $p < 0.001$; lamb vs. crab stew: $\chi^2_{(1)} = 56.27$, Cramer's $V = 0.61$, $p < 0.001$).

Next, foods were classified as hot- or cold-natured and analyzed using multilevel logistic regression. The results revealed that culture-based metaphorical temperature (hot-natured = 1, cold-natured = 0) interacted with imagined body temperature ('bodily hot' = 1, 'bodily cold' = 0) to predict food choices ($B = -4.95$, $SE = 0.18$, Wald $\chi^2 = 754.60$, $p < 0.001$; see Fig. 5). Participants tend to choose hot-natured foods (82%; vs. 18% cold-natured foods) in the imagined 'bodily cold' condition ($B_{(\text{hot - cold})} = 3.07$, $SE = 0.14$, *Wald* $\chi^2 = 502.21$, $p < 0.001$), but were less likely to choose hot-natured foods (28% vs. 72% cold-natured foods) in the imagined 'bodily hot' condition ($B_{(\text{hot - cold})} = -1.88$, $SE = 0.12$, *Wald* $\chi^2 = 257.60$, $p < 0.001$).

As hypothesized in H2, imagined bodily temperature consistently moderated the mediating effect of perceived healthiness (*Effect size* = −1.71, 95% CI [−1.92, −1.51]). That is, the participants rated hot-natured foods as less healthy and were significantly less likely to choose them in the condition where they imagined themselves to be 'bodily hot' (*Effect size* = −0.26, 95% CI [−0.35, −0.18]), but considered hot-natured foods to be healthier and

were more likely to select them in the 'bodily cold' condition (*Effect size* = 1.28, 95% CI [1.08, 1.48]). Consistent with the results of Study 2, these findings therefore suggest that health-related considerations shape food choices under different imagined bodily temperature—not by altering perceptions of foods' overall healthiness, but by influencing judgments of their perceived healthiness for one's current bodily condition.

Discussion

The research outlined here examined the effect of culture-based metaphorical temperature, distinct from a food's actual physical temperature or calorie content, on food choices (see Table 1). Importantly, culture-based metaphorical temperature is considered stable and unchangeable, offering a perspective for understanding food preferences that extends beyond prior explanations based solely on physical temperature or energy density. Specifically, individuals tended to choose hot-natured (vs. cold-natured) foods when imagining themselves as 'bodily cold' (vs. 'bodily hot'), regardless of the foods' actual serving temperature, because hot-natured foods were perceived as healthier in that context.

The present research makes several theoretical contributions. First, these findings extend research on food temperature and consumption by separating physical temperature from metaphorical temperature. Food perception is strongly related to sensory input[30], such as food smell and food temperature. However, culture-based metaphorical temperature is embedded in the characteristics of food that are relatively unchangeable and affect people's food choices. For example, the culture-based metaphorical temperature of crab is widely considered to be cold, irrespective of the ambient temperature and the objective temperature of the crab dishes. In contrast, the culture-based metaphorical temperature of lamb is hot, even if the cooked lamb (i.e., lamb meat jelly) happens to be served cold. This indicates that food preferences are shaped not only by sensory factors but also by culturally embedded expectations related to health. Although the culture-based metaphorical temperature has been examined in Chinese cultural context[7,14], it is also reported in other cultures, including Indian traditions (e.g., pitta humors) and in Latin American and Caribbean regions[2,3,31–34].

Second, this research contributes to understanding how culture-based metaphorical temperature shapes beliefs about foods' nutritional functions and further affects choice. Individuals use beliefs about culture-based metaphorical temperature to infer a food's likely function. Such functional inferences lead to the formation of perceived healthiness and guide selection and recommendation. Our findings are consistent with this sequence. When a cold internal state was salient (imagined or inferred), participants inferred greater health benefits from hot-natured foods, perceived them as healthier, and therefore showed higher choice and recommendation of those foods. It aligns with prior evidence that nutritional-function beliefs differ by metaphorical temperature[2,35,36]. The present research extends this literature by showing not only that these associations exist, but also that they function as state-dependent self-regulation[13], in which health judgments translate classifications of culture-based metaphorical temperature into specific food choices and recommendations for others.

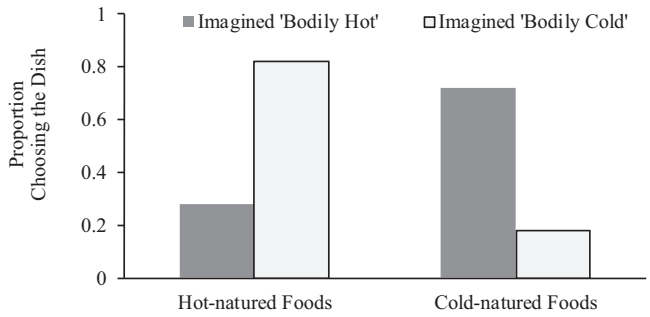

Fig. 5 | Food choice under culture-based metaphorical temperature and imagined bodily temperature in Study 3.

Third, culture-based metaphorical temperature can be understood as a form of lay theory[11,12,28], through which people make sense of complex and ambiguous food decision-making via hot-cold complementary thinking[28]. Metaphorical temperature functions less as a scientific taxonomy and more as a widely shared heuristic that guides everyday food choice. Such heuristics may be particularly useful when decision-making involves multiple attributes like taste, healthiness, and convenience[9]. Specifically, foods that are more recognized as contextually appropriate (e.g., "warming" foods when feeling unwell) may be evaluated more positively and chosen more often, because they fit salient expectations about restoring internal balance[37]. This is especially true for individuals familiar with TCM[38], who may apply hot–cold classifications deliberately and consider their perceived health benefits when making dietary decisions.

Fourth, this research also identified hot–cold complementary thinking in individuals' food choices. It differs from compensatory motivation, which leads people to reduce self-discrepancy triggered by external threats, such as social comparison[39]. Although people choose specific foods to achieve a hot-cold balance after disease exposure, their choices reflect hot-cold complementary thinking rather than coping with self-discrepancy. According to embodiment theory[40], social exclusion (i.e., cold metaphor) leads people to consume warm dishes and choose hot drinks[41]. People tend to adopt a compensatory strategy to reduce the 'mental cold (or hot)' caused by environmental cues, thus choosing hot (or cold) foods[42]. However, this effect has not always been replicated[43], suggesting that the psychological meaning of 'warmth' may not be universal and could vary depending on culturally shaped interpretations. In particular, culture-based metaphorical temperature is considered a food characteristic that is rooted in local food culture, which may interact with the actual temperature of food or drinks to influence behavior. In line with that, body temperature and ambient temperature are considered to jointly regulate food intake in thermoregulation theory[44]. For example, those feeling cold might seek not only hot foods to provide physical warmth or energy but also hot-natured foods to restore internal balance. This process is also consistent with lay theories in the health domain: namely, individuals often rely on simple, culturally available rules to judge what is appropriate for their current condition[11,12,28,45]. Thus, hot–cold complementary thinking may provide an accessible, health-motivated framework that shapes perceived healthiness and, in turn, guides food choice[46,47].

The findings also have important practical implications. Culture-based metaphorical temperature has been documented across multiple cultures

Table 1 | Overview of studies

Study	Research purpose	Participants	Findings
1	The effect of culture-based metaphorical temperature on food choices under conditions of imagined 'bodily hot' (vs. 'bodily cold').	149 employees	Individuals who imagined 'bodily hot' (vs. 'bodily cold') tend to choose cold-natured (vs. hot-natured) foods.
2, 3	The mediating role of perceived healthiness in the relationship between culture-based metaphorical temperature and food choices.	150 adults, 363 elderly adults	The two studies replicated the findings of Study 1 by using both cold (meat jelly and pudding) and warm dishes (strew and soup), and further provided evidence of the mediating role of perceived healthiness.

(e.g., Ayurveda), although the present research provides empirical evidence only in the Chinese context[31,48,49]. Because culture-based metaphorical temperature can function as a cognitive heuristic that guides food choices, particularly when internal states such as coldness or illness are salient[9], the medical and health industry should take these culturally grounded beliefs into account when designing patient education, dietary counseling, and health communications. For example, a summer public health message could encourage hydration and lighter meals while noting that foods such as watermelon or mung bean soup are commonly viewed as "cooling" in local culture. That said, such cultural classifications should not substitute for medical advice, particularly for high-risk groups.

In health marketing, cultural factors should be taken into account to enhance consumers' perceived healthiness. Given that many consumers seek health information online[50], this also creates an opportunity to integrate culturally relevant recommendations, such as "complementary" pairings within hot–cold food traditions, into targeted advertising. Restaurants and food brands might similarly consider hot- and cold-natured foods, together with seasonal conditions, when designing menus or products (e.g., promoting hotter-natured ingredients in colder seasons and colder-natured options in warmer seasons). Food delivery platforms could further incorporate these cultural cues into recommendation systems in order to offer more personalized and culturally meaningful meal suggestions.

There were several limitations in this research. First, no sample size determination was conducted a priori, and the studies relied on self-reported measures and imagined scenarios, which may limit their ecological validity. Although the observed effect sizes were relatively large, future research could conduct formal power analyses and incorporate actual behavioral outcomes, such as food selection and consumption[51]. Second, although foods are often classified as hot- or cold-natured, some are considered neutral, suggesting that perceived thermal nature may lie on a continuum rather than in discrete categories. Future studies could clarify whether this construct is best conceptualized as categorical or continuous, and examine how people combine hot-, cold-, and neutral-natured foods in everyday diets. Third, although our research focused on Chinese dishes and was grounded in *Yin–Yang* philosophy, hot–cold balance beliefs are also observed in other cultures. Future studies should test the generalizability of these findings across regions and cultural contexts. Moreover, within China, the salience of such thinking may vary by region and may be particularly pronounced in southern areas such as Guangdong, where traditional dietary balance beliefs remain influential[52].

Methods

Study 1

In Study 1, a 2 (imagined temperature: 'bodily hot' vs. 'bodily cold') between-subjects experimental design was used. 149 healthy Chinese participants (63.1% females; $M_{age} = 26.43 \pm 8.43$ years) were recruited from a technology company in mainland China with the assistance of human resource managers. Participation was voluntary and conducted via the survey platform (www.wjx.cn). This research protocol received ethical approval from the Ethics Committee of Macau University of Science and Technology (Approval No. 202402005), covering the online collection and analysis of anonymous survey data from adults aged 18 years or older. Participants provided electronic informed consent before completing the questionnaire. The online consent form explained the study purpose, anonymity, and the academic use of the data, and stated the incentive (2 Yuan RMB) upon completion; only those who consented could proceed. Data were collected in accordance with the approved protocol, kept strictly anonymous, and used solely for research purposes. Studies 2–3 followed the same ethical approval and electronic informed consent procedures as Study 1, and all studies were conducted in accordance with the Declaration of Helsinki.

Following prior scenario-based experimental designs[53], participants were randomly instructed to imagine either a 'bodily hot' (上火, shàng huǒ) or 'bodily cold' (體內寒, tǐ nèi hán) in a normal temperature environment. Common symptoms of 'bodily hot' include feeling hot, flushed, thirsty, and having headaches. 'Bodily cold' often manifests as feeling cold (especially in the extremities), low energy, and a feeling of fatigue. The participants were instructed to choose a main course (lamb stew or crab stew) and a soup (red bean or mung bean) for their dinner, taking their imagined bodily temperature into account. Finally, the participants provided demographic information.

According to the culture-based metaphorical temperature, participants rated the four dishes on a 5-point scale. The item was: "To what extent do you think the dish is _____?" (1 = cold-natured, 2 = slightly cold-natured, 3 = neutral, 4 = slightly hot-natured, 5 = hot-natured). The results indicated a significant difference in the culture-based metaphorical temperature of the food (all $ps < 0.001$). Specifically, lamb stew ($M = 4.15 \pm 0.82$) and red bean soup ($M = 3.44 \pm 0.77$) were perceived as significantly hotter than crab stew ($M = 2.14 \pm 1.07$; $t = 16.08$, $p < 0.001$) and mung bean soup ($M = 2.29 \pm 0.84$; $t = 14.02$, $p < 0.001$), respectively.

The manipulation of imagined bodily temperature was assessed with an item: "How hot/cold do you imagine yourself feeling?" Responses were recorded on a 9-point scale (1 = feeling very cold, 5 = neutral, and 9 = feeling very hot). The manipulation was successful ($t = 10.41$, $p < 0.001$). Participants in the imagined 'bodily hot' condition ($M = 7.13 \pm 1.46$) reported significantly higher bodily temperatures as compared to those in the condition where they were instructed to imagine 'bodily cold' instead ($M = 3.93 \pm 2.21$).

Study 2

Study 2 involved a 2 (body temperature: 'bodily hot' vs. 'bodily cold') between-subjects experimental design. 150 healthy Chinese participants (61.3% females; $M_{age} = 30.57 \pm 8.40$ years) were recruited from a Chinese online survey platform (www.credemo.cn).

The research protocol was identical to that of Study 1. After they provided online informed consent, participants were randomly assigned to imagine either 'bodily hot' or 'bodily cold' while in a normal temperature environment, and were then instructed to choose a cold dish (lamb meat jelly or crab meat jelly) and a dessert (red bean pudding or mung bean pudding) for their dinner, taking their imagined body temperature into account. The perceived healthiness of the four foods was rated using two items: "In this context, how healthy is [*food item*] considered?" and "In this context, what are the perceived health benefits of this [*food item*]?" Both items were anchored on a 5-point scale (1 = very unhealthy, 3 = unsure, 5 = very healthy). After completing the study, the participants received 1 Yuan RMB.

According to the culture-based metaphorical temperature, lamb meat jelly ($M = 7.69 \pm 1.68$) and red bean pudding ($M = 6.66 \pm 1.70$) were perceived as being significantly culture-based hotter than crab meat jelly ($M = 2.63 \pm 1.76$; $t = 21.24$, $p < 0.001$) and mung bean pudding ($M = 2.89 \pm 1.55$; $t = 16.99$, $p < 0.001$), respectively.

Additionally, imagined bodily temperature was assessed in the same way as in Study 1. The manipulation was successful (hot vs. cold: $M = 7.15 \pm 2.10$ vs. $M = 3.24 \pm 2.42$; $t = 10.55$, $p < 0.001$).

Study 3

Study 3 used a between-subjects design. A total of 363 healthy elderly adults (45.5% females; $M_{age} = 62.03 \pm 5.75$ years) from several elderly dance clubs in China. They all provided online informed consent, which was approved by the Ethics Committee of Macau University of Science and Technology.

Two trained research assistants visited elderly dance clubs in a northeastern Chinese city and invited the elderly adults to participate in the study using their smartphones. They were randomly assigned to either hot or cold bodily temperature conditions. The experimental procedure was identical to Study 2. Participants were asked to rate the perceived healthiness of four food items (i.e., lamb stew, crab stew, red bean soup, and mung bean soup) using two questions: "In this context, how healthy is [*food item*] considered?" and "In this context, what are the perceived health benefits of this [*food item*]?" Both items were anchored on a 5-point scale (1 = very unhealthy, 3 = unsure, 5 = very healthy). After completing the study, participants received 2 Yuan RMB.

According to the culture-based metaphorical temperature, participants perceived lamb stew ($M = 4.23 \pm 0.83$) and red bean soup ($M = 3.58 \pm 0.82$) as culturally hotter compared to crab stew ($M = 2.25 \pm 0.95$; $t = 27.39$, $p < 0.001$) and mung bean soup ($M = 1.96 \pm 0.80$; $t = 31.47$, $p < 0.001$).

Additionally, the manipulation of imagined bodily temperature was successful (hot vs. cold: $M = 6.37 \pm 2.08$ vs. $M = 4.10 \pm 2.41$; $t = 9.62$, $p = 0.003$).

Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to no prior agreement with the ethical committee, but are available from the corresponding author.

Code availability

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Author contributions

Y.Y.: investigation, formal analysis, visualization, writing—original draft, writing—review and editing. L.Z.: conceptualization, methodology, writing—review and editing, project administration, supervision, funding acquisition. C.L.: resources, writing—review and editing. C.H.: writing—review and editing. J.L.: data curation, funding acquisition, writing—review and editing. S.P.: writing—review and editing. C.S.: writing—review and editing. All authors contributed to and accepted the final manuscript.

Competing interests

The authors declare no competing interests.

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