CHINESE CONSUMERS’ PERCEPTIONS OF FUNCTIONAL FOODS DESIGNED TO HELP THE IMMUNE SYSTEM RECOVER FROM THE IMPACT OF AIR POLLUTION

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Abstract

The deterioration of air quality in China has resulted in many people looking for technological approaches or medical remedies to counteract the impact that air pollution is perceived to be having on their health and wellbeing. As the importance of diet on immune health is becoming increasingly well recognised, there is increasing interest in the development of food products designed to help the immune system recover from the impact of air pollution. To support the successful development of new functional foods it is vital to understand the consumers in the target market.

The overall aim of this thesis research was to investigate Chinese consumers’ perceptions of functional foods designed to help the immune system recover from the impact of air pollution. A combination of consumer research techniques was employed in four studies. Firstly, a narrative literature review (Study 1) was conducted to elucidate Chinese consumers’ acceptance and market potential of functional food products designed to help the immune system recover from the impact of air pollution. Consumers’ attitudes towards functional foods including those designed to enhance the immune system were mainly positive, with scientific validation being important in determining the credibility of a product. This was despite the fact that the effectiveness of products currently in the market, purported to be remedies for pollution-driven impacts on the lung, did not appear to be supported by scientific evidence. The lack of scientific validation for such products was interesting as numerous studies have reported on compounds originating from food that appear to provide a wide range of benefits to immune health, including helping pollution-driven immune issues. Review of the literature showed what would appear to be market demand for effective and scientifically-proven functional food products that help Chinese consumers’ immune system recover from the impact of air pollution.

Further, a netnography study (Study 2) was conducted to explore consumers’ understanding of the impact of air pollution on their health, and key attributes (expected benefits, forms and patterns of consumption) they desire in functional foods designed to help the immune system cope with the impact of air pollution. The impact of pollution on the respiratory system was considered to be of the most concern and homemade Traditional Chinese Medicine therapies and diet adjustment were the main forms of remedies discussed online. Most of the network users who posted comments were living in the East of China, which is the most economically developed area and one of the areas that suffer the most air pollution. Consumers in these areas are also generally well educated, have higher incomes, are more likely to have been exposed to Western concepts, brands etc., and are more open to trying novel foods from overseas countries than consumers in other parts of China. Therefore, the following studies chose
participants having a middle-upper income and living in Shanghai or Suzhou, which are two of the most developed cities in East China.

Focusing on immune health, a study (Study 3) using focus groups (n=4) and in-home semi-structured interviews (n=12) was conducted to investigate consumers’ views and living experiences of coping with poor immunity, especially under polluted air, and to obtain an understanding of the links individuals were making between their immune health and food choice. Participants tended to use the phrase “immunity” in reference to their immune system and the overall role and importance of immunity in their daily life was widely agreed upon. A spectrum of health issues was believed to be caused by poor immunity, ranging from the common cold or flu through to cancer. Among the range of perceived reasons of poor immunity, the most common reasons given were an irregular lifestyle, exposure to polluted air and increasing age. Many participates believed that immunity could be changed by modifying what they were consuming.

The final research study (Study 4) was focussed on exploring ideal product attributes consumers require in functional food products designed to combat the adverse impact of air pollution via Consumer Idealised Design (CID) workshops (n=4), each involving ten participants. Over the course of workshops, participants designed nineteen products including nine supplement-based and ten conventional-food-based designs. A tablet was the most common format in the supplement designs and the majority of conventional-foods were designed as a snack, drink, or dairy option. Participants favoured using terms such as “boosting immunity” as a health claim when products designed to be used long term and terms such as the “relieve respiratory symptoms” to promote products designed for acute use. Supplements and conventional-format functional foods were perceived differently by consumers and had differing expected health benefits and target markets. Consumers’ high attention to food safety suggested that product producers should apply multi-methods to communicate the safety of their products to consumers, such as using ingredients or processing products from authorised countries, applying authentications or scientific reports, and utilising natural ingredients rather than synthetic ones.

The results from the series of studies presented in this thesis have revealed that there is a strong potential for the increased use of functional foods to help combat the effects of air pollution in China and the innovators should develop products based on a good understanding of the unique perceptions of Chinese consumers. In addition, this research has demonstrated the advantages of using a range of consumer-oriented methodologies to obtain an understanding of targeted consumers’ perceptions when undertaking new product development. The insights gained in this thesis indicate an exciting time ahead for manufacturers of functional foods for the Chinese market.
Acknowledgements

Balancing life as a mother and wife with the challenges of completing doctoral study has not been easy, especially for someone in a country new to them. However, it has been a fulfilling and rewarding experience motivated by the knowledge that my hard work may one day contribute to helping consumers suffering air pollution and help manufacturers targeting the Chinese market. During the past three years, many people have contributed to the successful completion of my PhD.

First and foremost, I would like to say a big Thank You to my supervisors Professor Phil Bremer and Associate Professor Miranda Mirosa for your commitment to making this research possible. With both Bachelor and Master degrees in the field of food technology, I was quite uncertain about starting a PhD project in consumer studies at the very beginning. My supervisors provided continuous encouragement to me and there is no doubt that you always guided me the right directions on every step of my research. I am heartily thankful for your huge amount of supervision time and patience you have invested in furthering my education. Without your support, I cannot imagine how I would have finish my studies.

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Publications and conference presentations

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Cong, L., Mirosa, M., Kaye-Blake, W., Bremer, P. ‘Can immunity be improved through eating?’ Insights of Chinese consumers having perceived poor immunity. Under review.


Cong L., Bremer PJ., Mirosa MJ. (September, 2017). Chinese consumers’ understanding on helping the immune system recover from the impact of air pollution. Poster session presented at the High-Value Nutrition Conference 2017, Auckland, NZ.

Bremer PJ., Cong L. (July, 2017). Determining consumer preferences in Asia. Verbal presentation at High-Value Nutrition Medical Forum, Otago Postgraduate Medical Society, Dunedin, NZ.
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>FOSHU</td>
<td>Food for Specified Health Uses</td>
</tr>
<tr>
<td>FSANZ</td>
<td>Food Standards Australia New Zealand</td>
</tr>
<tr>
<td>FSL</td>
<td>Food Safety Law</td>
</tr>
<tr>
<td>CFDA</td>
<td>China Food and Drug Administration</td>
</tr>
<tr>
<td>PM</td>
<td>Particulate Matter</td>
</tr>
<tr>
<td>TCM</td>
<td>Traditional Chinese Medicine</td>
</tr>
<tr>
<td>SNS</td>
<td>Social Networking Sites</td>
</tr>
<tr>
<td>CQA</td>
<td>Community Question Answering</td>
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<tr>
<td>INV</td>
<td>Interview</td>
</tr>
<tr>
<td>FG</td>
<td>Focus group</td>
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<tr>
<td>GI</td>
<td>Gastrointestinal</td>
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<tr>
<td>CID</td>
<td>Consumer Idealised Design</td>
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</table>
**List of key definitions**

<table>
<thead>
<tr>
<th><strong>Functional food</strong></th>
<th>In a broad way a functional food can be (i) a natural food, (ii) a food to which a component has been added, (iii) a food from which a component has been removed, (iv) a food where one or more components has been modified, (v) a food in which the bioavailability has been modified or (vi) any combination of these.</th>
</tr>
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<tbody>
<tr>
<td><strong>Supplements</strong></td>
<td>A supplement can provide nutrients either extracted from food sources or synthetic, individually or in combination, to increase the quantity of their consumption. The class of nutrient compounds includes vitamins, minerals, fibre, fatty acids and amino acids. Dietary supplements can also contain substances that have not been confirmed as being essential to life, but are marketed as having a beneficial biological effect, such as plant pigments or polyphenol. Animals can also be sources of supplement ingredients, for example collagen from chickens or fish.</td>
</tr>
<tr>
<td><strong>Health food</strong></td>
<td>Any food stuff claiming to have specific health functions, or to supplement nutrition with vitamins and minerals for a specific functional purposes. A health food should be designated as useful for specific consumers, can regulate bodily functions, is not designed to treat disease, and does not cause any acute, sub-acute or chronic negative effects when consumed by humans. It is translated from the Chinese term 保健食品.</td>
</tr>
<tr>
<td><strong>Blue hat</strong></td>
<td>The logo of the certification for health food authorised by China Food and Drug Administration. The image looks like a small hat with sky blue colour.</td>
</tr>
<tr>
<td><strong>PM2.5</strong></td>
<td>It is a term meaning particulate matter less than 2.5μm in diameter. This term has entered the public lexicon in China as citizens monitor daily reports of pollution levels.</td>
</tr>
<tr>
<td><strong>Moisten lung</strong></td>
<td>A typical TCM term, whose meaning in TCM is restricting overactive functions or relieving inflammation in lungs.</td>
</tr>
</tbody>
</table>
Netnography
A methodology that applies ethnography to the internet and it is believed a way to avoid the biases and limitations of transforming participants’ ethos and sensibility by listening to consumers in their natural habitats.

Food nourishment
The regimen of incorporating foods with known medical benefits, mostly TCM benefits, into the everyday diet. The corresponding Chinese is 食补.

Qi
A TCM term, pronounced chi, denotes vital energy and is an essential substance for maintaining the activities of life. According to the principles of TCM, human physiological functions are maintained by Qi; the zang-fu or internal organs; blood; bodily fluids; and jing-luo or meridians and collaterals.

TCM medical gel
It is a traditional method of TCM decoction, also translated as TCM paste, with the form of thick liquid.

TCM patent medicine
A sort of Chinese drug that is used on the basis of understanding TCM syndrome of patients and is guided by TCM theory. It usually contains more than one Chinese medication. Innovation of TCM patent medicine now mainly includes four methods: innovation of those ancient famous and effective prescriptions; summarizing new clinic experience according to the needs of consumers and changes of diseases; innovation of effective prescriptions descended through family; reform of the traditional dosage form.

Consumer Idealised Design
A methodology instructs potential end consumers to actually design their own ideal product or service. It is similar to a focus group, in which a small group of participants are involved and a moderator facilitates the session. However, the method aims to reach a consensus about a particular product or service; therefore, uncovering underlying consumers wants, needs and expectations.
Chapter 1. Introduction
This introductory chapter includes four sections. First, the background to the research is presented. Second, the aim and objectives of this thesis are stated. Third, the key contributions of the research are highlighted and finally, an overall thesis outline is presented.

1.1 Background to the research

Rapid industrialisation and urbanisation in developing countries has caused an increase in air pollution, along a similar trajectory to that previously experienced in developed nations (Seinfeld, 2004). In China, particulate pollution is a serious environmental problem that is influencing air quality, regional and global climates, and human health (Cao, 2012; Wang, Zhang, & Saravanan, 2014). According to the World Health Organization Air Quality Guidelines (Brauer, 2016; World Health Organization, 2006), less than 1% of the Chinese population can breathe air that is considered safe. Air pollution is progressively taking a devastating toll on the Chinese people (Johnson, Mol, Zhang, & Yang, 2017). With every breath about 500 ml of air and more than one million particles are inhaled, resulting in a volume of more than 10,000 litres of air and about 300 million particles being inhaled per person per day (Gehr & Heyder, 2000). The predominant air pollutant in China is particulate matter (PM) that has an aerodynamic diameter ≤ 2.5μm (PM$_{2.5}$). Also of concern is particulate matter with an aerodynamic diameter ≤10μm (PM$_{10}$), Ozone (O$_3$), Nitrogen Dioxide (NO$_2$) and Sulfur Dioxide (SO$_2$) al (R.-J. Huang et al., 2014). Humans are not “allergic” to pollutants; that is, people do not generate adaptive immune responses to pollutants per se, rather most airborne pollutants function as mucosal adjuvants and, by interacting with both the innate and adaptive immune cells, moderate the adaptive immune responses leading to adverse health outcomes (Saxon & Diaz-Sanchez, 2005). For example, particulate and gaseous pollutants can initiate and exacerbate cellular inflammation of respiratory mucosa cells, in the upper or lower airways (Müller & Jaspers, 2012). In particular, PM exposure increases the morbidity of respiratory illnesses, such as lower respiratory infections (LRIs), asthma and chronic obstructive pulmonary disease (COPD). In addition, long-term exposure of the population to air pollutants increases the rates of cardiovascular, metabolic, and respiratory mortality (Chen, Zhao, & Kan, 2013; Wright, Ji, Geng, & Ding, 2016).

A survey of people living in the three megacities of Shanghai, Wuhan and Nanchang found that approximately 57% of 3,868 participants were not satisfied with the current air quality and around 46% of them felt anxious when exposed to polluted air (Liu et al., 2016). A recent survey of 1,050 Beijing residents, reported that 54% of respondents agreed or strongly agreed with the statement “the air pollution here is intolerable” and 68% agreed or strongly agreed that “smoggy and hazy weather has become a ‘new normal’” (Johnson et al., 2017). These two studies thereby provide evidence that air pollution is a serious problem in China that is affecting the quality of life of its citizens (Johnson et al., 2017; Liu & Mu, 2016; Liu et al., 2016). It is
therefore not surprising that the greatest perceived concern about air pollution is the risk that it is posing to health, with 62% of 1,050 Beijing residents agreeing or strongly agreeing with the statement “my health has been very much affected by air pollution” (Johnson et al., 2017). The survey aforementioned also reported that the perceived three highest health risks linked to exposure to air pollution were coughs/colds (approx. 69%), eye problems (approx. 63%) and skin allergies (approx. 49%) (Liu et al., 2016). Coping with the long-term exposure to polluted air through managing immune defence is a powerful benefit applicable to people of all ages. A survey in 2011 on health food consumption in China reported that 77% of consumers ranked "immune enhancement" as an important function, with 49% of consumers ranking "nutritional supplementation" and "antifatigue," as being the second equal most important functions (Medina, 2011).

Given the concerns around the impact of air pollution on health it should not be surprisingly that there is significant public, commercial and governmental interest in developing ways to protect individuals from the impact of air pollution and in the development of products to help the immune system recover from it. In this regard, functional foods can be considered to be a suitable option as Chinese consumers have a strong tradition based beliefs, owing to their life long exposure to Traditional Chinese Medicine (TCM) based principles, that food cannot only satisfy hunger and provide required nutrients but it can also improve physical and mental well-being (Menrad, 2003; Roberfroid, 2000). The modern term functional food varies from country to country in terms of its definition and scope, as do the regulatory frameworks that control its use (Kaur & Singh, 2017). Most countries describe functional foods as containing bioactive components and ingredients that provide additional health benefits beyond basic requirements and are capable of reducing certain diseases (Lau, Chan, Tan, & Kwek, 2012). Some definitions are more specific and state that the food must provide “a clinically proven and documented health benefit for the prevention, management, or treatment of a chronic disease” (Martirosyan & Singh, 2015) while for other countries documented proof of the efficacy of a functional food is not required. Due to confusion around the meaning and regulation of functional foods some commentators believe that the term “Functional food” is essentially a marketing term (Henry, 2010; Siró, Kápolna, Kápolna, & Lugasi, 2008). Therefore, while scientists are investing considerable resources into developing functional foods for which validated scientific claims can be made (e.g. New Zealand National Science Challenge (Anon, 2019c)), many commonly available products that claim to be functional foods appear to have limited scientific backing.

A good understanding of the target consumers and market potential is required when developing any new products in this area. The research within this PhD thesis has been carried out in conjunction with a High Value Nutrition, National Science Challenge funded project which has an Immune Defence research platform that is working to develop functional foods
that can help the immune system recover from the impact of air pollution (Anon, 2019d). Specifically, the PhD project aimed to use a consumer-oriented approach to obtain an understanding of Chinese consumers’ perceptions of functional foods designed to help the immune system recover from the impact of air pollution. A combination of consumer research techniques, such as netnography, in-home interviews, focus groups and consumer Idealised design (CID) workshop, have been used to explore these issues. By truly understanding the priorities of Chinese consumers, the research will both help focus the Immune Defence research platform investments on consumer-relevant biomarkers as well as empower New Zealand food and beverage providers to address real market needs (Anon, 2019a).

1.2 Thesis aim and objectives

The overall aim of this thesis research is to investigate Chinese consumers’ perceptions of functional foods designed to help the immune system recover from the impact of air pollution. Specifically, the following objectives will guide this thesis:

1. To explore Chinese consumers’ attitudes towards immune-boosting functional foods and the market potential in this area;

2. To explore Chinese consumers’ understanding of the impact of air pollution on their health, and key attributes (expected benefits, forms and patterns of consumption) desired in functional foods to help the immune system cope with the impact of air pollution;

3. To explore Chinese consumers’ views and living experiences of coping with polluted air and to obtain an understanding of the links they make between their immune health and food choice;

4. To explore desirable attributes of any products Chinese consumers may purchase to enhance their immune health.

1.3 Key contributions of the research

To the author’s best knowledge, this research is the first to investigate Chinese consumers’ perceptions of immune-boosting foods and how those perceptions influence dietary choices they make to help their immune system recover from the effects of persistent polluted air. Thus, this thesis makes a novel academic contribution by presenting a useful extension to the available consumer behaviour literature on functional food and beverage products. In addition, approaches used in the present thesis have proven to be fruitful methods to investigate consumers’ perceptions in a non-Western setting. The thesis also makes a strong practical contribution by providing important information to food manufacturers and marketers working with the development of functional foods exported into Chinese market.
1.4 Overall thesis outline

**Introduction**

**Study 1**

Objective 1
Explore Chinese consumers’ attitude towards immune-boosting functional foods and market potential in this area.
Methodology
Literature Review

**Study 2**

Objective 2
Explore Chinese consumers’ understanding of the impact of air pollution on their health, and key attributes (expected benefits, forms and patterns of consumption) of functional foods to help the immune system cope with the impact of air pollution
Methodology
Netnography

**Study 3**

Objective 3
Explore Chinese consumers’ views and living experiences of coping with polluted air and to obtain an understanding of the links they make between their immune health and food choice
Methodology
In-home interview
Focus group

**Study 4**

Objective 4
Explore desirable attributes of any products Chinese consumers may purchase to enhance their immune health
Methodology
Consumer Idealized Design (CID) workshop

**General discussion and conclusion**

**Chapter 1**

Immune-boosting functional foods: a potential remedy for Chinese consumers living under polluted air

**Chapter 2**

Literature Review
Chinese Consumers’ Perceptions of Functional Foods: A Netnography Study of Foods that Help the Immune System Recover from Air Pollution

**Chapter 3**

‘Can the immunity be improved through eating?’ Insights of Chinese consumers having perceived poor immunity

**Chapter 4**

Ideal attributes of functional food products helping the immune system recover from the impact of air pollution: a consumer-led product design

**Chapter 5**

**Chapter 6**
Chapter 2. Literature Review

Part of this chapter has been submitted and under review:

The deterioration of air quality in China has resulted in many people looking for technological approaches or medical remedies to counteract the impact that air pollution is perceived to be having on their health and wellbeing. As the importance of diet on immune health is becoming increasingly well recognised, there is increasing interest in the development of food products designed to help the immune system recover from the impact of air pollution.

While there are numerous studies reviewing either consumer-based literatures, such as perceptions of functional foods or air pollution, or laboratory-based literature, such as immune-boost ingredients, research has been published that reviews and integrates the research achievements from these disparate fields. It is well-known that narrative reviews can be used to investigate the needs and/or preferences of particular population groups (Best, Manktelow, & Taylor, 2014; Popay et al., 2006) by summarizing different primary studies from which conclusions may be drawn into an integrated interpretation (Kirkevold, 1997; Kitson, Marshall, Bassett, & Zeitz, 2013; Mays, Pope, & Popay, 2005). Therefore, to understand Chinese consumers’ acceptance and market potential of functional food products designed to help the immune system recover from the impact of air pollution, an interdisciplinary narrative review of the literature was conducted based on both English and Chinese literatures. This chapter starts off by summarising definitions and legislation criteria of functional foods (Subsection 2.1), introduced Traditional Chinese Medicine (TCM) and the links between TCM and functional foods (Subsection 2.2), and then assesses the pollution-driven responses of Chinese consumers and the functional food market (Subsection 2.3). It then reviews consumers’ perceptions of immune-boosting functional foods (Subsection 2.4) and summarizes scientific findings about functional foods designed to help immune health (Subsection 2.5). Such information can be used to support the commercial success of functional food products designed to help the immune system recover from pollution-driven impact.

2.1 Definition and legislation of functional foods

2.1.1 Origin and definition of term “functional food”

The concept of “functional foods” is often cited as a newly emerging field. However, this idea was first described in the ancient Vedic texts from India, and in Chinese traditional medicine. The vision to develop functional foods reflects the oriental philosophy that: ‘Medicine and food have a common origin’ (Henry, 2010). The recent conviction to develop functional foods first emerged in Japan in the 1980s, for food products fortified with special constituents that possess advantageous physiological effects (Hardy, 2000; Henry, 2010; Kwak & Jukes, 2001; Siró et
The term “functional food” first appeared in 1993 in the *Nature* under the heading “Japan explores the boundary between food and medicine” (Swinbanks & O'Brien, 1993).

There is no doubt that the interest of Japanese consumers in functional foods has increased awareness of such products worldwide. The concept of functional foods embraces the idea that food can have a role beyond gastronomic pleasure and energy and nutrient supply (Lopez-Varela, Gonzalez-Gross, & Marcos, 2002). The interest in functional foods continues to grow, powered by progressive research efforts to identify properties and potential applications of nutraceutical substances, and coupled with public interest and consumer demand (Wildman, 2016).

Functional food is essentially a marketing term and in most countries there is no legislative definition of the term (Henry, 2010; Siró et al., 2008). Although the term “functional food” has already been defined several times by academic authorities, so far there is no unitary accepted definition for this group of food (Alzamora et al., 2005). From very simple to more complex, a number of proposed definitions from international academic authorities are listed below:

**International Food Information Council (IFIC)** – Foods or dietary components that may provide a health benefit beyond basic nutrition (Bagchi, 2008; Wildman, 2016).

**International Life Sciences Institute of North America (ILSI North America)** – Foods that by virtue of physiologically active food components provide health benefits beyond basic nutrition (Bagchi, 2008; Wildman, 2016).

**Functional Food Science in Europe (FuFoSE), International Life Sciences Institute of Europe (ILSI Europe) & European Union (EU)** – A food can be regarded as “functional” if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutritional effects, in a way that is relevant to either an improved state of health and well-being and/or reduction of risk of disease. Functional foods must remain foods and they must demonstrate their effects in amounts that can normally be expected to be consumed in the diet: they are not pills or capsules, but part of a normal food pattern (Action, 1999).

Basically, functional foods could be considered as a kind of interdisciplinary products between conventional foods and pharmaceuticals (Figure 2-1). Drawing a border line between these three is challenging even for nutrition and food experts. Typically, a food marketed as
functional contains added, technologically developed, ingredients with a specific health benefit (Niva, 2007).

* Different terms describing foods with specific health benefits, such as nutraceuticals, health foods, and dietary supplements, etc., can be included in this area.

**Figure 2-1.** Nature of the relationship between pharmaceuticals, conventional foods and functional foods.

With regard to pharmaceuticals, the core definition is any article that is “intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or other animals.” (Page 3, Wildman, 2016). At the same time, certain health claims can be made for foods and ingredients that are associated with health conditions. In order to distinguish functional foods and pharmaceuticals, it is important to highlight that functional foods must be foods and their beneficial effects should be obtained by consuming normal food amounts within the “normal” diet (Lopez-Varela et al., 2002). Figure 2-2 shows benefits of foods perceived by consumers. From basic to functional, specific health benefits differentiate functional foods from conventional ones. In contrast to conventional foods, functional foods, have demonstrated physiological benefits and can reduce the risk of chronic disease beyond basic nutritional functions (Wildman, 2016).
Therefore, what are functional foods? There is a consensus about “functional” that is functional foods are used to enhance certain physiological functions, in order to prevent or even to cure diseases (Roberfroid, 2000). However, controversial discussions still occur regarding the nature of functional foods, such as (i) whether capsules, pills and powders should be included, (ii) whether a distinct class for these products should be set up, and (iii) restrictions of health claims etc.. Despite these controversies, in a broad way a functional food can be (i) a natural food, (ii) a food to which a component has been added, (iii) a food from which a component has been removed, (iv) a food where one or more components has been modified, (v) a food in which the bioavailability has been modified or (vi) any combination of these (Henry, 2010), which is the definition of functional foods adopted in this thesis.

2.1.2 Legislation criteria of functional foods in different countries

Since there is no concrete definition of “functional food” worldwide, a series of different terms, such as nutraceutical, health food, and dietary supplement, have contributed to increasing the confusion among professionals and consumers. As Figure 2-1 illustrates, the nature of these terms can be considered to lie between pharmaceuticals and conventional foods. In addition, the meaning and common usage of such terms can be significantly influenced by the legislation in different countries. Examples include “health food” in China (Anon, 2015), “nutraceutical” in US (Lopez-Varela et al., 2002) and “FOSHU” in Japan (Ministry of Health Labour and Welfare of Japan, 2013a). It is interesting to notice that the legislation regarding functional foods diverge considerably between the East and the West, with culture differences considered to be one of the most important reasons for the differences (Siró et al., 2008). Japan and China, for instance, consider functional foods as specific food categories, which means that after approval particular symbols can be displayed on the food label. However, in Western countries,
such as EU, Australia and New Zealand, functional foods are accepted as a concept, legislated by health claims. The case of functional foods often means adding functionality to an existing traditional food product (often a mainstream product), and such food products do not create a separate group (Síro et al., 2008). As typical examples of two different legislative approaches, regulations regarding functional foods in Japan, New Zealand and Australia are introduced below.

**Japan**

Japan was the first country to legislate functional food products (Lopez-Varela et al., 2002). In 1991, the Japanese Ministry of Health introduced rules for approval of a specific health-related food category called Food for Specified Health Uses (FOSHU) which included the establishment of specific health claims for this type of food (Hosoya, 1998). Today, a more detailed category is applied to Food with Health Claims (FHC), regulated by Ministry of Health, Labour and Welfare (MHLW) (Ministry of Health Labour and Welfare of Japan). Table 2-1 illustrates two categories of FHC, (i) Foods with Nutrient Function Claims (FNFC): foods that are labelled with functions of nutritional ingredients (vitamins and minerals) and (ii) FOSHU: foods officially approved to claim their physiological effects on the human body.

**Table 2-1. Categories of Medicine, Food with Health Claims and Other Food regulated by MHLW (Ministry of Health Labour and Welfare of Japan).**

<table>
<thead>
<tr>
<th>Medicine</th>
<th>Food with Health Claims (FNFC)</th>
<th>Other Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foods with Nutrient Function Claims (FNFC) (standard regulation system)</td>
<td>Food for Specified Health Uses (FOSHU) (individual approval system)</td>
<td>(some may include in functional foods)</td>
</tr>
</tbody>
</table>

A general consensus in academia is that FOSHU is the initial concept of functional foods (Henry, 2010; Lopez-Varela et al., 2002; Síro et al., 2008). However, Table 2-1 obviously presents a wider and more comprehensive concept about functional foods in Japan nowadays, that is the scope of functional foods is larger than FOSHU and even larger than FNFC. Meanwhile, FOSHU could be considered as a typical kind of functional foods.

Japanese law regulates functional foods by combining specifically legislative food categories and a restriction on health claims that can be made on packages. Any foods that comply with specifications and standards by MHLW and labelled with certain nutritional or health functions are categorised into FNFC. Meanwhile, only products for which approved health claims can be made (Table 2-2) and meet certain requirements (Ministry of Health Labour and Welfare of Japan).
Japan) can have the FOSHU symbol on their packages (Figure 2-3). Packs of Yakult, a product that can modify gastrointestinal conditions and is marketed in Japan, China and Australia New Zealand show examples of different label information in Figure 2-4. Note the occurrence of a clear symbol for FOSHU on the Japanese pack, whereas, no similar symbols are found in packs for other countries.

**Table 2-2.** Claims permitted under FOSHU criteria (Ministry of Health Labour and Welfare of Japan)

<table>
<thead>
<tr>
<th>Approved FOSHU products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foods to modify gastrointestinal conditions</td>
</tr>
<tr>
<td>Foods related to blood cholesterol level</td>
</tr>
<tr>
<td>Foods related to blood sugar levels</td>
</tr>
<tr>
<td>Foods related to blood pressure</td>
</tr>
<tr>
<td>Foods related to dental hygiene</td>
</tr>
<tr>
<td>Cholesterol plus gastrointestinal conditions, triacylglycerol plus cholesterol</td>
</tr>
<tr>
<td>Foods related to mineral absorption</td>
</tr>
<tr>
<td>Foods related to osteogenesis</td>
</tr>
<tr>
<td>Foods related to triacylglycerol</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approved reduction of disease risk claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium and Osteoporosis</td>
</tr>
<tr>
<td>Folic Acid and Neural Tube Defect</td>
</tr>
</tbody>
</table>

**Figure 2-3.** Symbol for FOSHU approval in Japan (Ministry of Health Labour and Welfare of Japan).
FOSHU is considered as one of the five kinds of Food for Special Dietary Uses (FOSDU), together with (i) formulas for pregnant or lactating women, (ii) infant formulas, (iii) food for the elderly with difficulty in masticating or swallowing, and (iv) medical foods for the ill (Ministry of Health Labour and Welfare of Japan). It is noted that after are vision of the rules issued in 1991, in 2001, FOSHU products in Japan can take the form of capsules and tablets, although the great majority of products are still in more conventional forms (Ohama, Ikeda, & Moriyama, 2006).

**New Zealand and Australia**

A common phenomenon in western societies is that the legislation does not consider functional foods as specific food categories, but rather a concept, as in the European Union, Australia and New Zealand. Rather than regulating the product group *per se*, legislative efforts in these countries are directed towards restricting the use of health claims on packs and in marketing (EC, 2007; Niva, 2007; Siró et al., 2008). As a case study, the current activity in health claims in Australia and New Zealand is discussed in this sub-section.

Since passage of the Food Standards Australia New Zealand Act of 1991, these 2 countries have shared a food regulatory system under the statutory agency Food Standards Australia New Zealand (FSANZ) (Tapsell, 2008). The food standards code *Standard 1.2.7 – Nutrition, health and related claims* (FSANZ, 2017b) regulates the current use of nutrient content claims and health claims, with the extending standard, *Schedule 4 – Nutrition, health and related claims* (FSANZ, 2017a), providing the specifics of the claims.
Differing from nutrient content claims, health claims link a nutrient to a health effect. Australia and New Zealand share common food standards managed through the authority of FSANZ. The standard for health claims addresses foods and the representation of their nutritional or health benefits through general- or high-level claims. The approach of the standard is to remove ambiguity in the marketplace, provide a comprehensive framework, protect and assist consumers, provide opportunity for industry, have regard to costs, and work with community support (Tapsell, 2008). The framework of FSANZ focuses on the substantiation of different types of claims in a managed system while integrating current practices and allowing for a phase-in period. Importantly, this means that not all foods are treated as equal; that is, foods must first meet eligibility criteria based on their overall nutritional profile (FSANZ, 2016a). The Nutrient Profiling Scoring Criterion (NPSC) is a nutrient profiling system used in Australia and New Zealand to determine whether a food is suitable to make a health claim, based on its nutrient profile. Only foods that meet a certain score will be allowed to have health claims made about them (FSANZ, 2016b).

The claims framework is based on a risk assessment model that starts with a principle of “do no harm” with a defining point of not addressing serious disease. Thus, although it is acknowledged that food is essential for life, there is still much not known about the underlying physiological mechanisms. In contrast, disease generally requires medical treatment, and health claims on food should not deter the consumer from seeking it (Tapsell, 2008).

General-level claims can be understood as health maintenance claims. For example, with regard to the nutrient Calcium, general health claims include “necessary for normal teeth and bone structure”, “necessary for normal nerve and muscle function”, “Necessary for normal blood coagulation”, “contributes to normal energy metabolism”, “contributes to the normal function of digestive enzymes”, “contributes to normal cell division” and “contributes to normal growth and development” (FSANZ, 2017a). According to Schedule 4, there are 200 approved general health claims for 39 nutrients. High-level claims require formal pre-approval. These claims are associated with more serious conditions and cover biomarker and risk reduction claims. Table 2-3 shows 13 high level health claims extracted from Schedule 4. Claiming specific health effects should be in-line with requirements of relevant population, context claim statements and other conditions (FSANZ, 2017a).
Table 2-3. Permitted high level health claims in Australia New Zealand, extracted from Schedule 4 (FSANZ, 2017a).

<table>
<thead>
<tr>
<th>Food or property of food</th>
<th>Specific health effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>A high intake of fruit and vegetables</td>
<td>Reduces risk of coronary heart disease</td>
</tr>
<tr>
<td>Beta-glucan</td>
<td>Reduces blood cholesterol</td>
</tr>
<tr>
<td>Calcium</td>
<td>Reduces risk of osteoporosis</td>
</tr>
<tr>
<td>Calcium and Vitamin D</td>
<td>Reduces risk of osteoporosis</td>
</tr>
<tr>
<td>Folic acid (but not folate)</td>
<td>Reduces risk of foetal neural tube defects</td>
</tr>
<tr>
<td>Increased intake of fruit and vegetables</td>
<td>Reduces risk of coronary heart disease</td>
</tr>
<tr>
<td>Phytosterols, phytostanols and their esters</td>
<td>Reduces blood cholesterol</td>
</tr>
<tr>
<td>Saturated fatty acids</td>
<td>Reduces total blood cholesterol or blood LDL cholesterol</td>
</tr>
<tr>
<td>Saturated and trans fatty acids</td>
<td>Reduces total blood cholesterol or blood LDL cholesterol</td>
</tr>
<tr>
<td>Sodium or salt</td>
<td>Reduces blood pressure</td>
</tr>
</tbody>
</table>

2.1.3 Legislation criteria of functional foods in China

Compared with the term “functional food”, “health food” (保健食品) as a term is better-known by the public in China. When the first Chinese health food was approved in late 1996, the Chinese health food industry started its journey and market value has expanded dramatically from the early days (Hu, 2016). It was estimated that China’s health food market will grow at an average annual rate of 10-15%, from RMB260 billion in 2016 to RMB400 billion in 2021. Moreover, consumers’ mind-set about health food is gradually shifting from them being seen as luxury goods to ordinary consumer products (Anon, 2017a). China’s health food market including nutrient supplements has become one of the largest markets in the world (Hu, 2016). Meanwhile, the Chinese government is actively raising people’s nutrient intake which will make the development of health food one of its priorities (Ministry of Agriculture of PRC, 2014). This will help boost the development of China’s health food market (Anon, 2017a).

According to the legislation, health foods cannot be considered as having the same scope as functional foods. Under National Standard for Food Safety – Health Food (GB 16740-2014),
a health food is defined as “any food stuff claiming to have specific health functions, or to supplement nutrition with vitamins and minerals for a specific functional purposes. A health food should be designated as useful for specific consumers, can regulate bodily functions, is not designed to treat disease, and does not cause any acute, sub-acute or chronic negative effects when consumed by humans.” (Anon, 2014a). Moreover, the latest regulations regarding this category and approval of health foods were released in Food Safety Law (FSL), October 2015, by the China Food and Drug Administration (CFDA) (Anon, 2015). Three material schedules published through FSL have attracted a great deal of interest.

**Raw Material Schedule for Health Food** (保健食品原料目录). The CFDA’s schedule of raw material includes names of the raw material, daily usage and health functions. Article 75 of FSL states that “raw materials included in the schedule shall be used for the production of health food only and may not be used for the production of other food” (Anon, 2015). A further explanation specifies that raw materials included in the schedule, with regulated usage and claiming corresponding health functions, can only be used for the production of health food (China Food and Drug Administration, 2016a). Additionally, based on this schedule, the requirements of product approval methods are distinguished. Filing with CFDA is required for health foods using raw materials within the schedule and nutrient supplements (vitamins and minerals, etc.) imported into China for the first time. Meanwhile, health foods which use raw materials not listed in the schedule and health food products imported for the first time (excluding nutrient supplements of vitamins and minerals, etc.) are required to register in CFDA (Anon, 2015). Specifically, the regulatory requirements about health foods fall into four categories which are indicated in Table 2-4.

**Table 2-4.** Regulatory requirements of health food products in different categories after October 2015 in China (Anon, 2015).

<table>
<thead>
<tr>
<th>Category</th>
<th>Approval method</th>
<th>Governmental section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health foods using raw materials within the schedule</td>
<td>Filing</td>
<td>Provincial FDA</td>
</tr>
<tr>
<td>Nutrient supplements of vitamins and minerals, etc. imported into China for the first time</td>
<td>Filing</td>
<td>CFDA</td>
</tr>
<tr>
<td>Health foods which use raw materials not listed in the schedule</td>
<td>Registration</td>
<td>CFDA</td>
</tr>
<tr>
<td>Health food products imported for the first time (excluding nutrient supplements of vitamins and minerals, etc.)</td>
<td>Registration</td>
<td>CFDA</td>
</tr>
</tbody>
</table>
To date, only part one of the schedule, regarding raw materials of nutrient supplements (营养素补充剂原料目录), has been published and implemented (China Food and Drug Administration, 2017).

**Schedule of Permissible Functional Health Claims Allowed to be Used on Health Food** (允许保健食品声称的保健功能目录). According to FSL, health foods can claim health functions, which should be supported by scientific evidence and cannot cause any acute, sub-acute or chronic negative effects on human bodies. CFDA, collaborating with other relevant governmental sections, is responsible to plan, adjust and publish the Schedule of permissible functional health claims allowed to be used on health foods (Anon, 2015). In other words, all health claims for health foods are required to comply with this schedule. Exported food products which use CFDA’s schedule of raw materials for health food, as well as CFDA’s schedule of permissible functional health claims, will be considered health foods, and are required to have scientific evidence to support the functional health claims which are made (Ministry for Primary Industries of New Zealand, 2017). Based on Seeking comments regarding administration of health functions claimed by health food (draft for comments), released for periodic reviews by CFDA in December 2016, health claims include two categories: nutrient supplements claims (营养素补充剂声称), describing as “supply XXX”, and general function claims (一般功能声称). The latter indicates claims of assisting health maintenance and improvement, without involving diseases (China Food and Drug Administration, 2016b). To date, only the first category, functional health claims of nutrient supplements (营养素补充剂保健功能目录), have been published and implemented (China Food and Drug Administration, 2017). Part two of the schedule is yet to be published. It should be noted that previous claims (Table 2-5), published in Technical Standards for Testing & Assessment of Health Food (2003) by Chinese Ministry of Health, should be superseded by the new schedule about functional health claims.

<table>
<thead>
<tr>
<th>Health claims for functional foods</th>
<th>保健食品功能声称</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Enhancing immunity</td>
<td>增强免疫力</td>
</tr>
<tr>
<td>2. Assisting blood lipids reduction</td>
<td>辅助降血脂</td>
</tr>
<tr>
<td>3. Assisting bold sugar reduction</td>
<td>辅助降血糖</td>
</tr>
<tr>
<td>4. Antioxidative</td>
<td>抗氧化</td>
</tr>
<tr>
<td>5. Memory improvement</td>
<td>辅助改善记忆</td>
</tr>
<tr>
<td>6. Alleviating eye fatigue</td>
<td>缓解视疲劳</td>
</tr>
<tr>
<td>7. Enhancing lead excretion</td>
<td>促进排铅</td>
</tr>
<tr>
<td>8. Clearing throat</td>
<td>清咽</td>
</tr>
<tr>
<td>9. Assisting blood pressure reduction</td>
<td>辅助降血压</td>
</tr>
<tr>
<td>10. Sleep improvement</td>
<td>改善睡眠</td>
</tr>
<tr>
<td>11. Facilitating breast milk secretion</td>
<td>促进泌乳</td>
</tr>
<tr>
<td>12. Alleviating physical fatigue</td>
<td>缓解体力疲劳</td>
</tr>
<tr>
<td>13. Enhancing anoxia endurance</td>
<td>提高缺氧耐受力</td>
</tr>
<tr>
<td>14. Assisting irradiation hazard protection</td>
<td>对辐射危害有辅助保护功能</td>
</tr>
<tr>
<td>15. Weight control</td>
<td>减肥</td>
</tr>
<tr>
<td>16. Promoting child growth</td>
<td>改善生长发育</td>
</tr>
<tr>
<td>17. Increasing bone density</td>
<td>增加骨密度</td>
</tr>
<tr>
<td>18. Alleviating nutritional anemia</td>
<td>改善营养性贫血</td>
</tr>
<tr>
<td>19. Protecting liver against chemical injury</td>
<td>对化学性肝损伤的辅助保护作用</td>
</tr>
<tr>
<td>20. Eliminating acne</td>
<td>祛痤疮</td>
</tr>
<tr>
<td>21. Eliminating skin chloasma</td>
<td>祛黄褐斑</td>
</tr>
<tr>
<td>22. Improving skin water content</td>
<td>改善皮肤水份</td>
</tr>
<tr>
<td>23. Improving skin oil content</td>
<td>改善皮肤油份</td>
</tr>
<tr>
<td>24. Regulating gastrointestinal tract flora</td>
<td>调节肠道菌群</td>
</tr>
<tr>
<td>25. Facilitating digestion</td>
<td>促进消化</td>
</tr>
<tr>
<td>26. Facilitating defecation</td>
<td>通便</td>
</tr>
<tr>
<td>27. Assisting the protection of gastric mucosa</td>
<td>对胃黏膜损伤有辅助保护功能</td>
</tr>
</tbody>
</table>
Schedule of Substances Which Are Both Food and Traditional Chinese Medicines (按照传统既是食品又是中药材物质目录). Over the history of using TCM, some substances that have also been used for foods for a considerably long time, can be used as herbs in TCM prescriptions. When producing foods, these substances should not be considered as medicine, since they are foods originally. Based on this tradition, a schedule regulating substances which are both food and traditional Chinese medicines will be released by the National Health and Family Planning Commission of the PRC. Currently a draft version is available for comment and there are 101 substances in total in the schedule (Anon, 2014b). According to FSL, medicines cannot be included in food products, whereas, substances considered both food and TCM herbs are excluded from this regulation (Anon, 2015).

In conclusion, the Raw Material Schedule for Health Food is the most important criterion for categorizing health foods. Meanwhile, all health claims on foods are required to comply with Schedule of Permissible Functional Health Claims Allowed to be Used on Health Food. Although medicines cannot be included in food products, substances considered both food and TCM herbs may be involved. Following FSL, it is easy to find that legislative regulations are focusing on health foods. However, based on health claims, health foods cannot cover all functional foods. Foods with substances considered to be both food and TCM herbs, and even other foods may be parts of functional foods. Excluding health foods, National Food Safety Standard for Nutrition Labelling of Pre-packaged Foods (Anon, 2011) regulates 65 standard nutrient function claims for prepacked food products. Categories with regard to functional foods and the legislative criteria of their health claims are summarized in Table 2-6.

Approved functional foods are authorised by the CFDA to bear the health food certification commonly known as the Blue Hat logo (Figure 2-5). The packs of the beverage Red Bull, a common energy drink worldwide, in Japan, China, Australia and New Zealand illustrate differences in label information. A clear symbol for health foods (Blue Hat) is seen on the Chinese pack, whereas, a similar symbol is not used on the packs from other countries.

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1 An introduction of TCM can be found in Subsection 2.2.
Table 2-6. Categories with regard to functional foods and the legislative criteria of their health claims.

<table>
<thead>
<tr>
<th>Category</th>
<th>Legislative criteria of functional materials</th>
<th>Legislative criteria of health claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health foods</td>
<td>Raw Material Schedule for Health Food</td>
<td>Schedule of Permissible Functional Health Claims Allowed to be Used on Health Food</td>
</tr>
<tr>
<td>Foods with substances considered both food and TCM herbs</td>
<td>Schedule of Substances Which Are Both Food and Traditional Chinese Medicines</td>
<td>National Food Safety Standard for Nutrition Labelling of Prepackaged Foods</td>
</tr>
<tr>
<td>Other foods (excluding special foods)</td>
<td>N/A</td>
<td>National Food Safety Standard for Nutrition Labelling of Prepackaged Foods</td>
</tr>
</tbody>
</table>

Figure 2-5. Symbol authorised by CFDA for products of health foods.

Figure 2-6. A commercial package example of beverage Red Bull in Japan, China and Australia New Zealand.
CFDA has opened its dynamic database so that the general public can search for information about a specific domestic or imported health food products including claims made, ingredients and country of origin (Anon, 2017b). As of July 2017, CFDA had approved a total of 16,631 health food products, of which, 15,879 were domestically made and 752 were imported. It is important to note that “enhancing immunity” was the most frequently approved health claim (Anon, 2017a). Similarly with Japan, health foods in China are considered as one of the three kinds of special foods, together with (i) formulas for special medical uses, and (ii) infant formulas (Anon, 2015).

2.2 Traditional Chinese Medicine (TCM)

2.2.1 What is TCM?

TCM has been practiced for at least 2000 years in China (Stockert et al., 2007). TCM differs from Western medicine in that it takes a holistic approach towards treating patients, and aims to help provide a healthy lifestyle in which illnesses are prevented (Liu, 2017). TCM is based on two fundamental theories, *Yin-Yang* and five elements (*Wu Xing*), which together explain all change as well as all natural phenomena in the universe, including human beings (Wang, 1979). *Yin-Yang* theory posits that the universe is a whole composed of two opposites, *Yin* and *Yang*, which are interdependent and can transform into each other. Their equilibrium ensures that harmony, including the harmony of the body, is maintained (Lao et al., 2012). Five Element theory, also known as Five Phase theory, developed from an ancient Chinese philosophical system in which the universe was held to consist of five basic elements: wood, fire, earth, metal, and water. Five Element theory describes the relationships between the human body and the external environment and the physiological and pathological interactions among the internal organs within the body (Lao, 1999).

According to the principles of TCM, human physiological functions are maintained by *Qi*; *Zang-Fu* (internal organs); blood; bodily fluids; and *Jing-Luo* (meridians and collaterals). *Zang-Fu* explains the physiological functions and pathological changes of the internal organs, which are determined by observing the outward manifestations of the body. The five *Zang* are the heart, liver, spleen, lung, and kidney; the six *Fu* are the gallbladder, stomach, small intestine, large intestine, urinary bladder, and Sanjiao (triple warmer) (Lao et al., 2012). Based on TCM principles and theories, the five *Zang*, including the lung, should be considered as *Yin*-organs (Stockert et al., 2007). Although the five internal organs’ names are the same as in modern medicine, their connotations are fundamentally different. The name of an organ in TCM is only
a symbol of a functionally inter-related unit or system, and not the real structural organ in modern medicine (Jiang, 2005). For example, any TCM treatment aimed at the lung, as a *Yin*-organ, implicates the treatment and regulation of the whole breathing system and bases on diagnosis of *Yin* deficiency (Lao et al., 2012; Stockert et al., 2007).

### 2.2.2 How to position TCM among pharmaceuticals, health foods and regular diet?

TCM modalities include Chinese herbal medicine (*zhong yao*), acupuncture, Chinese massage (*tui na*), mind/body exercise, and dietary therapy (Lao et al., 2012) (Lao, Xu, & Xu, 2012; Xu & Yang, 2009). Through TCM modalities, it is easily to see that TCM, pharmaceuticals and the regular diet are three eating categorisations intertwined inextricably with each other. In addition, based on the legislative regulations of health foods in Food Safety Law (available in Subsection 2.1.3), health foods, including nutrient supplements, also overlap with TCM and the regular diet. How TCM relates to pharmaceuticals, health foods and a regular diet, can therefore be illustrated (Figure 2-7) based on an understanding of TCM modalities and the legislative criteria of health foods.

![Figure 2-7](image)

**Figure 2-7.** Schematic illustration of relationships among TCM, pharmaceuticals, the regular diet and health foods.

**Connection between TCM and pharmaceuticals**

Chinese herbal medicine is an integral part of traditional Chinese culture and medical practice, which includes the use of plants, animals and minerals (Xu & Yang, 2009), mostly in the form of decoctions. Typically, an herbal practitioner will prescribe a formula (*fang zi*) containing several herbs with differing functions, natures, and flavours, which have been selected based
on the syndrome to be treated. In these carefully constructed formulations, the herbs are believed to act synergistically to harmonise their effects and to neutralise or minimise any toxicity that individual constituents may have (Bensky & Barolet, 1990). The herbal medicine preparation (pao zhi) is also very critical and unique (Xu & Yang, 2009). TCM medical gels (gao fang), are a popular way for older people to maintain health in China and they are a common example of Chinese herbal medicines.

TCM is more often used for chronic conditions than acute conditions, however, the efficacy issues of TCM are still major challenges in China as it is complicated to evaluate their clinical effects. For example, some Chinese herbal medicines are prescribed to treat diseases from the root cause rather than to decrease the symptoms immediately. So, it might take months or years for patients to recover, which is problematic for most clinical trials to evaluate long-term outcomes (Jia, 2005). Therefore, it is very common for Chinese people to apply TCM if treatment by Western medicine is not successful, rather than them being the first option for curing diseases. In a survey conducted among 1161 out-patients in Jiangsu province, 42% participants tried TCM when they had chronic conditions which had not shown sustaining improvement after treatment by Western medicine (25%) or had been unsuccessfully treated from Western medicine (17%). Only 11% of respondents claimed they would try TCM before they tried Western medicine to cure diseases (Huang, Chen, Zhu, & Wu, 2007).

In recent time, TCM has also experienced further development and modernization. Guided by TCM theory, Chinese “drugs” termed TCM patent medicine (zhong cheng yao), have been developing rapidly and are widely accepted by the Chinese people owing to their convenience (Chen, Liu, Wang, Ren, & Liu, 2014). TCM patent medicine usually contains more than one Chinese herbal medication. Innovation in TCM patent medicine mainly includes four methods: innovation of the ancient famous and effective prescriptions; summarising new clinical experience according to the needs of consumers and changes of diseases; innovation in effective prescriptions “handed down” through generations; or refinement of traditional forms (Xiong, Wang, Zhang, & Li, 2015; Zhang, Liu, & Kang, 2016). However, owing to the complexity of Chinese herbal medicine, the critical component combinations and the appropriate standard component combinations are not clear. For instance, since there are neither strict standards for controlling critical components in the medicine nor regulations on their production process, some unethical manufacturers are either using less effective components or cheap substitutes (Xu & Yang, 2009).
Connection between TCM and the regular diet

Owing to their life long exposure to TCM based principles, the Chinese population has a deeply entrenched appreciation for the health benefits of foods, with many people believing that food cannot only satisfy hunger and provide required nutrients but it can also improve physical and mental well-being (Menrad, 2003; Roberfroid, 2000). On the basis of this overall cultural appreciation of the prophylactic and therapeutic properties of foods (O’Brien, 2015), dietary therapy, as a typical TCM treatment, has a profound impact on the daily diet. As shown in Figure 2-7, people are used to cooking meals with TCM ingredients in order to obtain functional TCM benefits (Zi, 2009).

The fruit of Lycium barbarum (L. Barbarum L.) named Fructus Lycii, or called wolfberry in the West (or Goji berry), for example, has a long tradition in China of use as both a food and a traditional herbal medicine. According to TCM rational, wolfberry can nourish the liver and the kidney, helping to balance the *Yin* and *Yang* in the body, and preventing premature aging (Vidal et al., 2012). Therefore, it is normally used as a tonic food in China and needs to be cooked before consumption. A common way of using it is to add wolfberries to rice congee or soups, in combination with chicken or pork, vegetables, and other herbs such as *Dang Gui* (Yang, 2015).

Connection among TCM, health foods and the regular diet

The triple overlap among TCM, health foods and the regular diet is shown in Figure 2-7. As introduced in Subsection 2.1.3, health foods are a group of products regulated by Chinese legislation, whose scope covers food products claiming to have specific health functions as well as nutrient supplements. It is important to note that high acceptance of TCM by Chinese people and especially its connection with the regular diet, impacts on food production and influences policy development. As stated earlier, a special schedule regulating substances which can be considered as being both foods and TCM herbs has been produced by the Chinese government. This schedule to some extent, regulates the application of TCM to manufactured functional foods from a legal perspective.

After efficacy, safety is the main focus when using TCM formulations regardless of the intended format for TCM products (e.g. dietary therapy or health food products including supplements). The same with applying TCM in the pharmaceutical industry, there are many factors contributing to the safety concerns of TCM therapies and supplements, such as the limited legislation around manufacturing processes, the intrinsic toxicities of herbs (e.g. long-
term toxicity, dose-dependent toxicity), or the environmental contaminations of herbs (such as air pollution, soil contaminations, and heavy metals) (Liu, Chuang, Lam, Jiang, & Cheng, 2015) which should be all carefully evaluated before using TCM.

2.3 Pollution-driven responses from Chinese consumers and the functional food market

2.3.1 Chinese consumers’ interest in air pollution and existing remedies to reduce the impact of air pollution

The frequency of words entered into search engines such as Baidu provide a useful indicator of the level of interest or concern that people have in an issue (Zhang, Shen, Zhang, & Xiong, 2013). Using Baidu Index, a search for the popular keyword regarding air pollution, “雾霾” (Fog & smog) was compared to the keyword “奶粉” (Milk powder). Milk powder was chosen as a comparison topic, as owing to historical scandals (Pei et al., 2011) Chinese consumers have significant food safety concerns around milk powder. The relative search frequency of the pollution-related term Fog & Smog was dramatically higher than for milk powder (Figure 2-8), with the frequency of searching mirroring episodes of severe smog weather in China, including December 2013 (Wikipedia, 2018), December 2015 (Liansai, 2016) and December 2016 (Greenpeace, 2016).

Further evidence of consumers’ interest in searching for remedies against air pollution is the evolution of the “Smog Economy” which is based on the sale of equipment such as air purifiers, air monitoring equipment and anti-pollution masks (Johnson et al., 2017). For example, during a bout of smog in 2014 in Beijing, approximately 217,000 facemasks were sold within one week (Duggan, 2014; XinhuaNet, 2014), and state media reported panic buying of facemasks during the December 2015 red alert (Independent, 2015). Another example of the concern that Chinese people have around air pollution includes the popularity of mobile phone apps that provide air quality data (Johnson et al., 2017) and the promotion of holidays to smog-free destinations, such as in 2014 when a major Chinese travel agency Ctrip, spent 360 million Yuan on subsidizing travel for tourists from seven cities including Beijing, Tianjin, and Taiyuan, in order to promote its “smog (haze)-escape-trips” (Johnson et al., 2017).
2.3.2 Functional foods available in the Chinese market to help fight against the adverse effects of air pollution

Based on TCM principles, Chinese consumers have a holistic approach to food and medicine believing that they are of equal importance in preventing and treating disease (Weng & Chen, 1996). Therefore, dietary therapy is well accepted by Chinese people who wish to keep a healthy lifestyle in which illnesses are prevented (Stockert et al., 2007). This acceptance of the role of food in health accounts for the quick market production and uptake of TCM “anti-smog” therapies and lung-related supplements, touted to deal with the adverse impact on the lung. Many "anti-smog" foods are widely available in Chinese medicine shops, pharmacies and online sites (Wong, 2017). Approximately 31% participants of 1050 residents in Beijing chose to eat more “anti-haze (smog)” food to protect themselves and their families against air pollution (Johnson et al., 2017). While the idea of using TCM to counteract the harmful effects of air pollution has been promoted by Chinese media (Liu, 2017) and on social media platforms, such as WeChat (Liu, 2017), scientific evidence supporting the health claims of many of the products on the market is hard to find. This is in part due to the fact that while TCM has been practiced for at least 2000 years in China (Stockert et al., 2007), pollution-related concerns are a relatively new area for TCM. To help meet the market demand for products to address pollution related concerns, products have been produced based on existing TCM anti-inflammation therapies. Therapies in the form of anti-smog teas, soups or porridge (Wong, 2017) which contain TCM herbs such as dried flowers and roots are being touted being able to help people deal with smog and “cleanse lungs (清肺)”, a Chinese term which means cleaning.
pollutants or dust from the lung (Liu, 2017). This is despite the fact that according to TCM principles and theories, the real meaning of “cleanse lungs” is restricting overactive functions or relieving inflammation, namely “cleanse the hyperfunction of lungs (清肺热)” (Wang, 2016). So in reality the function of many TCM based herb therapies is to help to relieve inflammation symptoms caused by exposure to polluted air and to help in the maintenance of a healthy immune system instead of removing pollutants (Jiang, 2005; Lao, Xu, & Xu, 2012; Stockert et al., 2007). A number of TCM experts have publicly denied the efficacy of so-called “anti-smog” foods (Ecns.cn, 2017; Liu, 2017; Wang, 2016; Wong, 2017) and many TCM experts believe that such products should only be recommended by professional TCM practitioners, based on an individuals’ specific health conditions.

A related concept to the use of TCM is the use of supplements which mainly claim to deal with the impact of polluted air on the lung. Examples of such products available in China or online include commercial products from Australia and New Zealand (Table 2-7). Imported “health” related products from western countries have better credibility in China owing to Chinese scandals of health foods including dietary supplements (Xing, 2011). The rise of cross-border imported e-commerce has boosted the use of Western products by providing an efficient and convenient channel for consumers to purchase international products. A survey in 2011-2016 of consumers in tier 1 to 3 cities found that approximately 40% of them purchased imported supplement products through cross-border imported e-commerce, and about 70% of them believed that international brands were of higher quality than local brands and stated that they were willing to pay a premium for imported brands (Berger, 2017). Of the categories of oversea products purchased dietary supplements was one of the most common and Australia and New Zealand were among most popular countries of origin (Tmall Global, 2017). For instance, during the Double Eleven Sale in 2017, the online shop Chemist Warehouse, an Australian pharmacy retailer, reached 100 million in gross merchandise volume within 7 hours on Tmall, the biggest cross-border e-commerce importer (Tmall Global, 2017). Similarly, New Zealand based companies have been enjoying considerable success in selling supplements in China in recent years (Scattergood, 2018).
Table 2-7. Examples of supplements available in the Chinese market which claim to combat the adverse impacts of air pollution.

<table>
<thead>
<tr>
<th>Product</th>
<th>Advertised Benefits</th>
<th>Key Ingredients</th>
<th>Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear Lungs</td>
<td>• Protect the lungs from the effects of air pollution &amp; other inhaled toxins</td>
<td>• Thyme</td>
<td>Radiance</td>
</tr>
<tr>
<td></td>
<td>• Support those with dry or productive coughs &amp; a wheezy chest</td>
<td>• Elecampane</td>
<td>(Radiance, 2018)</td>
</tr>
<tr>
<td></td>
<td>• Ease &amp; soothe a red raw throat</td>
<td>• White horehound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Support the liver against environmental toxins</td>
<td>• Manuka Honey</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provide antioxidant support</td>
<td>• Licorice</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Rosemary</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ginger</td>
<td></td>
</tr>
<tr>
<td>Deep Lung Health</td>
<td>• Aid removal of mucus built up in the lungs</td>
<td>• Cayenne pepper or Chilli</td>
<td>Harker Herbals</td>
</tr>
<tr>
<td></td>
<td>• Support healthy breathing</td>
<td>• Coltsfoot</td>
<td>(Harker Herbals, 2018)</td>
</tr>
<tr>
<td></td>
<td>• Support clogged or “heavy” lungs and airways</td>
<td>• Elecampane</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Support lung health</td>
<td>• Ginger</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Help smoker's congestion</td>
<td>• Horehound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Help those living in areas of high air pollution</td>
<td>• Kumarahou</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Recover from ills and chills</td>
<td>• Lungwort</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Boost the immune system</td>
<td>• Pleurisy root</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Help fight the effects of air pollution</td>
<td>• Thyme</td>
<td>Goodhealth (2018)</td>
</tr>
<tr>
<td></td>
<td>• Help clear the airways</td>
<td>• White Horehound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Support healthy breathing</td>
<td>• Ginger</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Aniseed</td>
<td></td>
</tr>
<tr>
<td>Healthy Lungs</td>
<td>• Support lung health</td>
<td>• Vitamin C</td>
<td>Bioglan (2018)</td>
</tr>
<tr>
<td></td>
<td>• Maintain healthy mucous membranes of the respiratory tract to support healthy respiratory function</td>
<td>• Thyme</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Help healthy respiratory function</td>
<td>• Mullein</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contain natural anti-inflammatory matters</td>
<td>• Turmeric</td>
<td></td>
</tr>
<tr>
<td>Lung Clear Capsules</td>
<td>• Help relieve wheezing, shortness of breath and a sore throat</td>
<td>• Rosemary</td>
<td>Thompson’s (2018)</td>
</tr>
<tr>
<td></td>
<td>• Help clear excess mucus from the lungs</td>
<td>• Marshmallow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provide antioxidant activity, assisting the lungs with oxidative stress caused by environmental pollution and second hand smoke, whilst also supporting the immune system</td>
<td>• Fenugreek</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Relieve coughs and colds</td>
<td>• Blackcurrant anthocyanidins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reduce oxidative stress and inflammation</td>
<td>• Broccoli</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Boost immune function and regulate allergic reactions</td>
<td>• Licorice root</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Relieve bronchial and respiratory irritation</td>
<td>• Horse-heal root</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Relieve cough and mucus congestion</td>
<td>• Reishi mushroom</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Assist in the management of upper respiratory tract infection</td>
<td>• Fruit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Help make breathe easier by drying the secretion of nose</td>
<td>• Ginger rhizome</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• relieve oxidative stress as potent antioxidant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Counter the harmful effects of pollutants as chelating agents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Original Lung Detox Liquid</td>
<td></td>
<td>• Broccoli seed extract</td>
<td>Healthy Care (2018)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Olive leaf extract</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Horseradish root extract</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Taurine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Methionine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pyridoxine hydrochloride</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Peppermint oil</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Rosemary oil</td>
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</tbody>
</table>
In addition to claiming to reduce pollution-driven impacts on the lung, many of the products listed in Table 2-7 including Deep Lung Health (Harker Herbals), Lung Restore Capsules (Thompson’s) and Original Lung Detox Liquid (Healthy Care), claim that they also work on and support the immune system. However, reliably scientific validation to back up the claims of many of these products is hard to find, despite a number of the products indicating that they perform specific functions. For example, Lung Clear (Bioglan) on its official website states that “its formulation is based on traditional and scientific evidence to help your lungs and supports healthy respiratory function” (Bioglan, 2018).

2.4 Consumers’ perceptions of immune-boosting functional foods world-wide and in China

Due to the obvious challenge that air pollution is presenting to Chinese consumers and the positive attitude that Chinese consumers have towards dietary therapy, there is a strong market potential for functional food products that can address Chinese consumers’ concerns around air pollution, such as its impact on immune health. As a deep understanding of consumers can be the difference between the success of a new product and one that disappears without trace, it is vital to fully understand consumers’ perceptions of immune-boosting functional foods.

2.4.1 Evidence that consumers are interested in foods that can boost immune health

In western societies it has been reported a wide range of consumers have positive attitudes towards immune-boosting foods, including consumers in California, USA who had a positive attitude towards the use of probiotics (Bruhn et al., 2002); consumers in Des Moines and Harrisburg, USA, who were willing to pay more for intragenic products labelling enhanced antioxidant compared with products with conventional plain labels (Colson & Huffman, 2011); adults in USA and adolescents in Australia who take a wide range of nutritional supplements to achieve perceived benefits regarding immune health such as maintaining overall health and wellness, preventing common cold, etc. (Dickinson, Blatman, El-Dash, & Franco, 2014; O’Dea, 2003). Higher educated and older females are positively associated with seeking health benefits (Lynam, McKevitt, & Gibney, 2011) and in a study from Ireland it was reported that elderly consumers were more likely to make specific purchases to maintain their health status, such as the purchase of dairy products claiming to help boost the immune system (Lalor, Madden, McKenzie, & Wall, 2011).

Evidence is available in China as well. Based on four focus groups and twelve interviews in Shanghai, a recent qualitative study indicated that functional food, including immune-related
supplements and TCM therapies with perceived properties of boosting the immunity, was a popular option Chinese consumers took to help improve their immunity (Bremer, Mirosa, Kaye-Blake, Cong, & Harker, 2018). A survey in 2011 on health food consumption in China reported that 77% of consumers ranked "immune enhancement" as an important function, with 49% of consumers ranking "nutritional supplementation" and "antifatigue," as being the second equal most important functions (Centre for High-Value Nutrition, 2014; Medina, 2011). Health food is a very important component of functional foods and such products are required to receive approval and validation by the Chinese government. Under National Standard for Food Safety – Health Food (GB 16740-2014), a health food is defined as “any food stuff claiming to have specific health functions”, or “to supplement nutrition with vitamins and minerals for a specific functional purposes”. A health food should be designated as being useful for specific consumers, owing to its ability to regulate bodily functions, such foods are not designed to treat disease, and they should not cause any acute, sub-acute or chronic negative effects when consumed by humans” (Anon, 2014a). Of the 27 health claims for health foods, approved by Chinese Ministry of Health, “enhancing immunity” is the health claim most frequently used (Anon, 2017a, 2017b). The evidence presented above suggests that immune health and foods making immune health claims are an important focus for Chinese consumers.

2.4.2 Chinese consumers’ perceptions of the importance of scientifically validated health claims

The information available to consumers can have a significant effect on purchase decision making, with scientific information playing an important role in the marketing of scientifically validated products (Bruhn et al., 2002; Karim et al., 2011; Xing, 2011). In USA for example, FDA (Food and Drug Administration) approval as well as endorsement by recognized health groups increased the believability of a health claim associated with probiotic products (Bruhn et al., 2002).

In China scientific validation is also believed to play an important role in enhancing the credibility of food products. The percentage of acceptance of foods providing medical function and improved nutrition increased from approximately 41% to 48% when 500 participants in Nanjing were shown scientific information (e.g. opinions of scientists and research report) (Zhong, Marchant, Ding, & Lu, 2002). Through the aspect of consumers’ purchase intention and information trust, the role of scientific validation could be reflected as well. According to two recent studies conducted in Beijing (Zhang et al., 2018; Zhang, Xu, Oosterveer, & Mol, 2016), Chinese consumers’ purchase intention is positively impacted by how much they trust
the information supplied, which is largely derived from institutions based on strict, science-based, government regulations applied by private firms and controlled by public authorities (Seuring & Gold, 2013; Vergragt, Akenji, & Dewick, 2014). However, in general, scientific validation of food products, especially health foods are lacking in the Chinese market, with a survey of 500 participants’ in Taiyuan reporting that 48.2% of participants were concerned about misleading advertisements and the lack of scientific validation of health foods (Xing, 2011).

2.5 Potential of functional foods to help the immune system

A number of scientifically validated functional foods reported to have immune system enhancing properties are currently available (Lopez-Varela et al., 2002) including functional yogurt containing probiotics and micronutrient supplement claiming immune-boosting properties (Table 2-8). The compounds identified from the research could be food ingredients or natural immune-boosting whole foods. In addition, many studies are working on identifying plant compounds that target specific cellular events and complement the body’s own immune actions on exposure to known allergens such as air pollution (Coleman, Kruger, Sawyer, & Hurst, 2016; Sawyer, Stevenson, McGhie, & Hurst, 2017). In any event it is likely that the results from this research will support the development of functional foods with beneficial biological activities to help the immune system recover from the impact of air pollution (Nyanhanda et al., 2014).

2.5.1 Immune-boosting food ingredients

Probiotics, micronutrients, herbs, flavonoids and carotenoids have been reported to provide a wide range of benefits to immune health (Table 2-8). The immune-boosting property of probiotics is believed to be achieved by stimulating cytokine production and hence modulating gastrointestinal function (Table 2-8). For example, the ingestion of probiotic containing yoghurt can improve phagocytic activity of granulocytes, which involves importantly with natural immunity (Marteau, de Vrese, Cellier, & Schrezenmeir, 2001; Schiffrin, Rochat, Link-Amster, Aeschlimann, & Donnet-Hughes, 1995).

Micronutrients, including vitamins and minerals, are nutrients that people require in relatively small quantities (Opara, 2002). A deficiency of Selenium (Se) is accompanied by a reduction in immune function (Lopez-Varela et al., 2002; Rayman, 2000), therefore supplementation with Se, even in “selenium-replete” individuals, has marked immunostimulant effects, including an enhancement of proliferation of activated T cells (cytotoxic lymphocytes) and an
improvement of NK-cell activity (Kiremidjian-Schumacher & Roy, 1998). Oxidant-mediated tissue injury is a particular hazard to the immune system, since phagocyte cells produce reactive oxygen species as part of the body’s defense against infection. Adequate amounts of neutralizing antioxidants are required, therefore, to prevent damage to the immune cells themselves (Lopez-Varela et al., 2002). Some antioxidant can be obtained directly from the diet including Vitamin A, C, E, flavonoids and carotenoids. The immune-boosting properties of Vitamins A, C, E have been approved by numerous studies. A notable example is the research on reducing symptoms duration of a common immune-related disease – cold by ingesting relatively high doses of Vitamin C (Hemilä & Chalker, 2013).

Flavonoids are biologically active polyphenolic compounds ubiquitously found in fruits, vegetables and nuts. A noticeable flavonoid group in fruits is proanthocyanidins and their monomer units, catechins (procyanidin) or gallo catechins (prodelphinidins), which are the natural substrates of polyphenol oxidases and are, therefore, involved in the browning phenomenon of fruits. A number of studies suggest that flavonoids have immunomodulatory properties, including anti-inflammation and antioxidant (González-Gallego et al., 2010).

Carotenoids are a family of pigmented compounds that are synthesized by plants and microorganisms but not animals. They are present as micro-components in plants and are responsible for their yellow, orange and red colours (Rao & Rao, 2007). Fruits and vegetables constitute the major sources of carotenoid in the human diet (Agarwal & Rao, 2000; Britton & Khachik, 2009; Johnson, 2002). Close to 90% of carotenoids in the diet are represented by α-carotene, β-carotene, lycopene, lutein and cryptoxanthin (Gerster, 1997). Studies on the role of Carotenoids in antioxidant, gene regulation and apoptosis have advanced our knowledge on the mechanisms by which carotenoids regulate immune function (Chew & Park, 2004).

Herbs are popular ingredients that are included in commercial products, such as dietary supplements. Some herbs have the property of immune stimulants that can active the body's nonspecific defence mechanisms against infectious organisms, particularly viral and bacterial pathogens. In practice, species of two botanical genera stand out among the immune-stimulant herbs: coneflower (Echinacea spp.) and mistletoe (Viscum album) (Schulz & Blumenthal, 2004).
### Table 2-8. Food ingredients reported to provide a benefit to immune health.

<table>
<thead>
<tr>
<th>Food ingredient</th>
<th>Immune-boosting property</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Probiotics</strong></td>
<td>Modulate the immune system</td>
<td>(Isolauri, 2001; Marteau et al., 2001; Roberfroid, 2000)</td>
</tr>
<tr>
<td></td>
<td>- Alleviate intestinal information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Normalise gut mucosal dysfunction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Down-regulating hypersensitivity reactions</td>
<td></td>
</tr>
<tr>
<td><strong>Micronutrients</strong></td>
<td><strong>Selenium</strong></td>
<td>Effect immunostimulant</td>
</tr>
<tr>
<td></td>
<td>- Enhance proliferation of activated T cells (cytotoxic lymphocytes)</td>
<td>(Kiremidjian-Schumacher &amp; Roy, 1998)</td>
</tr>
<tr>
<td></td>
<td>- Improve NK-cell activity</td>
<td></td>
</tr>
<tr>
<td><strong>Vitamin A, C, E</strong></td>
<td>Prevent damage to the immune cells (antioxidant)</td>
<td>(Grimble, 1996; Hughes, 1999; Lopez-Varela et al., 2002; Meydani, Fawzi, &amp; Han, 2001)</td>
</tr>
<tr>
<td></td>
<td>- Neutralize reactive oxygen species</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Improve immune functions and increase resistance to infection (Vitamin A)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Anti-inflammation and involve in immune responses on delayed-type-hypersensitivity skin tests, antibody production, lymphocyte proliferation and pulmonary function (Vitamin C)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Modulate host immune functions and differentiate immature T cells in the thymus (Vitamin E)</td>
<td></td>
</tr>
<tr>
<td><strong>Flavonoids</strong></td>
<td>Modulate the immune system</td>
<td>(González-Gallego, García-Mediavilla, Sánchez-Campos, &amp; Tuñón, 2010)</td>
</tr>
<tr>
<td></td>
<td>- Antioxidant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Anti-inflammation</td>
<td></td>
</tr>
<tr>
<td><strong>Carotenoids</strong></td>
<td>Regulate immune function</td>
<td>(Chew &amp; Park, 2004)</td>
</tr>
<tr>
<td></td>
<td>- Antioxidant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Involve in gene regulation and apoptosis</td>
<td></td>
</tr>
<tr>
<td><strong>Herbs</strong></td>
<td>Stimulate immune response</td>
<td>(Schulz &amp; Blumenthal, 2004)</td>
</tr>
<tr>
<td></td>
<td>- Active the body’s nonspecific defence mechanisms against infectious organisms</td>
<td></td>
</tr>
</tbody>
</table>

### 2.5.2 Naturally immune-boosting foods

Flavonoids and carotenoids, as discussed above, are important dietary antioxidants beneficial to the immune system. Fruits and vegetables, in which the levels of these two antioxidants are high have been referred to as natural immune-boosting foods. The daily consumption of fruits...
### Table 2-9. Some naturally immune-boosting foods that have been reported in the scientific literature.

<table>
<thead>
<tr>
<th>Foodstuff</th>
<th>Immune-boosting property (flavonoids-dominated)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>Anti-inflammatory</td>
<td>(Sawyer et al., 2017)</td>
</tr>
<tr>
<td></td>
<td>Manage airway inflammation</td>
<td></td>
</tr>
<tr>
<td>Blackberry</td>
<td>Anti-inflammatory</td>
<td>(Dai, Patel, &amp; Mumper, 2007)</td>
</tr>
<tr>
<td></td>
<td>Antiproliferative</td>
<td></td>
</tr>
<tr>
<td>Blackcurrant</td>
<td>Anti-inflammatory</td>
<td>(Coleman et al., 2016; Hurst et al., 2010; Nyanhanda et al., 2014)</td>
</tr>
<tr>
<td></td>
<td>Manage airway inflammation</td>
<td></td>
</tr>
<tr>
<td>Blueberry</td>
<td>Antioxidant</td>
<td>(Y.-P. Wang et al., 2010)</td>
</tr>
<tr>
<td></td>
<td>Immunomodulatory (T-cell function)</td>
<td></td>
</tr>
<tr>
<td>Boysenberry</td>
<td>Anti-inflammatory</td>
<td>(Shaw, Hurst, &amp; Harper, 2016)</td>
</tr>
<tr>
<td></td>
<td>Alleviate lung inflammation</td>
<td></td>
</tr>
<tr>
<td>Cherry</td>
<td>Anti-inflammatory</td>
<td>(Ferretti, Bacchetti, Belleggia, &amp; Neri, 2010)</td>
</tr>
<tr>
<td></td>
<td>Antioxidant</td>
<td></td>
</tr>
<tr>
<td>Cocoa</td>
<td>Antioxidant</td>
<td>(Sanbongi, Suzuki, &amp; Sakane, 1997)</td>
</tr>
<tr>
<td></td>
<td>Immunomodulatory (inhibitory mechanism)</td>
<td></td>
</tr>
<tr>
<td>Cranberry</td>
<td>Antioxidant</td>
<td>(Dinh et al., 2014)</td>
</tr>
<tr>
<td></td>
<td>Antimicrobial</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Immunomodulatory (immunity-promoting)</td>
<td></td>
</tr>
<tr>
<td>Grape</td>
<td>Anti-inflammatory</td>
<td>(Percival, 2009)</td>
</tr>
<tr>
<td></td>
<td>Immunomodulatory (T-cell function)</td>
<td></td>
</tr>
<tr>
<td>Pomegranate</td>
<td>Anti-inflammation</td>
<td>(Johanningsmeier &amp; Harris, 2011; Zhao et al., 2016)</td>
</tr>
<tr>
<td></td>
<td>Antioxidant</td>
<td></td>
</tr>
<tr>
<td>Raspberry</td>
<td>Antioxidant</td>
<td>(M. Liu et al., 2002)</td>
</tr>
<tr>
<td></td>
<td>Antiproliferative</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Foodstuff</th>
<th>Immune-boosting property (carotenes-dominated)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broccoli</td>
<td>Antioxidant</td>
<td>(Mukherjee &amp; Mishra, 2012)</td>
</tr>
<tr>
<td></td>
<td>Immunomodulatory</td>
<td></td>
</tr>
<tr>
<td>Carrot</td>
<td>Antioxidant</td>
<td>(Sharma, Karki, Thakur, &amp; Attri, 2012)</td>
</tr>
<tr>
<td></td>
<td>Antimutagenic</td>
<td></td>
</tr>
<tr>
<td>Mango</td>
<td>Antioxidant</td>
<td>(Rocha Ribeiro, Queiroz, Lopes Ribeiro de Queiroz, Campos, &amp; Pinheiro Sant’Ana, 2007)</td>
</tr>
<tr>
<td>Spinach</td>
<td>Antioxidant</td>
<td>(Bergman, Varshavsky, Gottlieb, &amp; Grossman, 2001)</td>
</tr>
<tr>
<td>Sweet potato</td>
<td>Antioxidant</td>
<td>(Shih, Kuo, &amp; Chiang, 2009)</td>
</tr>
<tr>
<td></td>
<td>Anti-aging</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anti-inflammatory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antiproliferative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antimutagenic</td>
<td></td>
</tr>
<tr>
<td>Tomato</td>
<td>Antioxidant</td>
<td>(Blum, Monir, Wirsansky, &amp; Ben-Arzi, 2005; Watzl et al., 2000)</td>
</tr>
<tr>
<td></td>
<td>Immunomodulatory</td>
<td></td>
</tr>
</tbody>
</table>
and vegetables is a common dietary recommendation to support good health. The understanding of immune benefits of fruits and vegetables is a good evidence to support this recommendation (Kaur & Kapoor, 2001).

Fruits, especially berry fruits such as blackberry, blackcurrant, blueberry, cranberry and raspberry, are good source of flavonoids with immune-boosting functional properties like anti-inflammatory, antioxidant and antiproliferation. Although carotenoids exist in many fruits and vegetables the quantitative carotenoid contents varies widely. Generally speaking, there is a clear correlation that dark green vegetables and yellow, orange or red plant tissues have high concentrate of carotenoids (Britton & Khachik, 2009), and that these fruits and vegetables normally present similar immune-boosting properties as berry fruits (Table 2-9). The naturally occurring food compounds, such as flavonoids and carotenoids, impart bright colour to fruits and vegetables and act as antioxidant and anti-inflammatory agents in the human body, which benefit to the whole immune system (Kaur & Kapoor, 2001).

Antioxidant has been identified in blueberries, cherries, cocoa, cranberry, pomegranate, raspberries, broccoli, carrots, mango, spinach, sweet potatoes and tomatoes, and anti-inflammation has been identified in almost all fruits in Table 2-9. The two most commonly reported immune-boosting functional properties from the literature, antioxidant and anti-inflammation, are, therefore, considered to be useful biomarkers that are relevant to human health (Dangour et al., 2010).

2.6 Conclusion

From its general definition, functional foods could be considered as a kind of interdisciplinary products between conventional foods and pharmaceuticals. Many terms describing foods with specific health benefits, such as nutraceuticals, health foods and dietary supplements, can be included in the scope of functional foods. Different countries have different legislation concerning functional food products, Health Food, which is an important part of functional foods, is the category requiring governmental approval in China.

Chinese consumers pay a lot of attention to air pollution and its consequences, with the evolution of the “Smog Economy” being a case in point illustrating consumers’ demand for remedies against air pollution. The early functional food products in the market designed to meet Chinese consumer’s desire for remedies including “anti-smog” tea and lung-related supplements mainly claim to deal with pollution-driven impacts on the lung, however many of
them do not appear to be supported by scientific evidence. For example, “cleanse lungs”, the claim of “anti-smog” tea, has been publicly stated as being as a misleading promotion.

Both in China and in western societies, consumers’ attitudes towards functional foods, including those designed to enhance the immune system, are generally positive. Evidence demonstrating Chinese consumers’ acceptance of immune-boosting functional foods includes their preference of the health claim, enhancing immunity. Importantly, research indicates that Chinese consumers’ acceptance of food products could be increased by providing information about scientific-validated benefits.

Numerous studies have reported that functional foods could provide a wide range of benefits to immune health, including helping pollution-driven immune issues. Immune-boosting food ingredients include probiotics, micronutrients, herbs, flavonoids and carotenoids and many fruits and vegetables can be considered as naturally immune-boosting foods including berry fruits, dark green vegetables and plants with yellow, orange or red plant tissues, owing to their high content of flavonoids and carotenoids these.

This chapter is the first interdisciplinary review that comprehensively integrates literatures of pollution-driven responses of Chinese consumers and the functional food market, consumers’ perceptions of immune-boosting functional foods and scientific findings about functional foods helping immune health. The gap between the market demand and potential products suggests a prospect for effective and scientifically-proven functional food products that help Chinese consumers’ immune system recover from the impact of air pollution.

The present thesis uses consumer-oriented methods to obtain an understanding of Chinese consumers’ perceptions of helping the immune system recover from the impact of air pollution. The following chapter will describe Chinese consumers’ understanding of the impact of air pollution on their health, and key attributes (expected benefits, forms and patterns of consumption) of functional foods to help the immune system cope with the impact of air pollution (Chapter 3); Chinese consumers’ views and living experiences of coping with polluted air and to obtain an understanding of the links they make between their immune health and food choice (Chapter 4); desirable attributes of any products Chinese consumers may purchase to enhance their immune health (Chapter 5).
Chapter 3.

Chinese Consumers’ Perceptions of Functional Foods: A Netnography Study of Foods that Help the Immune System Recover from Air Pollution

Part of this chapter has been published in:

3.1 Introduction

Air pollution is becoming an increasing problem in many developing or expanding economies, with China being one of the most affected. Due to the occurrence of episodes of severe and persistent smoggy weather in China, air pollution is at the forefront of public attention (Huang, 2015; Huang et al., 2014; Johnson et al., 2017). Previous research on Chinese people’s perceptions about air pollution have identified that air pollution is considered to be a serious problem that affects their quality of life, especially their health (Johnson et al., 2017; Liu & Mu, 2016; Liu et al., 2016). It has been scientifically proved that air pollution can have adverse effects on the immune system. Most airborne pollutants function as mucosal adjuvants and, by interacting with both the innate and adaptive immune cells, moderate the adaptive immune responses leading to adverse health outcomes (Saxon & Diaz-Sanchez, 2005). For Chinese consumers facing persistent air pollution, a pressing concern is the search for physical means to limit their exposure to air pollution and therapies to help their immune system cope with this stress. In this regard, functional foods can be considered as a good option as consumers increasingly believe that foods are not only intended to satisfy hunger and provide the necessary nutrients for life but also to improve their physical and mental well-being (Menrad, 2003; Roberfroid, 2000).

In China, the long-standing practice of using Traditional Chinese Medicine (TCM) has embedded the believe that food and medicine come from the same source and both are of equal importance in preventing and treating disease (Weng & Chen, 1996). This philosophy greatly boosts consumers’ acceptance of functional foods, with dietary therapy being a common approach to maintain health and prevent illnesses (Stockert et al., 2007). In a recent survey of 1050 Beijing residents, approximate 31% of respondents stated that they choose to eat more “anti-haze (smog)” food to protect them and their families against the deleterious effects of air pollution (Johnson et al., 2017). Despite the interests Chinese consumers have in food-based remedies, only limited products purported to work on pollution-driven effects are available in the market. Example products include “anti-smog” tea and lung-related supplements. More importantly, many of them do not appear to be supported by scientific evidence.

In laboratories around the world many scientists are working on identifying plant compounds that target specific cellular events and complement the body’s immune response on exposure to allergens such as air pollution (Coleman et al., 2016; Sawyer et al., 2017). It is likely that the results from such research will support the development of functional foods with beneficial biological activities to help the immune system recover from the impact of air pollution.
(Nyanhanda et al., 2014). However, research about consumers’ perceptions of functional foods designed to help combat the impact of air pollution has not been reported. Furthermore, the benefits Chinese consumers wish to obtain, the forms of such products, and how frequently and when they may be consumed is unknown.

As a deep understanding of consumers can be the difference between the success of new product or one that disappears without trace, it is vital to gain a good understanding of the perceptions of the consumers in the target market when developing a new product. As well as being an important means of communication, the internet is also becoming an important resource for consumer and market research. Such research termed netnography whereby ethnography is applied to the internet (Kozinets, 2010), has become widely accepted in the field of consumer and marketing research (Liang & Scammon, 2011) as a way to avoid the biases and limitations of transforming participants’ ethos and sensibility by listening to consumers in their natural habitats (Bernoff & Li, 2008) on their own terms (Hamilton & Hewer, 2010). As an important data collection source of netnography studies, Social Networking Sites (SNS) have become extremely popular worldwide and although the nature and nomenclature of SNS may vary from country to country (Boyd & Ellison, 2007), they normally offer abundant text-based discussions as raw data for researchers. Popular SNS sites include forums (e.g. Reddit, Tianya and Baidu Tieba), community question answering (CQA) websites (e.g. Quora, Zhihu and Baidu Knows) and social websites (e.g. Facebook, LinkedIn and Renren) (Li, Huang, Tan, & Liu, 2017).

There is no doubt that the internet plays an important role in the daily lives of Chinese people. In 2017, China had 772 million internet users in total, including 40.74 million new users, with each user being online for an average of 27 hours per week (China Internet Network Information Centre, 2018). It can be imagined that after episodes of air pollution in China, a large number of pollution-related discussions occurred online, especially in SNSs (Lynch, 2015). Therefore, to explore Chinese consumers’ understanding of the impact of air pollution on their health, and some key attributes (expected benefits, forms and patterns of consumption) expected of functional foods designed to help the immune system cope with the impact of air pollution, we analyzed discussions from selected Chinese SNS using the netnography approach.
3.2 Methods

3.2.1 Data collection

A seven-step netnography data collection procedure was used based on the following desired principles: 1) Consider research ethics; 2) Formulate research questions; 3) Determine search terms; 4) Find SNS; 5) Identify SNS; 6) Search relevant discussions; 7) Select relevant discussions (Bowler Jr, 2010; Kozinets, 2010; Lynch, 2015; McDermott, Roen, & Piela, 2013).

1) Consider research ethics

Research ethics must be considered at the beginning of a study and applied during the whole process. While netnographic researchers have not achieved consensus on the main ethical issues of informed consent, public versus private discussions, and rules for quoting social media discussions (Lynch, 2015), in the current study we used the approach of McDermott et al. (2013) for the selection of online data by netnography (McDermott et al., 2013). This involved the following two considerations: what are the participants’ likely expectations of privacy, and would participants experience harm as a result of their discussions being analyzed?

For data to be considered as being public, we believed that there needed to be no request for membership, registration, sign-in, or a password, and the SNS needed to be publicly accessible through popular internet search engines, such as Baidu. Moreover, with the purpose of protecting the online participate, discussions were selected which did not contain controversial or sensitive topics or opinions (Lynch, 2015; McDermott et al., 2013). Following these guidelines, the present study was conducted with the following guidelines: data was only included if (i) it was publicly available; (ii) participants were not considered vulnerable individuals; and (iii) the topic was not considered to be sensitive.

2) Formulate research questions

In order to achieve the objectives of the current study two research questions were formulated:

- Question 1 – Which perceived impacts caused by air pollution are being talked about most frequently by Chinese consumers?
- Question 2 – What kind of functional food products are being discussed online by Chinese consumers to help the immune system cope with the impact of air pollution?

3) Determine search terms

The current study utilised the commercial internet search engine Baidu, which in China has a market share of 76% (StatCounter, 2017). Baidu offers the service Baidu Index at
https://index.baidu.com/, which can be considered as a keyword analysis tool that represents the search frequency of certain keywords in Baidu search engine based on actual searching behavior of its users (Zhang et al., 2013).

As China has frequently experienced smoggy weather since 2013 (Huang et al., 2014), the current study selected Baidu’s data from 2013 till April 2017. Among Baidu’s annual Top 10 search rankings of 2013-2015, the three most frequently used search phrases for air pollution, were determined as being “雾霾” (Fog & smog) (Baidu, 2014), “PM2.5” (Baidu, 2014, 2016) and “霾” (Smog) (Baidu, 2015).

These three phrases were typed into Baidu Index and the weighted sum of the search frequency regarding each search term was calculated by Baidu (Baidu Index, 2018b), for conversation covering the time from the middle of 2013 to April 2017 (Figure 3-1). As the frequency of use for the phrase “霾” (Smog) was significantly less than the use of the terms “雾霾” (Fog & smog) or “PM2.5” (Figure 3-1), only the terms “雾霾” (Fog & smog) and “PM2.5” were used in the following stages of the current study. Unsurprisingly, increases in the use of the three terms coincident with incidents of heavy air pollution during December 2013, February 2014, December 2015, December 2016 and January 2017 (Huang, 2017).

Figure 3-1. Search index (weighed sum) of “雾霾” (Fog & smog), “PM2.5” and “霾” (Smog) in Baidu, from 1st January 2013 till 18th April 2017.

2 PM2.5, is a term meaning particulate matter less than 2.5μm in diameter. This term has entered the public lexicon as citizens monitor daily reports of pollution levels (Huang, 2015; Nielsen & Ho, 2017).
During the data collection process, participant confidentiality was maintained, since only the search index and the weighted sum of the search frequency for each search term as calculated by *Baidu* (Baidu Index, 2018b), was available.

4) Find SNS

The phrases “雾霾” (Fog & smog) and “PM2.5” were typed separately into *Baidu*. The results from the top 10 pages were examined to find relevant SNS. According to previous research, SNS can be defined to be social network sites as web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) connect with other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system (Boyd & Ellison, 2007). Four SNS, 知乎 (*Zhihu*), 百度贴吧 (*Baidu Tieba*), 百度知道 (*Baidu Knows*) and 天涯 (*Tianya*), were found using the search result for “雾霾” (Fog & smog) and two SNS, Zhihu and Baidu Knows, were found using the search result for “PM2.5” (Table 3-1).

**Table 3-1.** Results of SNS by searching “雾霾” (Fog & smog) and “PM2.5” in Baidu within top 10 pages, on 18 April 2017.

<table>
<thead>
<tr>
<th>Search term</th>
<th>Name (Chinese / English)</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>雾霾 (Fog &amp; smog)</td>
<td>知乎 / Zhihu</td>
<td><a href="https://www.zhihu.com/">https://www.zhihu.com/</a></td>
</tr>
<tr>
<td></td>
<td>百度贴吧 / Baidu Tieba</td>
<td><a href="https://tieba.baidu.com/">https://tieba.baidu.com/</a></td>
</tr>
<tr>
<td></td>
<td>百度知道 / Baidu Knows</td>
<td><a href="https://zhidao.baidu.com/">https://zhidao.baidu.com/</a></td>
</tr>
<tr>
<td></td>
<td>天涯 / Tianya</td>
<td><a href="http://www.tianya.cn/">http://www.tianya.cn/</a></td>
</tr>
<tr>
<td>PM2.5</td>
<td>知乎 / Zhihu</td>
<td><a href="https://www.zhihu.com/">https://www.zhihu.com/</a></td>
</tr>
<tr>
<td></td>
<td>百度知道 / Baidu Knows</td>
<td><a href="https://zhidao.baidu.com/">https://zhidao.baidu.com/</a></td>
</tr>
</tbody>
</table>

5) Identify SNS

To determine which of the four candidate SNS would be most suitable for the current study, they were assessed for how closely they matched our previously determined selection criteria. Of the four SNS listed in Table 3-1, *Zhihu* and *Baidu Knows* met the selection criteria as they were (i) publicly available with no membership or password protection, (ii) provided popular discussions about air pollution (identified through the name of the topic and through an examination of the description of the topic), (iii) written in Chinese and (iv) identified in the results of both search terms, “雾霾” (Fog & smog) and “PM2.5”. *Baidu Tieba* and *Tianya* were rejected because they did not meet the inclusion criteria of being identified in the results of
both search terms. The SNS, Zhihu, could be considered to be a semi-open forum, because although the homepage was password-protected, the relevant discussions in Zhihu could be accessed through Baidu search results and after accessing the discussion pages, the forum was publicly available, including the function of search engine and search results. Therefore, Zhihu was used in the current study. Baidu Knows met all of the inclusion criteria. Consequently, data from Zhihu and Baidu Knows was used in the study.

Interestingly both Zhihu and Baidu Knows were CQA websites, which have become extremely popular (Wu, Wu, Li, & Zhou, 2015). In CQA websites, users can ask questions, answer questions posted by others and read answers to questions. The current study defines the term “discussion” and “comment” to explain communications on these two SNS. A discussion was defined as the entirety of each posted question and all of its answers, while a comment referred to a single answer.

6) Search relevant discussions

Table 3-2. List of keyword combinations and their corresponding translation.

<table>
<thead>
<tr>
<th>No.</th>
<th>Keywords (Chinese)</th>
<th>Keywords (English)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>雾霾 健康</td>
<td>Fog &amp; smog Health</td>
</tr>
<tr>
<td>2</td>
<td>雾霾 影响</td>
<td>Fog &amp; smog Impact</td>
</tr>
<tr>
<td>3</td>
<td>雾霾 食品</td>
<td>Fog &amp; smog Food</td>
</tr>
<tr>
<td>4</td>
<td>雾霾 免疫</td>
<td>Fog &amp; smog Immune</td>
</tr>
<tr>
<td>5</td>
<td>雾霾 食物</td>
<td>Fog &amp; smog Foodstuff</td>
</tr>
<tr>
<td>6</td>
<td>雾霾 宝宝</td>
<td>Fog &amp; smog Baby</td>
</tr>
<tr>
<td>7</td>
<td>雾霾 小孩</td>
<td>Fog &amp; smog Kid</td>
</tr>
<tr>
<td>8</td>
<td>雾霾 儿童</td>
<td>Fog &amp; smog Child</td>
</tr>
<tr>
<td>9</td>
<td>雾霾 老人</td>
<td>Fog &amp; smog The elderly</td>
</tr>
<tr>
<td>10</td>
<td>雾霾 保护</td>
<td>Fog &amp; smog Protect</td>
</tr>
<tr>
<td>11</td>
<td>PM2.5 健康</td>
<td>PM2.5 Health</td>
</tr>
<tr>
<td>12</td>
<td>PM2.5 影响</td>
<td>PM2.5 Impact</td>
</tr>
<tr>
<td>13</td>
<td>PM2.5 食品</td>
<td>PM2.5 Food</td>
</tr>
<tr>
<td>14</td>
<td>PM2.5 免疫</td>
<td>PM2.5 Immune</td>
</tr>
<tr>
<td>15</td>
<td>PM2.5 食物</td>
<td>PM2.5 Foodstuff</td>
</tr>
<tr>
<td>16</td>
<td>PM2.5 宝宝</td>
<td>PM2.5 Baby</td>
</tr>
<tr>
<td>17</td>
<td>PM2.5 小孩</td>
<td>PM2.5 Kid</td>
</tr>
<tr>
<td>18</td>
<td>PM2.5 儿童</td>
<td>PM2.5 Child</td>
</tr>
<tr>
<td>19</td>
<td>PM2.5 老人</td>
<td>PM2.5 The elderly</td>
</tr>
<tr>
<td>20</td>
<td>PM2.5 保护</td>
<td>PM2.5 Protect</td>
</tr>
</tbody>
</table>

In both SNS, Zhihu and Baidu Knows, discussions were located by searching keyword combinations through search engines within each SNS. Each search combination contained
one primary keyword and one complementary keyword. Primary keywords remained “雾霾” (Fog & smog) and “PM2.5”, while complementary keywords were developed based on Questions 1 and 2 and words that frequently appeared in the initially identified discussions, such as “健康” (Health), “影响” (Impact), “食品” (Food), “免疫” (Immune), “食物” (Foodstuff), “宝宝” (Baby), “小孩” (Kid), “儿童” (Child), “老人” (The elderly), and “保护” (Protect). Table 3-2 shows the list of search terms and their translation.

7) Select relevant discussions

Owing to the large number of results obtained by the search engines, selection of these results was conducted based on the criteria of relevance and popularity, with the outcomes being ranked in default order of their relevance. In order, to measure the popularity of a discussion, a theory conceptualized as “Like” economy was used, which simply reflected the number of times a comment had been “Liked” by the online participants. Comments that receive more “Likes” generate more traffic and engagement than comments with fewer “Likes” (Gerlitz & Helmond, 2013). Based on this theory, the number of “Likes” plays an important role in intensifying participant affects and, consequently, foster further participant engagement to multiply and scale up popularity. “Like” counters were available for comments made within discussions in both SNS. In the current study only discussions containing comments that obtained more than 10 “Likes” were used.

In Zhihu, the ranking of search results can be re-ordered manually by the number of “Likes” they obtained, so that data collection can proceed in turn from highest to lowest. After deleting irrelevant discussions, for example for advertisements and unrelated topics, a total of 18 discussions, containing approximate 1000 valid comments, remained for further analysis. However, the search results at this stage were ranked in a default order, based on their relevance to the keywords, in Baidu Knows only the top 760 search results could be listed during each search. The selection of discussions was, therefore, conducted manually to exclude irrelevant items and to meet the “Like” number requirement within search results. Screening the date in this manner resulted in the identification of 127 discussions, which included approximately 200 valid comments.

Therefore, the combined results from Zhihu and Baidu Knows, provided 145 different discussions, including approximately 1,200 comments. All discussions selected through this process were saved as PDFs for subsequent analysis and the online profiles of their authors
were collected, including information such as where they lived and their educational background, occupation and parental status.

### 3.2.2 Data analysis

The discussions and comments obtained on air pollution were analyzed using the qualitative data analysis software NVivo 11 in Chinese. Texts related to research questions were extracted and meaning units were identified based on selected texts. The meaning units were then condensed to form node titles, where a node is a collection of comments about a specific theme (Table 3-3).

**Table 3-3.** An example of identified meaning units, condensed meaning units and nodes.

<table>
<thead>
<tr>
<th>Identified meaning unit</th>
<th>Condensed meaning unit</th>
<th>Node</th>
</tr>
</thead>
<tbody>
<tr>
<td>大气污染会降低机体免疫力。</td>
<td>降低免疫力</td>
<td>免疫力</td>
</tr>
<tr>
<td>Air pollution can impair the body’s immunity.</td>
<td>Impair immunity</td>
<td>Immunity</td>
</tr>
</tbody>
</table>

By merging similar nodes and considering the research questions, two tier 1 nodes were created which were: Perceived Impact and Perceived Functional Foods. Tier 2-3 nodes were moved iteratively between existing and new nodes arising from words appearing in an identified meaning unit. The coding schema was further developed by verifying that relevant identified meaning units had not been left out and ensuring that the nodes were mutually exclusive. The coding schema was finalized based on discussions between all three authors of this article. In order to validate the replicability of analysis and reliability of data, another Chinese-speaking researcher was asked to code part of the text separately, after manually categorizing all texts. Replicability was considered high because predominantly the same text was coded and placed under the same nodes (Pishchenko & Myriounis, 2016; Wu & Pearce, 2014).

### 3.3 Results and discussions

#### 3.3.1 Overview of the online participants

The amount of information on participants was dependent on what they chose to include in their profiles, including where they lived, their educational background, occupation and marital status (Table 3-4).

Assuming one comment was posted by one individual, 535 participants stated where they lived. These locations could be grouped into the East (Beijing, Tianjing, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan), the Middle (Shanxi, Anhui, Jiangxi, Henan, Hubei and Hunan), the West (Inter Mongolia, Guangxi, Chongqing, Sichuan, Guizhou,
Yunnan, Tibet, Shanxi, Gansu, Qinghai, Ningxia and Xinjiang), the Northeast (Liaoning, Jilin and Heilongjiang) (National Bureau of Statistics of China, 2011) and overseas. The majority of participants lived in the East, which is the most economically developed area in China. Of the participants profiled 235 had at least a tertiary education (in progress included), 391 were employed and 24 participants stated that they were parents.

3.3.2 Question 1 – Perceived impact caused by air pollution concerned Chinese consumers

The perceived impact caused by air pollution could be categorized into 21 nodes (Tier 2) as reported in Table 3-4 along with an illustrative quote and the frequency an impact mentioned by Chinese consumers is showed in Figure 3-2.

Air pollution impacted on many aspects of the participants’ lives, including their health where it was considered to impact on their respiratory system, cardiovascular system and mortality rate. Air pollution also impacted on participants’ life style, including the need to wear masks and use air purifiers in their homes, it reduced their outdoor activities and increased the risk of driving owing to a reduction in visibility, it also impacted on their work and their psychological health (Table 3-4). These finding were in line with the previously stated result that Chinese people consider air pollution to be a serious problem that affects their quality of life (Johnson et al., 2017; Liu & Mu, 2016; Liu et al., 2016).

The impact of air pollution on the respiratory system was talked about most frequently (Figure 3-2) with many adverse impacts being mentioned, including acute issues like sore throats, coughs, finding it hard to breath and pneumonia and long-term impacts such as lung cancer. Interestingly psychological health was the second most discussed adverse impact of air pollution. Facing exposure to long-term polluted air and the associated relevant health risks, numerous participants expressed their negative feelings. Helplessness, for example, was a word mentioned very frequently with many participants expressing a loss of hope of improvement in air quality because air pollution has proven to be so difficult to reduce. This loss of hope of improvement in air quality may explains why some people had considered moving cities within China or even emigrating.
Table 3-4. Adverse impacts caused by air pollution perceived by Chinese consumers.

<table>
<thead>
<tr>
<th>Perceived Impact</th>
<th>Node</th>
<th>Explanation</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adverse impact on the respiratory system</strong></td>
<td>Respiratory system</td>
<td>Respiratory diseases triggered or exacerbated by air pollution, including upper airway issues, such as sore throat, cough and hard breathing, and lower airway issues, such as pneumonia and lung cancer.</td>
<td>“At this moment, I was unable to sleep because of the coughing and nasal obstruction caused by the smog which has been attacked for two days...Until today, I realized that the previous nasal congestion, cough, sore throat was not a simple cold, but a pharyngitis caused by the smog. My body has become a tester. As long as I feel a little uncomfortable, there is definitely a fog and smog weather coming soon.” (Zhihu)</td>
</tr>
<tr>
<td><strong>Adverse impact on psychological health</strong></td>
<td>Psychological health</td>
<td>The negative emotion caused by air pollution, including being apathetic to air pollution due to dissatisfaction, feeling depressed, feeling panic about pollution-driven health risks and stigma about cities or the country due to air pollution.</td>
<td>“The smog weather can influence people’s attitude towards life progressively, so that you don’t have to take great enthusiasm to live. Life is like this, just muddling along.” (Zhihu)</td>
</tr>
<tr>
<td><strong>The need to wear masks and use air purifiers</strong></td>
<td>Masks &amp; air purifiers</td>
<td>The need for Chinese consumers to wearing masks and using air purifiers in order to reduce the health risk caused by air pollution.</td>
<td>“I can only wear a mask to go outside and try to avoid going out. It is better to buy an air purifier at home.” (Baidu Knows)</td>
</tr>
<tr>
<td><strong>Poor visibility</strong></td>
<td>Visibility</td>
<td>Poor visibility caused by air pollution and its consequences, including increased risk of flight delay, driving risk and traffic.</td>
<td>“The residential building on the opposite is surrounded by yellow smog, which can only be found faintly. The visibility should not exceed 50 meters. It is really a cloud of fog after adding a yellow filter. The sky is full of yellow smog...” (Zhihu)</td>
</tr>
<tr>
<td><strong>Reduced outdoor activities</strong></td>
<td>Outdoor activity</td>
<td>Decrease of outdoor activities, such as outdoor sport, shopping, parties, etc., in order to avoid pollution-driven health problems</td>
<td>“My daughter is almost 3 years old. Every day, she is keen to go out, to get in touch with the nature, to run outside, but frequently facing the weather of (PM2.5 reading) more than 200, I really do not have this courage.” (Zhihu)</td>
</tr>
<tr>
<td><strong>Having plans of moving cities or emigrating</strong></td>
<td>Moving cities or emigrating</td>
<td>Plans to move to other cities or overseas triggered by adverse impact of air pollution</td>
<td>“When the fog and smog weather appears, the constant talking topic with friends having kids is: the thoughts of escaping from Beijing to go abroad or live in Hainan.” (Zhihu)</td>
</tr>
<tr>
<td><strong>Adverse impact on the cardiovascular system</strong></td>
<td>Cardiovascular system</td>
<td>Cardiovascular diseases triggered or exacerbated by air pollution</td>
<td>“After entering the human body, harmful particles with heavy metals and various...”</td>
</tr>
</tbody>
</table>

3 The perceived impacts were ranked by the frequency of comments.
pathogenic bacteria can penetrate into the blood through the circulatory system of the human body, therefore, causing damage to organs including the heart and blood vessels.” (Baidu Knows)

**Adverse impact on child development**

**Node:** Child development  
**Explanation:** Pollution-driven risks affecting children’s development, including bodies and minds  
**Illustrative quote:** “Due to the reduction of sunshine in smoggy days, children’s absorption of ultraviolet radiation is insufficient, and the production of vitamin D in the body is insufficient. This can cause the absorption of calcium is greatly reduced. When the situation is getting worth, rickets in infants and slow growth of children may be caused.” (Baidu Knows)

**Lack of fresh air**

**Node:** Airflow  
**Explanation:** No fresh air outside to help with the airflow inside room  
**Illustrative quote:** “Cannot open the window to get fresh air. Inside the room is not ventilated; outside the room is full of smog. No places to breath.” (Zhihu)

**Reduced work efficiency**

**Node:** Work efficiency  
**Explanation:** Negative impact on work efficiency  
**Illustrative quote:** “Power outage in factories, shutdown in construction sites, difficulties of getting on the road for trucks and difficulties of supplying the concrete after smoggy weather! The construction period is far away, and how to talk the efficiency!” (Zhihu)

**Increased eye, skin or ear health issues**

**Node:** Eye, skin & ear  
**Explanation:** Eye, skin and ear issues triggered or exacerbated by air pollution  
**Illustrative quote:** “The year I came to Beijing as a freshman, the fog and smog weather ravaged Beijing. As soon as I was blown by the wind after going out, I got small pimples in my whole face... At the same time, my body was also full of itchy rash. The doctor said that the wind was too dirty and it was rubella.” (Zhihu)

**Increased frequency of personal cleaning**

**Node:** Personal cleaning  
**Explanation:** Frequent need to clean nose and skin owing to polluted air  
**Illustrative quote:** “When entering the room after staying outside, you should wash your face, rinse your mouth, clean your nose, and remove the contaminated residue attached to your body. ... In addition to facial cleansing, the exposed parts of the body also need to be cleaned.” (Baidu Knows)

**Increased mortality rate**

**Node:** Mortality rate  
**Explanation:** Increased mortality rate caused by air pollution  
**Illustrative quote:** “The smog does not kill you directly, but it can harm your heath and let you die early.” (Zhihu)

**Adverse impact on reproductive system**

**Node:** Reproductive system  
**Explanation:** Reproductive system diseases triggered or exacerbated by air pollution  
**Illustrative quote:** “Recently the Chinese Academy of Social Sciences and the China Meteorological Administration issued the "Green Book on Climate Change", which reported that fog and smog weather affects health, and except the well-known impact on respiratory and cardiovascular systems, it can also affect the reproductive capacity.” (Baidu Knows)

**Close attention on the weather, especially pollution status**

**Node:** Weather focus  
**Explanation:** Close attention to the weather paid by Chinese consumers, such as checking air quality via smartphone app and sharing pictures of polluted or unpolluted weather via Wechat, etc.  
**Illustrative quote:** “Now if the weather in Beijing is a little better, many people will pick up the camera and keep taking photos. Sometimes I feel that we are so ridiculous. The blue sky is a necessity
Adverse impact on immunity
Node: Immunity
Explanation: The adverse impact on immune system caused by air pollution
Illustrative quote: “Air pollution can impair the body’s immunity. This is the biggest impact.” (Zhihu)

Dusty appearance of items exposed to the polluted air
Node: Dusty appearance
Explanation: Becoming dusty easily when items are exposed to the polluted air, such as floors, bedding and furnishings.
Illustrative quote: “After moving to Beijing, I was surprised to find that no matter how often I clean the house, it is still dusty, even if I wipe the floor every day. This is really hopeless.” (Zhihu)

School and industry closure
Node: School & industry closure
Explanation: The closure of schools and shut down of industry when air pollution is too heavy.
Illustrative quote: “One day, primary and secondary schools in Harbin were closed. After asking I found out it is because the smog was too heavy and the school bus could not see the road.” (Zhihu)

Risk of eye diseases when wearing contact lenses
Node: Wearing contact lenses
Explanation: Health risk when wearing contact lenses under polluted air, e.g. conjunctivitis.
Illustrative quote: “… I am near-sighted and I usually wear contact lenses. However, I cannot wear them in the weather of fog and smog. The air is too dirty.” (Zhihu)

Difficulty of drying clothes naturally
Node: Drying clothes naturally
Explanation: Being inappropriate for drying clothes naturally
Illustrative quote: “In winter, if I want to sunbathe or dry a sheet by the sun, then I have to read the smog forecast!” (Zhihu)

Fluctuation of housing price
Node: Housing price
Explanation: Fluctuation of housing price in metropolis, such as Beijing, and cities with good air quality, such as Hainan.
Illustrative quote: “Smog does not affect housing prices directly, but it is quite possible to influence the housing prices indirectly. First, due to smog, the government will make significant adjustments in policies, such as moving industries, which may affect the housing prices. Second, due to smog, the rich people with strong migration abilities may leave Beijing for a long time, so that prices of communities that rich people live may decline.” (Zhihu)
Figure 3-2. The number of time a perceived adverse impact caused by air pollution was mentioned by Chinese consumers. The adverse impacts were illustrated by the name of nodes.

Children were found to be mentioned frequently as being the most vulnerable group to persistent air pollution. It is easy to understand that children were perceived as being the most vulnerable considering their immature immune systems and their demands for outdoor activities (Zhang, Li, Gao, Wang, & Yao, 2016). Not surprisingly, participants who stated they were parents, said that air pollution had a significant impact on their psychological health as being parents they worried about the effect air pollution was having on their child’s development and they tended to put their child’s health and happiness first:

“If you are single, or do not have children, the effect of polluted air on your mood may be neglected. But when you upgrade to parents and are responsible for another person’s life, when you are more and more aware of the pollution-driven impact on children’s bodies, when you find children around you feel unwell one by one, when you
have to cancel your perfect travel plan due to the stupid weather, I don’t know if anyone can be happy.” (Zhihu)

The adverse impact of air pollution on the immune system was mentioned by many participants. All relevant comments agreed that air pollution could impair immunity. An example is shown in Table 3-4. Compared with the strong symptoms reported for the impact of air pollution on the respiratory system, there seemed no clear symptom that defined the decline in immune system. This lack of specific symptoms may explain why it was not as frequently mentioned as the impact of air pollution on the respiratory system:

“The immunity declines, but people can’t feel it. For example, at the beginning some people reacted the smog weather by having headache, fever, cough and other symptoms. After a period of time, the reaction has gone. This does not mean your body has gained the resistance, but has lost the relevant ability, that is, part of your immunity has been surrendered.” (Zhihu)

3.3.3 Question 2 – Perceived functional foods in coping with air pollution discussed by Chinese consumers

In order to have a general idea of the type of functional foods perceived by Chinese consumers to be used in coping with air pollution, their key attributes, expected benefits, forms and patterns of consumption were explored, with the remedies Chinese consumers discussed online summarized as preparing homemade tea, soup or porridge with TCM ingredients or adjusting dietary habits to consume more fresh fruits and vegetables than the regular amount (Table 3-5).

Eating fresh fruits and vegetables was considered the most fundamental method of maintaining a healthy diet during smoggy days, and one which could be combined with other remedies, such as TCM therapies, regular life style and physical exercises, as explained by one participant:

“In smoggy days adjusting diet is important. Eating more fresh fruits and vegetables is the way not only benefiting lungs but also supplying vitamins to boost the immunity. If possible, you can choose to drink some homemade tea to solve the problems of dry throat or coughing. In addition, it is necessary to arrange a reasonable schedule to avoid staying up late and to do some exercise indoors.” (Baidu Knows)

With regard to the expected benefits, it is important to note that boosting immunity was an important perceived benefit that could be obtained from remedies (Table 3-6). Boosting immunity was mentioned as being important as a fundamental protection against air pollution
given the immune systems’ overall role in human health. In addition, most of benefits mentioned by online participants were quite specific and targeted the adverse impact of air pollution on the respiratory system, which was in line with the finding of Question 1 that participants talked about the pollution-driven impact on the respiratory system most frequently. Not surprisingly, when online participants talked about TCM ingredients, many of the benefits they expected to obtain were TCM-related. For example, moisten lungs⁴, reduce phlegm and clear throat are typical benefits of TCM therapies. Detailed quotes of the expected benefits Chinese consumers would like to obtain from functional foods were shown in Table 3-6. The benefits from functional foods discussed most frequently by participants was moistening lungs (Figure 3-3), which was evidence of Chinese consumers’ acceptance of TCM therapies. It was interesting to note that “removing pollutants from the blood and respiratory system” was one of the benefits online participants were seeking from their foods. Although inhaled particulate matter has been scientifically proven to be hard to be remove from human body (Deng, Deng, Miao, Guo, & Li, 2019), there seemed to be a gap between consumers’ perceptions and the scientific knowledge.

Table 3-5. Key attributes of perceived functional foods in coping with air pollution discussed by Chinese consumers.

<table>
<thead>
<tr>
<th>Examples</th>
<th>Forms</th>
<th>Patterns of consumption</th>
<th>Expected benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Luohanguo tea</td>
<td>TCM ingredients</td>
<td>Preparation of homemade tea, soup or porridge</td>
<td>· Moisten lungs</td>
</tr>
<tr>
<td>· White fungus and lotus seed soup</td>
<td>· lily bulb porridge</td>
<td>· Etc.</td>
<td>· Supply water</td>
</tr>
<tr>
<td>· Pear</td>
<td>· Orange</td>
<td>· Spinach</td>
<td>· Etc.</td>
</tr>
<tr>
<td>· Fresh fruits and vegetables</td>
<td>· Dietary adjustment to consume more than regular amount</td>
<td></td>
<td>· Remove pollutants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Reduce phlegm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Clear throat</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Boost immunity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Supply micronutrients</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Boost immunity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Anti-microbial</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Antioxidant</td>
</tr>
</tbody>
</table>

⁴ ‘Moisten lungs’ is a typical TCM term, meaning restricting overactive functions or relieving inflammation in lungs.
Table 3-6. Benefits Chinese consumers expect to obtain from food-related therapies or products.

<table>
<thead>
<tr>
<th>Expected Benefit</th>
<th>Node:</th>
<th>Explanation</th>
<th>Illustrated quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisten lungs</td>
<td>Moisten lungs</td>
<td>TCM term, meaning relief of lung inflammation</td>
<td>&quot;... Long-term inhalation of smoggy air can cause respiratory diseases ... It's better to eat some food to nourish Yin and moisten lungs, such as white fungus, black fungus, pig blood, pears, lily bulb, white radish, honey, loquat and so on. Do not smoke or drink alcohol.&quot; (Baidu Knows)</td>
</tr>
<tr>
<td>Supply micronutrients, e.g. vitamins</td>
<td>Supply micronutrients</td>
<td></td>
<td>&quot;Less spicy food, more light food. Have fruits and vegetables to supply vitamins.” (Zhihu)</td>
</tr>
<tr>
<td>Supply plenty of water</td>
<td>Supply water</td>
<td></td>
<td>“In the weather of fog and smog, water is the best drink for your baby. Water can dilute the dust and toxins accumulated in the body, and drinking more water can help detoxification.” (Baidu Knows)</td>
</tr>
<tr>
<td>Relieve pollution-driven coughing</td>
<td>Relieve cough</td>
<td></td>
<td>&quot;Homemade tea is also a good choice to solve the problem of a dry throat and coughing, while reducing the harm to lungs caused by air pollution.” (Baidu Knows)</td>
</tr>
<tr>
<td>Remove pollutants from the blood and respiratory system</td>
<td>Remove pollutants</td>
<td></td>
<td>“Eat something black, such as black fungus. It is said that they can help clean the lung.” (Baidu Knows)</td>
</tr>
<tr>
<td>Relieve phlegmatic symptom due to respiratory issues caused by air pollution</td>
<td>Reduce phlegm</td>
<td></td>
<td>“Smog can damage the respiratory system. Luohanguo is the first choice for clearing throat, relieving cough and reducing phlegm.” (Zhihu)</td>
</tr>
<tr>
<td>Relieve throat inflammation</td>
<td>Clear throat</td>
<td></td>
<td>“You can try to make tea with lily bulb. It can prevent pharyngeal itching and inflammation caused by inhaling dirty air in smoggy days.” (Baidu Knows)</td>
</tr>
<tr>
<td>Boost the immunity</td>
<td>Boost immunity</td>
<td></td>
<td>“It is not enough to rely on a mask. I would recommend you to see a good TCM doctor ... and have some TCM medicine to improve your immunity. A good body can help you to combat bad weather.” (Baidu Knows)</td>
</tr>
<tr>
<td>Help human body to fight off germs</td>
<td>Anti-microbial</td>
<td></td>
<td>“The fog and smog days are also a period of intense activity for various bacterial viruses. At this time, give more antibacterial foods to kids. For example, garlic and spring onion have the effect of killing bacteria in human bodies. Therefore, if eating a little garlic every night during the season of smog and influenza, it will effectively prevent your kids from getting flu and respiratory infections.” (Baidu Knows)</td>
</tr>
<tr>
<td>Help human body to resist oxidation</td>
<td>Antioxidant</td>
<td></td>
<td>“In order to prevent the respiratory system, eat more fruits and vegetables, because various polyphenols and carotenoids in fruits and vegetables have antioxidant effects, which can reduce the oxidative stress in human body... Try to pick species with deep colors which tend to be more resistant to oxidation. For example, purple-red fruits rich in anthocyanin such as strawberries and mulberries have stronger antioxidant ability than peaches, pears, and the like. Yellow peach is stronger than white peach. Purple potato is stronger than white meat sweet potato.” (Zhihu)</td>
</tr>
</tbody>
</table>

5 The expected benefits were ranked by the frequency of comments.
Figure 3-3. The benefits Chinese consumers expect to obtain from food-related therapies or products. The expected benefits were illustrated by the name of nodes.

Unfortunately, not many details of attributes about remedies or functional foods were discussed online, such as the taste, efficiency, price, etc. However, the majority of these remedies were recommended clearly on smoggy days, as emergency methods in addition to wearing masks.

3.4 Conclusions and implications

The objective of the current study was to explore Chinese consumers’ understanding of the impact of air pollution, especially its effect on immune health, and to explore the expected benefits, forms and patterns of consumption of these remedies. Air pollution was frequently stated to have an adverse impact on the respiratory system and emotions. Homemade TCM therapies and eating fresh fruits and vegetables were the main forms of functional food remedies discussed online and consumers considered these remedies as emergency methods during smoggy days. In line with the perceived impact, the expected benefits discussed by Chinese consumers mainly targeted the respiratory system. However, the impact of air pollution on their immunity and boosting their immunity were also mentioned as being important as a fundamental protection against air pollution given the immune systems’ overall role in human health. The TCM-related benefits were mentioned frequently, for instance, moistening lung was the benefit discussed the most, which suggested the popularity of TCM in China. Children were considered to be the most vulnerable group to the health risks posed...
by air pollution, and concerns over their children’s health impacted significantly on the physiological health of their parents.

Netnography has been proven to be a useful and relatively unbiased approach to obtain insights into Chinese consumers’ perceptions of the challenges that air pollution is presenting to their health and the steps they are taking to ameliorate its effect. Owing to the positive attitude that Chinese consumers have towards functional food remedies, there appear to be strong potential for the increased use of functional foods to help combat the effects of air pollution. However, in order to explore these initial findings, differing methodologies such as the use of interviews and focus groups will be required. Specific research questions to be addressed in this future work include: ‘what understanding do Chinese consumers have of the role of functional food products in improving their immune defenses against air pollution?’ and ‘how do Chinese consumers use functional foods in different stages of their health conditions?’ A better understanding of Chinese consumers’ perceptions regarding these topics will facilitate the development and commercial success of functional food products designed to help Chinese consumers recover from the impact of air pollution.
Chapter 4.

‘Can immunity be improved through eating?’ Insights of Chinese consumers having perceived poor immunity

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4.1 Introduction

Interest in foods designed to promote health is increasing as consumers increasingly believe that foods are intended not only to satisfy hunger and provide necessary nutrients but also to improve their physical and mental well-being (Menrad, 2003; Roberfroid, 2000). The idea of “functional foods” was first described in ancient Vedic texts from India, and in Traditional Chinese Medicine (TCM). Functional foods reflect the oriental philosophy that: ‘Medicine and food have a common origin’ (Henry, 2010), notwithstanding the fact that some authors believe the term “Functional Food” is essentially a marketing term (Henry, 2010; Siró et al., 2008). Different countries have differing views of functional food in terms of their definitions, scope and regulatory framework and there is no single universally accepted definition for functional foods (Kaur & Singh, 2017). Most countries describe functional foods as containing bioactive components and ingredients that provide additional health benefits beyond basic requirements and are capable of reducing certain diseases (Lau et al., 2012). In China, the functional food market is showing significant growth, owing to the traditional acceptance of foods as part of TCM regimes and China’s rapid economic development and was valued at US$ 24.6 billion in 2012 (Bogue, Collins, & Troy, 2017). The Chinese functional food market is one of the largest markets in the world (Hu, 2016). In 2013, China had the highest expenditure on health and wellness retail products, followed by Brazil, the United States, Russia, and Mexico (Bogue et al., 2017).

Among the various claims promoted for functional foods, immune health stands out as being of importance for Chinese consumers. A survey in 2011 on health food consumption in China reported that 77% of consumers ranked "immune enhancement" as an important function, with 49% of consumers ranking "nutritional supplementation" and "antifatigue," as being the second equal most important functions (Medina, 2011). Health food is a very important component of functional foods and such products are required to receive approval and validation by the Chinese government. Of the 27 health claims for health foods, approved by the Chinese Ministry of Health, “enhancing immunity” is the health claim most frequently used (Anon, 2017a, 2017b). Additionally, in 2002 a review (Lopez-Varela et al., 2002) of functional foods stated that they have the potential to enhance the immune system.

Given consumers’ interest in immune health and the potential of functional foods to help the immune system, it is not surprising that there is much interest in the development of functional foods designed to boost immunity. To underpin the development of successful functional food products, it is vital to gain a good understanding of the perceptions of consumers in the intended
target market. Many studies have shown that in western societies a wide range of consumers have a positive attitude towards immune-boosting foods including consumers in California, USA who ate probiotics in dairy products to enhance their immunity (Bruhn et al., 2002); consumers in Des Moines and Harrisburg, USA, who were willing to pay more for intragenic products labelled as containing enhanced levels of antioxidants compared to products which did not state this (Colson & Huffman, 2011); adults in the USA who took multi-vitamins to maintain overall health and wellness (Dickinson et al., 2014); and adolescents in Australia who took a wide range of nutritional supplements to prevent the common cold (O’Dea, 2003).

To date no research on Chinese consumers’ perceptions about functional foods designed to help immune health has been published. The current study therefore had the goal to explore Chinese consumers’ perceptions of immune health and the influence that their food choices plays in this. It is important to consider urban centres for such research, as consumers in these cities are more highly educated, have higher income, are more likely to have been exposed to Western concepts, brands etc., and are more open to trying novel foods from overseas countries. As an international metropolis and the most developed city in China, Shanghai has gained the most exposure to Western (food) cultures in China (Liu et al., 2011; Wang, Gellynck, & Verbeke, 2015), which is why it was chosen for the current study.

**Interpretivist approaches – focus groups and in-depth interviews**

Interpretivism is an approach which focuses on “furthering understanding” and which places “meaning-making” (the process of how people construe, understand, or make sense of life events, relationships, and the self) at the centre of the study (Daymon & Holloway, 2010). An interpretivist approach enables the researcher to capture and account for social, cultural and situational contexts (Schouten, 1991). It is an approach that views consumption as encoded with social meaning, and artefacts as cultural communicators (Pettigrew, 2000). Differing from positivist and post-positivist methodologies which are concerned with explaining, rather than understanding, the goal of interpretivist research is not to generalise and predict causes and effects, but to understand and interpret meanings in human behaviour, including motives, meanings, reasons and other subjective experiences which are time and context bound (Hudson & Ozanne, 1988). Focus groups and in-depth interviews are widely used in interpretivist work, however, they are used for differing reasons.

Focus groups are used for generating information on collective views, and the meanings that lie behind those views (Gill, Stewart, Treasure, & Chadwick, 2008). Focus groups are believed
to be particularly useful when trying to understand consumers’ perceptions and feelings about a particular issue, product, service or idea (Beaudin & Pelletier, 1996; Krueger & Casey, 2014), and in generating a rich understanding of participants’ experiences and beliefs (Morgan, 1997). Focus groups are especially useful in a multi-method design, to explore a topic or collect group language or narratives which can benefit later stages (Bloor, 2001). Furthermore, focus groups rely on the dynamics of group interaction, both positive and negative, to reveal participants’ similarities and differences of opinion (Krueger & Casey, 2014; Morgan, 1996). Group interaction may facilitate an exchange of ideas and information thereby stimulating individual group members thinking and allowing group members to build on each other’s ideas. However, members within a group may fail to exchange all information they have due to problems of only focusing on shared information, the presence of dominant group members or owing to peer pressure (Levine & Moreland, 1995; Morgan, 1996).

In contrast, in-depth interviews are guided, one-on-one sessions. The researcher uses the same interview guide for each session and makes comparisons of the interview data to determine similarities and differences (Weiss, 1994). The purpose of in-depth interviews is to explore the views, experiences, beliefs and/or motivations of individuals on specific matters. Therefore, interviews are particularly appropriate for exploring sensitive topics (e.g. their specific health issues), where participants may not want to talk about such issues in a group environment (Gill et al., 2008). Interviews are especially insightful when the interviews are arranged in interviewees’ homes, an in-home interview enables the researcher to elicit the social world from the point of view of the respondent. For example, the respondent can be encouraged to provide examples products to illustrate how they experience health issues and the interviewer can then focus on these examples as media for exploring the ways in which the respondent is thinking, making-sense of, emotionally responding to, and deriving attitudes about these examples (Åkerlind, 2012).

There are many examples of studies which have used multi-methods design combining both focus groups and in-depth interviews to gain a deep understanding of people’s perceptions regarding food consumption. For example, Padel and Foster (2005) utilised focus groups and in-depth interviews to explore the values that underlie consumers purchasing decisions of organic food. According to these authors, a mixed method study was important as the qualitative element was able to explain how complex consumers’ decision-making process is when buying organic products and the differences in motivations and barriers between product categories.
The study outlined in the current chapter was supported by the Consumer Insights programme of the New Zealand High-Value National Science Challenge (HVN-NSC). The Consumer Insights programme of the HVN-NSC goal was to help underpin the market success of a wide range of new functional food products being developed to benefit various consumer needs being developed by the HVN-NSC science teams including, helping immune health, digestive health and metabolic health by conducting a series of consumer-oriented studies (Anon, 2019a). As immune health was one of the key areas being explored by HVN-NSC, this chapter focused on exploring Chinese consumers’ perceptions of immune health in order to help understand the link between perceptions of immune health and food choices. However, in order to keep consistency between the consumer studies on the differing topics and to therefore gain an overall understanding of Chinese consumers’ food choices, it was important that all of the focus groups and in-home interviews for the various topic were conducted following a similar format. Therefore, in this chapter the research was carried out using the HVN-NSC standard format for focus groups and in-home interviews carried out with Chinese consumers living in Shanghai in order to better understand their views and personal experience of immune health and how this knowledge influences the foods they chose to eat. Initially four focus groups were conducted in order to collect a diverse and comprehensive range of consumers’ opinions. An interview guide was subsequently developed based on this initial data in order to further explore consumers’ understanding by conducting twelve in-home interviews.

4.2 Methods

4.2.1 Participants

Twelve in-home interviews and four focus groups were conducted in Shanghai, China, in October 2017. Six participants were recruited for each focus group and one interviewee was recruited for each in-home interview. The participants were recruited by a professional company of market research and none had participated in any market survey in the past six months. Recruited participants were all on a middle-upper income (defined as monthly income of at least 12,000RMB) to ensure that they were likely to be in a financial position to purchase high-priced food products such as functional foods. Other inclusion criteria were that participants: fell into one of the specified age groups (25-40, the young group or 41-56, the senior group); perceived they had poor immunity; and had a relatively strong interest in food consumption and a strong interest in their health. Additionally, half of participants in each focus group or interview of either lived with or cared for someone that they also perceived to have poor immunity. This last criterion was included as it is well documented that the consumer of
a health product is often not the purchaser, for example, adult children may very well be purchasing food items for their older parents to consume or for their own children (Lei, Strauss, Tian, & Zhao, 2015; Xu, 2013).

In total 36 adults participated in the study, 12 in in-home interviews and 24 in focus groups. The participants were selected to ensure that there was variation in gender, marital status and family structure (Table 4-1). The participants were sampled to ensure that there was variation in gender, marriage status and family structure. The participants’ agreement to take part in the interview and focus groups was based on fully informed consent and all participants are anonymized in this article on the study’s findings.

Table 4-1. Participant summary of all sessions.

<table>
<thead>
<tr>
<th>Session</th>
<th>Age (M/F)</th>
<th>Gender (M/F)</th>
<th>Married (Y/N)</th>
<th>Having child (Y/N)</th>
<th>Living with</th>
</tr>
</thead>
<tbody>
<tr>
<td>INV1</td>
<td>25-40 F</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Parents</td>
</tr>
<tr>
<td>INV2</td>
<td>25-40 F</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Spouse &amp; child &amp; parents(in-law)</td>
</tr>
<tr>
<td>INV3</td>
<td>25-40 F</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Spouse &amp; child &amp; parents(in-law)</td>
</tr>
<tr>
<td>INV4</td>
<td>41-56 F</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Spouse &amp; child</td>
</tr>
<tr>
<td>INV5</td>
<td>25-40 M</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Spouse &amp; parent(s)</td>
</tr>
<tr>
<td>INV6</td>
<td>41-56 M</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Spouse</td>
</tr>
<tr>
<td>INV7</td>
<td>41-56 M</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Spouse</td>
</tr>
<tr>
<td>INV8</td>
<td>41-56 F</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Spouse &amp; child</td>
</tr>
<tr>
<td>INV9</td>
<td>25-40 M</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Spouse &amp; child</td>
</tr>
<tr>
<td>INV10</td>
<td>41-56 F</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Spouse</td>
</tr>
<tr>
<td>INV11</td>
<td>25-40 M</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Spouse &amp; child</td>
</tr>
<tr>
<td>INV12</td>
<td>41-56 M</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Spouse &amp; parent(s)</td>
</tr>
<tr>
<td>FG1</td>
<td>25-40 M (3)</td>
<td>Y (4)</td>
<td>Y (2)</td>
<td>Parents (2)</td>
<td></td>
</tr>
<tr>
<td>FG1</td>
<td>F (3)</td>
<td>N (2)</td>
<td>N (4)</td>
<td>Spouse (2)</td>
<td></td>
</tr>
<tr>
<td>FG2</td>
<td>25-40 M (3)</td>
<td>Y (4)</td>
<td>Y (1)</td>
<td>Parents (1)</td>
<td></td>
</tr>
<tr>
<td>FG2</td>
<td>F (3)</td>
<td>N (1)</td>
<td>N (4)</td>
<td>Spouse (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Untold (1)</td>
<td>Untold (1)</td>
<td></td>
<td>Spouse &amp; child (1)</td>
<td></td>
</tr>
<tr>
<td>FG3</td>
<td>41-56 M (3)</td>
<td>Y (6)</td>
<td>Y (5)</td>
<td>Spouse (1)</td>
<td></td>
</tr>
<tr>
<td>FG3</td>
<td>F (3)</td>
<td>N (1)</td>
<td></td>
<td>Spouse &amp; child (5)</td>
<td></td>
</tr>
<tr>
<td>FG3</td>
<td>41-56 M (3)</td>
<td>Y (6)</td>
<td>Y (5)</td>
<td>Spouse (1)</td>
<td></td>
</tr>
<tr>
<td>FG3</td>
<td>F (3)</td>
<td>N (1)</td>
<td></td>
<td>Spouse &amp; child (5)</td>
<td></td>
</tr>
</tbody>
</table>

4.2.2 Moderation processes

Data collection was in Chinese. Four focus groups were carried out by an experienced qualitative moderator from the hired market research company and each focus group lasted for

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6 INV=interview; FG=focus group.
approximately ninety minutes. All authors of this article observed and co-moderated all sessions in a purpose-built observation room. A simultaneous interpreter was hired to provide simultaneous English translation during sessions between the English-speaking research team and the participants.

The corresponding author of this article conducted eight in-home interviews and the same moderator that ran the focus groups conducted four in-home interviews. Each interview session lasted for approximately one hour. In all interviews, authors of this article observed and asked additional questions when appropriate. Again, an interpreter was hired to provide simultaneous translation. In addition to running through the interview guide, researchers were shown through the interviewee’s kitchen, as well as shown products that related to the questioning (e.g., supplements, health food products, imported food products and TCM).

In order to obtain a range of ideas about immune health, participants were asked to talk about their personal health issues and indicate those that they believed were relevant for immunity. Participants were also asked their opinions about the factors that they thought contributed to poor immunity. Afterwards "catching a cold" was utilised as an example of a common immune-related health issue to allow participants talk about what actions they took of foods they ate at different stages of the illness (e.g. healthy condition, anticipation of the illness, peak of the illness and recover from illness). This led to reflections on attitude towards food as a remedy. Participants were also asked to expand on their ideas about triggers of improving poor immunity and to explain where they got information about immune health and possible remedies. The focus groups and interviews followed a path that was logical to the participants, rather than a structure imposed by the moderator, in order to draw on the consumers’ own cultural values and evoke truthful interactions.

4.2.3 Data analysis procedures

The focus groups and interview sessions were transcribed based on the translator’s simultaneous interpretation by a professional transcriber from a transcribing company. The data analysis, conducted by the lead author who is an English-speaking Chinese national, was based on both the Chinese recordings and English transcriptions. The qualitative data analysis software NVivo 11 was used to conduct a thematic analysis of the results.

By utilizing the method developed by Graneheim & Lundman (2004) and Landstrom, Hursti and Magnusson (2009), texts related to research questions were extracted and meaning units
were identified based on selected texts. The meaning units were then condensed to form node titles, where a node is a collection of comments about a specific theme (see Table 4-2).

Table 4-2. An example of identified meaning units, condensed meaning units and nodes.

<table>
<thead>
<tr>
<th>Identified meaning unit</th>
<th>Condensed meaning unit</th>
<th>Node</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think I’ve got low immunity which means I always feel that, and if I do something I just don’t have enough energy to do that.</td>
<td>don’t have enough energy</td>
<td>Not energetic</td>
</tr>
</tbody>
</table>

By merging similar nodes and considering the research questions, an open coding schema was developed. Nodes were moved iteratively between existing and new nodes arising from words appearing in identified meaning unit. The coding schema was further developed by verifying that no relevant identified meaning units had been left out and by ensuring that nodes were multi-exclusive. The coding schema was finalized based on discussions between the authors of this article and can be found in Appendix 1.

4.3 Results

4.3.1 What are immune health issues and their causes perceived by Chinese consumers?

In order to discuss immune health in a language participants were familiar with, their familiarity with the terms “immune system” and “immune health” was assessed. The technical terms such as “immune system” and “immune health” seemed not to resonate well with participants, while the term “immunity” (免疫力) was widely recognised. Therefore, the study used the term “immunity” in subsequent discussions. To participants, immunity was understood to be the defence system for the body, which protects the body from health–related risks as one participant explained, “If you have good immunity, that means you have all the protection you need around you. Even in some bad environment, if somebody has got sick, or got a cold or flu, you can talk to him or her, you won’t be getting infected. (INV3, F)”. It is important to note that immunity was spoken about in a very holistic sense. Immunity and overall health were two concepts intertwined inextricably by participants. Base on the participants’ personal experiences, immune-related health issues and their understanding of the factors that caused poor immunity, a schematic diagram illustrating the range of causes and effects of poor immunity was developed (Figure 4-1).

Perceived immune health issues

Participants believed that poor immunity can result in a whole spectrum of consequences that range from acute health issues, such as the common cold/flu, right through to long-term issues...
including serious diseases such as cancer, which can have significant adverse impacts on their psychological health and affect both work and family life (Figure 4-1). Some of the most common acute issues can be grouped into four categories: getting sick; sub-health; sleep quality and GI (gastrointestinal) symptoms (Figure 4-1). Among the four categories of acute health issues, getting sick and sub-health were the symptoms most frequently mentioned by participants and they were also considered the most important indicators participants used to determine whether their immunity was good or not.

**Getting sick and sub-health.** Participants frequently reported they could easily get sick owing to their poor immunity which was further explained as getting minor health issues easily. Catching cold or flu and the consequential symptoms (e.g. having a fever), skin “allergy” meaning rashes developed in the skin, being inflamed somewhere in the body (e.g. dental ulcer) and health issues due to the decline of body function (e.g. backache, shoulder ache, breathing and palpitation problems etc.) were all included in participants’ description of “getting sick”. While acknowledging that other people also sometimes experienced these minor health issues, there was a commonly held belief that those with poor immunity were most at risk of being the first among their family members and colleagues to catch an illness and that the consequences of falling sick were worse for them than for others. The majority of participants tended to use the term “sub-health” to describe a range of symptoms including, increased tiredness, a lack of energy and an unhealthy appearance (e.g. looking pale all the time).

**Sleep quality and GI symptoms.** Many people suffering from “poor immunity” reported experiencing poor sleep quality, which directly affected the quality of their daily life. It was not the amount of time spent sleeping per se that was problematic but rather the quality of sleep. Many participants connected poor sleep quality directly to poor immunity. This connection was spoken about in a cyclical manner; poor sleep led to poor rest and consequent poor immunity, meanwhile, poor immunity caused poor sleep. Similarly, there was another loop connecting GI symptoms and poor immunity. Poor appetite and GI problems (e.g. diarrhoea and inability to digest food properly) were the main GI symptoms mentioned by participants. GI symptoms can lead to poor uptake of nutrition by the body and poor detoxifying by the body, which can lead to poor immunity. Poor immunity can cause poor appetite and GI problems.
Figure 4-1. A schematic illustration of participants’ immune health issues and their understanding of the causes and effects.
Perceived key factors causing poor immunity

Participants attributed a wide range of factors as being a cause of poor immunity, including environmental reasons (e.g. air pollution, season/temperature change), lifestyle reasons (e.g. irregular eating and sleeping, lack of exercises) and individual reasons (e.g. increased age, genetic makeup). Among these factors, environmental reasons, specifically air pollution and temperature change, were mentioned the most frequently by participants, followed by age and poor sleep quality.

Environmental reasons, including changeable seasons and temperature, air pollution and exposure to virus, were commonly talked about having a direct connection with poor immunity. Many participants spoke of falling sick because of the cold and changeable weather. For instance, participants believed they were more likely to catch a cold or flu in autumn and winter than summer owning to the lower temperature. All participants agreed upon the fact that poor air quality leads to negative impacts on one’s immunity. “It [air pollution] has an impact on our immunity. I’m very sensitive, you know. So, when we have bad air, runny nose, sore throat. (INV11, M)”. “The bad air accumulates in your body. Gradually, your immunity goes down, and then you’re more likely to have inflammation or get sick. (FG4, F)”. The language used to describe the air quality situation was extremely negatively loaded: “I would say toxin that everything is toxic. (FG3, F)”.

Individual reasons for poor immunity included age (sometimes closely connected with menopause for women), genetic makeup (so-called constitution by Chinese people) and their body’s ability to absorb nutrition. Among these reasons, an increase in age was believed to have the strongest link with decreased immunity. A widespread belief was that immunity began to decline from a certain age. Interestingly, there was different opinion about the age at which immunity started to decrease. Many participants in the younger groups spoke of experiencing increased illness during the colder months and having less energy for late night activities from 30 onwards. However, senior group participants widely agreed they were very healthy and had good immunity in their 30s, but by 40 years of age they believed that because of decreased immunity, minor health issues can happen frequently. Due to the increased age, sleep quality and the body’s ability to absorb nutrients and detoxify decreased.

Lifestyle reasons for poor immunity included factors related to people’s daily lifestyle. For example, people cannot always eat when they need to eat and cannot sleep when they need to sleep and this was believed to impact on immunity. Additionally, a lack of exercise, smoking
and excessive drinking and over-use of antibiotics were all perceived to compromise people’s immune health.

### 4.3.2 How Chinese consumers take actions to help with immune health?

Participants generally decided to take actions to improve their immunity owning to multiple triggers, such as age, abnormal symptoms, a mentality of following others and product promotions. Due to the direct link between age and immunity, reaching a certain age was a trigger that all participants agreed on. Abnormal symptom included the appearance of getting sick easily and sub-health conditions, and abnormal indicators from participants’ annual medical physical checks. The mentality of following others, the popularity, especially within participants’ own peers or social networks, of certain immune-boosting methods significantly encouraged new adopters to try it, which often came along with a large-scale promotion of relevant product.

**Approaches to improve immunity**

In the current study, participants discussed numerous approaches to improve poor immunity or treat acute illness that can be summarized as either a regular diet, supplements, TCM or Western medicine as shown in Figure 4-2. It is important to note that some foods in a regular diet, supplements and TCM can be in more than one group. For example, food nourishment can be considered as both part of a regular diet and TCM. Therefore, eating solutions were further divided into sub-groups: dietary adjustment, food nourishment, TCM medical gel, TCM patent medicine, TCM-based supplements and Non-TCM supplements.

**Diet adjustment.** A healthy diet was perceived to be the key for good immunity and therefore good health at all stages of health. Food, while not seen to always be the most convenient option, nor the most efficient way of absorbing nutrients, was seen to be the safest. It was widely stated that a healthy diet should contain a high intake of natural vegetables and fruits, especially ones rich in vitamin and dietary fibre, such as oranges, kiwi fruit or broccoli. Participants believed that natural vegetables and fruits were a good source of vitamins and dietary fibres, which can benefit immunity. Many participants prefer “natural or coarse” grains (e.g. oatmeal, coix seed, buckwheat, walnut, flax, Chinese yam, black rice and sesame, etc.) over ‘processed’ foods (i.e. white rice, food made with flour) as these were perceived as having “original nutrition and better digestion”. Other methods of adjusting the diet included minimizing greasy foods (e.g. less cooking oil, less sugar, less salt, less fried food and less spicy food) and increasing the consumption of high-protein food (e.g. shrimp, fish, egg, bean
curd and milk). It is interesting to note that eating certain food was often mentioned on obtaining similar benefits as provided by Western medicine, for instance, garlic can help with antibacterial function; black fungus can soften people’s blood vessels; milk can help with sleep etc. Supplying water was another frequently mentioned method that helped immunity. For example, when catching a cold, drinking warm or hot water was considered to be one of the most important ways of helping recovery.

Figure 4-2. Approach Chinese participants took to improve poor immunity and recover from acute health issues, such as catching a cold.

Food nourishment (食补). There was a large emphasis of incorporating foods with known medical benefits, mostly TCM benefits, into the everyday diet. The participants explained how they seek out these functional foods because of the benefits they contain. For example, they used Ginseng to supply Qi\textsuperscript{7} to aid energy levels and long-term immunity, as well as Sea Cucumber and Fish Glue to improve the immunity due to their collagen and high-quality protein contents. Making soup and tea were the two most common methods participants used. Key examples of food nourishment that were often frequently discussed or shown to the research team include Ginseng, Cordyceps Sinensis, Sea Cucumber, Fish Glue and Goji Berries.

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\textsuperscript{7} A TCM term, pronounced \textit{chi}, denotes vital energy and is an essential substance for maintaining the activities of life. According to the principles of TCM, human physiological functions are maintained by \textit{Qi}; the \textit{zang-fu} or internal organs; blood; bodily fluids; and \textit{jing-luo} or meridians and collaterals (Lao et al., 2012).
Supplements (including TCM-based and non-TCM ones). Supplements were taken on a regular basis by almost all of the participants even when they did not have acute health issues. Researchers were shown what were often quite extensive arrays of different types of supplements, which were kept in kitchen cupboards, left out on dining room tables or carried in handbags. When asked, participants explained that many of their supplements were linked explicitly to improving their immunity. Supplements could be grouped into TCM-based or non-TCM ones. For instance, Ganoderma Spore powder and Ginseng liquid were typical TCM-based supplements while non-TCM supplements such as vitamin supplements, fish oil or protein powder. Common supplements that were discussed (and often shown to the research team), were multi-vitamin tablets, protein powder, fish oil and Ganoderma Spore powder. The convenience of taking supplements to maintain good health was widely acknowledged. Supplements were seen to be an easier, more practical and less time consuming option for ensuring nutritional needs were met compared with eating food or taking TCM medical gel. Supplements were also seen to offer ‘better absorption’ than foods as was illustrated in the following quote: “I do not eat a lot, plus poor absorption, so that leads to the deficiency of all kinds of ingredients. Some of the ingredients that we get from Centrum (a vitamin supplement brand) are not available from our regular food... and that’s what I like to get from Centrum (FG2, M)”.

TCM medical gel and TCM patent medicine. The benefits of TCM were widely acknowledged and often discussed. The use of TCM medical gel\(^8\) (膏方) and TCM patent medicine\(^9\) (中成药) were frequently reported by participants. With TCM medical gel being used in winter to improve immunity and overall health, TCM patent medicine was commonly consumed when the participants thought they were catching a cold in order to minimise the impact of the cold.

Western medicine. There was a clear belief that Western medicine has no overlap with a regular diet, TCM or supplements. Western medicine was considered as being appropriate to use only when cold symptoms such as sore throat, coughing or fever persisted, because Western medicine was perceived as being the most effective approach to control the more acute symptoms. However, while accepting its effectiveness, there was widespread concern about the side effects of Western medicine, especially if used on a regular basis, as the following

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\(^8\) Also translated as TCM paste, with the form of thick liquid. Detailed explanation can be found in Subsection 2.2.1.

\(^9\) Detailed explanation can be found in Subsection 2.2.1.
participant explained “[If taking Western medicine for long term], we maybe have got a kind of resistance to it in our body. So, I always try to avoid Western medicine if it is possible. (INV1, F)”. Further evidence of the concern participants had about side effects was that it was stated that Western medicine should not be used in the early stages of cold development, as it was too strong for mild symptoms and may accumulate side effects in the body.

In conclusion, participants maintained their health by using a combination of approaches. All participants appeared to use a combination of methods to achieve their health related goals, a point illustrated by the following participant. “You can just never have too many things that are good for your health. (INV7, M)”.

Note that in addition to modifying what they consumed, participants took other actions to enhance their immunity, such as taking massages or undertaking cuppings (physical TCM remedies). They also tried to have a healthier lifestyle, such as having regular sleep and meals, or they tried to reduce exposure to air pollution by wearing masks when they were outdoors or using air purifiers indoors.

**Consumption regimen for immunity and illness**

Participants had well-ordered consumption regimens for managing food, medicine and supplements around bouts of illness. According to participants, different items should be consumed at different times depending on the condition of a person’s health, due to their perceived efficiency and side effects. Figure 4-3 summarises this regimen, which was described consistently across participants. Using the categories summarized in Figure 4-2, Figure 4-3 shows how consumption of food, medicine and supplements changes over time. Each column represents a different stage of wellness or illness and the different products are listed down the left-hand side. The boxes are shaded to show whether participants indicated normal use compared to extra use or effort.

In Figure 4-3, it is shown that the methods for maintaining good overall health (first column) are essentially the same as the methods for recovering from acute health issues (last column). Dietary adjustment, which is the arrangement of conventional foods, food nourishment, TCM medical gel and supplements, are common methods utilised for improving immunity at this time. Compared with the general use of food nourishment, TCM gel is perceived to be suitable only for the elderly. Generally speaking, all these four solutions were perceived to have low or no side-effects, meaning that it was possible to consume them on an ongoing long-term basis.
Medicines, including TCM patent medicine and Western medicine, were only taken when acute health issues occur. Due to the different expectation of efficiency and concern of side effects, these two kinds of medicine were used at different stages of illness. An exception to supplements in general is vitamin C effervescent. Although it is perceived as belonging to the category of supplements, it is normally only taken at the anticipation of illness.

It is important to note that, when acute health issues occur, participants discontinued food nourishment (e.g. Ginseng tea and Sea Cucumber soup), TCM medical gel and most supplements, except for vitamin C effervescent, as they were concerned their ingredients could interfere with the effectiveness of Western medicine. However, dietary adjustment was perceived as being safe during all stages and some particular items are taken in extra amounts for specific benefits, e.g. extra oranges or kiwifruit for obtaining large amounts of vitamin C. This approach demonstrated that foods were perceived as being the safest approach by participants.

<table>
<thead>
<tr>
<th>Western medicine</th>
<th>Supplements</th>
<th>VC effervescent tablets</th>
<th>TCM patent medicine</th>
<th>TCM medicinal gel</th>
<th>Food nourishment</th>
<th>Dietary adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Healthy condition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Anticipation of illness</td>
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<td></td>
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<td></td>
<td>Peak of illness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Recover from illness</td>
</tr>
</tbody>
</table>

**Figure 4-3.** Consumption solutions for improving immunity taken by research participants during different stages of catching a cold/flu.
4.4 Discussion

4.4.1 Chinese consumers’ perceptions of immune health

The overall role of immunity in participants’ daily health was widely confirmed and immune health was perceived as underpinning all aspects of everyday life, affecting both work and family life. This finding helps to explain why Chinese people have a preference for functional foods with health claims related to boosting immunities, as mentioned in the introduction.

Chinese people are concerned about their overall health (and therefore immune health). Evidence for this is the popularity of the idea that “I am under sub-health condition”, which was initially a marketing term promoted by media reports (Bunkenborg, 2014). Proponents of sub-health claim that only a minority can be said to be truly healthy and while another minority is ill, the majority of the world’s population actually fall between these extremes (Bunkenborg, 2014). The result of the current study supports this idea. Although there were no clear indicators to clinically establish the existence of sub-health, participants believed that they were in this condition, which triggered them to take actions to improve their immunity.

There are multiple reasons to explain Chinese people’s strong concern about their health. One possible reason is that many participants seem trapped in the inertia of their lives and find it difficult to make changes. For example, despite stating that an irregular lifestyle can cause gastrointestinal (GI) health issues and sleep problems, which can cause poor immunity, participants were rarely willing to change their lifestyle. It is hard for participants to make big changes to their lifestyle with many choosing relatively modest methods to improve their quality of life and enhance their immunity, such as consuming remedies or taking massage or cupping. This is consistent with people’s accustomed understanding of life in developed area of China, especially metropolises like Shanghai. According to a recent survey about the cost of living city world-wide in 2018 conducted by Mercer, Shanghai and Beijing were ranked 7th and 9th most expensive places to live (Anon, 2019b). The high living cost brings great stress on people’s lives, making it difficult for people to reduce their heavy workloads. In 2018 a study reported that 81.9% Chinese employees believed that they were overworked and 80% of them had less than five hours per week for doing exercise (Han, 2018). In this context, people hope to use modest ways to improve their perceived poor immunity.

Another important reason for concerns around their health arises from the occurrence of episodes of severe and persistent smoggy weather in China recent years. Previous research on Chinese people’s perceptions about air pollution has identified that air pollution is considered
a serious problem that affects their quality of life (Liu & Mu, 2016; Liu et al., 2016). It is therefore not surprising that greatest perceived concern about air pollution was the risk that it was posing to health, with 62% of 1050 Beijing residents agreeing or strongly agreeing with the statement “my health has been very much affected by air pollution” (Johnson et al., 2017). Chinese people in online discussions have also expressed concern about the impact of air pollution on immune health and the overall importance of the immune health on health in general (Cong, Bremer, & Mirosa, 2019a). These findings are in line with the current study, which found that air pollution was considered one of the most important causes of poor immunity.

Participants’ attention to immune health was positively related to age. It is obvious that older people paid greater attention on their immune health. Reaching a certain age was the trigger that older participants used to take supplements or food nourishment aimed to improve immunity, with many people stating “everyone is eating this”, highlighting the popularity of supplements and food nourishment within this age group. This finding is consistent with other research which found that age is positively associated with the behaviour of seeking health benefits (Lalor et al., 2011; Lynam et al., 2011). For example, in a study in Ireland it was reported that elderly participants were more likely to make specific purchases to maintain their health status, such as the purchase of dairy products claiming to help boost the immune system (Lalor et al., 2011). Due to greater health awareness, younger participants also agreed reaching a certain age, which was relatively younger than the senior group perceived, was the reason to pay attention to immune health. For example, they may start to increase the intake of fruits and vegetables on purpose. However, for younger participants, a common reason for taking supplements was to combat a perceived deficiency, such as taking multivitamin tablets to help improve a low vitamin intake caused by them having an irregular diet or being a picky eater, or owing to their genetic makeup.

4.4.2 Consequent influences on food choices

Since Chinese people pay close attention to their immune health, immune-boosting remedies were actively discussed. As mentioned earlier, dietary adjustment, food nourishment, TCM medical gel and supplements were solutions frequently mentioned by participants for the long-term maintenance of their immune health.

Functional food seemed to be an unfamiliar concept to Chinese people. This meant that except for TCM medical gel, the other eating solutions were simply categorized as either “Bao Jian
Generally speaking, participants perceived products in the dietary adjustment group and food nourishment to be food while Bao Jian Pin referred to the supplement group. Chinese people believed that there was a clear difference between food and Bao Jian Pin. However, in the legislation, Bao Jian Pin is the shorten name of Bao Jian Shi Pin (保健食品), whose common translation is Health Food. Under the Chinese National Standard for Food Safety – Health Food (GB 16740-2014), a health food is defined as “any food stuff claiming to have specific health functions, or to supplement nutrition with vitamins and minerals for a specific functional purpose. A health food should be designated as useful for specific consumers, can regulate bodily functions, is not designed to treat disease, and does not cause any acute, sub-acute or chronic negative effects when consumed by humans” (Anon, 2014a). While participants perceived supplements to be equal to health foods, it is apparent that, from a regulatory perspective, health food covers supplements and has a much wider range which can cover some functional food products.

The regular way for Chinese people to distinguish food and supplement is the format of the product. Participants believe that tablets, capsules and oral liquid are all typical supplement formats, because their effective ingredients have been processed and concentrated, while food covers meals, natural foods, beverages, snacks, etc. An example of using a product format as the distinction criteria is that vitamin gummies is considered as food rather than supplement, because its format is similar to candy. In the current study, participants discussed pros and cons of taking foods or supplements. For example, food was perceived as being the safest, while supplements, compared with food, were more convenient to take and had better absorption. This combination of findings provides some support for the conceptual premise that the format of potential functional food products is an important attribute to consider for product producers.

While it has previously been reported that Western consumers had a positive attitude towards immune-boosting foods (Bruhn et al., 2002; Colson & Huffman, 2011; Dickinson et al., 2014; O’Dea, 2003), the current study is the first to report that this positive attitude towards immune-boosting foods (functional foods) is also shared by Chinese consumers.

It is important to note that TCM treatment thinking influences Chinese people profoundly. The long-standing use of TCM in China has embedded the belief that food and medicine come from the same source and both are of equal importance in preventing and treating disease (Weng & Chen, 1996). In the current study all participants used TCM at some stage in the past for healing chronic disease or health maintenance. The popularity of food nourishment and TCM-based
supplements was further evidence of the acceptance of TCM. Moreover, participants always tried to obtain specific benefits, sometimes even Western benefits, from certain foods. An implication of this finding is the possibility incorporating TCM ingredients and benefits when developing functional food products designed to boost immunity.

4.5 Conclusions

The interviews and focus groups for this work found that the phrase “immunity” was more appropriate to use than “immune system” or “immune health”. Chinese people believe that poor immunity places them at high risk for a spectrum of consequences ranging from the common cold/flu through to cancer. Owing to the common perception of the overall role that immunity plays in general health, they actively look for remedies to improve their immunity. They believe that immunity can be changed through eating appropriate foods.

When participants choose certain foods, supplements and medicines, they are relying on a well-organised structure that links the products to health states. Products are considered appropriate and effective at specific stages of wellness and illness. Participants stated that products should be used during certain stages but not at other stages to support good immunity. Using a product in the wrong stage of illness could even harm immunity.

Participants attributed poor immunity to a wide range of causes, with irregular lifestyles, polluted air and age commonly cited. An implication of this is the possibility of using “improving immunity” as health claim when promoting products. Consumers had different expectations of product formats, such as supplements versus foods, which suggests that innovators could develop the product format based on products’ expected benefits. Due to the wide acceptance of TCM in China, the involvement of TCM elements, such as developing health claims conforming to TCM thinking or involving TCM ingredients, could be beneficial for products with health benefits.

This study can support the commercial success of functional food products helping with immune health, especially for people facing inescapable health impacts, such as irregular lifestyle, air pollution or increased age. In the meantime, this research has uncovered many questions in need of further investigation, such as which product attributes target consumers prefer and the reasons for their preferences. To further explore the market potential, research questions of Idealised product attributes could be investigated in future work.
Chapter 5.

Ideal attributes of functional food products helping the immune system recover from the impact of air pollution: a consumer-led product design

This chapter has been submitted and under review:

Cong, L., Mirosa, M., Kaye-Blake, W., Bremer, P. Ideal attributes of functional food products helping the immune system recover from the impact of air pollution: a consumer-led product design.
5.1 Introduction

The World Health Organization’s Air Quality Guideline (Brauer, 2016; World Health Organization, 2006) states that less than 1% of the Chinese population breathes air that is considered safe. Due to the occurrence of episodes of severe and persistent smoggy weather in China, air pollution is at the forefront of public attention (Huang, 2015; Huang et al., 2014; Johnson et al., 2017). Previous research on Chinese people’s perceptions about air pollution has identified that air pollution is considered a serious problem that affects their quality of life, especially their health (Johnson et al., 2017; Liu & Mu, 2016; Liu et al., 2016). Air pollution can adversely affect the immune system when the particulates in the air interact with immune cells to moderate the adaptive immune response and cause adverse health outcomes (Saxon & Diaz-Sanchez, 2005). In online discussions Chinese people express concern about the impact that air pollution is having on their immune health and the overall importance of immune health on health in general (Cong, Bremer, & Mirosa, 2019b). For Chinese people, facing a future of persistent air pollution, the limited availability of remedies to help their immune system cope with air pollution is of pressing concern.

Functional foods have a strong potential to be used to help combat the effects of air pollution owing to the positive attitudes that Chinese consumers have towards functional food remedies (Cong, Bremer, et al., 2019b). The Chinese functional food market with a reported value of US$ 37.6 billion in 2018 (Euromonitor International, 2019) is one of the largest in the world (Hu, 2016). In 2013, China had the highest expenditure on health and wellness retail products, followed by Brazil, the United States, Russia, and Mexico (Bogue et al., 2017). Additionally, recent evidence suggests that immune health could serve as a useful bridge to help marketers make connections between functional food products and air pollution in the minds of consumers (Cong, Mirosa, Kaye-Blake, & Bremer, 2019).

Given the consumer pull for functional foods designed to ameliorate the impact of air pollution on the immune system, it is not surprising that research into developing effective new products is intensifying (Anon, 2019d). To underpin the development of successful functional food products, a better understanding of the attributes that consumers want in such products is required. An effective way to determine product attributes of interest is to incorporate consumers into the initial stages of product development via the use of Consumer Idealised Design (CID) workshops. This is a relatively new task-orientated method, developed and explained by Ackoff (1994) and Ciccantelli and Magidson (1993). Unlike other consumer-orientated product development methods, such as surveys, focus groups or questionnaires,
which ask consumers about their wants and needs, this method instructs potential end users to actually design their own ideal product or service. It is similar to a focus group, as small group of participants are involved and a moderator facilitates the session. However, the method aims to reach a consensus about a particular product or service; therefore, uncovering underlying consumers wants, needs and expectations (Clarkson, Mirosa, & Birch, 2018). Although this method has been used in Western societies in many settings (Ciccantelli & Magidson, 1993; Clarkson et al., 2018), research reporting the use of CID workshops in China has not been published.

Chinese consumers have experienced rapid growth in personal income (Wang, Gellynck, & Verbeke, 2017) making the fast growing Chinese market very appealing for Western countries. However, the drivers that control Chinese consumers’ purchase decisions, such as traditional Chinese culture and values (Wu, 2014), their lifestyles (Grunert et al., 2011), and their unique society structure (Goh & Kuczynski, 2009; Jackson & Howe, 2004; Lei et al., 2015) means that Chinese consumers are very different from Western consumers. Further, China is very diverse and when researching consumer demand for Western products it is important to focus on consumers in economically developed cities. They generally are more highly educated, have higher incomes, are more likely to have been exposed to new concepts and brands, and are more open to trying novel foods (Sun & Collins, 2004; Wang, De Steur, Gellynck, & Verbeke, 2015). As such, the current study, using CID workshops to determine the idealised attributes that Chinese consumers want in functional foods designed to ameliorate the adverse impact that air pollution has on the immune system was carried out in Suzhou which is a city with one of the highest levels of Gross Domestic Product (GDP) in China (Gu et al., 2018).

5.2 Methodology

5.2.1 Session and participants

Four CID workshops, involving 10 participants for each workshop, were conducted in Suzhou, China, in October 2017. The participants were recruited by a professional market research company. Participants were had a middle-upper income (defined as monthly family income of at least 15,000RMB) to ensure that they were likely to be in a financial position to purchase high-priced food products such as functional foods. They had not participated in a market survey in the past six months, they were in an age group of either 25-40 (the young group) or 41-56 (the senior group) and they had answered “yes” to the questions “do you have poor immunity” and “do you think your health frequently suffer from the adverse impact of air pollution?”
“pollution”. Additionally, half of the participants in each focus group either lived with or cared for someone that they also perceived to have poor immunity and were impacted by air pollution. This criterion was included as it is well documented that the consumer of health products is often not the purchaser, for example, adults may very well be purchasing food items for their parents or their children (Lei et al., 2015; Xu, 2013).

In total, 40 adults participated in the study. The participants were selected to ensure that there was variation in gender, marital status and family structure (Table 5-1). Participants’ agreed to take part in the CID workshops based on fully informed consent and all of the study’s findings were anonymized. Ethical approval was accepted by the University of Otago Human Ethics Committee (17/123) after detailed description of the method was outlined.

Table 5-1. Summary of participant in the current study.

<table>
<thead>
<tr>
<th>Session</th>
<th>Age (M/F)</th>
<th>Gender (M/F)</th>
<th>Married (Y/N)</th>
<th>Having child (Y/N)</th>
<th>Living with</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25-40</td>
<td>M (5) F (5)</td>
<td>Y (8) N (2)</td>
<td>Y (8) N (2)</td>
<td>Parents (1)</td>
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<td></td>
<td></td>
<td>Single (1)</td>
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<td></td>
<td></td>
<td></td>
<td>Spouse &amp; child (3)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>Spouse &amp; child &amp; parent(s) (in law) (5)</td>
</tr>
<tr>
<td>2</td>
<td>25-40</td>
<td>M (5) F (5)</td>
<td>Y (8) N (2)</td>
<td>Y (7) N (3)</td>
<td>Parents (2)</td>
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<td>Spouse (1)</td>
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<td>Spouse &amp; child (5)</td>
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<td></td>
<td></td>
<td>Spouse &amp; child &amp; parent(s) (in law) (2)</td>
</tr>
<tr>
<td>3</td>
<td>41-56</td>
<td>M (5) F (5)</td>
<td>Y (9) N (1)</td>
<td>Y (8) N (2)</td>
<td>Spouse (1)</td>
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<td></td>
<td></td>
<td>Single (1)</td>
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<td>Spouse &amp; child (6)</td>
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<td></td>
<td>Spouse &amp; child &amp; parent(s) (in law) (2)</td>
</tr>
<tr>
<td>4</td>
<td>41-56</td>
<td>M (5) F (5)</td>
<td>Y (10) N (1)</td>
<td>Y (10) N (3)</td>
<td>Spouse (3)</td>
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<td></td>
<td>Spouse &amp; child (4)</td>
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<td></td>
<td></td>
<td></td>
<td>Spouse &amp; child &amp; parent(s) (in law) (3)</td>
</tr>
</tbody>
</table>

5.2.2 Process design

Data collection was in Chinese. The first author of this article guided all sessions. Based on the basic process developed by Ciccantelli & Magidson (1993), the workshop was designed by utilising and adjusting pathways of product design process summarized by Waage (2007). Three design pathways, Understand, Explore and Define/Refine, were followed in each CID session. Research questions for each pathway are illustrated in Table 5-2.

In the Understand section, a range of semi-structured questions regarding participants’ personal experience living with air pollution were asked in order to study what pollution-driven health effects were of concern to Chinese people. Later, in the Explore section participants were guided to share the food-based products they currently use to mitigate the adverse impacts of
air pollution. In order to stimulate conversations, a collection of real functional food products available in the Chinese and/or New Zealand market were displayed to participants. Forms of example products included tea, soft drink, yoghurt, chews, protein powder and lozenges.

Table 5-2. Design pathways and research questions for each CID workshops.

<table>
<thead>
<tr>
<th>Design pathway</th>
<th>Research question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand</td>
<td>What are main health effects caused by air pollution as perceived by Chinese consumers?</td>
</tr>
<tr>
<td>Explore</td>
<td>How do Chinese consumers use currently available food-based products to mitigate the adverse impacts of air pollution?</td>
</tr>
<tr>
<td>Define/Refine</td>
<td>What is the idealised design perceived by Chinese consumers for products that help the immunity system recover from the impact of air pollution?</td>
</tr>
</tbody>
</table>

The Define/Refine section aimed to reveal consumers’ underlying wants and needs from a product by asking them to design, discuss and reach consensus about the ideal attributes for this product. Participants in each session were separated into three groups and asked to design one hypothetical product. Each group, containing 3 or 4 people, was given 30-40 min to write down their ideal product attributes including form, ingredient, benefit, packaging, use, flavour, shelf life, storage, country of origin, claim, feature, authentication, price, availability. After a group presentation and discussion about the advantages and disadvantages of each design, each group was given 15 min to further develop and make any changes or improvements to their designs. If the design in the Define stage was a supplement-based product, participants were encouraged to change the format into conventional foods. Once the moderator was content with the discussion concerning the designs, participants were asked to rank the popularity of their designs using a ten-point scale.

5.2.3 Data analysis

Audio recording of the four workshops were fully transcribed by a professional transcriber from a transcribing company, and coded by the researcher following thematic qualitative analysis (Graneheim & Lundman, 2004; Landström et al., 2009) using software NVivo 11. Texts related to the research questions were extracted and meaning units were identified based on selected texts. The meaning units were then condensed to form node titles, where a node is a collection of comments about a specific theme (see Table 5-3). By merging similar nodes and considering the research questions, an open coding schema was developed. Nodes were moved iteratively between existing and new nodes arising from words appearing in identified meaning
unit. The coding schema was further developed by verifying that no relevant identified meaning units had been left out and by ensuring that nodes were multi-exclusive. The coding schema was finalized based on discussions between the authors of this article.

Table 5-3. An example of identified meaning units, condensed meaning units and nodes.

<table>
<thead>
<tr>
<th>Identified meaning unit</th>
<th>Condensed meaning unit</th>
<th>Node</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating fruits is the routine in order to improve immunity, which is known by everyone.</td>
<td>Routine to improve immunity</td>
<td>Routine</td>
</tr>
</tbody>
</table>

5.3 Results

5.3.1 What are main health effects caused by air pollution as perceived by Chinese consumers?

Participants agreed that air pollution caused many health concerns and they attributed a range of health effects to pollution. These pollution-driven effects could be categorised into two groups: the increase of health issues or deterioration of the respiratory system, including more frequent coughing, rhinitis, sپagitis and sore throats and deterioration of immunity. There was a commonly held belief that pollution-driven impacts on the respiratory system would be worse for people with perceived poor immunity, for instance, the elderly and children. Most participants (92.5% or 37 out of 40) reported that they were most concerned about the effects of air pollution on their parents or children.

5.3.2 How do Chinese consumers use currently available food-based products to mitigate the adverse impacts of air pollution?

There were no food products mentioned by participants that specifically worked on combating air pollution. To participants, the direct benefits they require from facing smoggy weather were either improving the air quality or removing the particulate pollutants from the lung. Wearing masks and using air purifiers were common methods that participants used to protect their families and themselves. However, participants admitted that such approaches could not completely prevent pollution-driven health impacts. In this regard, food was perceived as a remedy to mitigate the adverse impact through other benefits, such as relieving respiratory symptoms, boosting immunity and benefiting the lungs, as one participant reported:

“Currently in China, there seems no good products particularly helping combat air pollution. Everyone is wearing masks, but nothing can help remove PM2.5 from the
Food remedies can be grouped into two regimens depending on usage: routine remedies or emergency remedies. Foods in the routine remedy category were normally used to improve the immunity over a long-term basis, such as immune-boosting supplements (e.g. protein powder, vitamin, fish oil) or yoghurt. Participants mentioned that air pollution was a new norm and it was necessary to enhance their immunity as a routine in their daily lives to cope with this challenge. Foods in the emergency remedy category aimed mainly to relieve respiratory symptoms, for instance, a sore throat or coughing. An increased intake of fruits and vegetables, home-made soups (e.g. ginger soup and pear and rock candy soup), honey (usually mixed with water) or lozenges were commonly stated as examples of products in this category. It is important to note that participants’ behaviours were profoundly influenced by Traditional Chinese Medicine (TCM) principles. For example, pear was believed to be beneficial to the lung, and ginger soup was believed to be good for a sore throat and coughing. In general, participants showed positive attitudes towards trying new products.

5.3.3 What is the idealised design perceived by Chinese consumers for products that help the immune system recover from the impact of air pollution?

A total of 19 products (9 supplement-based and 10 conventional-food-based) were designed. Table 5-4 summarises the product attributes of supplement-based designs and Table 5-5 presents conventional-food-based designs. Recurring attributes from all designs were identified and explained using the 4P’s from the marketing mix (product, promotion, price and place) tailored for specific target markets, as explained by Kotler and Armstrong (2010).

Supplement-based design

Interestingly, the majority of groups (9 out of 12) designed supplement-based products in the Define stage. After encouraging participants to change the format into conventional foods, there were still two groups that insisted that their designs be for supplements.

The product formats were relatively simple in the supplement designs. A tablet (6 out of 9) was the most common format with capsules (2) and effervescent tablet (1) also being selected. All designs incorporated natural ingredients, including extracts from herbs, fruits, vegetables and animals. The two main benefits required by participants were boosting immunity and/or relieving symptoms in the respiratory track. All designs were for small packs with the doses per pack ranging from seven days to three months. The majority of the supplements (8 out of
9) were designed for daily consumption over a long-term basis, except for the effervescent tablet which was suggested for emergency use on smoggy days. Generally speaking, participants did not perceive flavour to be an important attribute for supplements due to the short period of time the tablets or capsules would be in the mouth. None of the designs required specific storage conditions and they had shelf lives ranging from one to two years. It is important to note that many participants preferred the product to come from countries without pollution, as one participant mentioned:

“Well like what we designed we use herbs, but now in China herbs are too much polluted ... I am so concerned about this. Australia and New Zealand are both good. No pollution there.” (Female, Session 3)

Due to concern about the regulatory systems in developing countries, participants preferred ingredients that did not come from developing countries, even if those countries did not have pollution. Therefore, developed countries without pollution were preferred suppliers of products as they were perceived as having a good environment and good regulations.

The inclusion of natural ingredients was key. It was important to note that the meaning of “natural ingredients” was perceived as an absence of chemical additives in the product and that all ingredients came from natural foods or herbs. All designs specified that “natural” was the most important feature to promote their products. Interestingly, the degree of processing a natural product was exposed to did not appear to detract from the product’s perceived naturalness. For example, turning fresh fruit into a tablet was still perceived as the production of a natural product. This perception was common despite the fact that participants preferred minimally processed over more heavily processed foods. Additionally, all designs promoted proper authentications and scientific evidence, e.g., certification from national-level authorities in China or the importing country. Although participants rarely pointed out specific institutions or symbols of identification, authentication and scientific evidence were promoted as being necessary and a strong guarantee for food safety. These supplement products were all designed to have a health benefits. However, some designs focused on boosting immunity where others chose to add relieving symptoms:

“Enhancing immunity is the most reliable claim for long-term usage. You can't alleviate your sore throat all the time.” (Female, Session 4)
“There are enough products for boosting immunity in the market, so we surely should have one more claim of relieving inflammation in throat, otherwise our product cannot attract attention.” (Male, Session 1)

The price for the designed products ranged from 3RMB to 10 RMB per day, which was perceived as the same as the normal cost for supplements currently available. Participants recommended that these products be sold in supermarkets and pharmacies, as well as via online shopping sites.

Table 5-4. Supplement-based designs illustrated by attributes of product, promotion, place and price.

|---------|--------------|-------------------|--------------------------------------------------------|----------------------------------------|---------------------------------------|------------------|------------------------|---------------------------|-----------------------------------------------|------------|----------------------------------------------------------------|-----------------|---------------------------------------------------------------|--------|---------------------|-----------------------------|----------------------------------------------------------------|

<table>
<thead>
<tr>
<th>Product</th>
<th>Form: tablet</th>
<th>Ingredient: herbs and other food ingredients</th>
<th>Benefit: boost immunity</th>
<th>Packaging: similar with lozenges</th>
<th>Use: one tablet per day; long-term use</th>
<th>Flavour: fruit or milk flavour</th>
<th>Shelf life: six months</th>
<th>Storage: room temperature</th>
<th>Country of origin: China</th>
<th>Promotion</th>
<th>Claim: boost immunity</th>
<th>Feature: all natural; herbal ingredients; additive free</th>
<th>Authentication: authorised institutions</th>
<th>Price</th>
<th>Daily: 3 RMB</th>
<th>Place</th>
<th>Availability: supermarket; pharmacy; online shopping sites.</th>
</tr>
</thead>
</table>

<p>| Product | Form: effervescent tablet | Ingredient: herbs, fruits and vegetables | Benefit: boost immunity; relieve sour throat at the beginning of a cold. | Packaging: 7 tablets per package | Use: one tablet per day at the beginning of a cold; emergency use. | Flavour: original or fruit flavour |</p>
<table>
<thead>
<tr>
<th>Product</th>
<th>Form: tablet</th>
<th>Ingredient: herbs</th>
<th>Benefit: boost immunity; relieve inflammation in throat; bring benefits to lung.</th>
<th>Packaging: small bottle pack</th>
<th>Use: one tablet per day; long-term use.</th>
<th>Flavour: original</th>
<th>Shelf life: one year</th>
<th>Storage: room temperature</th>
<th>Country of origin: China</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Promotion</strong></td>
<td>Claim: boost immunity; relieve sour throat at the beginning of a cold.</td>
<td>Feature: all natural; herbal ingredients; additive free.</td>
<td>Authentication: identification from European Union</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>Daily: 3 RMB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Place</strong></td>
<td>Availability: supermarket; pharmacy</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Product</th>
<th>Form: tablet</th>
<th>Ingredient: natural fruits or vegetables</th>
<th>Benefit: boost immunity</th>
<th>Packaging: formal pack – bottle pack weighted 500g; trial pack – transparent small pack weighted 100g</th>
<th>Use: one tablet per day; long-term use.</th>
<th>Flavour: original</th>
<th>Shelf life: two years</th>
<th>Storage: room temperature</th>
<th>Country of origin: Australia or New Zealand (countries without pollution)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Promotion</strong></td>
<td>Claim: boost immunity</td>
<td>Feature: all natural; herbal ingredients; additive free.</td>
<td>Authentication: supplement identification from CFDA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>Daily: 6-7 RMB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Place</strong></td>
<td>Availability: supermarket; pharmacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Product</th>
<th>Form: tablet</th>
<th>Ingredient: extractive from natural fruits, vegetables or herbs</th>
<th>Benefit: help the immunity recover; bring benefits to lung.</th>
<th>Packaging: similar with medicine strip, containing around 7-8 tablets; 4 strips per package</th>
<th>Use: long-term use – one to two tablet per week; smoggy days – one tablet per day.</th>
<th>Flavour: original or fruit flavour</th>
<th>Shelf life: three month</th>
<th>Storage: room temperature</th>
<th>Country of origin: Australia or New Zealand (countries without pollution)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Promotion</strong></td>
<td>Claim: help the immunity recover; bring benefits to lung.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---
<table>
<thead>
<tr>
<th>Product</th>
<th>Form</th>
<th>Ingredient</th>
<th>Benefit</th>
<th>Packaging</th>
<th>Use</th>
<th>Flavour</th>
<th>Shelf life</th>
<th>Storage</th>
<th>Country of origin</th>
<th>Claim</th>
<th>Feature</th>
<th>Authentication</th>
<th>Price</th>
<th>Place</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product 7</td>
<td>capsule</td>
<td>extractive from animals or plants</td>
<td>boost immunity; anti-allergy; anti-sub-health.</td>
<td>Plastic bottle (around 30 capsules per bottle for a month dosage)</td>
<td>one capsule per day; long-term use.</td>
<td>milk or fruit flavour</td>
<td>1-2 years</td>
<td>room temperature</td>
<td>Australia or New Zealand (countries without pollution)</td>
<td>boost immunity; anti-allergy; anti-sub-health.</td>
<td>all natural; additive free</td>
<td>both identification from FDA and Health Food certification from CFDA</td>
<td>10 RMB</td>
<td>pharmacy; online shopping sites</td>
<td></td>
</tr>
<tr>
<td>Product 8</td>
<td>tablet</td>
<td>natural ingredients</td>
<td>boost immunity</td>
<td>small package; a month dosage per package</td>
<td>one tablet per day; long-term use</td>
<td>original or fruit flavour</td>
<td>one year</td>
<td>room temperature; once opened, fridge storage</td>
<td>countries with good environment</td>
<td>boost immunity</td>
<td>all natural; high technology</td>
<td>3 RMB</td>
<td>supermarket; pharmacy; online shopping sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 9</td>
<td>tablet</td>
<td>herbs</td>
<td>boost immunity</td>
<td>small package</td>
<td>one tablet per day; long-term use</td>
<td>fruit flavour</td>
<td>one year</td>
<td>room temperature</td>
<td>countries without pollution</td>
<td>boost immunity</td>
<td>all natural</td>
<td>national level’s identification from China and imported countries</td>
<td>5 RMB</td>
<td>supermarket; pharmacy.</td>
<td></td>
</tr>
</tbody>
</table>
Conventional-food-based design

Only three groups designed conventional foods in the Define stage. After encouraging participants to change the supplement format into conventional foods, there were ten designs of conventional foods presented at the Refine stage (Table 5-5).

Table 5-5. Conventional-food-based designs illustrated by attributes of product, promotion, place and price.

<table>
<thead>
<tr>
<th>Product 1</th>
<th>Product 2</th>
<th>Product 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
<td><strong>Product</strong></td>
<td><strong>Product</strong></td>
</tr>
<tr>
<td>Form: soft drink</td>
<td>Form: jelly(^{10}) (similar to pudding format)</td>
<td>Form: pre-packed rice</td>
</tr>
<tr>
<td>Ingredient: natural fruits, vegetables and herbs</td>
<td>Ingredient: herbs</td>
<td>Ingredient: rice</td>
</tr>
<tr>
<td>Benefit: boost immunity; relieve inflammation in throat</td>
<td>Benefit: boost immunity; relieve inflammation in throat; bring benefits to lung</td>
<td>Benefit: boost immunity</td>
</tr>
<tr>
<td>Packaging: 150ml per bottle; transparent bottle</td>
<td>Packaging: one bite one jelly, twelve jelly per pack</td>
<td>Packaging: 2.5kg per product</td>
</tr>
<tr>
<td>Use: flexibly</td>
<td>Use: flexibly, three times a week suggested</td>
<td>Use: usual cooking; long-term use</td>
</tr>
<tr>
<td>Flavour: good taste</td>
<td>Flavour: honey (natural sweetening)</td>
<td>Flavour: original</td>
</tr>
<tr>
<td>Shelf life: 15-30 days</td>
<td>Shelf life: one year</td>
<td>Shelf life: one year</td>
</tr>
<tr>
<td>Storage: room temperature or fridge</td>
<td>Storage: room temperature</td>
<td>Storage: room temperature</td>
</tr>
<tr>
<td>Country of origin: China</td>
<td>Country of origin: China</td>
<td>Country of origin: China</td>
</tr>
<tr>
<td><strong>Promotion</strong></td>
<td><strong>Promotion</strong></td>
<td><strong>Promotion</strong></td>
</tr>
<tr>
<td>Claim: boost immunity; relieve inflammation in throat</td>
<td>Claim: boost immunity; relieve inflammation in throat; bring benefits to lung</td>
<td></td>
</tr>
<tr>
<td>Feature: all natural</td>
<td>Feature: all natural; herbal ingredients; additive free</td>
<td></td>
</tr>
<tr>
<td>Authentication: authorised institutions</td>
<td>Authentication: identification from authorised institutions</td>
<td></td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td><strong>Price</strong></td>
<td><strong>Price</strong></td>
</tr>
<tr>
<td>Daily (per product): 3 RMB</td>
<td>Daily (per product): 3 RMB</td>
<td></td>
</tr>
<tr>
<td><strong>Place</strong></td>
<td><strong>Place</strong></td>
<td><strong>Place</strong></td>
</tr>
<tr>
<td>Availability: supermarket; online shopping sites</td>
<td>Availability: supermarket</td>
<td>Availability: supermarket</td>
</tr>
</tbody>
</table>

\(^{10}\) The format was designed to be similar to the Gui Ling Jelly, a traditional food used as an anti-inflammatory.
• **Country of origin:** China or Thailand

**Promotion**
• **Claim:** boost immunity
• **Feature:** no tiredness of eating
• **Authentication:** green products; scientific patent

**Price**
• **Daily:** 3 RMB

**Place**
• **Availability:** supermarket; online shopping sites

---

**Product 4**

**Product**
• **Form:** candy
• **Ingredient:** extractive from natural fruits, vegetables or herbs
• **Benefit:** help the immunity recover; bring benefits to lung/throat
• **Packaging:** similar with Mentos roll wrap
• **Use:** long-term use – one candy per day
• **Flavour:** good taste; multi-flavours for different consumer groups (e.g. child, young and senior)
• **Shelf life:** six month
• **Storage:** room temperature
• **Country of origin:** developed countries

**Promotion**
• **Claim:** help the immunity recover; bring benefits to lung/throat
• **Feature:** all natural; additive free
• **Authentication:** national level’s identification

**Price**
• **Daily:** 2 RMB

**Place**
• **Availability:** supermarket; online shopping sites

---

**Product 5**

**Product**
• **Form:** lite milk biscuits
• **Ingredient:** milk, herbs and food ingredients
• **Benefit:** boost immunity
• **Packaging:** small package (2-3 pieces of biscuits)
• **Use:** flexibly
• **Flavour:** good taste; multi-flavours for different consumer groups (e.g. child, young and senior)
• **Shelf life:** six month
• **Storage:** room temperature
• **Country of origin:** developed countries

**Promotion**
• **Claim:** boost immunity
• **Feature:** all natural; additive free
• **Authentication:** identification from authorised institutions demoniacally and internationally

**Price**
• **Daily:** 2-4 RMB

**Place**
• **Availability:** supermarket; online shopping sites

---

**Product 6**

**Product**
• **Form:** milk chews
• **Ingredient:** herbs, honey, mint and other plant-based extractive
• **Benefit:** boost immunity; anti-allergy
• **Packaging:** small package
• **Use:** flexibly
• **Flavour:** non-bitter taste
• **Shelf life:** six month
• **Storage:** room temperature
• **Country of origin:** China or other countries with good environment

**Promotion**
• **Claim:** boost immunity; anti-allergy
• **Feature:** all natural; additive free
• **Authentication:** identification from authorised institutions
Price • Daily: 5-6 RMB
Place • Availability: supermarket; online shopping sites

<table>
<thead>
<tr>
<th>Product 7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
</tr>
<tr>
<td>- Form: soft drink</td>
</tr>
<tr>
<td>- Ingredient: natural fruits or vegetables</td>
</tr>
<tr>
<td>- Benefit: boost immunity; relieve inflammation in throat; bring benefits to lung</td>
</tr>
<tr>
<td>- Packaging: around 150ml per package; paper packaging</td>
</tr>
<tr>
<td>- Use: flexibly</td>
</tr>
<tr>
<td>- Flavour: original flavour</td>
</tr>
<tr>
<td>- Shelf life: six month</td>
</tr>
<tr>
<td>- Storage: room temperature</td>
</tr>
<tr>
<td>- Country of origin: China or developed countries</td>
</tr>
<tr>
<td><strong>Promotion</strong></td>
</tr>
<tr>
<td>- Claim: boost immunity; relieve inflammation in throat; bring benefits to lung</td>
</tr>
<tr>
<td>- Feature: all natural; additive free</td>
</tr>
<tr>
<td>- Authentication: national level’s identification</td>
</tr>
</tbody>
</table>

Price • Daily: 5 RMB
Place • Availability: supermarket; online shopping sites

<table>
<thead>
<tr>
<th>Product 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
</tr>
<tr>
<td>- Form: milk shake</td>
</tr>
<tr>
<td>- Ingredient: natural ingredients</td>
</tr>
<tr>
<td>- Benefit: boost immunity; relieve symptoms in the upper respiratory track</td>
</tr>
<tr>
<td>- Packaging: small package</td>
</tr>
<tr>
<td>- Use: flexibly</td>
</tr>
<tr>
<td>- Flavour: original or fruit flavour</td>
</tr>
<tr>
<td>- Shelf life: 90 days</td>
</tr>
<tr>
<td>- Storage: fridge storage</td>
</tr>
<tr>
<td>- Country of origin: countries with good environment</td>
</tr>
<tr>
<td><strong>Promotion</strong></td>
</tr>
<tr>
<td>- Claim: boost immunity; relieve symptoms in the upper respiratory track</td>
</tr>
<tr>
<td>- Feature: all natural; high technology</td>
</tr>
<tr>
<td>- Authentication: national level’s identification from China and imported countries</td>
</tr>
</tbody>
</table>

Price • Daily (per product): 5 RMB
Place • Availability: supermarket; online shopping sites

<table>
<thead>
<tr>
<th>Product 9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
</tr>
<tr>
<td>- Form: honey water (soft drink)</td>
</tr>
<tr>
<td>- Ingredient: honey; water; herbs</td>
</tr>
<tr>
<td>- Benefit: relieve coughing; bring benefits to lung; benefit to skin</td>
</tr>
<tr>
<td>- Packaging: 125ml, transparent glass bottle</td>
</tr>
<tr>
<td>- Use: flexibly, one time a day suggested</td>
</tr>
<tr>
<td>- Flavour: sweet flavour</td>
</tr>
<tr>
<td>- Shelf life: three month</td>
</tr>
<tr>
<td>- Storage: room temperature</td>
</tr>
<tr>
<td>- Country of origin: China with imported honey</td>
</tr>
<tr>
<td><strong>Promotion</strong></td>
</tr>
<tr>
<td>- Claim: relieve coughing; bring benefits to lung; benefit to skin</td>
</tr>
<tr>
<td>- Feature: all natural; remarkably efforts</td>
</tr>
<tr>
<td>- Authentication: identification from authorised institutions</td>
</tr>
</tbody>
</table>

Price • Daily (per product): 5 RMB
Place • Availability: supermarket; vending machine

<table>
<thead>
<tr>
<th>Product 10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
</tr>
<tr>
<td>- Form: yoghurt</td>
</tr>
<tr>
<td>- Ingredient: yoghurt and herbs</td>
</tr>
<tr>
<td>- Benefit: boost immunity</td>
</tr>
</tbody>
</table>
### Packaging
- 125ml per product; small package

### Use
- flexibly, one time a day suggested

### Flavour
- fruit flavour

### Shelf life
- 21 days

### Storage
- fridge storage

### Country of origin
- China with imported raw milk

### Promotion
- **Claim:** boost immunity
- **Feature:** all natural
- **Authentication:** national level’s identification from China and imported countries

### Price
- **Daily:** 5 RMB

### Place
- **Availability:** supermarket

Interestingly, most of the products (9 out of 10) were designed as a convenient snack, drink, or dairy option. These formats included soft drink, jelly (similar to pudding format), biscuit, milk chews, milk shake, yoghurt or candy. All of the foods were designed to target a wide range of consumers, and they were considered to be especially suitable for children and the younger generation. Similar to supplement-based design, these designs also emphasised natural ingredients and boosting immunity, with half of them adding the benefit of relieving symptoms in the respiratory track. Small pack sizes were specified in each design with reasons such as “It won’t be wasted” (Female, Session 2) or “Eating such snack will not make me full so not influence the intake of a normal meal.” (Female, Session 3). As snacks, the consumption regimen were designed to be flexible, regardless of if they were to be taken daily or in emergency situations. Since these products were considered as replacements for normal conventional foods, their flavour was to be good. The majority of products were designed to be stored at room temperature so they could be easily transported. It is important to note that all designs had relatively short shelf lives. Participants agreed that a long shelf life meant preservatives would have to be added, as the participant explained below:

“The maximum of shelf life is six months. Because it is purely natural and has no additive, the shelf life cannot be any longer than six months, otherwise, it must add something.” (Female, Session 1)

Due to the restriction on shelf life, China was often chosen as the most appropriate country of origin. However, some design teams suggested that important ingredients be imported from developed countries with good environments.

Interestingly, it was suggested that the conventional foods be promoted the same way as the supplement designs, e.g. using natural ingredients, claiming that they boost immunity and/or relieve respiratory symptoms, and having credible authentications. Participants thought that
these conventional foods should be priced the same as similar products in the market, for example, soft drinks priced at 3-5RMB and a small pack of biscuits priced at 2-4RMB. In terms of their distribution, the preference was for conventional foods to be sold in supermarkets, both online and offline, rather than in pharmacies like the supplements.

**Comparison of two types of design**

Summarizing the supplement-based and conventional-food-based designs, common preferred qualities can be identified, such as the preference for natural ingredients, claims and benefits of boosting immunity and relieving respiratory symptoms, small pack sizes and room

<table>
<thead>
<tr>
<th>Table 5-6. Common and specific attributes in the designs of supplements and conventional foods.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
</tr>
<tr>
<td>Form</td>
</tr>
<tr>
<td>Ingredient</td>
</tr>
<tr>
<td>Benefit</td>
</tr>
<tr>
<td>Packaging</td>
</tr>
<tr>
<td>Use</td>
</tr>
<tr>
<td>Flavour</td>
</tr>
<tr>
<td>Shelf life</td>
</tr>
<tr>
<td>Storage</td>
</tr>
<tr>
<td>Country of origin</td>
</tr>
<tr>
<td><strong>Promotion</strong></td>
</tr>
<tr>
<td>Claim</td>
</tr>
<tr>
<td>Feature</td>
</tr>
<tr>
<td>Authentication</td>
</tr>
<tr>
<td><strong>Price</strong></td>
</tr>
<tr>
<td>Daily</td>
</tr>
<tr>
<td><strong>Place</strong></td>
</tr>
<tr>
<td>Availability</td>
</tr>
</tbody>
</table>
temperature storage, and authentication and online shopping sites. Additionally, participants had a positive attitude about developed countries having good environments and good regulations and thought that they would be suitable countries of origin for either products or important ingredients.

The product form was the main criterion for participants to distinguish between the two types of design. For example, tablets and capsules were perceived as being a typical supplement design. In addition, there was wide agreement that supplements need to be taken long-term to be effective and that their intake was mainly for obtaining health benefits, while the intake of conventional foods was flexible and more pleasurable than taking supplements. Consequently, having a nice flavour was more important for conventional foods than for supplements.

5.4 Discussion

5.4.1 The bridge connecting air pollution and functional foods

Facing persistent air pollution which has become a new norm in China (Johnson et al., 2017), the most desirable change Chinese people want is either an improvement in air quality or the ability to remove particulate pollutants from the lung. According to results of the current study, participants did not link functional foods with either of these two changes, which is in line with a recent qualitative study in Shanghai (Cong, Mirosa, et al., 2019). However, the results of this study have indicated that functional foods including supplements were perceived to be a popular method for Chinese people to boost immunity and relieve respiratory symptoms in order to mitigate the adverse impact of air pollution. Based on two types of design, boosting immunity was the main expected benefit. This result further supports the idea that immune health could serve as a useful bridge to help marketers make connections between functional food products and air pollution in the minds of consumers (Cong, Mirosa, et al., 2019). It was obvious that for products designed to be an emergency remedy in heavy smoggy days, relieving respiratory symptoms was a very important benefit desired by Chinese people, which matches results observed in earlier studies of pollution-related online discussion (Cong, Bremer, et al., 2019b).

5.4.2 The different expectations concerning benefits of conventional foods and supplements

The current study showed that were different expectations of the benefits of conventional foods and supplements. Participants emphasised the functional benefits of supplements and did not pay much attention to their consumption methods or favour/taste. Conventional-food-based
products were the opposite in that participants designed them as a replacement for normal conventional foods. Therefore, flavour/taste was emphasised but functional benefits was perceived as being less important than for supplements. This result concurs with previous studies, in which consumer acceptance of functional foods is far from being unconditional, with one of the main conditions for acceptance pertaining to taste, in addition to product quality, price, convenience and trustworthiness of health claims. As a rule, consumers seem to evaluate functional foods first and foremost as foods. Functional benefits may provide added value to consumers but cannot outweigh the sensory properties of foods (Siró et al., 2008).

5.4.3 The concern about safety issues of Chinese food products

Based on attributes of different designs, there seems to have been a strong safety concern among participants. Evidence included the preference for natural ingredients and the products being additive free; the preference for imported products/ingredients from developed countries without pollution and the preference for authentication/scientific evidence as an extra safety guarantee. These results could be associated with public concern about food safety scares in China (Desmarchelier & Fang, 2016). In recent years, the Chinese food industry has indeed suffered from numerous highly publicised scandals - e.g. the presence of melamine in milk-based foods produced in China in 2008 and 2010, and the avian influenza A(H7N9) (poultry) outbreak in 2013. In several instances, social behaviour in China in relation to food safety issues has even exhibited the features of collective panic, which are characterized as emergent collective phenomena that are wholly or mostly unorganized (Desmarchelier & Fang, 2016). One remarkable case is that Chinese milk producers, after the melamine scare of 2008, have still been unable to recover sales volumes to the level of 2007, with the explosion in local demand over the past decade solely fulfilled by imports (Scott & Zhang, 2012). In line with previously published studies, the current study illustrated that participants had a high awareness of food safety but limited knowledge about recognition of the relevant labels. However, participants hold positive attitudes towards food products designed to be safe (Liu, Pieniak, & Verbeke, 2013).

5.4.4 The preference of small package size

It is interesting to note that all design teams chose the small pack sizes. This result is in accordance with previous studies indicating Chinese consumers tended to consume milk products in small packages (Wang, Mao, & Gale, 2008). One of the reasons behind this was avoiding food waste. Apparently, with small and single portion packs it is easier to eat all of
the food and avoid waste. Actually, recent research has indicated that anticipated food waste decreased when large packs were sold as individual units (Petit, Lunardo, & Rickard, 2017), which is consistent with the current study. In addition, it has been suggested that small pack sizes resulted in impulse consumption (Eckert, Haron, Heintzelman, Lane, & McKnight, 2004). This may be another reason for participants to design the ideal products to be small package size, as this attribute may potentially increase their purchase willingness.

5.5 Conclusion

This study is the first attempt to uncover the ideal attributes of functional food products to mitigate pollution-driven health impacts. It is also the first study to utilise CID workshops with Chinese consumers. In the promoting of products designed for long-term use, health claim such as “Boosting immunity” were seen as being very important, with the use of claims such as “Relieving respiratory symptoms” being deemed to be more suitable to promote products designed for use in acute situations. Supplements and conventional-format functional foods were perceived differently by consumers and so have different expected health benefits and target markets. Consumers’ attention to food safety suggests that producers should apply multiple methods to communicate the safety of their products to consumers, such as using ingredients or processing products from authorised countries, relying on authentication or scientific reports, and utilizing natural ingredients rather than synthetic ones.

Overall, the study provided information about the desired attributes of functional foods designed to combat air pollution in China, contributing to both industry product development and limited academic literature.
Chapter 6. General discussion and conclusions
This chapter includes four sections. First, key findings of this thesis are summarized (Subsection 6.1). Second, the implications and contributions to both academic community and the food industry are discussed (Subsection 6.2). Third, the limitations and possibilities for future research are presented (Subsection 6.3). Finally, the conclusions from the presented are reported (Subsection 6.4).

6.1 Summary of key findings

The results from the series of studies presented in this thesis have demonstrated that there is a strong potential for the increased use of functional foods to help combat the effects of air pollution in China (Chapters 2 to 5). The findings of this thesis can be summarized into four aspects: consumers’ perceptions of air pollution and its health impacts (Subsection 6.1.1); consumers’ perceptions of immune-boosting functional foods (Subsection 6.1.2); the bridge connecting air pollution and functional foods in the mind of the consumers (Subsection 6.1.3) and consumers’ preferred attributes for functional foods designed to help the immune system recover from the impact of air pollution (Subsection 6.1.4). These key findings are pictorially displayed in Table 6-1.

6.1.1 Consumers’ perception of air pollution

Persistent and severe episodes of poor air quality have raised the Chinese population’s awareness of the deleterious impact that air pollution can have on their health (Huang et al., 2014; Johnson et al., 2017). In Chapter 2 and 3 it is reported that Chinese consumers pay a lot of attention to air pollution and its consequences, and it is believed that air pollution (smoggy days) is the “new” norm (Chapter 1 and 5). In line with scientific evidence on the impact of pollution on immune health (Chapter 1), Chinese consumers stated that air pollution can cause poor immunity (Chapter 3 to 5) and have an adverse impact on the respiratory system (Chapter 3 and 5). Children were considered to be the most vulnerable group to the health risks posed by air pollution, and concerns over the children’s health impacted significantly on the physiological health of their parents (Chapter 3 and 5), with the elderly (Chapter 3 and 5) being another vulnerable group.

6.1.2 Consumers’ perceptions of immune-boosting functional foods

Although numerous studies have reported that functional foods can provide a wide range of benefits to immune health, including helping pollution-driven immune issues, there was a lack of scientific evidence to support the purported effectiveness of the functional food products currently sold in the market as remedies for pollution-driven impacts to the lungs (Chapter 2).
Figure 6-1. Key finding summary. (consumers=Chinese consumers; C=Chapter; FF=functional food; AP=air pollution)

**Air pollution**
Consumers pay a lot of attention to air pollution and its consequences (C2, C3).
Consumers agree air pollution weather (smoggy days) has become a new norm (C1, C5).
Scientific evidence shows air pollution can cause adverse impacts on immune health (C1).

**Immune health**
Consumers agree that air pollution is an important factor that can cause poor immunity. (C3, C4, C5)
Consumers believe immunity can be changed through eating appropriate foods (C3, C4, C5), over a long-term basis (C4, C5).

**Functional food**
Scientific evidence shows that functional foods could provide a wide range of benefits to immune health (C2).

**Respiratory health**
Consumers perceive that air pollution has an adverse impact on the respiratory system (C3, C5)
Consumers consider proper food remedies as emergency methods to relieve respiratory symptoms during smoggy days (C3, C5).

**Functional foods designed to help the immune system recover from the impact of air pollution**

There appear to be strong potential for the increased use of FFs to help combat the effects of air pollution (C2, C3, C4, C5).

In the promoting of products designed for long-term use, health claim such as “Boosting immunity” were seen as being very important (C4, C5), with the use of claims such as “Relieving respiratory symptoms” being deemed to be more suitable to promote products designed for use in acute situations (C5).

Supplements and conventional-format functional foods were perceived differently by consumers and so have different expected health benefits and target markets (C4, C5).

Consumers’ attention to food safety suggests that producers should apply multiple methods to communicate the safety of their products to consumers, such as using ingredients or processing products from authorised countries, applying authentications or scientific reports, and utilizing natural ingredients rather than synthetic ones (C2, C5).

Due to the wide acceptance of TCM in China, the involvement of TCM elements, such as developing health claims conforming to TCM thinking or involving TCM ingredients, could be beneficial for products with health benefits (C3, C4, C5).
Chinese consumers’ attitudes towards functional foods including those designed to enhance the immune system were positive (Chapter 2 to 5). This conclusion is supported by the finding that immunity status is believed to be able to be changed through eating appropriate foods (Chapter 3 to 5). There was a very structured understanding of interactions between diet and wellness, which meant products were used during specific stages of wellness to support immunity (Chapter 2). Foods used as a routine remedy were normally used over a long-term basis, such as immune-boosting supplements (e.g. protein powder, vitamin, fish oil), adjusted dietary (e.g. eating fruits, vegetables and yoghurt) and some TCM therapies (e.g. Ginseng tea and Sea Cucumber soup) (Chapter 3, to 5). Consumers considered homemade TCM therapies (e.g. ginger soup and pear soup with rock candy) and an adjusted diet (e.g. eating fresh fruits and vegetables and taking honey water) as an emergency response, to be taken during smoggy days to relive respiratory symptoms, for instance, a sore throat or coughing, and to boost immunity (Chapter 3, to 5).

6.1.3 Bridge connecting air pollution and functional foods

There were common perceptions that immunity played an overall role in general health (Chapter 3 to 5) with the deterioration of the respiratory system being Chinese consumers most acute health concern relating to air pollution (C3, C5). Although foods were not perceived as being able to combat air pollution directly as Chinese people could not envisage food being able to help remove particulate pollutants from their lungs (Chapter 4 and 5), functional foods including supplements were perceived to be a suitable method to boost immunity and relieve respiratory symptoms in order to mitigate the adverse impact of air pollution (Chapter 3 to 5). Therefore, immune health and respiratory health could both serve as a useful bridge to help marketers make connections between functional food products and air pollution in the minds of consumers (Chapter 4 and 5).

6.1.4 Preference for attributes of potential functional foods

In the promoting of products designed for long-term use, health claim such as “Boosting immunity” were seen as being very important (Chapter 4 and 5), with the use of claims such as “Relieving respiratory symptoms” being deemed to be more suitable to promote products designed for use in acute situations (Chapter 3 and 5). Supplements and conventional-format functional foods were perceived differently by consumers and so they had different expected health benefits and target markets (Chapter 4 and 5). Consumers emphasised the functional benefits of supplements and did not pay much attention to their consumption method or
favour/taste. In contrast functional-food-based products were considered to be a replacement for conventional foods and therefore, flavour/taste was emphasised with functional benefits being less important in these products than for supplements (Chapter 4 and 5). A tablet was the most preferred format in the supplement category, with the majority of conventional-foods were designed as a snack, drink, or dairy option (Chapter 5). It was stated that the target market of supplements were mainly adults, especially senior people (Chapter 4 and 5), while functional foods were targeted at a wide range of consumers and especially suitable for children and the younger generation (Chapter 5). Consumers’ attention to food safety suggested that producers should apply multiple methods to communicate the safety of their products to consumers, such as using ingredients or processing products from authorised countries, applying authentications or scientific reports, and utilising natural ingredients rather than synthetic ones (Chapter 2 and 5). Due to the wide acceptance of TCM in China, the involvement of TCM elements, such as developing health claims conforming to TCM thinking or involving TCM ingredients, could be beneficial for products with health benefits (Chapter 3 to 5).

6.2 Implications and contributions of the thesis

The findings from the series of studies described in this thesis make a number of practical and academic contributions. The practitioner-oriented contributions are discussed in Subsection 6.2.1 and the academic contributions are highlighted in Subsection 6.2.2.

6.2.1 Opportunities and challenges for the functional food industry

Results of this thesis suggest both a number of opportunities for functional foods and a number of challenges. These considerations are discussed below.

Opportunities for pre-packed products

As stated in Subsection 6.2.2, except for supplements, there were hardly any pre-packed products utilised by consumers either routinely or as emergency remedies to combat air pollution (Chapter 4 and 5). Although home-made TCM therapies have high acceptance by Chinese consumers, people often complained that their preparation was “less convenient” than directly consuming supplements (Chapter 4). Chinese consumers stated that the most important advantages of taking supplements included that they were easy, practical and quick to take (Chapter 4). These advantages largely relate to Chinese people’s high-pace lifestyles.

A previous study in Belgium showed that working households were less likely to spend time on cooking than non-working households (Daniels & Glorieux, 2015). This finding could also reflect the situation in China. Owing to China’s rapid socioeconomic development, people’s
eating patterns have been fundamentally changed (Yu, Veeck, & Yu, 2015). In many Chinese cities, especially metropolis such as Shanghai, people have now become accustomed to working or studying for many hours a day (Han, 2018). Busier professional schedules for adults and school children means that family members are more likely to reduce the time they spend cooking and choose less time-consuming food options (Veeck, Yu, Yu, Veeck, & Gentry, 2014), such as patronising fast food restaurants, choosing processed food products or eating snacks (Yu et al., 2015).

Compared with the mature market for immune-boosting supplements, there are very few convention-format functional foods available in the market that can either boost consumers’ immunity on a long-term basis or relieve respiratory symptoms as an emergency response on smoggy days (Chapter 2 to 5). Limited examples include taking yoghurt for enhancing immunity and consuming lozenges for relieving a sore throat (Chapter 5). The designs of functional food products, especially the convention-format ones (e.g. soft drinks, convenient snack) (Chapter 5), offer food producers ideas for convenient and novel products to fill the market gap of using foods to combat the effects of air pollution.

**Opportunities to create products for children and the elder population**

In China, children and senior consumers play an important role in the market due to China’s unique population structure and proportion. Since the implementation of the one-child policy in 1979, children in China have been raised during a period of rapid and dramatic cultural change that has altered both the structure and dynamics of family life (Goh & Kuczynski, 2009). The influence of Chinese children on their families’ spending is around 68%, much higher than the approximate 40% people in the US spent on their children (McNeal, 1992; McNeal & Yeh, 1997). Although the universal two-child policy has been implemented since October 2015 to boost fertility behaviour (Zeng & Hesketh, 2016), its influence on Chinese families has been far less than expected. The expected baby boom has not eventuated and many families have accepted the situation of having only one child (Qiu et al., 2019). In the meantime, the aging population is increasing and it is predicted that by 2040 there will be 400 million Chinese, representing 26% of the total population, who are at least 60 years old (Jackson & Howe, 2004; Zhang, 2001). Senior consumers will be a significant force in the Chinese food market (Wu, 2014).

When developing new products, it is critical to develop product attributes preferable to the targeted consumers. Chapters 4 and 5 showed that consumers perceived supplements and
convention-format functional foods differently in terms of their functional benefits and flavour/taste. Importantly, supplements were perceived especially suitable for the senior group while conventional foods (e.g. soft drinks and convenient snacks) were appealing for use by children and the younger generation. Given that children and the elderly were considered to be the most vulnerable groups to the health risk posed by air pollution (Chapter 3 and 5), the results from this thesis reveal promising market uptake for supplements that are targeted towards senior consumers and conventional-format foods that are targeted to children.

**Opportunities for developed countries to leverage the ‘country of origin’ effect**

As stated in Subsection 5.4.3, Chinese consumers have strong concerns about the safety of domestic food products, owing to a series of highly publicised scandals in their food industry, with the presence of melamine in milk-based products in 2008 being the most notable one (Desmarchelier & Fang, 2016). Even today, the influences caused by these scandals on consumers’ perceptions of country of origin are still existing. A recent study of in-depth interviews across China illustrated that Chinese residents had a preference towards dairy products from developed countries, particularly Australia, New Zealand, Germany, Netherlands and USA (Yang, Ramsaran, & Wibowo, 2018). This preference offers a good opportunity for developed countries in a wide range of food products. A survey in 2011-2016 reported that about 70% of consumers in Tier 1 to 3 cities believed that international brands were of higher quality than domestic brands and consumers stated that they were willing to pay a premium for imported brands (Berger, 2017). Further evidence includes the results in Chapter 5 that Chinese consumers perceived developed counties as having good credibility for food products because of their good regulatory systems (Chapter 5).

The episodes of poor air quality in recent years has promoted consumers' affection for developed countries with good environment. For example, many people in online discussions mentioned the idea of emigrating to developed countries in order to escape pollution (Chapter 3) and consumers showed the preference for importing products/ingredients from developed countries without pollution in their designs of functional foods (Chapter 5).

In general, Chinese consumers have positive attitudes about developed countries having good food regulations and good environments and believe they would be suitable countries of origin for food products (Chapter 5). Developed countries should leverage this perceived competitive advantage, for example, in the marketing of their functional products.

**Ethical considerations**
As stated in Subsection 2.3.2, many of the early functional food products promoted as meeting Chinese consumer’s desire to combat the adverse impacts of air pollution do not appear to be supported by scientific evidence, including “anti-smog” tea and supplements claiming to deal with pollution-driven impacts on the lung. This lack of scientific validations means that it is difficult for consumers to discern between products that are truly effective, from ones only touting to be effective. The controversial use of functional components in food production is reported on from time to time. For example, while the use of plant sterols in food to reduce cholesterol seems to be a good idea, there is research which indicates that some plant sterols may be more harmful than cholesterol (Köhler, Teupser, Elsässer, & Weingärtner, 2017). Therefore, any products developed without solid scientific backing may cause health risks to consumers.

With regard to Chinese consumers, the adverse impacts may be more serious than to Westerns, owing to China's unique cultural and social phenomena. Previous studies have illustrated that compared with Western (American, Canadian, Western European), East Asian (Chinese, Japanese, Korean) populations have more collective understandings rather than individual ones (Henrich, Heine, & Norenzayan, 2010). Plenty of evidence arising from this thesis can support this statement, for example, many consumers have high acceptance of TCM without understanding the principles of TCM (Chapter 4). Given the tendency to simply believe what others do, Chinese consumers risk suffering health/economic damage. This suggests that policy makers must develop further regulations and practices legislating the production and promotion of functional foods, especially in China.

Challenges of educating consumers

In this thesis, a number of strands of evidence illustrated the important role of scientific validation in enhancing the credibility of food products (Chapter 2), and therefore, influencing consumers’ preference on products (Chapter 2 and 5). Since science and technology are areas where many consumers lack knowledge, decisions on foods will likely to be highly influenced by trust in institutions that validate products with authentications or labels in the market (Behrens, Barcellos, Frewer, Nunes, & Landgraf, 2009). The result in Chapter 4 and 5 showed that while consumers demand a high level professional authentication or science evidence when selecting products, they normally have low recognition of the relevant labels and limited ability to identify professionalism. When promoting scientifically-proven functional food products in China, vendors should think about meaningful ways to introduce the scientific
background of the product to consumers, for example, resorting to well-reputed media platforms (e.g. TV programme, public account in WeChat or Webo).

The results from this thesis have provided food manufacturers and marketers better knowledge on the market opportunities in China and strategic guidance for effectively designing and marketing functional foods helping the immune system recover from the impact of air pollution in China.

6.2.2 Contributions to academic community

Regarding the contribution to the literature, to the author’s best knowledge, this research is the first to investigate Chinese consumers’ perceptions of immune-boosting foods and how those perceptions influence consumers’ food choices to help their immune system recover from persistent polluted air. Thus, this thesis makes a novel academic contribution by presenting a useful extension to the available consumer behaviour literature for food and beverage products. While it has previously been reported that Western consumers have a positive attitude towards immune-boosting foods (Bruhn et al., 2002; Colson & Huffman, 2011; Dickinson et al., 2014; O’Dea, 2003), this thesis is the first to report that this positive attitude is also shared by Chinese consumers (Chapter 4). This thesis also the first attempt to apply CID workshops with Chinese consumers in a non-Western, cultural setting to uncover the ideal attributes of functional food products to mitigate pollution-driven health impacts (Chapter 5). With regard to methodology, this thesis has demonstrated the value of using qualitative approaches (Netnography, Interviews, Focus groups, CID workshops) to support consumer-oriented new product development targeting a non-Western market. In the future, these approaches could be used in other consumer applications to investigate consumers’ perceptions of novel food products.

6.3 Limitations and future research

Participants in this thesis were selected based on a self-reporting criteria of having a relatively strong interests in food and concerns about air pollution. According to the Chinese Economic Map (National Bureau of Statistics of China, 2011), Chinese provinces can be grouped into the East (Beijing, Tianjing, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan), the Middle (Shanxi, Anhui, Jiangxi, Henan, Hubei and Hunan), the West (Inter Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shanxi, Gansu, Qinghai, Ningxia and Xinjiang) and the Northeast (Liaoning, Jilin and Heilongjiang). Due to differences in the rate of socioeconomic change, consumers in various regions differ in income, values, lifestyles, and extent of contact with the outside world. These differences in turn affect people's
purchase behaviour (Cui & Liu, 2000). After analysing participants (network users) who posted comments about air pollution and food remedies in Chapter 3, most of these media-active participants were living in the East, which is the most economically developed area in China, and people in these areas generally have a relatively good socioeconomic background. Given the nature of this thesis, it is important to consider urban centres for such research, as consumers in these cities are more highly educated, have higher incomes, are more likely to have been exposed to Western concepts, brands etc., and are more open to trying novel foods from overseas countries (Sun & Collins, 2004; Wang, Steur, et al., 2015). Therefore, for the research described in Chapters 4 and 5 participants were chosen who had a middle-upper income and were living in Shanghai or Suzhou, which are two of the most developed cities in China.

Given the size of China, cultural and linguistic differences and the geographical spread of the Chinese market, means that even consumers in developed cities in the East may differ from each other in terms of perceptions about functional foods and air pollution. Further research is recommended to collect data from metropolis in different regions of the East, such as Beijing, Guangzhou and Shenzhen to allow regional comparability with the results obtained by this study.

Two age groups, the young group (aged 25 to 40) and the senior group (aged 41-56), were specified when recruiting participants for the research described in Chapters 4 and 5. While some conclusions can be drawn about different perceptions owing to age, such as older people appeared to pay greater attention to their immune health compared to the younger group. Further research could further explore whether consumers in different age groups have different acceptance levels for function foods. In addition, this thesis confirmed that children are considered to be the most vulnerable group to the health risks posed by air pollution. Future studies could also investigate whether Chinese consumers with different household structures (e.g. couples having young children versus couples without children) differ in their perceptions of air pollution and health consciousness.

While the qualitative nature of this thesis allows for an in depth understanding of consumers’ perceptions, future studies should include quantitative methodologies, such as surveys, providing more generalisable data from a larger sample size, for example, using questionnaires to investigate consumers’ preferences of and willingness to pay for products with specific attributes.
Additionally, future studies could apply sensory experiments to support new product development. For instance, researchers can investigate how sensory perceptions of the designs (including taste, packaging, texture and price) impact on the willingness to try and purchase new products.

6.4 Conclusions

The overall aim of this thesis research was to investigate Chinese consumers’ perceptions of functional foods designed to help the immune system recover from the impact of air pollution. A combination of consumer research techniques was used to explore consumers’ concerns of air pollution, acceptance of functional food, understanding of immune health and preference of potential products. There is a strong potential for the increased use of functional foods to help combat the effects of air pollution in China. Immune health and respiratory health could both serve as a useful bridge to help marketers make connections between functional food products and air pollution in the minds of consumers. Specifically, pre-packed products, especially conventional-format functional foods that are convenient to eat are desirable. Insights gained in this thesis reveal opportunities to market functional products to seniors or children. Further, functional food and beverages are most desirable from developed countries with good food regulation systems and a clean environment. New Product Innovators should develop functional products based on a good understanding of the unique perceptions of Chinese consumers, such as their interest in TCM, the desire for scientific validation and their different expectations about product formats. This thesis will support the commercial success of functional food products helping with immune health for people facing persistent air pollution, contributing to both industry product development and the academic literature.
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Appendix
Appendix I – Coding schema utilised in Chapter 3

Table. The coding schema utilised in the current study.

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<th>Discussion</th>
<th>Comments</th>
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Appendix II – Coding schema utilised in Chapter 4

Table. The coding schema utilised in the current study.

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12 Total number of times mentioned across all sessions.
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Appendix III – Moderator guide utilised in Chapter 4

UNDERSTANDING CHINESE CONSUMERS WITH IMMUNE HEALTH ISSUES

MODERATOR GUIDE

This is a guide only, due to the semi-structured nature of the interviews, questions may be adjusted during the interview period to attain all possible data and to best fit the interviewee.

(Before each session, for each respondent, please identify the basic demographic information: age, gender, etc.)

Thank you for participating in this interview. Please read the information sheet, if you have any questions feel free to ask. As part of my research, I am investigating Chinese consumers’ understanding of the use of functional foods to build immune defence against air pollution or influenza. I am interested in your thoughts and feelings about immune-related functional foods and the role that such foods may play in your life. I am genuinely interested in your thoughts, feelings, attitudes and behaviours – there are no right or wrong answers, just your own opinions.

Introduction

We are interested in your experiences with illnesses and how it is affected by the foods you eat and the environment you live in. We want to hear about how you protect yourself and your family from these illnesses and especially your thoughts and feelings about foods and supplements which help to improve protection from these illnesses. There are no right or wrong answers – your perceptions and opinions are all equally valid, and very important in helping us to further understand Chinese consumers.

Participant background

1. Tell me a little bit about yourself. Your family? Your hobbies? What kind of work do you do?
2. How busy is your lifestyle?
3. What does “health” mean to you? What would you like to do to improve health (medicine, diet, exercise, sleep etc.)?

Personal experience with immune health issues

4. What are your health concerns? What do you do to protect yourself from these? Probe colds and flu (also probe for SARs/Bird flu-type)? Probe understanding of phrase immune system (have you heard of the phrase your immune system --- what does it mean for you)?
5. Tell me about your own experiences with any of these health issues / your immune system. Has this been a long time problem? Is it seasonal? Do you know when you are at greatest risk?
6. Tell me about things you have tried so far to improve things? Probe Have you taken anything?

Lifestyle changes
7. Have you visited a doctor? Probe: If so, were they traditional or western or both? Do you see them before you become ill or once you get symptoms?

8. Tell me what advice the doctor gave to you. Probe: how easy hard, did they make any changes, how long for?

9. What things do you think improve or worsen your risk of becoming sick? Probe: situations, stress, sleep, environment (pollution and air quality in particular), smoking, foods etc.

10. How concerned are you with this type of health issue? (probe self-efficacy vs hopelessness)

**Personal dietary practice and lifestyle**

11. Do you think there is a link between your daily diet and lifestyle (choices and necessary due to commitments) and your natural protection from illness? Probe: If yes, in what ways? To what extent do you think there is a link between food you eat and your immune health issue?

12. In terms of food/diet/lifestyle, have you ever made any changes because of reasons related to immunity? Probe: If yes, what, how and what’s the outcome? How long maintained?

13. In terms of food/diet/lifestyle, what do you think is practical for you to help to improve your immunity? Probe: Why?

14. For long term benefits, are you taking any actions to protect support your immune system and protect yourself from colds and flu? Probe: Details? Why? How? Effects?

15. Are you going to take any further actions for your immune system? Probe: Details? Why? How?

16. Tell me what you have found to be the most helpful for you so far? Probe: Family/friend support, lifestyle change, medication etc.

**Actions took at different stages of catching a cold**

17. What do you do when you could feel some initial symptoms of catching a cold, such as a sore throat and a headache. Probe: Have you tried any food-related products? Why?

18. When do you perceive you are in the peak of the cold? What will you do then?

19. When you are in the recovery stage of the cold, what do you do to support the recovery or maintain a good immunity? Probe: Why?

**Attitude towards functional foods**

20. Explain fortified/functional concept. What do you think about fortified food and supplements in general? Probe: Have you tried any of such products? Why? How did you find about such products?

21. How open are you towards new food with health claims that will help your immunity? Probe: who would you trust to certify such claims? Country of origin?

22. Do you prefer herbal/natural/technological? Explain if necessary. Probe: Do you or don’t you mind? Do you believe it? Why? Why not?
23. Have you tried any fortified/functional food in order to improve immunity/protect from colds and flu? **Probe:** more explanation for why/not

24. What kinds of benefit (in general) for immunity do you think fortified/functional food may provide? **Probe:** why are these important?

25. Are you willing to try new products which claim to be beneficial to immunity/protection from colds and flu? **Probe:** What kind of specific benefits of fortified food/supplements may be of interest to you?

26. What kind of information would you want in order to be sure that the food is beneficial to your immunity? (e.g., scientific report, clinical proof, word of mouth, recommendations from experts, etc)

27. In what ways would you be persuaded to try new foods with immunity claims (e.g., “clinical proven” statement on package, celebrity endorsement, word-of-mouth from others, recommendations from doctors and experts, advertisements and social media, etc.).

28. What are your types of products you prefer e.g. a supplement, or a conventional-format functional food? **Probe:** why?

29. What would be easy for you to consume with your daily eatery? In what form? **Probe:** What are the preferable types of products, and preferable ways to intake such food or supplements?

30. Do you have any concerns about fortified food/supplements? **Probe:** What concerns? Why?

31. How much more would you be willing to pay for fortified/functional food products which claim to be beneficial to immunity/protection from colds and flu? **Probe:** if they aren’t and if they are, why they are

**NZ Perception**

32. How much do you know about NZ foods, and what do you think about foods from NZ?

33. Where do you get information regarding NZ food? What types of information source would be trustworthy for you?

34. For fortified foods or supplements from NZ based on scientific research which are beneficial to your immunity/protection from colds and flu, how much are they appealing to you? **Probe:** what types/formats of foods or supplements from NZ would you be interested in?

**Closing**

35. Do you have any other relevant comments or opinions that you haven’t mentioned yet?

*Thank you again for participating in this project.*

*-End of Interview-*
Appendix IV – Selection criteria utilised in Chapter 4

In pre-screening, the two questions, showed as below, were answered to identify participants’ perceptions of having immune health issues:

1. *How many times do you catch cold/flu each year?* Only people who answered 6 or more times per year were recruited for the study.

2. *What do you do when you are unwell and how many times do you do the following actions (a,b,c)?* 
   a. Do nothing and completely rely on one’s immune system to overcome; 
   b. Self-treat with Western Medicine/TCM/Fortified Food/Supplements; 
   c. Go to a doctor. Only the ones whose answer indicated b+c was four times or above were included in the study.

Two line scales were utilised to evaluate people’s interest in food (Table 4-3) and health (Table 4-4). Only people whose overall score were more than 20 for Table 4-3 and who chose 6 or above for Table 4-4 were eligible for the study.

**Table 4-3.** Line scale for evaluating people’s interests in food.

<table>
<thead>
<tr>
<th></th>
<th>Disagree strongly</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am always among the first to notice and try new food products.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I constantly follow websites, blogs and WeChat public accounts etc. for food info.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am willing to spend more time (20% and above) than my peers on food searching, preparing, shopping…</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am willing to spend more money (20% and above) than my peers on food products.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am open to a great variety of food.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4-4.** Line scale for evaluating people’s interest in health.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree moderately</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree moderately</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I consider myself very health conscious.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>I think it is important to know well how to eat healthy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I often dwell on my health.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix V – Consent form/information sheet/confidentiality agreement in Chapter 4

[Reference Number 17/123]
[31 August 2017]

UNDERSTANDING CHINESE CONSUMERS WITH IMMUNE HEALTH ISSUES: THE POTENTIAL OF NEW ZEALAND FORTIFIED FOOD PRODUCTS AND SUPPLEMENTS IN CHINA

CONSENT FORM FOR FOCUS GROUP PARTICIPANTS

- I have read the Participant Information Sheet about the study. I understand the purpose of the research. I have had the opportunity to ask questions and have them answered to my satisfaction. I agree to participate in the focus group discussion for the above study.

- I understand that the focus group discussion will take about around one and a half hours, and that my personal details will not be discussed with anyone outside of the consumer insights group.

- I understand that the focus group discussion will be video- and audio-recorded.

- I understanding that my details will remain confidential and that my personal identity will not be revealed in any future report or publication based on the research. I undertake to avoid mentioning any issues discussed outside the Focus Group.

- (Please cross out one of the following) I DO / DO NOT give permission to the potential use of my image for presentations of this research work or reporting purposes

- I understand that I can withdraw from the project at any time before the study findings have been written up and published without giving a reason but that I cannot withdraw my data as it cannot be separated from everyone else’s.
• I understand that the focus group recordings will be transcribed by a person who will be asked to sign a confidentiality agreement and that I will not receive the recordings or the transcripts.

Participant’s Name

Participant’s Signature

Date

(This form will be kept for a period of 6 years)

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph +64 3 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
了解有免疫健康问题的中国消费者：
新西兰强化食品和保健品在中国市场的潜能

焦点小组参与者的知情同意书

• 我已经阅读了关于本项目的给焦点小组参与者的通知，我了解此次研究的目的。我有机会提出问题并且可以得到令我满意的答案。我同意参加此次焦点小组讨论。

• 我了解此次焦点小组讨论所需时间约为 1.5 小时，我的个人资料不会被消费者洞察课题组外任何其他人讨论。

• 我了解此次焦点小组讨论会进行录音和录像。

• 我了解关于我的细节会被保密，并且我的个人身份不会在任何基于本研究项目的报告或出版物中透露。我同意避免在此焦点小组外提及任何相关事宜。

• （请划掉您不想选择的答案）我 同意 / 不同意 给予关于潜在地使用我的图像以及我的家庭的图像的许可，这些图像可能用于本研究项目的展示或报告。

• 我了解我可以在项目项目成果被撰写及发表前的任何时间退出本研究项目而不需要提供理由，但是我的相关数据不能够撤销，因为单个参与者的数据不能独立于其他人。
我了解此次访谈的录音将由专业人士笔录，该专业人士会被要求签署保密协议。但是，我将不会得到相应的录音或者笔录副本。

参与者名字  ____________________________________________

参与者签名  ____________________________________________

日期 ______________

（此表格将被保存六年）

此次研究已经被奥塔哥大学人类伦理委员会批准。如果你有任何关于道德伦理方面的疑虑，你可以随时通过人类伦理委员会的工作人员（电话+643 479 8256 或电邮 gary.witte@otago.ac.nz）与委员会成员取得联系。您提出的任何问题都将被保密地处理和调查，你将被及时告知相应的结果。
UNDERSTANDING CHINESE CONSUMERS WITH IMMUNE HEALTH ISSUES: THE POTENTIAL OF NEW ZEALAND FORTIFIED FOOD PRODUCTS AND SUPPLEMENTS IN CHINA

INFORMATION SHEET FOR FOCUS GROUP PARTICIPANTS

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part, there will be no disadvantage to you and we thank you for considering our request.

What is the Aim of the Project?
Our research is funded by the National Science Challenge High Value Nutrition consumer insights group. We are a group of researchers from the University of Otago, Plant and Food Research Institute, University of Auckland and PwC New Zealand. At the same time, this project is being undertaken as part of the requirements for Lei Cong’s PhD degree.

The aim of this project is to better understand the needs, attitudes, emotions and concerns of Chinese consumers with immune health issues in the area of fortified food products and supplements, especially NZ products.

What Type of Participants are being sought?
Around 6-8 participants have been sought for this focus group that meet the following criteria:

- People of Chinese ethnicity
- People aged between 25-40 or between 41-56
- People who live in Shanghai no less than 3 years
- People who have an individually monthly income at least 12,000RMB
- People who have relatively strong interests in food and immune health
- People (50%) who live with/care for someone having relatively strong interests in food and immune health.

What will Participants be Asked to Do?
If you agree to participate in this research, the interview should take up to 90 minutes. It will be video- and audio-recorded.
What Data or Information will be Collected and What Use will be Made of it?

We assure you that your personal details will not be discussed with anyone else outside of HVN consumer insights group and your circumstances will remain unspecified in any reports resulting from this research. We will ask you to avoid mentioning any issues discussed outside the Focus Group. Participants may withdraw from the project at any time without giving a reason but they cannot withdraw their data as this cannot be separated from everyone else’s. We would like your permission to potentially use your image, during presentations of our work, or for reporting purposes, but we will not use your names. You can indicate your permission on our consent form, but you may still participate in this study if you do not want to give this permission. If you allow us to use your image then potentially someone who knows you may see that you have participated in our research, however, they will not be able to identify information you have personally provided because all of the discussions will be reported as a collective account. Any quotes used to illustrate specific points will be attributed to a pseudonym.

We will not be able to give you the recordings or the transcripts. However, you will be paid 225 yuan to reimburse costs associated with attending the session.

The discussion will be transcribed in to English by a person who will be asked to sign a confidentiality agreement, and the data will be kept stored on a University password protected computer for at least 6 years in our university office, and used to write research papers and articles.

I hope that you will agree to participate. Thank you very much for your time and for making this study possible.

Can Participants Change their Mind and Withdraw from the Project?

You may withdraw from participation in the project at any time before the study findings have been written up and published, and without any disadvantage to yourself of any kind.

What if Participants have any Questions?

If you have any questions about our project, either now or in the future, please feel free to contact either:

Dr Miranda Mirosa or Prof Phil Bremer
Department of Food Science Department of Food Science
University of Otago University of Otago
lei.cong@postgrad.otago.ac.nz phil.bremer@otago.ac.nz

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新西兰强化食品和保健品在中国市场的潜能

给焦点小组参与者的通知

感谢您对本研究项目给予热情。请您在决定是否参加本项目之前仔细阅读以下通知。如果您愿意参加本项目，我们将非常感激。如果您决定不参加本项目，您的决定不会对您有任何不利的影响，我们仍然非常感谢您认真考虑了我们的请求。

此次研究的目的是什么？
我们的研究得到了新西兰国家科学挑战 – 高价值营养项目（消费者洞察子项目）的资助。我们是一支来自新西兰奥塔哥大学、植物食品研究所、奥克兰大学以及普华永道（新西兰）会计事务所的研究团队。同时，本研究项目是博士生丛蕾为取得其博士学位工作量的一部分。

本项目的目的是为了更好的了解有免疫健康问题的中国消费者在强化食品和保健品（尤其是新西兰的相关产品）方面的需求、态度、情绪及关注点。

什么类型的参与者被考虑参与本项目？
每个焦点小组需要约 6-8 名满足以下条件的参与者：

- 中国消费者，
- 年龄分布于25-40岁之间，或41-56岁之间，
- 在上海居住不低于3年，
- 个人月收入不低于1.2万人民币，
- 在食品和免疫健康方面有相对强烈的兴趣，
- （50%受访者）共同居住或照顾在食品和免疫健康方面有相对强烈兴趣的人。

受访者会被要求做什么？
如果您同意参与此次研究，焦点小组讨论将会持续约 90 分钟。整个过程会进行录音和录像。

哪些数据或信息会被收集并做何用途？
我们向您保证，您的个人资料不会被除高价值营养项目消费者洞察子项目的研究人员外的其他任何人讨论，并确保您的个人情况不会在任何由此次研究得出的报告中明示。我们将要求您避免在焦点小组外提及任何相关事宜。参与者可以在任何时间从项目中退出并不提供理由，但是他们不能够撤销相关数据因为单个参与者的数据不能独立于其他人。我们希望得到关于潜在地使用您的图像以及您的家庭的图像的许可，这些图像可能用于我们成果展示或报告中，但是我们不会使用您的名字。您可以在知情同意书上签字以示许可，同时如果您不想给予许可，您仍然可以参加此次研究。如果您允许我们使用您的图像，那么可能会有认识您的人认出您参与了我们的研究。但是，他们将无法识别您个人所提供的信息，因为所有讨论都将作为一个整体进行汇报。用于说明具体观点的任何引用都将使用化名。

我们将不能为您提供相应的录音或笔录副本。但是，您将被支付 225 元以补偿您参加本次讨论相关的花费。

本次讨论的内容将由专业人士笔录并翻译成英文，该专业人士会被要求签署保密协议。本次讨论的数据将会被保存在我们大学的一台有密码保护的计算机上至少 6 年，以用于撰写研究论文和文章。

希望您同意参与。非常感谢你为此花费的时间，您的参与使我们的研究成为可能。

受访者可否改变主意并退出本项目？

您可以项目成果被撰写及发表前的任何时间退出本研究项目，而您的决定不会给您带来任何不利的影响。

受访者如何提出疑问？

如果您对本项目有任何问题，无论是现在或者是将来，请随时联系：

Miranda Mirosa 博士
奥塔哥大学
食品学院
lei.cong@postgrad.otago.ac.nz

Phil Bremer 教授
奥塔哥大学
食品学院
phil.bremer@otago.ac.nz

此次研究已经被奥塔哥大学人类伦理委员会批准。如果你有任何关于道德伦理方面的疑虑，你可以随时通过人类伦理委员会的工作人员（电话 +643 479 8256 或电邮 gary.witte@otago.ac.nz）与委员会成员取得联系。您提出的任何问题都将被保密地处理和调查，你将被及时告知相应的结果。
UNDERSTANDING CHINESE CONSUMERS WITH IMMUNE HEALTH ISSUES: THE POTENTIAL OF NEW ZEALAND FORTIFIED FOOD PRODUCTS AND SUPPLEMENTS IN CHINA

CONSENT FORM FOR INTERVIEW PARTICIPANTS

- I have read the Participant Information Sheet about the study
- I understand the purpose of the research.
- I have had the opportunity to ask questions and have had them answered to my satisfaction.
- I agree to participate in an interview for the above study, conducted as part of the High Value Nutrition project on Immune Function lead by the University of Otago.
- I understand that the interview will take about an hour, and that my personal details will not be discussed with anyone outside of the consumer insights group.
- I understand that the interview will be audio-recorded.
- I understanding that my details will remain confidential and that my personal identity will not be revealed in any future report or publication based on the research.
- (Please cross out one of the following) I DO / DO NOT give permission to the potential use of my image and the image of my home for presentations of this research work or for reporting purposes
- I understand that I can withdraw from the project at any time before the study findings have been written up and published without giving a reason and that I can withdraw my data.
- I understand that the interview recordings will be transcribed by a person who will be asked to sign a confidentiality.

Participant’s Name __________________________________________________________

Participant’s Signature ______________________________________________________

Date __________________

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph +643 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
了解有免疫健康问题的中国消费者：
新西兰强化食品和保健品在中国市场的潜能

访谈受访者的知情同意书

- 我已经阅读了关于本项目的访谈受访者的通知。
- 我了解此次研究的目的。
- 我有机会提出问题并且可以得到令我满意的答案。
- 我同意参与此次访谈，该访谈是高价值营养项目关于免疫防御方向的一部分，由奥塔哥大学主持。
- 我了解此次访谈所需时间约为一小时，我的个人资料不会被消费者洞察课题组外任何其他人讨论。
- 我了解此次访谈会进行录音。
- 我了解关于我的细节会被保密，并且我的个人身份不会在任何基于本研究项目的报告或出版物中透露。
- (请划掉您不想选择的答案) 我同意 / 不同意给予关于潜在地使用我的图像以及我的家庭的图像的许可，这些图像可能用于本研究项目的展示或报告。
- 我了解我可以在项目成果被撰写及发表前的任何时间退出本研究项目而不需要提供理由，并且我可以撤消我的数据。
- 我了解此次访谈的录音将由专业人士笔录，该专业人士会被要求签署保密协议。

受访者姓名 ____________________________________________

受访者签名 ____________________________________________

日期 ________________

此次研究已经被奥塔哥大学人类伦理委员会批准。如果你有任何关于道德伦理方面的疑虑，你可以随时通过人类伦理委员会的工作人员（电话 +643 479 8256 或电邮 gary.witte@otago.ac.nz）与委员会成员取得联系。您提出的问题都将被保密地处理和调查，你将被及时告知相应的结果。
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What is the Aim of the Project?
Our research is funded by the National Science Challenge High Value Nutrition (consumer insights group). We are a group of researchers from the University of Otago, Plant and Food Research Institute, University of Auckland and PwC New Zealand. At the same time, this project is being undertaken as part of the requirements for Lei Cong’s PhD degree.

The aim of this project is to better understand the needs, attitudes, emotions and concerns of Chinese consumers with immune health issues in the area of fortified food products and supplements, especially NZ products.

What Type of Participants are being sought?
A total of 12 participants are being sought for this study that meet the following criteria:

- People of Chinese ethnicity
- People aged between 25-40 or between 41-56
- People who live in Shanghai no less than 3 years
- People who have an individually monthly income at least 12,000RMB
- People who have relatively strong interests in food and immune health
- People (50%) who live with/care for someone having relatively strong interests in food and immune health.

What will Participants be Asked to Do?
If you agree to participate in this research, the interview should take about an hour. It will be audio-recorded, and will take place at your home.
What Data or Information will be Collected and What Use will be Made of it?

We assure you that your personal details will not be discussed with anyone outside of HVN consumer insights group and your circumstances will remain unspecified in any reports resulting from this research. We would like your permission to potentially use your image, and the image of your home, during presentations of our work, or for reporting purposes, but we will not use your names. You can indicate your permission on our consent form, but you may still participate in this study if you do not want to give this permission. If you allow us to use your image then potentially someone who knows you may see that you have participated in our research, however, they will not be able to identify information you have personally provided because all of the interviews will be reported as a collective account. Any quotes used to illustrate specific points will be attributed to a pseudonym. You will be paid 225 yuan to reimburse costs associated with attending the session.

The discussion will be transcribed in to English by a person who will be asked to sign a confidentiality agreement, and the data will be kept stored on a University password protected computer for at least 6 years in a university office, and used to write research papers and articles.

I hope that you will agree to participate. Thank you very much for your time and for making this study possible.

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If you have any questions about our project, either now or in the future, please feel free to contact either:

Dr Miranda Mirosa  
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This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph +643 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
了解有免疫健康问题的中国消费者：
新西兰强化食品和保健品在中国市场的潜能

给访谈受访者的通知

感谢您对本研究项目给予热情。请您在决定是否参加本项目之前仔细阅读以下通知。如果您愿意参加本项目，我们将非常感激。如果您决定不参加本项目，您的决定不会对您有任何不利的影响，我们仍然非常感谢您认真考虑了我们的请求。

此次研究的目的是什么？

我们的研究得到了新西兰国家科学挑战 – 高价值营养项目（消费者洞察子项目）的资助。我们是一支来自新西兰奥塔哥大学、植物食品研究所、奥克兰大学以及普华永道（新西兰）会计事务所的研究团队。同时，本研究项目是博士生丛蕾为取得其博士学位工作量的一部分。

本项目的目标是为了更好的了解有免疫健康问题的中国消费者在强化食品和保健品（尤其是新西兰的相关产品）方面的需求、态度、情绪及关注点。

什么类型的受访者被考虑参与本项目？

本项目一共需要 12 名满足以下条件的受访者：

- 中国消费者，
- 年龄分布于25-40岁之间，或41-56岁之间，
- 在上海居住不低于3年，
- 个人月收入不低于1.2万人民币，
- 在食品和免疫健康方面有相对强烈的兴趣，
- （50%受访者）共同居住或照顾在食品和免疫健康方面有相对强烈兴趣的人。

受访者会被要求做什么？

如果您同意参与此次研究，面试将会持续约一小时。整个过程会进行录音，并且面试会在您的家中举行。

哪些数据或信息会被收集并做何用途？
我们向您保证，您的个人资料不会被除高价值营养项目消费者洞察子项目的研究人员外的其他任何人讨论，并确保您的个人信息不会在任何由此次研究得出的报告中明示。我们希望得到关于潜在地使用您的图像以及您的家庭的图像的许可，这些图像可能用于我们成果展示或报告中，但是我们不会使用您的名字。您可以在知情同意书上签字以示许可，同时如果您不想给予许可，您仍然可以参加此次研究。如果您允许我们使用您的图像，那么可能会有认识您的人认出您参与了我们的研究。但是，他们将无法识别您个人信息所提供的信息，因为所有访谈都将作为一个整体进行汇报。用于说明具体观点的任何引用将使用化名。您将被支付 225 元以补偿您参加会议相关的花费。

本次访谈的内容将由专业人士笔录并翻译成英文，该专业人士会被要求签署保密协议。本次访谈的数据将会被保存在我在大学的一台有密码保护的计算机上至少 6 年，以用于撰写研究论文和文章。

希望您同意参与。非常感谢您为此花费的时间，您的参与使我们的研究成为可能。

受访者可否改变主意并退出本项目？

您可以在项目成果被撰写及发表前的任何时间退出本研究项目，而您的决定不会给您带来任何不利的影响。

受访者如何提出疑问？

如果您对本项目有任何问题，无论是现在或者是将来，请随时联系：

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此次研究已经被奥塔哥大学人类伦理委员会批准。如果你有任何关于道德伦理方面的疑虑，你可以随时通过人类伦理委员会的工作人员（电话+643 479 8256 或 电邮gary.witte@otago.ac.nz）与委员会成员取得联系。您提出的问题都将被保密地处理和调查，你将被及时告知相应的结果。
UNDERSTANDING CHINESE CONSUMERS WITH IMMUNE HEALTH ISSUES: THE POTENTIAL OF NEW ZEALAND FORTIFIED FOOD PRODUCTS AND SUPPLEMENTS IN CHINA

TRANSCRIBER CONFIDENTIALITY AGREEMENT

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Transcriber:

I, _________________________________________________, the Transcriber, agree to:

1. Keep all the research information shared with me confidential by not discussing or sharing the research information in any form of format (e.g., digital recordings, transcripts) with anyone other than the Researchers.

2. Keep all research information in any form or format (e.g., digital recordings, transcripts) secure while it is in my possession.

3. Return all research information in any form or format (e.g., digital recordings, transcripts) to the Researcher when I have completed the research tasks.

4. After consulting with the Researchers, erase or destroy all research information in any form or format regarding this research project that is not returnable to the Researcher (e.g., information stored on computer hard drive).

Transcriber

_________________________________________________  _________________________  ______
(Print name)                                  (Signature)                                         (Date)

APPROVED BY THE UNIVERSITY OF OTAGO HUMAN PARTICIPANTS ETHICS COMMITTEE ON 31 AUGUST 2017 FOR THREE YEARS REFERENCE NUMBER 17/123.
了解有免疫健康问题的中国消费者：新西兰强化食品和保健品在中国市场的潜能

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笔录人保密协议

我是笔录人 __________________________________________，我同意：

1. 为所有我接触到的研究内容保密，包括对任何形式的研究内容（例如数字录音、笔录文字等）不与研究人员以外的任何人进行讨论或共享。

2. 保证所有我接触到的包括所有形式或格式（例如数字录音、笔录文字等）的研究内容在我保存的时候都是安全的。

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4. 在与研究人员协商后，将所有形式或格式的与本项目相关的、不可返还给研究人员的研究内容擦除或销毁（例如，存储在计算机硬盘驱动器上的内容）。

笔录人

_________________________ ________________ __________________
（印刷体书写的姓名） （签名） （日期）

于 2017 年 8 月 31 日被奥塔哥大学人类伦理委员会批准，为期三年的档案编号为 17/123。
UNDERSTANDING CHINESE CONSUMERS WITH IMMUNE HEALTH ISSUES: THE POTENTIAL OF NEW ZEALAND FORTIFIED FOOD PRODUCTS AND SUPPLEMENTS IN CHINA

TRANSLATOR CONFIDENTIALITY AGREEMENT

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Translator:
I, _________________________________________________, the Translator, agree to:

1. Keep all the research information shared with me confidential by not discussing or sharing the research information in any form of format (e.g., digital recordings, transcripts) with anyone other than the Researchers. I understand that this information is confidential and must not be shared.

Translator

__________________________         __________________
(Print name)                                  (Signature)                                         (Date)

APPROVED BY THE UNIVERSITY OF OTAGO HUMAN PARTICIPANTS ETHICS COMMITTEE ON 31 AUGUST 2017 FOR THREE YEARS REFERENCE NUMBER 17/123.
Appendix VI – Moderator guide utilised in Chapter 5

GUIDE FOR CONSUMER IDEALISED DESIGN WORKSHOP MODERATOR

Exploring desirable attributes of functional food products designed to help the immune system recover from the impact of air pollution

Participants: 4 CID workshops in total / 10 participants per workshop;
- People of Chinese ethnicity;
- People aged between 25-40 or between 41-56;
- People who live in Suzhou no less than 3 years;
- People who have a household income more than 1,5000RMB;
- People are concerned about their immunities and report that they frequently suffer from the adverse impact of air pollution;
- 50% of participants of each workshop should live with/care for families with the same situation.

Moderator (facilitator): Lei Cong

I. Introduction and background (10mins)

Welcome, my name is Lei Cong, I am Chinese, from Yantai, I am currently study for PhD degree from the Department of Food Science at the University of Otago, which is in the city of Dunedin. A city which is almost at the south most end of New Zealand. I am pleased you could all join me here today for this focus group. As part of my research, I am exploring desirable attributes of any products Chinese consumers may purchase to help their immunities recover from the impacts of air pollution.
大家好，我叫丛蕾。我来自中国，我的家乡是山东烟台。现在我在新西兰奥塔哥大学的食品科学系攻读博士学位。我现在生活的城市叫做达尼丁，是几乎位于新西兰的最南端的一座城市。非常高兴大家都能来参加今天的消费者理想设计座谈会。作为我研究的一部分，今天我想要探索中国消费者可能购买的以帮助其免疫力从空气污染的影响中恢复的功能性食品的理想属性。

The workshop should not take any longer than 3 hours to complete and at the end you will receive some compensation to reimburse your costs associated with attending this session. You can stop participating in the workshop at any time or choose not to answer any of the questions if you feel uncomfortable. Our conversation’s will be audio recorded and all information will be kept anonymous. There is no right or wrong answer so please feel free so share with us all you want to say. If you have a cell phone, I would appreciate it if you turn it off or change it to silent mode. There are refreshments on the table please help yourselves to that whenever you like at any time during the morning / afternoon / evening.

整个讨论过程不会超过3个小时，并且在结束时大家会收到一定金额的报酬以补偿您参加本次讨论相关的花费。在座谈会进行的过程中，您可以在任何时间退出讨论或者选择不回答任何您觉得不合适的问题。整个讨论会被录音和录像，但是所有相关信息都会做匿名处理。所有问题的回答都没有正确与否之分，您只要与我分享您的想法即可。如果您有手机，希望您能关机或者调成静音模式。我们为您提供了茶点，请您在需要时随意取用。

Please read the information sheet in front of you, if you have any questions feel free to ask. Once you have read the information sheet and are comfortable in taking part in this workshop please sign the consent form and we will start.

请仔细阅读在您面前的给座谈会参与者的通知。如果您有任何问题，请随时提问。在您阅读了通知之后，若您同意参加本次座谈会，请在知情同意书上签字，然后我们就可以开始了。

(After participants read and sign, Moderator collects sheets.)

Are there any questions before we begin? Ok. Let’s begin by going around the room and introducing ourselves. Information may include our family members and who the person is that you are mainly concern about who is suffering from the exposure to persistent air pollution. I will start firstly. I am Lei. I have married and have a three-year old daughter. I am concerned about her the most under severe air pollution.

在我们开始之前，大家有什么问题吗？好的，那么让我们从自我介绍开始。大家轮流简单介绍一下自己。大家可以分享一下你的名字，家庭成员以及在空气污染的情况下，谁是你最担心的人。先从我开始，我叫丛蕾，我已经结婚了并且有一个三岁的女儿，我最担心我女儿受到空气污染的伤害。

(After participants self-introduce.)

Now that we know each other. Let’s just get right to the tasks at hand. From now on I am not going to go around the table looking for answer, rather anyone can answer when they want.现在我们互相认识了。让我们切入正题。大家不必拘泥于座次，只要你想回答，任何人都可以直接回答。
II. Personal experience with health issues caused by air pollution (20mins)

二、由空气污染引起的健康问题的个人经历（20 分钟）

(Find existing products which participants are familiar with through sharing their experiences)
（通过参与者分享个人经历找到他们熟悉的产品）

1. Do you think air pollution can have adverse impact on human health?
   你认为空气污染会对人体健康造成什么影响？

(Start a journey to deal with health issues caused by air pollution)
（还原参与者出现由空气污染造成的健康问题后的经历）

2. Have you have had any personal experiences with health issues caused by air pollution?
   你有过因为空气污染造成了健康问题的个人经历吗？

3. How did you deal with the issue? Probe: e.g. see a doctor (western or traditional) or did they buy any products to relieve the symptoms.
   你是怎样处理的呢？比如说：看医生了吗？中医还是西医？如果没有看医生，有买什么产品来缓解症状吗？

4. Other than prescription drugs, have you purchased any other products to help you recover?
   除了处方药之外，你有没有买其他的产品来帮助你恢复呢？如果有，是食品相关的产品吗？效果怎么样呢？

   Probe: If yes, were they food-related products? What was the outcome?
   如果有，是食品相关的产品吗？效果怎么样？

5. Do you think your immune immunity is helpful in protecting you against the adverse impacts of air pollution? Probe: If yes, how? If no, why not?
   你认为你的免疫力对保护你抵抗空气污染的负面影响有没有帮助？如果有，是怎么保护的呢？如果没有，为什么呢？

6. Do you think there is a link between the food you eat and your immunity? Probe: If yes, to what extent? Why? If no, why not?
   你觉得你吃的食物和你的免疫力之间有没有联系呢？如果有，你觉的联系大吗？为什么呢？如果没有，为什么没有联系？

7. In terms of food/diet/lifestyle, have you ever made any changes in these because for immunity related reasons? Probe: If yes, how and what’s the outcome? If not, why not?
   在食品/饮食/生活习惯方面，你有没有过因为免疫免疫力相关的原因做过任何的改变或尝试？如果有，效果怎么样？如果没有，你觉得为什么没有呢？

(Summarize products participants have used to combat air pollution, especially food-related products)
（总结参与者通常用来对抗空气污染的产品，尤其是食品相关的产品）

III. Brainstorming to prepare the list of specific attributes for the idea product (30mins)

三、准备理想产品属性清单的头脑风暴（30 分钟）

Thank you for sharing your experiences. Now we have got a rough idea what kinds of food-related products you are familiar with. Next I would like to show you some products available in the market, which are relevant with our topic today. (Display products)
感谢大家分享的经历。现在我们已经对大家熟悉的产品有了一个大致的了解。接下来我想向大家展示一些跟今天的题目相关的，现在在市场上存在的产品。（摆放商品）

(Moderator simply explain products from NZ, such as product forms, where to buy and whether they are available in China market or not.)
（主持人简单解释一下新西兰的几件产品，包括产品形式、购买地以及是否在中国市场流通等。）

Next I would like ask you to select one product which you are most likely to purchase to help your immunity recover from the adverse impact of air pollution. Which one you want to choose? Please write down the product in the paper in front of you.

接下来我想请大家在这些展示的商品中做一个选择。选择一件你最有可能购买的来帮助你的免疫力从空气污染的负面影响中恢复的产品。大家会选哪一件呢？请把你的答案写在面前的白纸上。

(Take 30 seconds for participants to write down)
（30 秒时间来写答案）

Could you please show me your choices? Ok, let’s see which one is the most popular. It’s product A… Could someone choosing A tell us the reason why you prefer A? What is the most important attribute for you to make the decision?

请大家把答案举在面前展示一下可以吗？好的，让我们来找到最受欢迎的商品是哪个。是 A。。。能不能请选择 A 的参与者解释一下，为什么选 A 呢？哪个商品属性对于你的选择而言是最重要的呢？

先给大家简单介绍一下什么是产品属性？商品属性就是产品所有性质和方面的集合。举个例子，汤臣倍健的蛋白粉。它的属性就包括功能、名称、原材料、健康声称..等等，所有的与产品相关的性质。

(Moderator simply explain what is product attribute. Based on the timeline, moderator decides 1-3 products to discuss. Around 20mins)
（根据时间，主持人选择 1-3 个商品来讨论。大约 20 分钟）

Ok, well done everyone. Now we have been familiar with existing products available in the market. Please imagine all of these products were destroyed overnight, and you have the opportunity to create something totally new in this area. You don’t need to be concerned with the feasibility of the designs you create, only with the features or attributes you would desire in the ideal product to help your immunities recover from the adverse impact of air pollution.

好的，非常好。现在大家应当已经对现存的产品有了一个大致的了解。现在请想象所有的产品都毁于一旦，所有在这里展示的产品以及在刚开始的讨论中大家分享的你熟悉的全部毁于一旦。现在大家有机会在这个领域创造新的产品。大家不需要担心你的设计的可行性。只需要将产品的特色和属性展现出来。最终的目的是设计出能保住你的免疫力能空气污染的负面影响中恢复的产品。

Let’s start by writing down your initial idea of the basic attributes which your ideal products should have. (Distribute the List)

Please look at the list in front of you. (Moderator simply explain each attribute.) You can simply write down your preferences and after this you will have opportunities to discuss with others. This is just a note for your further discussion. Please don’t worry if you don’t have any
clear ideas or struggling with specific attributes. Now you have 10 mins to write something down.

现在正在给大家分发的是大家将要设计的这种理想产品应该具有的基本属性的列表。首先请大家根据这张列表所示的这些基本属性，简单写一下你的最初设想。这个只是一个简单的记录，是为了接下来的小组讨论所准备的。大家将会有足够的时间来讨论和修改自己的方案，所以大家不需要纠结书写是否规范。如果暂时没有清晰的想法也无关紧要。现在大家有 10 分钟的时间来写一下，10 分钟过后，我们分小组来设计产品。

IV. Design the product (30mins)

四、设计产品 (30 分钟)

Ok, now we have got a basic list of attributes that the ideal product should have. Now I will ask you to separate into groups to design it. Remember YOU are the TARGET market for the product you are designing, try to design a product that you would be willing to purchase and be interested in if it actually got made. Work as a team and discuss your ideas, remember that we are just looking for your ideas, there are no right or wrong answers. There are sheets of A3 paper and coloured pens for you to use. Take your time with this and once you have some ideas, please do a rough drawing and outline the attributes. If you have any questions I will be going around to help.

好的，现在我们已经有了理想产品应该具有的基本属性的列表。现在请大家分成三组来设计这个产品。请记住你就是你所设计的产品的目标人群，因此请设计一款如果出现在市面上你就购买的或者感兴趣的产品。大家以团队为单位来设计并讨论你的想法。请记住这个座谈会的目的是为了了解大家的想法，没有所谓的正确的或错误的答案。桌上有 A3 纸和彩色笔供大家使用。大家慢慢来，不要着急。一旦各小组确定了想法，请将它画下来或者写下来。如果大家有任何问题，我会四处走动来帮助大家。

Once all the groups have finished, I will ask the group to present their ideas to the rest of the group. This is just a casual explanation of what your product is and the specific attributes. Remember you can stop participating in the workshop at any time or choose not to present if you feel uncomfortable. I will ask everyone to discuss each groups idea and if they have any suggestions. This is a casual group discussion to help with the design process, we are working together to help identify some possible products so any input is helpful.

在各组的设计都结束之后，我会请各组来介绍各自的设计。这个介绍是只是一个简单的展示，比如说你的产品是什么，它的属性都是什么。随后，我会请大家一起来讨论各组的设计，并请大家提供意见。用这种形式使大家共同参与到各组的设计中，来共同设计产品。

Once we have discussed each groups ideas, I will ask you to go back and taking into consideration any input from the other groups refine your designs. You are welcome to keep it the same, change your idea completely, or just change specific attributes.

在各组的设计都被讨论过之后，我会请大家再次分成两组。各小组思考刚才所得到的意见来完善各自的设计。大家可以保持设计不变、或者彻底改变它、或者只是修改其中的某些属性。

If you would like to go the toilet or grab some refreshments during this time, please feel free to do so.

如果您需要使用洗手间或者用一些茶点，请随意。
(Groups will do this task at the kitchen, they will be given a maximum of 30mins to complete the first step. Moderator will go around and answer any questions the groups have.)
（各组开始设计。此阶段 30 分钟。主持人四处走动并解答问题。）

V. Presentations of each design (40min)

五、介绍产品设计 (40 分钟)

Great work! Could the first group please come up and outline your design?
非常好！请第一组介绍一下你们的设计好吗？

1. Does anyone have any questions for the group?
   针对这个设计，大家有什么问题吗？
2. What are some good points about the products?
   大家觉得这个设计里面有哪些特别好的想法？
3. Are there any suggestions about how the products could be improved?
   大家有什么建议可以来完善这个产品的吗？
4. Does anyone agree or disagree with those suggestions?
   大家同意这个建议吗？不同意吗？为什么呢？

(After presenting two groups’ designs, moderator leads a discussion comparing the different designs of the same attributes.)
（三组都介绍完设计后，主持人引导大家来比较同样的属性下不同的设计。并最终试图对同一属性取得一致的观点。）

VI. Refine designs + presentations (40mins)

六、完善设计并陈述 (40 分钟)

Thank you for all of your sharing! That was fantastic. Now that we have achieved some agreement with attributes of …… Could everyone please go back to your groups and if you would like to change or add anything to your design please do so.
感谢大家的分享！大家的设计都非常出色。现在我们已经得到了一些相同的看法。比如说：。。。。现在请大家重新分小组来完善各自的设计。

Thank you for your hard work. Now could the first group explain what you changed and what differences there in your ideal product compared to the first one you presented? How about the second group? Ok, now we got our ideal product(s)! The basic attributes of this product are…..
感谢大家。现在请第一组解释一下你们都进行了哪些修改，修改前后有哪些不同呢？第二组？太好了，现在我们已经得到了理想的产品设计。基本的产品属性是。。。

VII. Conclusive ranking (10min)

七、总结性排序 (10 分钟)

At this stage, I will ask you to write down what you consider are the top three ideas presented today for the final product. Please do this discreetly on the paper provided and do not discuss them with anyone.
最后，我想请大家写下来在今天的这个理想的产品设计中，大家最喜欢的三个想法。请大家不要讨论，写下来最直接的想法。

(Collect the paper with top 3 attribute designs.)
（收集写了三个想法的纸）

Thank you everyone for participating in this group discussion today. If you have anything else you wish to discuss on today’s topic, please feel free to email me anytime you want.

谢谢大家来参加今天的座谈会。关于今天的话题，如果大家有任何其他的想法想与我讨论，可以在任何时间通过邮件联系到我。谢谢。

-End of CID Workshop-
Appendix VII – Attribute list utilised in Chapter 5

A BASIC LIST OF ATTRIBUTES WHICH IDEAL PRODUCTS SHOULD HAVE
理想产品的基本属性

Please imagine all of these products were destroyed overnight, and you have the opportunity to create something totally new in this area. You don’t need to be concerned with the feasibility of the designs you create, only with the features or attributes you would desire in the ideal product to help your immunities recover from the adverse impact of air pollution.
请想象所有这些产品都毁于一旦，现在大家有机会在这个领域创造新的产品。大家不需要担心你的设计的可行性。只需要将产品的特色和属性展现出来，以此设计出能帮助你的免疫力从空气污染的负面影响中恢复的产品。

The list below includes the basic attributes which your ideal product should have. Please follow the list to write down your initial idea of preference.
下面的列表提供了理想产品的一些基本属性。请根据以下列表简单写一下您的初步设想，方便我们接下来的讨论。

1. **Form/type (what is the product)** 类型/形式 (是什么产品？)
   What product form would you prefer in such a product? e.g. a normal food form like soft drink, yoghurt, cracker, etc., or non-food form like tablet, capsule, powder, drop, etc.?
   对于此类产品，你更喜欢什么产品类型？比如：传统产品类型像软饮料、酸奶、饼干等等，或者非传统食品的类型像片剂、胶囊、粉剂、滴剂等等

2. **Ingredients** 原材料

3. **Function / Benefit** 功能/效果
   What kinds of benefit do you think the ideal product should provide? Probe: In what ways do you think the product may benefit the immunity?
   什么类型的功能你希望此类产品能够提供呢？具体来说就是你觉得此类产品能够怎样帮助免疫力从空气污染的负面影响中恢复？

4. **Health claim** 健康声称
   What health claims would you like to see on the product’s packaging? and who would or what agency would you like these claims to be endorsed by?
   你希望在此类产品的包装上看到什么健康声称？你希望这个声称是由什么机构或者什么人出具？

5. **Feature (promote points / Advertisement)** 特色(卖点/广告推广)
   What features do you prefer in health promoting foods?  Probe: e.g., herbal/natural/technological? How much do you believe in such features?
   你希望此类产品是什么样的特色？比如说草本的、天然的、高科技的？

6. **Authentication** 认证
   Are there any groups or agencies that you are aware of that authenticate health claims in immune-related food products?
你知道有什么样的认证机构会认证与免疫相关的产品吗？对你来说，这个（些）机构有可信度吗？

7. **Packaging (Material, Colour, Weight, Size, Shape)** 包装（包装材料、颜色、重量、尺寸、形状）

8. **Suggested use (how to consume it)** 食用方法

9. **Regimen (how often to consume it)** 使用方式 / 频率
   How frequently would you like to use such a product? Probe: e.g. daily/regular intake as maintaining a good immunity or whenever air pollution occurs?
   你希望使用此类产品的使用频率是怎样的呢？比如说每天吃或者定期吃来维持一个好的免疫力呢？还是当空气污染来的时候再吃？

10. **Price** 价格

11. **Flavour** 风味

12. **Shelf life** 保质期

13. **Storage method** 储存方式

14. **Country of origin** 原产国

15. **Availability (where to buy)** 可获得性（在哪里购买）
   Where do you think such products should be sold?
   你觉得此类产品应该在哪里售卖？比如说超市、药店、网络？

16. **Product name** 产品名称
Appendix VIII – Display products utilised in Chapter 5

Note: real products were displayed in each session of the study.

- Protein powder
  - Health food (blue hat)
  - Claiming to enhance immunity
- Soft drink
  - Claiming to prevent inflammation
- Colostrum chewable tablets for kids
  - Health food (blue hat)
  - Claiming to enhance immunity
- Propolis tablet
  - Health food (blue hat)
  - Claiming to enhance immunity
  - NZ product
- Gummies for kids
  - Health food (blue hat)
  - Claiming to supply nutrients
- Yoghurt
  - Health food (blue hat)
  - Claiming to enhance immunity
  - NZ product
- Yoghurt
  - Health food (blue hat)
  - Claiming to enhance immunity
  - NZ product
- Soft drink
  - Health food (blue hat)
  - Claiming to clear throat
  - NZ product
- Soft drink
  - Health food (blue hat)
  - Claiming to clear throat
  - NZ product
- Lozenges
  - Health food (blue hat)
  - Claiming to clear throat
- Tea
  - Claiming to boost immunity
  - NZ product
<table>
<thead>
<tr>
<th>图片</th>
<th>产品名称</th>
<th>产品说明</th>
</tr>
</thead>
</table>
| ![蛋白粉](image1.png) | 蛋白粉 | 保健食品（蓝帽标识）
| | | 增强免疫力（保健功能声称） |
| ![儿童牛初乳咀嚼片](image2.png) | 儿童牛初乳咀嚼片 | 保健食品（蓝帽标识）
| | | 增强免疫力（保健功能声称） |
| ![儿童软糖](image3.png) | 儿童软糖 | 保健食品（蓝帽标识）
| | | 补充维生素（保健功能声称） |
| ![酸奶](image4.png) | 酸奶 | 保健食品（蓝帽标识）
| | | 增强免疫力（保健功能声称） |
| ![软饮料](image5.png) | 软饮料 | 预防上火（功能声称） |
| ![蜂胶片](image6.png) | 蜂胶片 | 保健食品（蓝帽标识）
| | | 增强免疫力（保健功能声称） |
| ![新西兰原产国儿童软糖](image7.png) | 新西兰原产国儿童软糖 | 保健食品（蓝帽标识）
| | | 补充维生素（保健功能声称） |
| ![新西兰原产国酸奶](image8.png) | 新西兰原产国酸奶 | 保健食品（蓝帽标识）
| | | 增强免疫力（保健功能声称） |
| ![茶](image9.png) | 茶 | 保健食品（蓝帽标识）
| | | 促进免疫力（功能声称） |
| ![润喉糖](image10.png) | 润喉糖 | 保健食品（蓝帽标识）
| | | 清咽（保健功能声称） |
CHINESE CONSUMERS’ PERCEPTIONS OF FUNCTIONAL FOODS DESIGNED TO HELP THE IMMUNE SYSTEM RECOVER FROM THE IMPACT OF AIR POLLUTION

CONSENT FORM FOR WORKSHOP PARTICIPANTS

- I have read the Participant Information Sheet about the study, I understand the purpose of the research. I have had the opportunity to ask questions and have them answered to my satisfaction. I agree to participate in the workshop discussion for the above study.

- I understand that the workshop discussion will take about around three hours, and that my personal details will not be discussed with anyone outside of the consumer insights group.

- I understand that the workshop discussion will be video- and audio-recorded.

- I understanding that my details will remain confidential and that my personal identity will not be revealed in any future report or publication based on the research. I undertake to avoid mentioning any issues discussed today outside of the workshop.

- (Please cross out one of the following) I DO / DO NOT give permission to the potential use of my image for presentations of this research work or for reporting purposes

- I understand that I can withdraw from the project at any time before the study findings have been written up and published without giving a reason but that I cannot withdraw my data as it cannot be separated from everyone else’s.
I understand that the workshop recordings will be transcribed by a person who will be asked to sign a confidentiality agreement and that I will not receive copies of either the recordings or the transcripts.

Participant’s Name ____________________________

Participant’s Signature ____________________________

Date ___________________

(This form will be kept for a period of 6 years)

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph +64 3 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
中国消费者对用于帮助免疫系统从空气污染的影响中恢复的功能性食品的感知

座谈会参与者的知情同意书

- 我已经阅读了关于本项目的给座谈会参与者的通知。我了解此次研究的目的。我有机会提出问题并且可以得到我满意的答案。我同意参加此次座谈会讨论。

- 我了解此次座谈会讨论所需时间约为3小时。我的个人资料不会被消费者洞察课题组外任何人讨论。

- 我了解此次座谈会讨论会进行录音和录像。

- 我了解关于我的细节会被保密，并且我的个人身份不会在任何基于本研究项目的报告或出版物中透露。我同意避免在此座谈会外提及任何相关事宜。

- （请划掉您不想选择的答案）我同意/不同意给予关于潜在地使用我的图像的许可，这些图像可能用于本研究项目的展示或报告。

- 我了解我可以在项目成果被撰写及发表前的任何时间退出本研究项目而不需要提供理由，但是我的相关数据不能够撤销，因为单个参与者的数据不能独立于其他人。
我了解此次座谈会的录音将由专业人士笔录，该专业人士会被要求签署保密协议。但是，我将不会得到相应的录音或者笔录副本。

参与者名字 ____________________________________________

参与者签名 ____________________________________________

日期 ________________

（此表格将被保存六年）

此次研究已经被奥塔哥大学人类伦理委员会批准。如果你有任何关于道德伦理方面的疑虑，你可以随时通过人类伦理委员会的工作人员（电话+64 3 479 8256 或电邮 gary.witte@otago.ac.nz）与委员会成员取得联系。您提出的任何问题都将被保密地处理和调查，你将被及时告知相应的结果。
CHINESE CONSUMERS’ PERCEPTIONS OF FUNCTIONAL FOODS DESIGNED TO HELP THE IMMUNE SYSTEM RECOVER FROM THE IMPACT OF AIR POLLUTION

INFORMATION SHEET FOR WORKSHOP PARTICIPANTS

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate in the workshop. If you decide to participate we thank you. If you decide not to take part, there will be no disadvantage to you and we thank you for considering our request.

What is the Aim of the Project?

Our research is funded by the National Science Challenge High Value Nutrition consumer insights group. We are a group of researchers from the University of Otago, Plant and Food Research Institute, University of Auckland and PwC New Zealand. At the same time, this project is being undertaken as part of the requirements for Lei Cong’s PhD degree.

The aim of this project is to explore desirable attributes of any products Chinese consumers may purchase to enhance their immune health.

What Type of Participants are being sought?

Around 10 participants have been sought for this workshop that meet the following criteria:

- People of Chinese ethnicity
- People aged between 25-40 or between 41-56
- People who live in Suzhou no less than 3 years
- People who have a household income more than 1,5000RMB
- People are concerned about their immunities and report that they frequently suffer from the adverse impact of air pollution
- 50% of participants of each workshop should live with/care for families with the same situation.

What will Participants be Asked to Do?

If you agree to participate in this research, the workshop should take up to 3 hours. It will be video- and audio-recorded.

What Data or Information will be Collected and What Use will be Made of it?
We assure you that your personal details will not be discussed with anyone else outside of the HVN consumer insights group and your circumstances will remain unspecified in any reports resulting from this research. We ask you to avoid mentioning any issues discussed here today outside the workshop. Participants may withdraw from the project at any time without giving a reason but they cannot withdraw their data as this cannot be separated from everyone else’s. We would like your permission to potentially use your image, during presentations of our work, or for reporting purposes, but we will not use your names. You can indicate your permission on our consent form, but you may still participate in this study if you do not want to give this permission. If you allow us to use your image then potentially someone who knows you may see that you have participated in our research, however, they will not be able to identify information you have personally provided because all of the discussions will be reported as a collective account. Any quotes used to illustrate specific points will be attributed to a pseudonym.

We will not be able to give you the recordings or the transcripts. However, you will be compensated 150 yuan to reimburse costs associated with attending the session.

The discussion will be transcribed into Chinese by a person who will be asked to sign a confidentiality agreement, and the data will be kept stored on a University password protected computer for at least 6 years in our university office, and used to write research papers and articles.

I hope that you will agree to participate. Thank you very much for your time and for making this study possible.

Can Participants Change their Mind and Withdraw from the Project?
You may withdraw from participation in the project at any time before the study findings have been written up and published, and without any disadvantage to yourself of any kind.

What if Participants have any Questions?
If you have any questions about our project, either now or in the future, please feel free to contact either:

Lei Cong  or  Professor Phil Bremer  
Department of Food Science  
University of Otago  
lei.cong@postgrad.otago.ac.nz  

Department of Food Science  
University of Otago  
phil.bremer@otago.ac.nz

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中国消费者对用于帮助免疫系统从空气污染的影响中恢复的功能性食品的感知

给座谈会参与者的通知

感谢您对本研究项目给予热情。请您在决定是否参加本项目之前仔细阅读以下通知。如果您愿意参加本项目，我们将非常感激。如果您决定不参加本项目，您的决定不会对您有任何不利的影响，我们仍然非常感谢您认真考虑了我们的请求。

此次研究的目的是什么？

我们的研究得到了新西兰国家科学挑战 - 高价值营养项目（消费者洞察子项目）的资助。我们是一支来自新西兰奥塔哥大学、植物食品研究所、奥克兰大学以及普华永道（新西兰）会计事务所的研究团队。同时，本研究项目是博士生丛蕾为取得其博士学位工作量的一部分。

本项目的目的旨在探索中国消费者可能购买的以增强其免疫健康的产品的设想属性。

什么类型的参与者被考虑参与本项目？

每个座谈会一共需要约 10 名满足以下条件的参与者：

- 中国消费者，
- 年龄分布于 25-40 岁之间，或 41-56 岁之间，
- 在苏州居住时间不少于 3 年，
- 家庭月收入不低于 1.5 万人民币，
- 对自身免疫系统表示担忧，并陈述自己经常受到空气污染的负面影响，
- 每组 5 名参与者正共同居住或需照顾有以上相同情况的人。

受访者会被要求做什么？

如果您同意参与此次研究，座谈会讨论将会持续约 3 小时。整个过程会进行录音和录像。

哪些数据或信息会被收集并做何用途？

我们向您保证，您的个人资料不会被除高价值营养项目消费者洞察子项目的研究人员外的其他任何人讨论，并确保您的个人情况不会在任何由此次研究得出的报告中明示。
我们将要求您避免在座谈会外提及任何相关事宜。参与者可以在项目成果被撰写及发表前的任何时间从项目中退出并无需提供理由，但是不能够撤销相关数据因为单个参与者的数据不能独立于其他人。我们希望得到关于潜在地使用您的图像的许可，这些图像可能用于我们成果展示或报告中，但是我们不会使用您的名字。您可以在知情同意书上签字以示许可，同时如果您不想给予许可，您仍然可以参加此次研究。如果您允许我们使用您的图像，那么可能会有认识您的人认出您参与了我们的研究。但是，他们将无法识别您个人所提供的信息，因为所有讨论都将作为一个整体进行汇报。用于说明具体观点的任何引用将使用化名。

我们将不能为您提供相应的录音或笔录副本。但是，您将被支付人民币 150 元以补偿您参加本次讨论相关的花费。

本次讨论的内容将由专业人士笔录，该专业人士会被要求签署保密协议。本次讨论的数据将会被保存在我们大学的一台有密码保护的计算机上至少 6 年，以用于撰写研究论文和文章。

希望您同意参与。非常感谢你为此花费的时间，您的参与使我们的研究成为可能。

**受访者可否改变主意并退出本项目？**

您可以项目成果被撰写及发表前的任何时间退出本研究项目，而您的决定不会给您带来任何不利的影响。

**受访者如何提出疑问？**

如果您对本项目有任何问题，无论是现在或者是将来，请随时联系：

丛蕾
奥塔哥大学
食品科学系
lei.cong@postgrad.otago.ac.nz

或

Phil Bremer 教授
奥塔哥大学
食品科学系
phil.bremer@otago.ac.nz

此次研究已经被奥塔哥大学人类伦理委员会批准。如果你有任何关于道德伦理方面的疑虑，你可以随时通过人类伦理委员会的工作人员（电话+643 479 8256 或 电邮gary.witte@otago.ac.nz）与委员会成员取得联系。您提出的任何问题都将被保密地处理和调查，你将被及时告知相应的结果。
CHINESE CONSUMERS’ PERCEPTIONS OF FUNCTIONAL FOODS DESIGNED TO HELP THE IMMUNE SYSTEM RECOVER FROM THE IMPACT OF AIR POLLUTION

TRANSCRIBER CONFIDENTIALITY AGREEMENT

Research team:
Prof Phil Bremer, University of Otago, phil.bremer@otago.ac.nz
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Lei Cong, University of Otago, lei.cong@postgrad.otago.ac.nz

Transcriber:
I, _________________________________________________, the Transcriber, agree to:

5. Keep all the research information shared with me confidential by not discussing or sharing the research information in any form or format (e.g., digital recordings, transcripts) with anyone other than the Researchers.

6. Keep all research information in any form or format (e.g., digital recordings, transcripts) secure while it is in my possession.

7. Return all research information in any form or format (e.g., digital recordings, transcripts) to the Researcher when I have completed the research tasks.

8. After consulting with the Researchers, erase or destroy all research information in any form or format regarding this research project that is not returnable to the Researcher (e.g., information stored on computer hard drive).

Transcriber

__________________                 _________________________                 ____________________
(Print name)                                  (Signature)                                         (Date)

APPROVED BY THE UNIVERSITY OF OTAGO HUMAN PARTICIPANTS ETHICS COMMITTEE ON 31 AUGUST 2017 FOR THREE YEARS REFERENCE NUMBER 17/123.
中国消费者对用于帮助免疫系统从空气污染的影响中恢复的功能性食品的感知

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