Doctoral thesis

Implicit attitudes about agricultural and aquatic products from Fukushima depend on where consumers reside

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Abstract

This thesis focuses on the assessment of Japanese consumers' implicit attitudes towards agricultural and aquatic products from the Fukushima region. Chapter 1 provides an overview of research as well as the research problems, purpose and hypotheses and reviews key theoretical approaches to implicit and explicit attitudes. Chapter 2 discusses methodological approaches to implicit and explicit attitudes assessments, with a focus on the Implicit Association Test (IAT) and self-report survey methods (e.g, Likert-type scale) which were used in the empirical studies. Chapter 3 (study 1) assesses whether Japanese consumers have negative implicit attitudes towards products from the Fukushima region and whether these are independent of their explicit attitudes. While the results of the study suggested that consumers have relatively negative implicit attitudes towards products from Fukushima, although their explicit attitudes are positive. This divergence was predominantly observed in the region near to Fukushima (i.e., Tokyo). These findings supported our hypothesis that it is implicit negative attitudes rather than explicit negative attitudes that underlie the hesitancy to purchase products from Fukushima. Chapter 4 (Study 2) assessed similar questions to Study 1 and explored the individual differences in the formation of these implicit attitudes towards products from Fukushima in terms of the Perceived Vulnerability to Disease (PVD). The results suggested that the negative implicit attitudes towards Fukushima products were attenuated (but still persistent) in participants with relatively low germ aversion in PVD. However, there was a large effect size amongst participants with high aversion to germs. Chapter 5 is a general discussion which summarizes the findings and discusses the outcomes of this research.

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CHAPTER ONE: INTRODUCTION

1.1 Research Overview

Fukushima prefecture is located in northern Japan in a region known as Tohoku. It is well known for its historical architecture, hot springs, lakes, gastronomy and more profound Japanese rice. The area has been experiencing an economic decline over concerns after a nuclear power plant disaster on the northeast coast of the Fukushima region following the Great East Japan Earthquake that occurred in 2011. The Japanese are concerned about its long -term sustainability and are still hesitant to purchase aquatic and agricultural products from the region (Hangui,2014; Fukushima Prefecture,2016; Consumers Affairs Agency,2017).

After the nuclear disaster, it was highly advisable to refrain from consuming Fukushima products due to suspicion of radioactive contamination and unreliable and reputational damage of general information (Hangui,2014; Fukushima Prefecture,2016; Consumers Affairs Agency,2017). However, the products are now officially safe for consumption; hence consumers do not need to avoid purchasing them (Fukushima Prefecture,2013). Nevertheless, this hesitancy, which is a response to the social stigma against Fukushima products, persists; social stigma is defined as the disapproval of someone, or something based on perceivable social characteristics used to differentiate it from others (Crocker & Mayor,1989). This is causing serious economic damage (i.e., a collapse in the price, Central Union of Agricultural Co-operatives, 2011; Fukushima Minyu Shimbun Sha, 2012; Ichinose ,2012). For example, the market prices of beef, peaches and rice, which are specialties from the Fukushima region, have continuously decreased since 2011 (e.g., by 9.3, 4.9, and 23.3% in 2017) with respect to the national average because of the disaster (Reconstruction Agency,2018).

The hesitancy to buy Fukushima products can be highly associated and interpreted based on error management theory (Haselton and Buss 2000). According to error management theory, an individual makes two possible errors (type I being false-positive and type II being false-negative errors) when making a decision in an uncertain scenario. Essentially, consumers tend to be afraid of making a type II error judgment, in which they mistake products that are dangerous as being safe. Instead, type I error judgments, where safe products are mistaken as dangerous, are more likely. In short, this hesitancy is caused by consumers' vigilance about products from Fukushima.

The government has constantly released information regarding Fukushima products as safe with evidenced screening for radioactive contamination to correct consumers` overcautious behaviors and prevent reputational damage (Ministry of Health, Labour and Welfare, 2018). The attempts to improve the products reputation have been successfully and the latest survey research has demonstrated that around 80 % of consumers are no longer overcautious about Fukushima products safety (Ministry of Agriculture, Forestry, and Fisheries, 2018). Furthermore, consumers do not currently have "explicitly" negative attitudes towards products from Fukushima, at least on paper (Kudo & Nagaya, 2017; Miura, Kusumi, & Ogura, 2016).

If this is so, then why do they still hesitate to purchase these products? It appears that another factor, which we consider to be their "implicit" attitudes, underlies this hesitation. It has been suggested that explicit and implicit attitudes differ from one another, particularly with respect to social stigma (Wilson, Lindsey, & Schooler, 2000). Thus, we hypothesized that implicit and explicit attitudes towards products from Fukushima are dissociated from one another and that, rather than explicit attitudes, negative implicit attitudes underlie the hesitancy regarding the purchase of Fukushima products.

However, before we can resolve this major hypothesis, it is necessary to validate the basic aspects of our hypothesis, namely: whether consumers indeed have negative implicit attitudes towards agricultural and aquatic products from the Fukushima region and whether these attitudes are independent of their explicit attitudes. We used the implicit association test (IAT), which is a well-known method for measuring implicit attitudes related to a target attribute relative to another (Greenwald, McGhee, & Schwartz, 1998). It is standard method used to measure attitudes related to a particular targeted attribute relative to another. In this research, participants had to complete an IAT to assess their implicit attitudes and a questionnaire for evaluating their explicit attitudes towards Fukushima products relative to products from another region (Parson et al.,2019).

Prior research based on IAT indicated that Japanese show positive implicit attitudes towards Fukushima products (Kudo & Nagaya, 2017). However, data interpretation from the research is limited. The research mainly focused on consumers` attitudes after a persuasive message, indicating that implicit attitudes assessments occurred after the initial letters manipulated the respondents. Implicit attitudes from the participants were likely biased already by the questionnaires issued or the message. The research did not also give information concerning where the respondents lived. According to Miura et al. (2016), the respondents` location and where the accident occurred are significant as it is likely that the lesser the physical distance, the more the participant is familiar with Fukushima brands. Hence, consumer attitudes towards Fukushima may be dependent on where they reside. However, it is not conclusive whether implicit consumer attitudes are modulated by their geographical residence. Therefore, the present research must examine whether consumers` implicit and explicit attitudes vary due to location, excluding other factors. Geographical location is a critical factor that needs consideration when one is marketing products from Fukushima.

1.2 Social Attitude

In recent years, there has been extensive research to investigate social cognition and attitude (Ranjbarshamsi et al.,2016). The measure of attitude and social cognition is crucial to human since they help explain how individuals view the world and what is happening around them. People have diverse opinions regarding different issues, and their perception allows them to express their attitude daily (Frye et al., 2012). Individual attitude exhibits their behavioral, affective, and cognitive elements, which determine how people make their choices and how people live. However, the expressions of attitudes are relatively divergent depending on how they are formed. Attitudes exist in two forms which are implicit and explicit (Frye et al., 2012). Therefore, it is crucial that when people decide based on their attitude, they are investigated appropriately so that corrective measures are used to determine them.

Consequently, it is logical to determine how these two levels of attitude in human beings are formed (Frye et al., 2012). The difference between explicit and implicit attitudes is that implicit attitudes happen at an unconscious level while explicit attitudes occur at a conscious level. The formation of the attitudes is involuntary as they lack conscious access, which is uncontrolled (Fazio & Olson,2003). The process that guides the formation of attitude is yet to be determined. For that reason, this part will provide an overview of implicit and explicit attitudes by comparing and contrasting them and providing reasons why they have a weak correlation.

An attitude gets characterized by accessibility, ambivalence, and strength (Fazio &Olson,2003). It is believed that when individuals have a strong attitude, it influences their behavior because they strongly conceive these attitudes. Crucial beliefs tend to have a substantial impact on people`s behavior. Ambivalence is the ratio of positive and negative measures that

constitute an attitude (Fazio & Olson,2003). The ambivalence of an attitude gets determined by the variance between negative and positive measures. The accessibility determines the explicit and implicit attitude as it deals with access to the consciousness (Fazio & Olson,2003).

1.2.1 Implicit and Explicit Attitude

Attitude involves evaluating an object of thought. The object in this reference refers to anything an individual can hold in their mind, including people, ideas and groups. Attitudes form core concepts that involve the long-standing (Allport,1935), and it has great significance to social psychology. Literature has emerged with the need to understand the concept of automatic, implicit factors which involve attitudinal processing, which is due to the invigorated debates on how best to conceptualize attitude (Fabrigar et al., 2005, Garb et al.,2002). Another issue is integrative theorizing on the different links in attitude structures and the processes involved in changing attitudes.

Implicit and explicit attitudes impact human behavior, and they get expressed irrespective of whether they occur voluntarily or involuntary (Ranjbarshamsi et al.,2016). However, the two levels have conspicuous differences whereby the explicit attitude is controllable, accounting for behavior among people or groups. Therefore, explicit attitudes can get altered, but it depends on the cognitive changes that occur in individuals (Faulkner at al., 2004). Explicit attitudes are easy to change because they need the manipulation of individuals` attitudes. In contrast, implicit attitude changes happen due to various mechanisms in a person`s cognitive mind. The manipulations of attitudes are relatively responsible for creating implicit responses (Bosson at al., 2000). Implicit attitudes are influenced by slow -learning and associative reasoning where contextual stimuli and social roles are significant factors (Faulkner at al., 2004).

The new response-time based paradigms have helped introduce new research areas and an understanding of the riches of attitudes. Some of the most popular paradigms include the Implicit Association Test (IAT) and the evaluative priming task (Dunton & Fazio,1997). The above paradigm assumes that in a perceiver`s mind, evaluative associations produce different levels of facilitation or inference, which happen due to responses to categorical and evaluative stimuli representing an attitude object. The differences in response time infer implicit attitudes (Dunton & Fazio,1997; Greenwald & Banaji ,1995). In an IAT test, the respondents sort stimuli by pressing left or right-hand keys into a dichotomous target category. In the prime evaluative priming task, the respondents press keys to determine their target stimuli and determine if the prime and target match, the response time is reduced. Still, if they do not match, the response time increases. However, there still exists contention on response -time – based paradigms (Bosson et al.,2000; Mortensen et al., 2010). But if the attitude is a temporary construction, it is crucial to measure any new aspect to help in predicting the evaluative outcome (Murray&Schaller,2012). Researchers are integrating evidence from implicit attitude on theories on what attitude is and how it changes in people.

1.2.1.1 Implicit attitude

Implicit attitudes are individual evaluations that exists without conscious awareness towards self, an object, or attitude. The evaluations are regarded as introspectively unidentified traces of personal experience that can be favorable or unfavorable thoughts, feelings, or actions towards a social object that arises from various influences (Frye et al., 2012). These evaluations impact an individual's behavior, and they may not be aware of them. They may cultivate from a reflection of former involvements, social norms, cultures, socialization, and experience, which play a crucial

role in developing lifelong implicit attitudes. Greenwald and Banaji (1995) explain implicit attitude within social psychology and cognitive basis known as implicit cognition. Implicit attitudes that result from experiences and socialization result from repeated pairings of either positive or negative stimuli with an object. A hypothesis exists that the more the pairings of negative stimuli, the more a negative implicit attitude will result, which forms the basics of classical conditioning (Bosson et al.,2000). An implicit attitude that pertains to self includes in-groups or self-esteem attitudes. People are likely to have an implicit preference towards self which is known as implicit egotism. Egotism manifests itself due to high perceived attractiveness, identification with a particular group, and negative attitudes towards non-self-groups known as implicit partnerships. Culture and social norms that a person perceives may also affect an individual`s attitude.

Implicit attitudes often relate to the kind of responses an individual exhibits towards a particular action, object, or even a product. Implicit attitudes can predict behaviors without identifying explicit attitudes. Evaluations prompted by implicit attitudes towards specific goods cause a direct influence on the behavioral tendencies towards the product (Frye et al., 2012). In the context of my research, the stimulus that activates a positive attitude is likely to trigger an instant positive reaction while a negative one is likely to evoke a fast avoidance behavior towards purchasing or consuming a particular product. Different people exhibit different perspectives towards a confident explicit social attitude perceived as either negative such as temporary and chronic concern about disease transmission, or positive attitudes, such as consumer satisfaction of a particular product (Dawis,1987; Demartini et al., 2019). My research focuses on the concept of perceived vulnerability to disease (PVD) because individuals' difference in terms of it may evoke diverse implicit attitudes in different individuals depending on a person`s belief about their

perceived vulnerability to contracting an infectious disease known as Perceived Infectability or a person`s likelihood of experiencing emotional discomforts upon exposure to a potentially contagious disease known as Germ Aversion.

Consumers` implicit attitudes towards Fukushima products and radioactive contamination are likely to vary based on their PVD or Perceived germ aversion. According to psychology research, it suggests that there is an adaptive strategy regarded as Behavioral Immune System (Bosson et al.,2000). It enables an individual to recognize and avoid objects that are perceived to threaten a person`s health. However, different individuals have different sensitivity levels, and whatever is perceived to endanger one`s health is subjective depending on an individual`s past experiences, socialization, or self-consciousness. There is a possibility that consumers` implicit attitudes towards Fukushima products may vary depending on individuals` aversive affective responses toward invisible threats, especially germ aversion based on their PVD (Bosson et al.,2000). Although radiation effects are not contagious, they can be associated with pathogenic threats due to both being invisible. Implicit attitudes are commonly measured by reaction time using various methods such as Implicit Association Test (Frye et al., 2012). It measures implicit attitudes towards particular attributes such as perceived disease vulnerability or germ aversion. In the case of Fukushima products, prior research indicates negative implicit attitudes may be associated to different consumers` perceived susceptibility to disease, which is likely to arise from radioactive contamination from the nuclear disaster (Dovidio et al.,2002). In addition, self or group -related implicit attitude formation may have influenced the perceived vulnerability to disease, influencing the consumption of aquatic and agricultural products from Fukushima. Particular groups may have mistaken Fukushima products as harmful, which could render an individual

attracted to a self- linked group to avoid their products to confirm to the formed group implicit behavior.

Implicit attitudes influence different people`s conduct or behaviors through various processes. Some people`s effect is spontaneous, while for others, it is deliberate. The deliberate approach comprises systematic processing of the relevant information that determines attitudes` effectiveness on influencing a person`s conduct (Mortensen et al., 2010). The process requires effort, and thus it needs motivation or an opportunity. However, automatic mode produces automatic feedback by automatically initiating the appropriate attitude that influences one`s conduct. Implicit attitudes that assume an impulsive structure are accountable for an immediate response, such as environmental stimuli. The computerized assessments produce outcomes by spreading stimulation through a network of associations in a memory system associated with behavioral tendencies of avoidance or approaches and activated by an encountered stimulus (Dovidio et al., 2002). A reflective system requires attentional control and often regulates deliberate conduct depending on different people`s standards. The aptitude to overcome an impulsive response relies on the availability of restrains and the automatic process impulse tendency. A sudden reaction may result in a temporal perceived awareness of a particular food product (Dawis ,1987; Demartini et al.,2019). The situational instance is likely to influence an anticipate implicit attitude that may result from a state of low motivation, unlike explicit attitudes that result from high stimulation towards a condition (Mortensen et al., 2010). A temporal perceived awareness by consumers on possible radioactive contamination may likely have resulted in an anticipated negative implicit attitude that resulted in negative impulsive responses towards purchasing or consuming Fukushima products.

Correlations between implicit and explicit attitudes can help determine people`s assertion that implicit attitudes exist without individual conscious awareness (Son Hing et al.,2008). Low correlations have been cited as support that people are not aware of their implicit attitudes. However, it is not conclusive as a lack of explicit endorsement may not directly imply a lack of awareness. For example, a person may have an unfavorable implicit attitude towards an ethnic minority and be aware of their biasness but consciously fail to accept it because they believe racial prejudice is incorrect. However, correlation tends to increase if respondents are inclined to respond more to self-report measures in a more deliberative or intuitive way (Son Hing et al., 2008). It implies that an individual analyses an initial, automatic reaction, its true value, and often rejects them if they find it subjectively wrong. It shows that to some extent, one can have conscious awareness of their implicit attitudes (Son Hing et al., 2008). People tend not to change their automatic associations during self-report in cases of uncontroversial initial analyses to the truth value. Studies involving known groups` measure stimuli tend to be consistent and with higher correlations than ambiguous stimuli such as the Flower-Insect Implicit Association Tests that typically report a more positive association of people to flowers than insects (Son Hing et al., 2008).

1.2.1.2 Explicit Attitude

These are attitudes that are at the conscious level and are accessible to self-report and deliberately developed. Through personal reflection or consideration, they get knowingly endorsed as opinions (Ranjbarshamsi et al., 2016; Mortensen et al., 2010). An affirmation or revision of an implicit attitude can be the explicit attitude. In most cases, individuals will form an implicit attitude towards a particular object or event. Still, they might not form an explicit attitude concerning the same thing. It depends on whether the individual expends additional cognitive efforts, which

require an implicit attitude. There has been widened use of implicit attitude. Results have indicated that explicit and implicit attitudes may yield different results even when formed on the same object.

In social psychology, explicit attitude measures are vital because they help determine consumer behavior and psychological feelings (Mortensen et al., 2010). In most cases, when the measure of attitude is on food and products, various explicit measures of attitude are utilized, including the self-report survey method such as the Likert-type scale, shown to possess essential psychometric criteria like efficiency and usefulness (Greenwald & Banaji,1995). While measuring the explicit attitude, participants must express their observations or views towards an attitude object, mainly done using a Semantic Differential scale or Likert scale (Dawis ,1987). While using a Likert scale, one utilizes a point bipolar response format that uses a certain number of points determined before assessing the attitude (in most cases, the point range is between five and seven). The respondents are required to rate their level of agreement with a scale ranging from ‘strongly disagree` to ‘strongly agree` on a certain questionnaire item. Using such a scale makes it possible to determine the explicit attitude of the consumers towards the products by determining their level of like or dislike.

When one wants to determine the respondents` feelings along a continuum, they use the Semantic Differential technique (Son Hing et al., 2008). In this case, participants rated on a continuum using specific values or words (e.g., From 1 to 5, quick to slow, modern to old, and good to bad) on their feeling about a specific question or situation (Dawis,1987). The explicit attitude measures have been in use for a long time, but they have several limitations that affect their use or reliability.

One main limitation that explicit attitude measure faces is that there is an assumption when used that the respondent has the ability and will be motivated to be truthful when providing their

responses. According to Greenwald and Banaji (1995), any measure of attitude that makes such as assumption will sometimes be erroneous. In explicit attitude measures, they often report distortion on a participant`s genuine attitude. They aim to provide socially acceptable responses, mainly when the reactions get conducted through self-presentation strategies (Greenwald and Banaji, 1995). The biases that emanate from these measures are most significant and prevalent, especially when investigating sensitive or contentious societal constructs such as racial prejudice (Dawis,1987; Demartini et al., 2019; Baccus et al., 2004). The attitudinal scales contain an in - built social desirability measure referred to as lie scales to assess responses` veracity to help overcome the shortcomings. However, even with such controls and validity checks, there is no way that the instruments provided can be used to assess the participants` attitudes or true feelings (Kudo & Nagaya,2017). The only aspect that the lie scales help determine is whether the responses attained the acceptable level of biasness.

In addition to veracity, documented evidence is another issue that affects the measure of explicit attitude. The limitation states that people have limited introspective access to psychological processes responsible for guiding their behaviors (Demartini et al., 2019). An example is when an individual can not explain why they acted or spoke in a particular manner, and such cases; they rely on external cues while inferring their reason (Dovidio et al.,2002). In such cases, a person can not explicitly explain their behavior or attitude, and instead, what they find that might have influenced them are the external factors. It raises a lot of concern, especially for the self-report measures, because it is impossible for a respondent to present a specific attitude, they are unaware of (Greenwald & Banaji ,1995). These problems have resulted in psychologists looking for alternative methods they can use to measure or assess the mind of their respondents. It has necessitated a shift from explicit to implicit attitude measurement while helping determine the

participants` attitudes on timed categorization tasks (Duncan & Schaller,2009). In the implicit attitude response, the reliance is on the reaction time which helps reduce the participants` mental control on what they respond by minimizing self-awareness and self- presentation time (Demartini et., al 2019). The implicit attitude measures, in this case, provide a way in which psychologists can access the underlying automatic attitudes; including those that individuals are unaware they possess (Duncan & Schaller ,2009).

1.3 Purpose of research

Research questions

I. Do Japanese consumers show negative implicit attitudes towards agricultural and aquatic products from Fukushima?
II. Do implicit and explicit attitudes differ from each other?
III. Do consumers` attitudes differ among residential areas?

The purpose of this research is to help answer the research questions above. It will allow producers, marketers, as well as government to apply the available knowledge and understanding in human attitudes to create innovative strategies that will help improve people`s perception of agricultural and aquatic products from Fukushima (Klauer & Mierke,2005). The basis of studying human feelings, thoughts and behavior in Fukushima is the Japanese implicit relationship among bias, past disasters, and purchasing behavior (Hasegawa et al., 2016). The importance of this research will spur the present and future beliefs regarding this issue.

CHAPTER TWO: APPROACHES TO IMPLICIT AND EXPLICIT ATTITUDE MEASUREMENT

In psychology, attitude is classified into two distinct groups, including explicit and implicit attitude. The two categories of attitude are important because they play a distinctive role in giving each individual a unique taste of opinion and personality when expressing themselves and that which they believe in. Simply put, attitude, whether explicit or implicit, helps determine and shape how one lives by influencing the choices one makes. In addition, measuring attitude is important because it helps in gathering crucial information about others, thus adjusting relationships and interactions accordingly. This chapter seeks to explore the various measures of attitude in the psychology field, giving the reader a detailed insight into each while discussing the various aspects and factors involved in facilitating their success.

As mentioned before, implicit attitudes require special tools and techniques for their assessment because they are not readily or directly accessible to the individual. Some of the highly prevalent techniques used in assessing implicit attitude include subliminal priming, associative categorization, and response latency (Rudman et al., 2001). Upon gathering the relevant implicit attitude measurement data, the results are discussed in accordance with the Implicit Association Test (IAT) stipulations (Greenwald, McGhee, & Schwartz, 1998). IAT is one of the highly utilized implicit attitude tests in psychology. Contrary, explicit attitudes are attitudes manifested at the conscious level. In other words, explicit attitudes are deliberately structured, not to mention that they are easy to report. Measurement of attitude psychology is instrumental in gathering vital information about consumer feelings and behaviors, thus adjusting the business or entity's operations accordingly to fit into the practical and convenient operational framework.

In social psychology, the explicit measure of attitude holds a central role in assessing a consumer's psychological emotions and their respective behaviors. Realizing the importance of explicit measures of attitude, particularly in economic and marketing fields, researchers, mostly those dealing with foods and other consumable products, heavily utilize explicit assessment to grow and advance their operations by studying and understanding the highly dynamic consumer behaviors. Similar to other analytic processes, the effectiveness of explicit attitude relies heavily on the adopted data collection technique. Usually, in an explicit attitude measure, participants are required to express their candid and unbiased views and opinions pertaining to the subject topic. To gather such information from participants, researchers use measuring tools and scales such as the Likert or Semantic Differential scales (Dawis, 1987).

2.1 Measurement of Implicit Attitude

The growth and advancement in the psychological field have been of much value, especially with the development of implicit attitude measurement. The utilization of the implicit attitude measurement over the years has made it one of the most critical developments in the psychology field in the last few decades. As mentioned earlier, implicit attitudes are not directly accessible to an individual, requiring special tools and techniques for its assessment. Some highly adopted methods include response latency, subliminal priming, and associative categorization (Rudman et al., 2001). However, it is worth noting that implicit attitude varies across the spectrum, implying that different individuals express unique emotional and psychological needs. To capture the diversity of implicit attitudes amongst individuals, researchers or practitioners utilize two techniques for assessing their clients. The two techniques include Affective Priming Task (APT) (Fazio et al., 1986) and the Implicit Association Test (IAT) (Greenwald et al., 1998).

2.1.1 The Affective Priming Task

The Affective Priming Task is a time-based reaction task designed to measure implicit prejudice. The invention of AFT has been instrumental in shaping research pertaining to the assessment of implicit attitudes and stereotypes (Bargh et al., 1996). The design of the Affective Priming Task sought to capture, assess, and evaluate the appropriate kind of associations activated as a response when an object or subject evokes emotions. Since the technique is designed to assess implicit attitude, its effectiveness was examined by its ability to involuntarily activate an individual's feelings or attitude in the presence or absence of the subject matter or object. Such an ability is critical to eliminating bias, especially when one is aware of the subject or object under study. Overall, APT's design aimed at assessing and measuring the degree of accessibility, not to mention the strength of the automatic attitudes.

When measuring a person's attitude, APT requires that the individual is briefed by showing them the subject. Upon seeing and coming into contact with the subject or object, one is required to quickly establish the impact of the subject or object in their attitude or emotions. In other words, one is asked to identify whether the subject had a positive or negative impact on them. Identifying the stimulus effect, positive or negative, is critical in establishing a suitable response regarding the subject. For instance, when the stimulus-response is positive, the subsequent stimulus is facilitated, while if the response is negative, the subsequent stimulus is inhibited. If, for instance, a participant is briefed with a picture of a spider and then sees the word dangerous (congruent trial) and/ or the word safe (incongruent trial), the participant's response is expected to reflect or express their attitude as either good or bad. The participant's response is based on their relationship or experiences with spiders, meaning that a good experience will influence a positive stimulus and vice versa.

2.1.2 The Implicit Association Test

The Implicit Association Test is perceived by many researchers and practitioners as a progression of the APT. This, IAT, technique is utilized mainly in attitude measurement, making it one of the highly accepted and embraced measuring techniques (Greenwald et al., 1998). The similarities between APT and IAT are evident in their functionality. Simply put, IAT heavily borrows concepts and logic from APT, utilizing logic such as the estimation of strengths of association between concepts and attributes (Lane et al., 2007). On the other hand, APT and IAT have their fair share of differences. For instance, unlike APT that pairs exemplars individually, IAT embraces dual categorization, a format that requires participants to categorize attributes and stimuli simultaneously. The simultaneous categorization of attributes and stimuli holds a central role in easing the assessment process in that it reduces the trials by half, thus making it a better choice than APT (Greenwald et al., 1998).

As mentioned earlier, IAT is designed and structured to assess the strength between attribute categories such as good/ bad, pleasant/ unpleasant, and target categories, which are contrasting subjects such as Coke/Pepsi, rock/pop, to name a few. To gather the collect data, participants are tasked with making a quick decision allocating the highlighted stimulus to their respective category by pressing an assigned key on a computer's keyboard. By pressing the assigned keys, the researcher hopes that congruent ideas share a response.

A typical IAT assessment entails seven steps, as indicated below.

Table 1

Procedural Steps of a Typical Implicit Association Test

Step 1	Learn Attribute Dimension
	Unpleasant vs. Pleasant words
Step 2	Learn Category Dimension
	Insect vs. Flower words
Step 3	Congruent Dual- Categorisation Task *
	Unpleasant and Insect words vs. Pleasant and Flower words
Step 4	Congruent Dual-Categorisation Task *
	Unpleasant and Insect words vs. Pleasant and Flower words
Step 5	Learn Transposed Category Responses
	Flower vs. Insect words
Step 6	Incongruent Dual-Categorisation Task *
	Unpleasant and Flower words vs. Pleasant and Insect words
Step 7	Incongruent Dual-Categorisation Task *
	Unpleasant and Flower words vs. Pleasant and Insect words

* Data from these steps are used for data analytic procedures.

Information gathered from each participant and correctly filed in the table above is used for analysis to make the final deductions. While participants are prompted to respond quickly to the subject topic or object, they have minimal room for errors. In other words, the IAT test only allows responses that fall in between 300ms and 3000ms response latencies. Any response below or above the set threshold is excluded from the analysis. The set limits are essential to help participants respond to the subject at a reasonable pace with no or minimal mistakes while avoiding long responses associated with explicit associations (Dasgupta, McGhee, & Greenwald, 2000).

Upon collecting the necessary data, congruent and incongruent trials are combined to calculate relative preference. To accuracy and precision, the IAT-D algorithm is recommended to facilitate the calculations due to its ability to calculate the differences between mean performance notable in the congruent and incongruent blocks. After that, the results are divided by the standard deviation of the trials in the blocks.

Psychometric properties of the IAT

Although this technique has been used mainly in the analysis process, projective studies have highlighted a few loopholes in its functional characteristics, such as low validity and low reliability. As defined and elaborate techniques of measuring attitude come up, skepticism of using IAT keeps advancing, disputing its usefulness when drawing conclusions (Grove et al., 2002). However, while there are some apparent gaps when using IAT, the latter has demonstrated acceptable psychometric features and properties, making it a choice because it meets the stipulated professional standards (Nosek et al., 2002). In particular, IAT measures of attitude are accepted for their consistency, the familiarity with IAT stimuli does not easily confound them, and unlike

other techniques, it is not sensitive to methodological factors such as types of target stimuli or even the number of trails (Greenwald et al., 1998).

Typically, the size of the IAT-D effect is influenced by the type of stimuli and the subject area. For instance, in Greenwald et al. (2005), the D value raged from 34 to 1.355 on Native/ Whites and Young/ Old attitude IAT, respectively. In matters discriminant validity, the correlation between explicit attitude assessed through self-report and implicit attitude assessed through IAT stood at r=.56 with the explicit attitude on the Creationism/Evolution IAT and r=.01 on the White/Asian IAT. The test outcome is either influenced by awareness or explicit endorsement of attitudes, which significantly varies across the domain.

Other players contributing to the witnessed difference include social desirability and culture. The discrepancies could also be attributed to faulty testing between contextual and individual differences. Despite the errors, the IAT's predictive validity averages at r=.27, which is relatively lower than the self-report measures conducted within the same study standing at r=.36. Overall, despite the difference, each study component was deemed helpful and essential for their distinguished roles and contributions in the study. For instance, explicit and implicit attitudes are helpful in that they help in predicting different types of behaviors. An explicit attitude predicts rational and controlled behaviors, while an implicit attitude predicts irrational and unpredictable behaviors (Dovidio et al., 2002). On the other hand, IAT is instrumental in predicting non-verbal and impulsive behaviors (Stangor et al., 1991).

Theoretical approaches to the IAT

The IAT model has task switching functionalities. Typically, when the model switches between different tasks, items are categorized into target concepts. On the other hand, when items are categorized into attribute concepts affects an essential IAT's mechanism. Even then, task switching is essential in behavioral tasks, particularly those that respondents are required to adhere to the set rules, which often vary across the trial spectrum. A participant's response can be simplified during an assessment by assigning different keys on a computer keyboard unique tasks or functions.

For instance, should a participant have a high preference and love for rock music than pop music, the researcher can simplify the congruent block by assigning the left key to mark positive congruence. In contrast, the right key is marked to mean a negative congruence.

In an incongruent trial block, such as sorting cards in a pile of diamonds or clubs and a pile of heart and spades, there is less common ground between the two stimulus types assigned to the existing keys, left and right. As such, participants are required to switch between making target category response and valence category response in each trial.

While a few studies have flagged the IAT for a biased performance, IAT is acknowledged as an implicit measure of attitude principally because of its indirect and automatic. In other words, when IAT is used to gather data, participants are not pressured to express or disclose information they do not wish to share, including their personal opinions. On the other hand, the IAT response latency limit is instrumental in ensuring that participants' responses remain automatics and natural.

2.1 Measurement of explicit attitude

The explicit measures of attitudes are regarded as a significant issue in terms of measuring psychological feelings and consumers' behavior in the social psychology. A majority of studies on attitudes towards foods and products have utilized explicit measures of attitudes such as self-report survey methods (e.g, Likert-type scale), due to important psychometric criteria such as usefulness and efficiency. Explicit attitude measures require participants to express their views towards attitude objects, often through the use of Likert or Semantic Differential scales (Dawis, 1987). Likert scales refer to a commonly utilised seven-point bipolar response format, though the scales may use greater or fewer points. Participants rate level of agreement with each statement on a scale that ranges, for instance, from Strongly prefer Fukushima products through to Strongly prefer Saga products in my research (see Table 2).

Table 2

Example of Likert scale questionnaire

Which statement best describes you?
1. I strongly prefer Fukushima products to Saga products**.**
2. I moderately prefer Fukushima products to Saga products.
3. I slightly prefer Fukushima products to Saga products.
4. I like Fukushima products and Saga products.
5. I slightly prefer Saga products to Fukushima products.
6. I moderately prefer Saga products to Fukushima products.
7. I strongly prefer Saga products to Fukushima products.

The Semantic Differential technique differs in that it is used to assess feelings along a continuum. For instance, participants may mark on a continuum ranging from Good to Bad (Valuable and Worthless and Beneficial and Harmful etc.,) how they feel about a particular question (see Table 3). It is a seven-point rating scale with end points associated with bipolar labels (such as good and bad, favorable, and unfavorable) that have semantic meaning. It can be used to find whether a respondent has a positive or negative attitude towards an object.

Table 3

Example of Semantic Differential Scale

Good	-	-	-	-	-	-	-	***Bad***
Valuable	-	-	-	-	-	-	-	***Worthless***
Pleasant	-	-	-	-	-	-	-	***Unpleasant***
Expensive	-	-	-	-	-	-	-	***Inexpensive***
Favorable	-	-	-	-	-	-	-	***Unfavorable***
Beneficial	-	-	-	-	-	-	-	***Harmful***

CHAPTER - 3

Study 1: Evaluating Japanese consumers` implicit attitudes towards products from Fukushima region

3.1 Overview of study 1

The purpose of this study was to evaluate whether Japanese consumers implicitly have negative attitudes towards agricultural and aquatic products from Fukushima regions and whether they are independent from explicit attitudes and whether a consumer`s attitude is modulated by where they live . In this study, firstly participants completed Implicit Association Test (IAT). This provided a measure of their implicit attitudes. Then they answered a questionnaire that measured their explicit attitudes. We recruited participants from two geographically distant areas (Hiroshima and Tokyo, which are 811 km and 239 km away from Fukushima as the crow flies). Then we compared the participants' attitudes. It was expected that the participants would show negative implicit attitudes towards agricultural and aquatic products from Fukushima regions.

3.2 Method

Ethics Statement

All of the experiments carried out in this study were reviewed and approved by the Institutional Review Boards of Hiroshima University (Hiroshima) and Rissho University (Tokyo), Japan. Written informed consent was obtained from all participants before and after the experiment.

Participants

We recruited 20 Japanese participants (12 female, mean age = 20.60 years, SD = 1.43 years) from Hiroshima and 20 Japanese participants (10 female, mean age = 20.00 years, SD = 0.45 years) from Tokyo with the aim of investigating human cognition. We ran the experiments in Hiroshima and Tokyo in parallel, and they took place between November 2017 and April 2018. The participants were blinded to the purpose of the study.

Stimuli

We used 12 full-color images as stimuli: four of aquatic products and eight of agricultural products (four flowers and four rice). All images were made in our laboratory. Two aquatic products, two flowers, and two rice images were randomly selected and labeled with the kanji for "Fukushima product." We labeled the products because the images themselves do not convey information regarding where they were produced. The other six images were labeled with the kanji for "Saga product." The word label was white, and was placed below the image. In addition, we used five positive word labels and five negative word labels (10 words total) as stimuli, based on Ishii and Numazaki (2009). These labels were written in white with kanji or hiragana scripts. Each stimulus was presented twice within a block. The visual angle of each image subtended 11° × 11° and each character subtended approximately 1.5° × 1.5°. The stimuli were presented at the center of the screen on a black background. The participants' viewing distance was about 57 cm.

We selected Saga prefecture, which is 1,048 km away from Fukushima prefecture, as the reference region. This is because Saga was ranked at a very similar position to Fukushima in the Japanese prefecture attractiveness rankings (Brand Research Institute, 2016) and that, like Fukushima, Saga

specializes in agricultural and aquatic products. The participants of our pilot study (n = 8 in Hiroshima, n = 8 in Tokyo) also evaluated Saga neutrally; participants in Hiroshima rated 3.00 on average (SD = 0.50) and those in Tokyo rated 2.88 on average (SD = 0.60) to the question, "How much do you favor Saga prefecture relative to Fukushima prefecture? (1 = not favorable at all, 5 = very favorable)".

Procedure

The participants performed the IAT task individually. The IAT was conducted in a laboratory under dimmed lighting conditions. We followed the IAT procedure developed by Greenwald *et al*. (1998), which consists of seven blocks. As shown in Table 4, in each of the blocks, the participants were required to categorize the presented target stimulus by pressing either the left (F) key or the right (J) key on the keyboard using their two index fingers as quickly and accurately as possible. The target stimulus remained on the screen until participants provided a response. A red cross appeared in the center of the screen when participants pressed the wrong key.

In Block 1, which consisted of 24 training trials, the participants were trained to discriminate between products labeled from Fukushima and products from Saga: the left key indicated a Fukushima product and the right key indicated a product from Saga. In Block 2 (20 training trials), the participants were trained to determine whether the meaning of the word label was positive or negative: pressing the left key for positive words and the right key for negative words. In Block 3, which consisted of 22 practice trials, and Block 4, which included 44 test trials, we combined Fukushima/Saga and positive/negative discriminations: pressing the left key for Fukushima or positive words and the right key for Saga or negative words. In the following blocks, the participants learned the opposite category-key mapping to that of Blocks 1, 3, and 4. In Block

5 (24 training trials), they were trained to indicate whether the product image was labeled as being from Saga or Fukushima: pressing the left key for Saga and the right key for Fukushima. Then in Block 6 (22 practice trials) and Block 7 (44 test trials), the participants pressed the left key when the presented stimulus was labeled as being from Saga or with a positive word, whereas they pressed the right key when the stimulus was labeled with Fukushima or a negative word. The order of the combinations was counterbalanced between the participants; blocks 1, 3, and 4 were switched with blocks 5, 6, and 7 for half of the participants .

Table 4 : Overview of the Implicit Association Test

Block	*No. of trials*	*Functions*	*Items assigned to left-key response*	*Items assigned to right - key response*
1	24	Practice	Fukushima products images	Saga products images
2	20	Practice	Pleasant words	Unpleasant words
3	22	Practice	Fukushima products images+ Pleasant words	Saga products images+ Unpleasant words
4	44	Test	Fukushima products images+ Pleasant words	Saga products images+ Unpleasant words
5	24	Practice	Saga products images	Fukushima products images
6	22	Practice	Saga products images+ Pleasant words	Fukushima products images+ Unpleasant words
7	44	Test	Saga products images+ Pleasant words	Fukushima products images+ Unpleasant words

Before each block, the participants were fully informed of the next task. Furthermore, we reminded the participants of the category-key mapping for each block as it came, and cue words were presented on the left-top or right-top of the screen for each trial.

After completing the IAT, the participants were requested to answer a questionnaire on paper (see Table 5), consisting of two items that assessed the absolute likeability of Fukushima and Saga on an 11-point Likert scale and one item that assessed their relative likeabilities on a 7-point Likert scale: (1) How much do you like products from Fukushima? (-5 = "I do not like Fukushima products at all," +5 = "I like Fukushima products very much"); (2) How much do you like products from Saga? (-5 = "I do not like Saga products at all," +5 = "I like Saga products very much"); (3) Which production area do you prefer? (-3 = "I strongly prefer Saga to Fukushima," +3 = "I strongly prefer Fukushima to Saga"). The neutral point was 0 for all three questions.

Table 5: 11- points Likert scale items included in Explicit Preference Questionnaire

1. Please rate how much do you like the products produced in Fukushima Prefecture? Evaluate the following scale.

0	1	2	3	4	5	6	7	8	9	10
Not at all likely										extremely likely

2. Please rate how much do you like the products produced in Saga Prefecture? Evaluate the following scale.

0	1	2	3	4	5	6	7	8	9	10
Not at all likely										extremely likely

Data Analyses

As traditional null-hypothesis significance tests do not allow for evidence in favor of the null hypothesis (Cumming, 2013; Wagenmakers, 2007), we used default Bayesian tests (Rouder & Morey, 2012) to determine whether the production area had any effect, or whether attitudes leaned to one side (positive or negative) or not (neutral). We treated the Bayes factors as measures of evidence for or against the effects of interest. Briefly, a Bayes factor (B_{10}) indicates the ratio of the likelihood that the data obtained favor a statistical model including the effects of interest, to the likelihood that they favor a model that excludes these effects. We use the terminology from Jeffreys (1961) and Wagenmakers, Wetzels, Borsboom, and van der Maas (2011) to denote the magnitude of the effects. A B_{10} value > 1 provides evidence for a statistical effect, whereas a B_{10} value < 1 provides evidence for the null hypothesis.

As an index of the positivity/negativity of the implicit attitudes towards Fukushima products relative to Saga products, we calculated the *D* score for each participant based on the reaction times (RTs) during the IAT (Greenwald, Nosek, & Banaji, 2003; Lane, Banaji, Nosek, & Greenwald, 2007, for more details). First, we excluded incorrect trials and trials with RTs < 300 ms and > 10,000 ms from the following analyses; consequently, 4.08% of the trials were excluded on average. Second, for each pair of practice (blocks 3 and 6) and test blocks (blocks 4 and 7), we subtracted the mean RTs from the Fukushima-positive/Saga-negative combined task from the mean RTs from the Fukushima-negative/Saga-positive combined task. Third, each difference was divided by the overall standard deviation of the RTs for that pair of blocks. Finally, we calculated the equal-weight average from the two ratios (mean differences/standard deviation) to obtain the *D* score. That is, a *D* score < 0 means that the Fukushima-negative/Saga-positive association is

stronger than the Fukushima-positive/Saga-negative association, whereas a *D* score > 0 means the reverse.

To compute internal consistency, we first separately subtracted each trial's RT in the Fukushima-negative/Saga-positive combination block from the RT of the corresponding trial of the Fukushima-positive/Saga-negative block. We then computed Cronbach's alpha (Cronbach & Meehl, 1955) of these different scores, following Bosson, Swann, & Pennebaker (2000). Cronbach's alpha is the most routinely used method to estimate the reliability of internal consistency (Parsons, Kruijt, & Fox, 2018). Alpha indicates the internal consistency in the tendency to associate Fukushima-related stimuli with a negative word (or impression), relative to Saga-related stimuli.

3.3 Results

Implicit Attitudes

The mean *D* scores of participants from Hiroshima and Tokyo were both less than 0, as shown in Figure 1. According to the results of a Bayesian one sample *t* test, there was moderate evidence that the score favored the null hypothesis in Hiroshima (B_{10} = 1/3.03, Cohen's d = 0.20), whereas there was moderate evidence that the score was less than 0 in Tokyo (B_{10} = 4.66, Cohen's d = 0.62). The Cronbach's alpha values were .91 for the IAT results of Hiroshima and .57 for Tokyo.

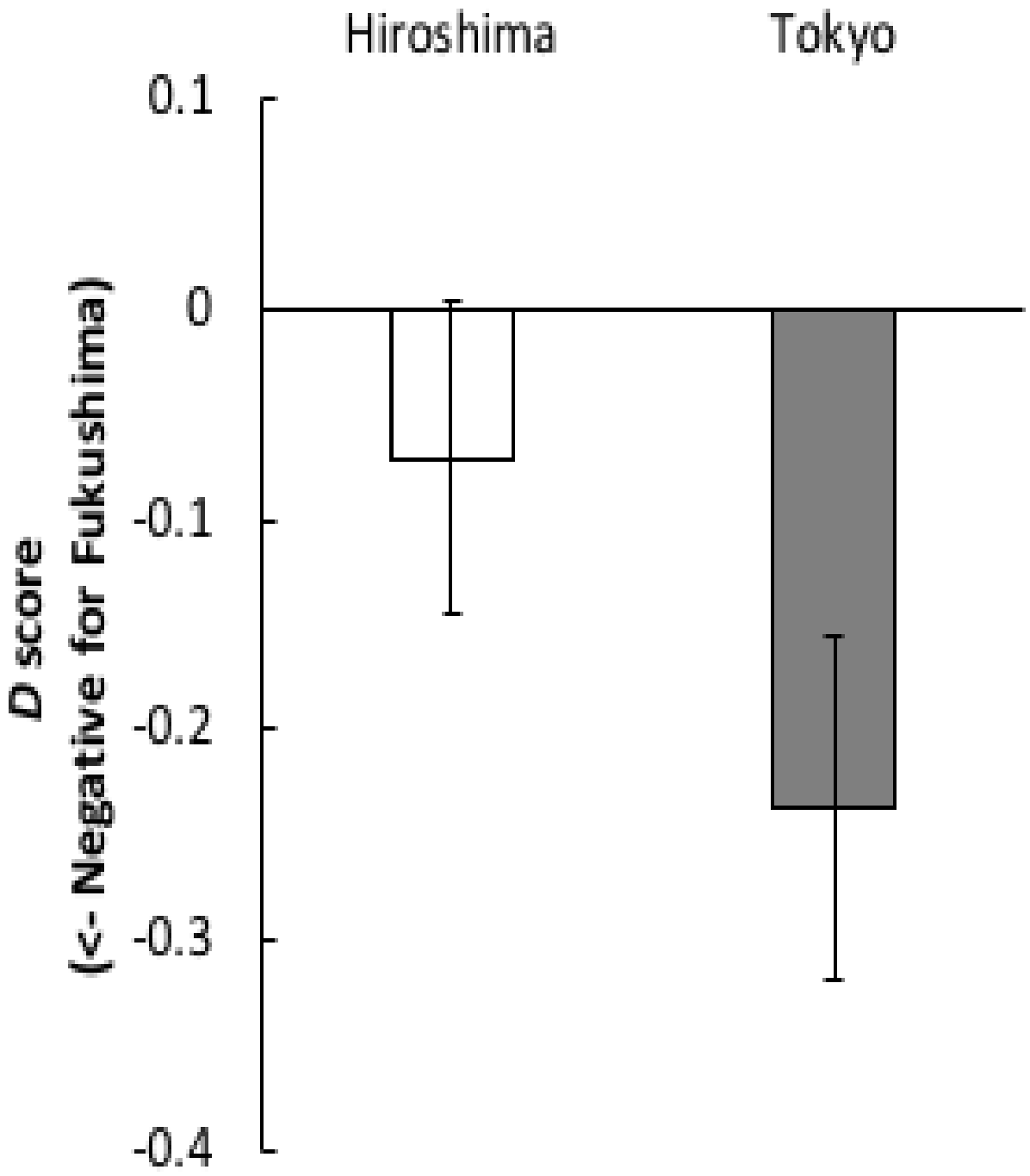

Figure 1: Mean D scores in Hiroshima and Tokyo. Error bars indicate standard error of the mean, which is informative to see how far the sample mean is likely to be from the true population mean.

Explicit Attitudes

We calculated the mean rating scores of absolute likeability (Figure 2) and relative likeability (Figure 3). For the participants from Hiroshima, Bayesian one sample *t* tests demonstrated moderate and strong evidence that the rating scores of absolute likeability were greater than 0 for products from Fukushima (B_{10} = 5.05, Cohen's d = 0.63) and Saga (B_{10} = 79.55, Cohen's d = 0.95). There was strong evidence that the participants from Tokyo rated the absolute likeability of Fukushima with a score greater than 0 (B_{10} = 39.96, Cohen's d = 0.87), but anecdotal evidence that the absolute likeability of products from Saga favored the null hypothesis (B_{10} = 1/1.29, Cohen's d = 0.38). In the case of the relative likeability, Hiroshima residents held moderately neutral attitudes (B_{10} = 1/4.34, Cohen's d = 0.05), whereas Tokyo residents anecdotally preferred Fukushima to Saga (B_{10} = 2.53, Cohen's d = 0.55).

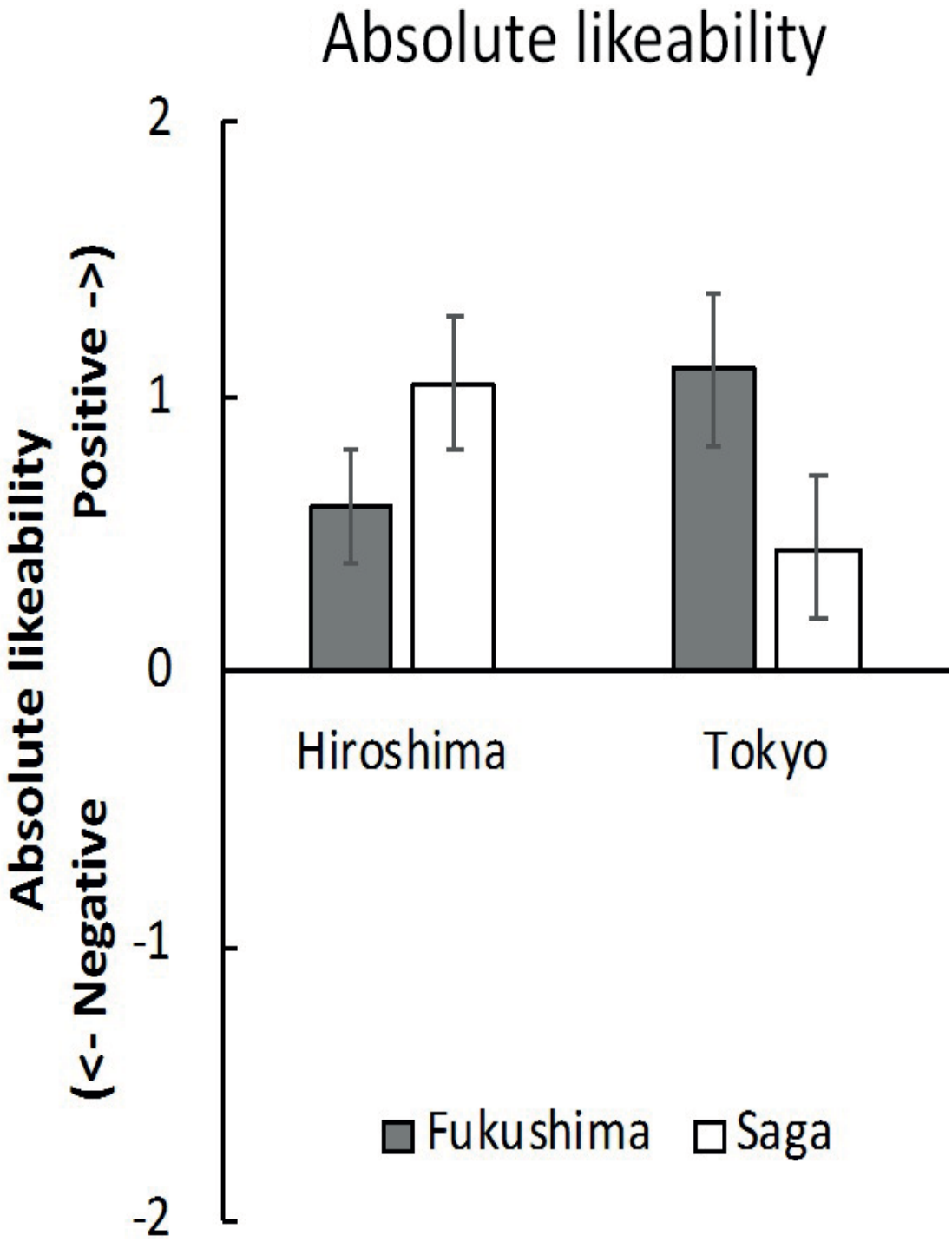

Figure 2: Mean rating scores of absolute likeability of Fukushima and Saga in Hiroshima and Tokyo. The neutral point is zero. Error bars indicate standard error of the mean, which is informative to see how far the sample mean is likely to be from the true population mean.

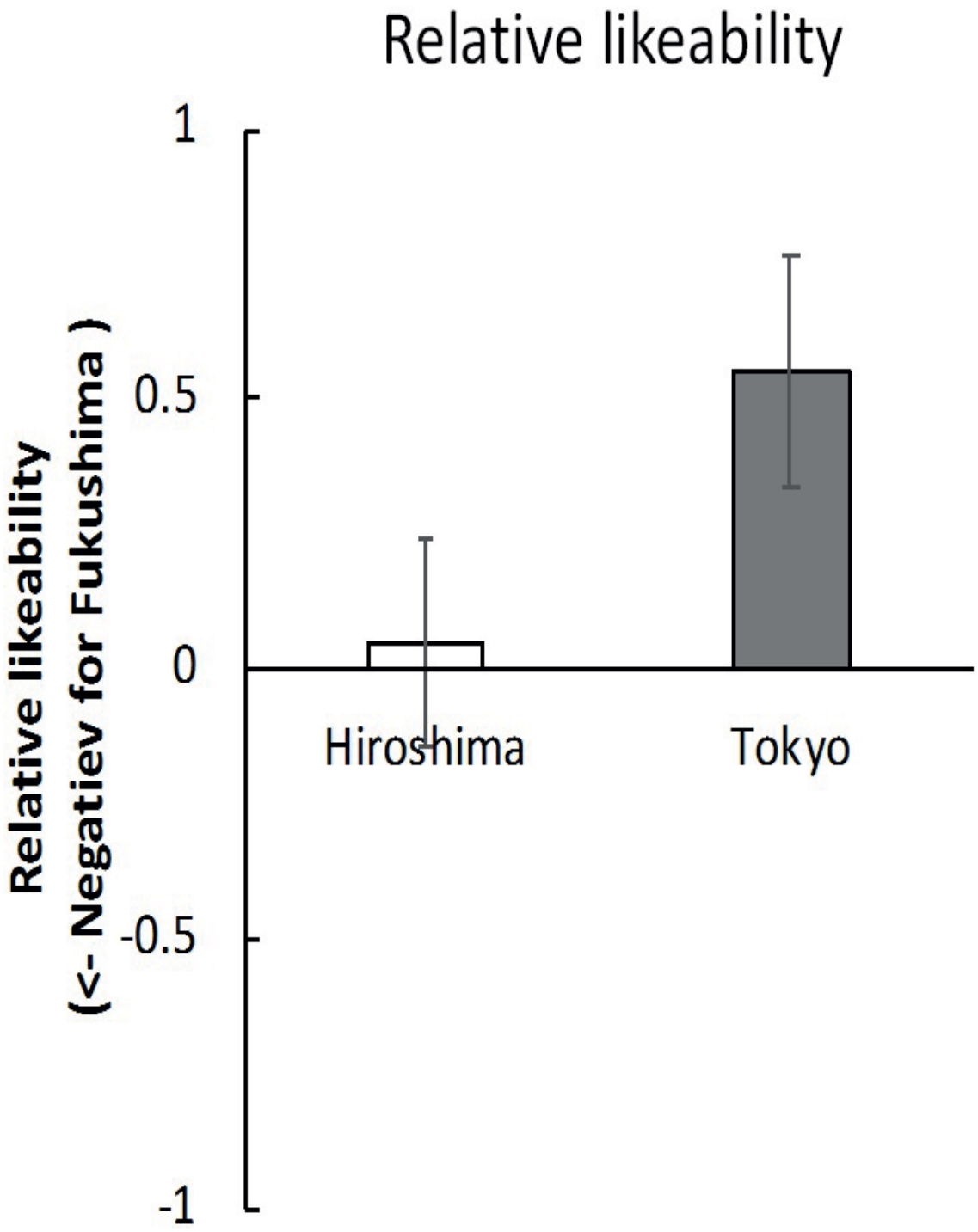

Figure 3: Mean rating scores of relative likeability of Fukushima in Hiroshima and Tokyo. The neutral point is zero. Error bars indicate standard error of the mean, which is informative to see how far the sample mean is likely to be from the true population mean.

3.4 Discussion

In Hiroshima, the Fukushima-negative/Saga-positive implicit association was equivalent to the Fukushima-positive/Saga-negative implicit association, suggesting that Hiroshima residents have neutral (or Saga-level) implicit attitudes towards Fukushima products; internal consistency was acceptable based on Cronbach's alpha. They held explicitly positive attitudes towards products from both regions. These results are consistent with those of previous work (Kudo & Nagaya, 2017; Miura *et al*., 2016) that found that Japanese consumers in general do not currently have negative implicit or explicit attitudes towards products from Fukushima.

On the other hand, the Fukushima-negative/Saga-positive implicit association was stronger than the Fukushima-positive/Saga-negative implicit association in the case of Tokyo residents; internal consistency was slightly low, which may have been due to the small sample size (but see acceptable evidence observed in study 2 below). This suggests that they have negative implicit attitudes towards products from Fukushima relative to those from Saga. Interestingly, their explicit attitudes were inconsistent with their implicit attitudes, which were consistently positive towards Fukushima. This discrepancy is in line with the previous suggestion (Wilson *et al*., 2000) that explicit and implicit attitudes can differ from one another, particularly with respect to social stigma.

Although we presented identical stimuli and tasks and used identical recruiting of participants in Hiroshima and Tokyo, the results of the IAT were different. This demonstrates that our current findings cannot be attributed to the physical characteristics of the stimulus images. Therefore, the results of study 1 suggest that consumers have relatively negative implicit attitudes towards products from Fukushima, although their explicit attitudes are positive. This divergence

was predominantly observed in the region near to Fukushima (i.e., Tokyo). These findings support our hypothesis that it is implicit negative attitudes rather than explicit negative attitudes that underlie the hesitancy to purchase products from Fukushima.

CHAPTER -4

Study 2: Exploring the individual differences between the negative implicit attitudes towards products from Fukushima region

4.1 Overview of Study

The results of study 1, we built on the findings in study 2, in which we explored the individual differences between the negative implicit attitudes towards products from Fukushima held by Tokyo residents. We focused on the *perceived vulnerability to disease* (PVD, Duncan, Schaller, & Park, 2009), which is defined as an individual's beliefs about their subjective vulnerability to the transmission of infectious diseases (*perceived infectability*) and an individual's tendency to experience emotional discomfort when exposed to potential disease transmission (*germ aversion*).

Because negative implicit and explicit social attitudes are associated with individual differences between chronic and temporary concerns about disease transmission (Duncan & Schaller, 2009; Duncan *et al*., 2009; Faulkner, Schaller, Park, & Duncan, 2004; Huang, Sedlovskaya, Ackerman, & Bargh, 2011; Murray, Jones, & Schaller, 2013; Schaller & Duncan, 2007), it is possible that consumers' implicit attitudes towards products from Fukushima, or radioactive contamination in Fukushima, would vary with their PVD. Although the effects of radiation are not infectious, they are parallel to pathogenic threats in terms of being invisible.

Previous research on evolutionary psychology proposes an adaptive strategy, which is conceptualized as the *behavioral immune system*. This allows us to detect and avoid objects perceived as a threat to health (Kurzban & Leary, 2001; Schaller & Duncan, 2007; Schaller & Park, 2011). Within this context, we predicted that the implicit attitudes towards Fukushima products

may depend on the individual differences between the participants' aversive affective responses to an invisible threat, particularly germ aversion, in terms of their PVD.

4.2 Method

Ethics Statement

All of the experiments carried out in this study were reviewed and approved by the Institutional Review Boards of Rissho University (Tokyo), Japan. Written informed consent was obtained from all participants before and after the experiment.

Participants

We recruited 60 Japanese participants (44 female, mean age = 19.88 years, SD = 6.84 years) from Tokyo with the aim of investigating human cognition. The experiment was run between April 2018 and July 2018. The participants were blinded to the purpose of this study.

Stimuli and Procedure

These were almost the same as those used in Study 1, except that the participants completed the Japanese version of the PVD questionnaire (Fukukawa et al., 2014) at the end of the experiment. The stimuli and procedures used are highly recommended and preferred for their role in assessing and establishing the degree to which people consider themselves to be susceptible to illnesses. To capture relevant data, the technique utilizes tools and equipment with a high precision rate in capturing the relevant information, thus assessing the vulnerability of the participants involved. Some of the statements used to assess a participant's susceptibility assume the following structure: *I have been highly vulnerable to infections and other conditions in the past*. Another example includes, *I prefer sanitizing my hands after visiting the washroom or shaking someone's hand*. Finally, according to Faulkner et al. (2004), the Cronbach's alphas ranges from 0.70 to 0.80.

4.3 Results

PVD

The perceived infectability ranged from 1.00 to 6.14 (M = 3.75, SD = 1.29), and germ aversion ranged from 2.13 to 6.38 (M = 4.14, SD = 0.98).

Implicit Attitudes and PVD

We first calculated the D score, as in Study 1, which demonstrated extreme evidence that the score was less than 0 (M = –0.28, SE = 0.04, B_{10} = 391.99 × 10^3, Cohen's d = 0.82); Cronbach's alpha was .92. The correlation between the D score and perceived infectability demonstrated moderate evidence for the null hypothesis (B_{10} = 1/5.46, r = –.07). The correlation between the D score and the germ aversion score also demonstrated moderate evidence for the null hypothesis (B_{10} = 1/3.64, r = –.14), though it was negative.

To assess the influence of perceived infectability from a different perspective, we divided the participants into a low group and a high group (with average scores of 2.70 vs. 4.80, n = 30 in each group, see Figure 4). We conducted Bayesian one sample t tests, which revealed strong evidence that the D scores were less than 0, independently of perceived infectability (B_{10} = 107.18, Cohen's d = 0.75 for low-score group; B_{10} = 808.47, Cohen's d = 0.90 for high-score group); it should be noted that evidence was statistically stronger under the high compared to low perceived infectability, though the scores themselves showed the reversed relationship. In terms of the germ aversion score (3.36 vs. 4.91 in average, n = 30 in each group, as shown in Figure 5), the high-score participants demonstrated extremely negative implicit attitudes towards products from Fukushima (B_{10} = 539.93 × 10^2, Cohen's d = 1.20). There was only moderate evidence among the low-score participants (B_{10} = 9.72, Cohen's d = 0.57).

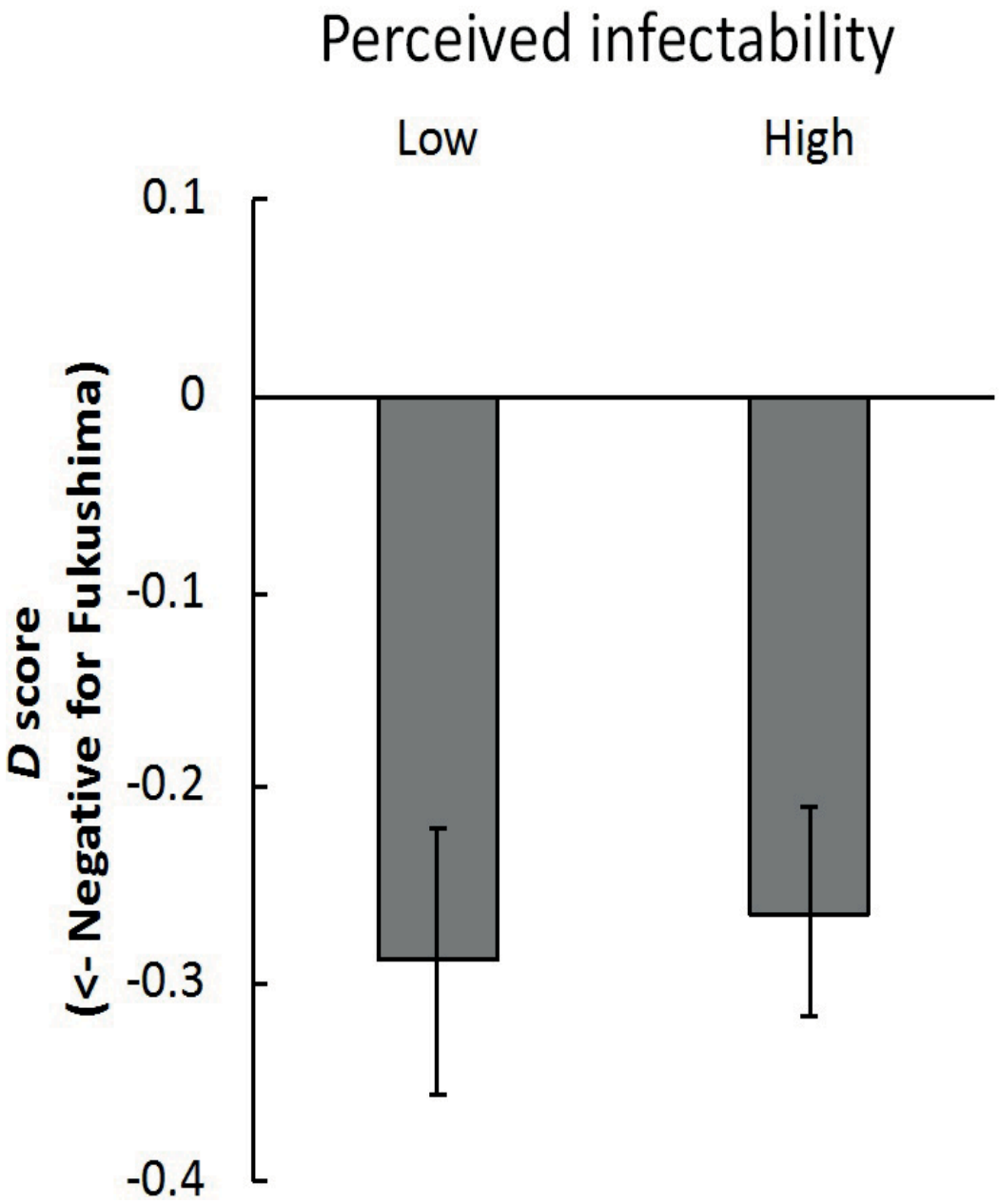

Figure 4: Mean D scores among Tokyo residents of low/high perceived infectability. Error bars indicate standard error of the mean, which is informative to see how far the sample mean is likely to be from the true population mean.

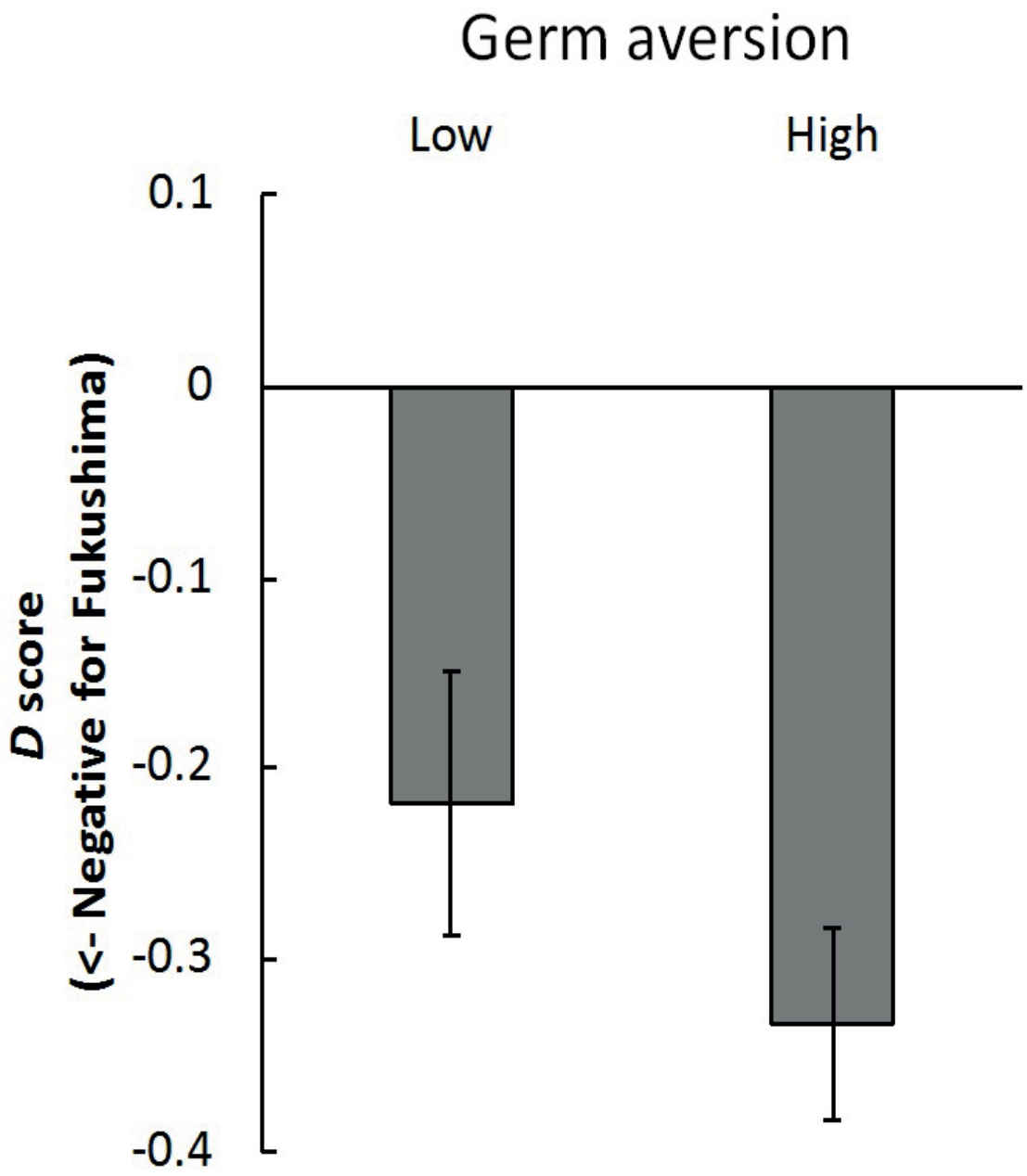

Figure 5: Mean D scores among Tokyo residents of low/high germ aversion. Error bars indicate standard error of the mean, which is informative to see how far the sample mean is likely to be from the true population mean.

Explicit Attitudes and PVD

We calculated the absolute and relative likeabilities, which demonstrated extreme evidence that all of the scores were above 0 ($M = 2.33$, $SE = 0.18$, $B_{10} = 247.20 \times 10^{13}$, Cohen's $d = 1.63$ for the absolute likeability of Fukushima; $M = 1.27$, $SE = 0.20$, $B_{10} = 424.55 \times 10^{3}$, Cohen's $d = 0.82$ for the absolute likeability of Saga; $M = 0.60$, $SE = 0.13$, $B_{10} = 830.98$, Cohen's $d = 0.59$ for the relative likeability of Fukushima to Saga). The correlation between the explicit attitudes and perceived infectability demonstrated evidence for the null hypothesis ($B_{10} < 1/1.16$, $r = -.24$ to $.12$). The correlation between the explicit attitudes and germ aversion also demonstrated evidence for the null hypothesis ($B_{10} < 1/3.33$, $r = -.15$ to $-.05$).

We calculated the mean rating scores, in terms of perceived infectability and germ aversion, for the absolute and relative likeability for both the low group and the high group. The results of our Bayesian one sample *t* tests demonstrated strong evidence that the absolute likeability rating scores were greater than 0 (Figure 6). These were less influenced by the perceived infectability ($B_{10} = 133.30 \times 10^{6}$, Cohen's $d = 1.81$ for Fukushima in the low-score group; $B_{10} = 15.12$, Cohen's $d = 0.60$ for Saga in low-score group; $B_{10} = 138.40 \times 10^{4}$, Cohen's $d = 1.45$ for Fukushima in the high-score group; $B_{10} = 232.34 \times 10^{2}$, Cohen's $d = 1.14$ for Saga in the high-score group). We have strong evidence that the relative likeability rating was greater than 0 among the low-perceived-infectability participants (Figure 7 , $B_{10} = 37.93$, Cohen's $d = 0.67$), whereas this evidence was moderate among the high-perceived-infectability participants ($B_{10} = 4.24$, Cohen's $d = 0.49$).

Perceived Infectability

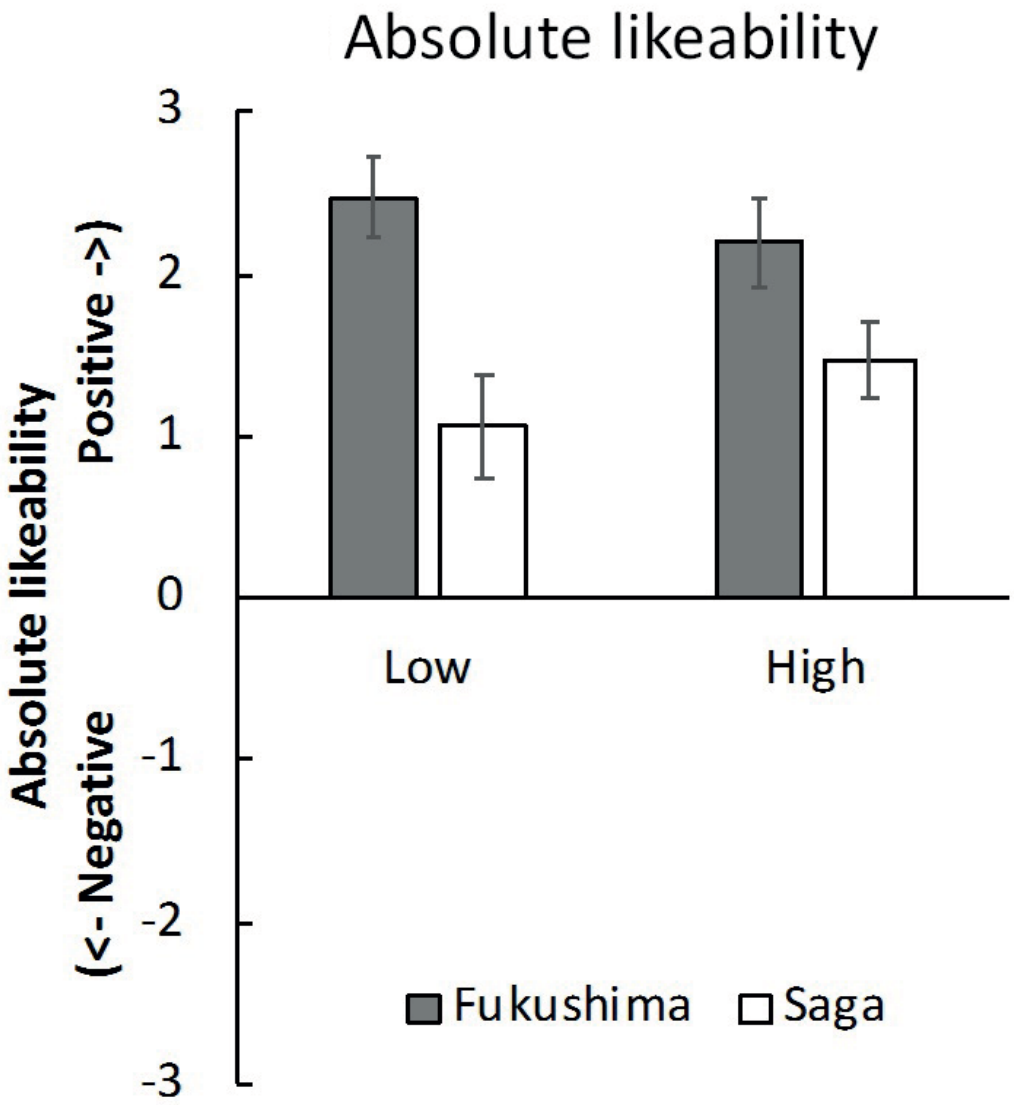

Figure 6: Mean rating scores of absolute likeability of Fukushima and Saga in each low/high perceived infectability group. Error bar indicates standard error of the mean, which is informative to see how far the sample mean is likely to be from the true population mean.

Perceived Infectability

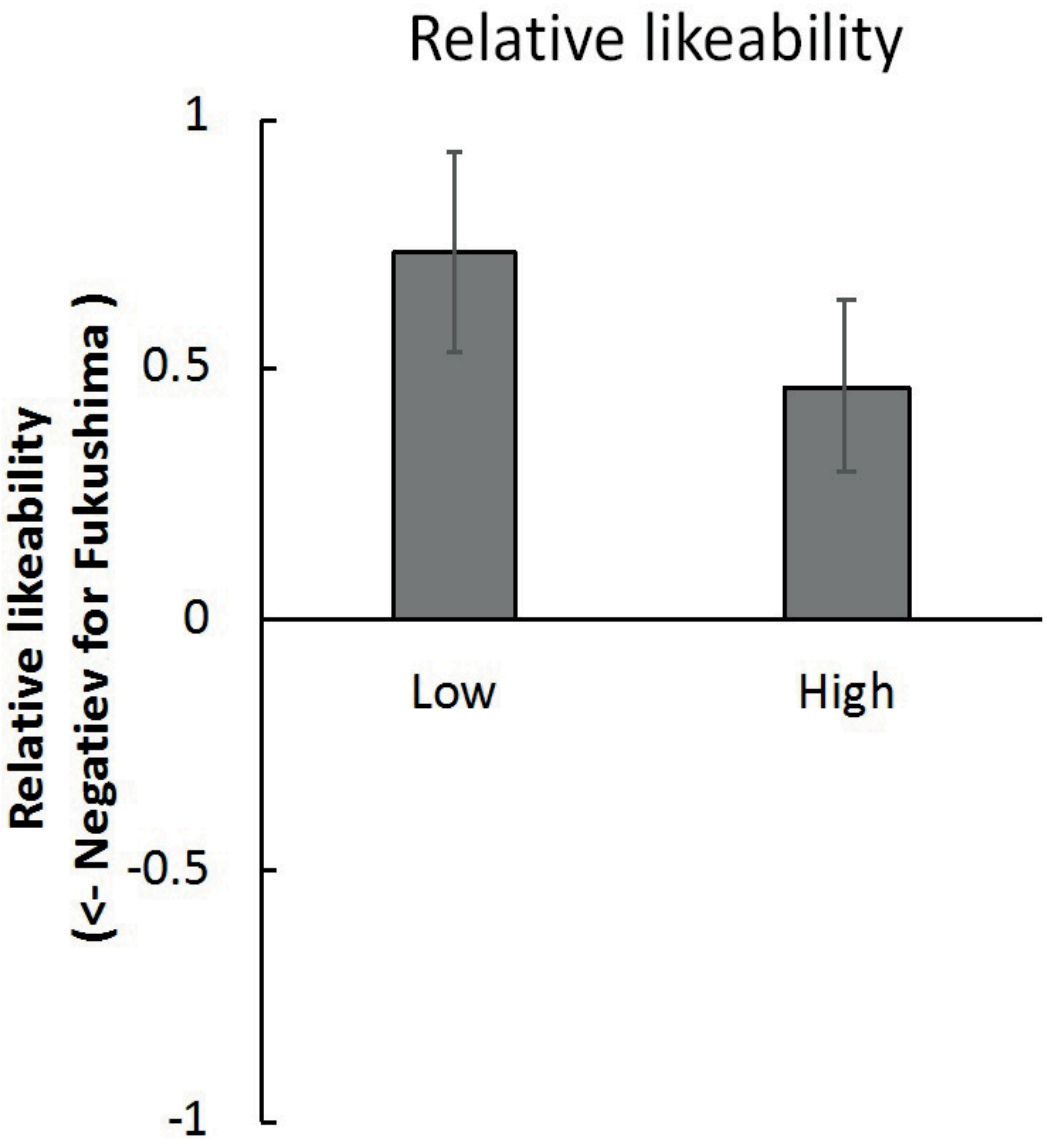

Figure 7: Mean rating scores relative likeability in each low/high perceived infectability group. Error bars indicate standard error of the mean, which is informative to see how far the sample mean is likely to be from the true population mean.

The absolute likeability rating scores were much greater than 0 (Figure 8), being less influenced by germ aversion (B_{10} = 708.40 × 10^4, Cohen's d = 1.57 for Fukushima in the low-score group; B_{10} = 64.21, Cohen's d = 0.71 for Saga in the low-score group; B_{10} = 208.80 × 10^5, Cohen's d = 1.66 for Fukushima in the high-score group; B_{10} = 151.18 × 10, Cohen's d = 0.95 for Saga in the high-score group). We have strong evidence that the relative likeability rating was greater than 0 among the low-germ-aversion participants (Figure 9 , B_{10} = 355.65, Cohen's d = 0.84), whereas our evidence was anecdotal in the case of the high-germ-aversion participants (B_{10} = 1.12, Cohen's d = 0.36).

Germ Aversion

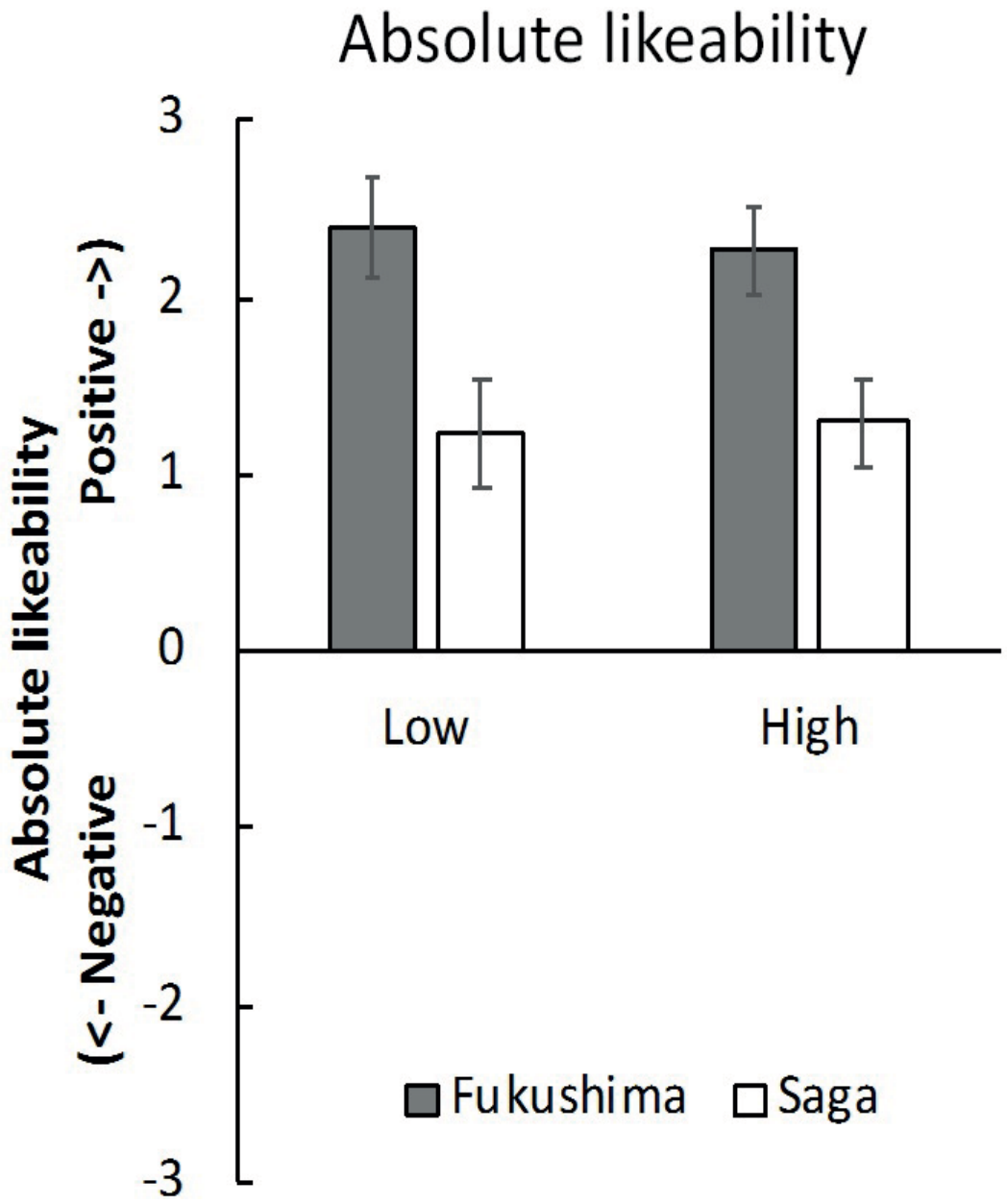

Figure 8: Mean rating scores of absolute likeability in each low/high germ aversion group. Error bars indicate standard error of the mean, which is informative to see how far the sample mean is likely to be from the true population mean.

Germ Aversion

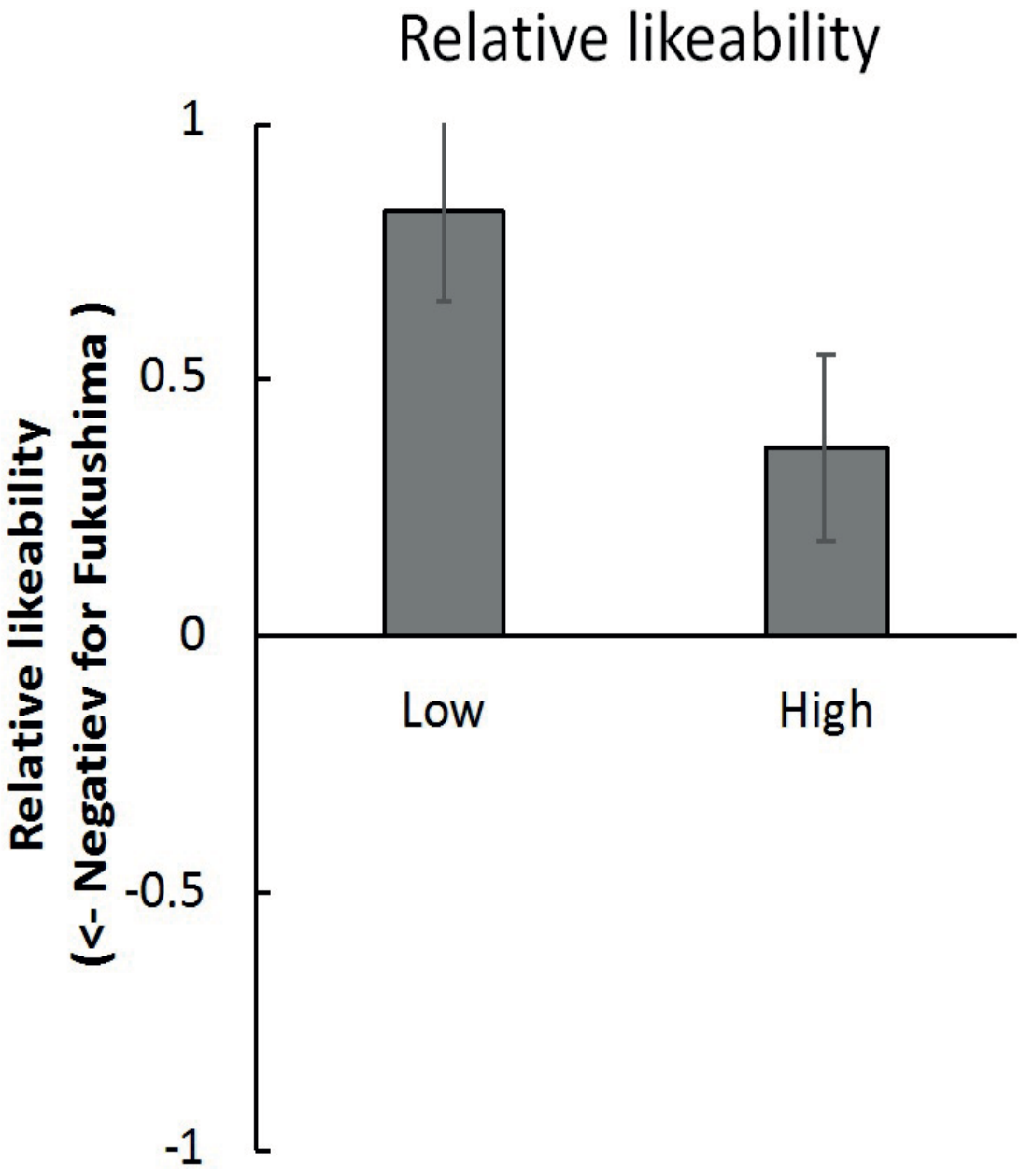

Figure 9: Mean rating scores of relative likeability in each low/high germ aversion group. Error bars indicate standard error of the mean, which is informative to see how far the sample mean is likely to be from the true population mean.

Correlation between Implicit and Explicit Attitudes

Because, prior to the PVD questionnaire, the procedure was identical to that of Study 1, we combined the data concerning the implicit and explicit attitudes of Tokyo residents gathered in Study 1 and 2. The correlation between the *D* scores and the relative likeability ratings for products from Fukushima was weakly negative (n = 80, B_{10} = 1/1.45, r = –.20), although the evidence anecdotally favored the null hypothesis.

4.4 Discussion

First, the implicit attitudes towards agricultural and aquatic products from Fukushima were again negative relative to those from Saga; internal consistency was now acceptable. Second, the explicit attitudes towards products from Fukushima were consistently positive, and hence dissociated from the implicit attitudes. Thus, the findings of Study 1 were robustly supported by those of Study 2.

Third, as predicted, we found a negative correlation between the *D* score and germ aversion, but it was not statistically supported. We consider that the absence of the statistical support is likely to be due to the extreme *D* score; that is, the correlation was undetectable due to the ceiling effect. After dichotomizing the data via a median split, we identified moderately negative implicit attitudes towards Fukushima amongst participants with low aversion to germs, compared to participants with high aversion to germs.

Furthermore, although this effect was moderate amongst participants with low aversion to germs, we detected a large effect in the participants with high aversion to germs, based on Cohen (1969). Although the median split is controversial (see Rucker, McShane, & Preacher, 2015), we would like to emphasize that it demonstrated a consistent trend with the correlation. On the other

hand, the negative implicit attitudes towards Fukushima, including the effect size, were independent of the perceived infectability. These results can be interpreted in the context of the behavioral immune system (Duncan *et al*., 2009; Kurzban & Leary, 2001; Schaller & Duncan, 2007; Schaller & Park, 2011).

As the perceived infectability in PVD reflects the self-perceived susceptibility to infection, it might be less relevant to radioactive contamination, which is not contagious. However, the aversion to germs in PVD reflects emotional discomfort in the presence of potential disease transmission vectors. Thus, converging evidence suggests that the participants of this study would have aversive affective responses to products from Fukushima so that they can avoid the invisible threat of radiation.

In terms of the correlation between implicit and explicit attitudes, there was a negative trend among the participants residing in Tokyo, although this was not supported by any statistical evidence. Therefore, current evidence suggests that the implicit attitudes were dissociated from, but not opposed to, the explicit attitudes; more work is needed with respect to this issue.

CHAPTER FIVE: GENERAL DISCUSSION

5.1 Overall Discussion

We investigated the following three questions: (1) Do Japanese consumers show negative implicit attitudes towards agricultural and aquatic products from Fukushima? (2) Do implicit and explicit attitudes differ from each other? (3) Do consumers' attitudes differ among residential areas?

The answers to these questions are all yes. Although Japanese participants consistently had positive explicit attitudes toward products from Fukushima, relative to those from Saga, their implicit attitudes towards Fukushima were reliably negative. These were more predominant in the region near Fukushima (i.e., Tokyo) than in the region further away (i.e., Hiroshima). This indicated that the physical distance between producers of products in Fukushima and the consumers influences the implicit and explicit attitudes of consumers towards products from Fukushima. This is likely because the people living far away (Hiroshima) from Fukushima are less exposed to the products in Fukushima in consumption and thus have less information about the products, compared to region near Fukushima (Tokyo).

The results of recent research and market surveys (Japan Agricultural Communications, 2018; Kudo & Nagaya, 2017; Miura *et al*., 2016) suggest that the current consumption situation embraces the apparent contradiction that products from Fukushima are somehow avoided by consumers who have no negative attitudes towards them. Focusing on the implicit attitudes and where consumers live, we succeeded in demonstrating a stepping stone towards the resolution of

this paradox. Implicit attitudes may be associated with hesitancy to purchase products from Fukushima.

Furthermore, we explored individual differences in the formation of these implicit attitudes towards products from Fukushima in terms of the PVD (Duncan *et al*., 2009). The results of our analyses suggest that the negative implicit attitudes towards Fukushima products were attenuated (but still persistent) in participants with relatively low germ aversion in PVD. However, participants with high germ aversion demonstrated a large negative implicit attitudes towards Fukushima products because they are very sensitive to what they hear about a product. The behavioral immune system of individuals with high germ aversion would be very active than those with low germ aversion. Therefore, they can identify products associated with health effects in time and avoid consuming such products, unlike low germ aversion individuals who do not care much what they hear about a product's health effects (Pilch & Hyla ,2017).

Previous research suggests that we establish negative implicit attitudes towards foreigners or outside groups based on threat-connoting cues (Duncan *et al*., 2009; Faulkner *et al*., 2004; Huang *et al*., 2011). In this research, the label "Fukushima products" might serve as a threat-connoting cue, which then activates the behavioral immune system. This is our evolutionary adaptive disease-avoidance mechanism (Kurzban & Leary, 2001; Schaller, 2011; Schaller & Duncan, 2007; Schaller & Park, 2011).

Because radiation is a serious threat to our health and survival that is also invisible, like a pathogen, it is plausible that consumers promote aversive, cautious (sometimes overcautious) attitudes towards products from Fukushima to minimize the impact of errors in judgment (they avoid making a type II false negative error in terms of error management theory, Haselton & Buss,

2000). As a result, consumers' attitudes are generally biased towards type I false-positive errors. This response is caused by the behavioral immune system (Kouznetsova, Stevenson, Oaten, & Case, 2012; Miller & Maner, 2012; Oaten, Stevenson, & Case, 2009; Schaller, 2011). It has been suggested that the aversive, cautious response varies not only between individuals but also across external contexts, such as geographical region (Schaller & Murray, 2008).

Our current findings (i.e., that negative implicit attitudes reliably observed in the region near Fukushima compared to the region far away) are consistent with this psychological survival function. Thus far, it has been shown that individuals' anxiety and knowledge regarding radiation risk interactively influence their attitudes towards products from radioactive contamination areas (Miura *et al*., 2016). Developing this knowledge, the results of this research suggest that it is not just these factors but also individual differences in PVD that contribute to consumers' attitudes.

5.2 How to change consumers' implicit attitudes

It is intriguing that consumers' implicit attitudes are negative depending on the PVD, even though the radiation risk is not contagious unlike pathogen. Investigating this issue would provide us important clues to change consumers' negative implicit attitudes to being positive. At present, we assume that consumers' negative implicit attitudes would shift to be positive if consumers were provided with scientifically correct information that radiation is not pathogenic. As a results, people might want to consume Fukushima products upon learning that they are disease-free. Apparently, future research is needed to investigate this issue.

Presumably, the good way to change the negative implicit attitudes of consumers towards products from Fukushima to be positive is by carrying out consumer education. Importantly, I

believe that it is science including my current findings that consumer education should be based on. This can be done by advertising products and informing consumers more about Fukushima products together with scientific findings through social medias such as newspapers and televisions and recently Facebook and Twitter etc. Nowadays, so many people interact through social media, thereby posting persuasive articles about Fukushima`s products may persuade people with negative implicit attitudes on Fukushima products and develop positive implicit attitudes towards the products. To achieve this, researchers including me should actively and comprehensively outreach their research outcome to the target consumers.

5.3 Limitations of this research

The research demonstrated that negative implicit attitudes might be highly associated with purchase hesitation of Fukushima products. However, it was difficult to directly establish a relation or measure negative implicit attitudes and their translation to negative purchase behaviors. Various interplaying factors influence people's social perceptions and conduct which may be natural or based on situational contexts. Group attitudes and stereotyping may be activated spontaneously from memories of the perceiver or may be triggered by exposure to a stimulus cue in the environment (Wittenbrink et al., 2001). It is attributed to variability in expected automatic activated attitudes, which may cause spontaneous prejudice based on a particular context. The perceiver is often unaware of activation and the subsequent influences on their judgment and behaviors; thus, establishing and quantifying a relation between implicit attitudes and purchase behavior of Fukushima products would be problematic (Forscher et al., 2019). In future research, one can avoid generalizability by changing the confines of a single experimental session to incorporate changes in implicit measures.

Other limitations were response biases on implicit tasks. Implicit measures are prone to various influences as they are based on procedures that associate a particular set of concepts, invoking specific goals or motivations (Ramos et al., 2015). Other procedures that induced affirmation, threats, or certain emotions or moods also relatively influenced implicit tasks. The tests exhibited some biases that could result in implicit effects inflation relative to their typical population values.

Adopting an approach that avoids automatic and deliberate processes can be more reliant since people will have sufficient motivation, awareness, or ability to reflect. Exposure was also a limitation of this research. Applying concepts such as reaction time in IAT to measure the strength of a particular association highly depended on whether an individual could identify with specific ideas; hence people who had excellent exposure to the Fukushima explosion were likely to exhibit more implicit bias towards Fukushima products than those with relatively lower exposure (Ramos et al., 2015). In this case, their implicit attitudes scores would not be dependent on typical attributes such as their perceived disease vulnerability or germ aversion; hence the reliability of the scores would be lower. Therefore utilizing it to determine consumer purchasing behavior would not be valid to some extent. In the future, researchers should adopt sustained repeated pairings of information rather than an automatically retrieved association that may shift upon re-exposure to the environment.

Furthermore, my experiments were conducted before COVID-19. Given my current findings, the consumers' PVD would have been increased and thus made their attitudes to be more negative for Fukushima products, since the outbreak of COIVD-19. In future, it would be interesting to see the influence of COVID-19 on the change of consumers' attitudes.

5.4 Limitations of IAT

The IAT is used to assess implicit attitude by measuring the relationship between a target concept and the two different extremes of an attribute (Baccus et al., 2004). It measures the familiarity and perceptual salience asymmetry, which makes it prone to various limitations. It may be inclined to demonstrate a particular amount of resistance to social desirability biases. It may also be susceptible to conscious control where an individual subject a deliberate obscure of a valid association where the audience has heightened awareness of the test's nature which may compromise the outcome through activation of fluencies and associations (Haines & Sumner, 2006). Since it relies on reaction time to establish the strength of association, it is challenging to associate positive attributes with less familiar concepts, resulting in a generalized outcome. For example, lack of familiarity may lead to an association with a negative trait. The measure is based on the favorableness toward two concepts that only tell whether one prefers A or B.Other factors include cognitive fluency and age. Participants with slower response times tend to have high IAT cores, such as the older generation, who may generally take longer to respond. Exposure to a particular stimulus cue may also affect IAT reliability as a repeated administration tends to decrease the magnitude effects of a specific person (Baccus et al., 2004). The IAT also demonstrates inconsistent internal consistencies. Consistency is measured by test-retest between multiple administrations whose scores vary, indicating a combination of traits and states characteristics.

5.5 The Importance of this research in the context of the Radiation Disaster and Social Recovery

The research demonstrates the significance of a coordinated strategy by all stakeholders, including businesses, the local government, and the community, in creating a united front and responses to address the source of these social issues and create a new opportunity for all stakeholders. The research was significant in enabling a review and understanding issues relating to radiation concern and the aftermath recovery process of the radiation accident. The research also illustrates the approach to engaging the public in recovery from radiation exposure concerns in day-to-day activities. Among the long-term initiatives in the management of radiation social recovery is adapting a cohesive and holistic approach in restoring sustainable livelihood and social re-integration. It also illustrated the significance of assessing and addressing public perceptions on risks and actual risks in reigniting social recovery and environmental remediation.

The research also illustrates how consumers' implicit and explicit attitude towards a particular product influences their purchasing patterns. The research also illustrated a need to publicize evidence screened reports for radioactive contamination in cases of radiation disasters to avert social stigma resulting from consumers' overcautious behaviors and prevent reputational damage. Manufacturing companies and farmers can utilize this research to understand factors that may cause negative implicit attitudes on their product, such as human cognition, based on their PVD or germ aversion. For example majority of consumers today are adopting green consumerism; hence adopting such strategies may positively impact consumers' attitudes towards an company's product.

5.6 Conclusion

Our results provide fundamental evidence supporting our hypothesis that it is implicit rather than explicit negative attitudes that elicit hesitancy about purchasing products from Fukushima. Future research is needed to validate our hypothesis more thoroughly. We will investigate whether the findings presented in this research do indeed underpin the hesitation towards products from Fukushima. In fact, PVD has previously been reported to relate to consumers' intentions to buy secondhand products (Kapitan & Bhargave, 2013). This supports our hypothesis. Future studies should determine whether a more negative implicit attitude towards Fukushima products is associated with a greater hesitancy to purchase these products.

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APPENDIX A

Stimuli photographs for the Implicit Association Test

Sunflowers:

Rice:

Fishes:

APPENDIX B

Words were used in IAT

Good:

輝かしい　元気　見事な　笑い　平和

Bad:

痛ましい ひどい 恐ろしい 苦悩　失敗

APPENDIX C

Explicit measure questionnaire sheet (Japanese version)

質問票

この度は，実験にご協力いただきありがとうございました。

この質問票は，福島県産の製品と佐賀県産の製品についてあなたの印象を尋ねるものです。回答の際は，あまり深く考えすぎず，思いついたままをお答えください。

お答え頂きました内容につきましては，学術的目的以外では使用しません。学術的目的で使用した場合にも，お答え頂いた内容はコンピュータで数量化・匿名化し，個人が特定される形で公表されることはありませんので，安心してお答えください。

また，回答はいつでも中止することができ，回答を中止しても不利益につながることはありません。

10段階の好感度例

10　ものすごく好きだ

9　非常に好きだ

8　かなり好きだ

7　やや好きだ

6　少し好きだ

5　どちらともいえない

4　少し嫌いだ

3　やや嫌いだ

2　かなり嫌いだ

1　非常に嫌いだ

0　ものすごく嫌いだ

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広島大学総合科学研究科　准教授　有賀敦紀

質問1.
あなたは福島県産の製品に対して，どの程度好感をもっていますか？上の例を参考にして，0から10の間で評価してください。

質問2.
あなたは佐賀県産の製品に対して，どの程度好感をもっていますか？上の例を参考にして，0から10の間で評価してください。

質問3. 次のうちあなたに最もあてはまるものはどれですか？数字で答えてください。
7= 佐賀県産の製品より福島県産の製品のほうがはるかに好きだ
6= 佐賀県産の製品より福島県産の製品のほうがかなり好きだ
5= 佐賀県産の製品より福島県産の製品のほうが少し好きだ
4= 福島県産の製品も佐賀県産の製品も同じくらい好きだ
3= 福島県産の製品より佐賀県産の製品のほうが少し好きだ
2= 福島県産の製品より佐賀県産の製品のほうがかなり好きだ
1= 福島県産の製品よりも佐賀県産の製品のほうがはるかに好きだ

質問4. あなたの性別を答えてください。

質問5. あなたの年齢を答えてください。

歳

質問6. あなたの出身地を答えてください。

APPENDIX D

Japanese version of the PVD questionnaire

	項目
8.	風邪やインフルエンザなどにとても感染しやすい
12.	風邪やインフルエンザが流行っていても，私はかかりにくい
10.	他の人よりも，病気にかかりやすいほうだ
5.	から，友人が病気になっても自分はならないと思う
14.	他の人ならかかる病気でも，私の免疫力が私を守ってくれるだろう
2.	何か病気が流行ったら，私もそれにかかるだろう
6.	昔は病気にかかりやすかった
7.	誰かと握手したあとは，手を洗いたくなる
15.	前に使った人から何かうつりそうなので，公衆電話は使いたくない
3.	友人が口をつけたボトルから，平気で水が飲める
9.	最後に着た人がわからないので，古着は着たくない
11.	お金に触ったあとでも，自分の手を汚なく感じたりはしない
4.	誰かの噛み跡がついた鉛筆では書きたくない
1.	口に手をあてずにくしゃみをする人とは，一緒にいたくない
13.	病気の人がそばにいても，いやではない

注） 項目 3，5，11，12，13，14 は逆転項目