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Implications of Conflicting Health Information for Trust in the Media and Scientists in the ASEAN Region

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Abstract

This working paper explores how conflicting health information—specifically concerning probiotic supplements—shapes public trust in media and scientific authorities across five ASEAN countries: Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. Amid global concerns about the erosion of trust in science, the study reveals that health-conscious individuals often seek more health information yet may simultaneously exhibit scepticism toward health claims, particularly in emerging product categories. Using cross-sectional survey data, the paper identifies varied impacts of media platforms on trust and confusion, noting that traditional media and websites are more associated with nutrition confusion, while social media and experts can contribute to backlash. The findings highlight the complex interplay between information exposure, media consumption, and cultural context in shaping public attitudes. The study calls for harmonized regulations, improved communication strategies, and deeper, culturally grounded research to strengthen public trust in science across the region.

Keywords

public trust, conflicting information, probiotics, ASEAN, health communication, media influence, scientific authority

Table of Contents

Abstract	3
Table of Contents	4
Executive Summary	5
Introduction	6
Trust in Science & Media	6
Conflicting Information	7
Health Consciousness	8
Research Questions	8
Methodology	8
Results	11
Key Points	13
Limitations of the Study	16
Way Forward	17
References	17
Annexes	20

Executive Summary

The working paper is a timely and insightful analysis of how conflicting information about health, specifically probiotic supplements, influences public trust in media and scientific authorities across five ASEAN countries: Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. Situated within the broader context of the United Nations Secretary-General's Scientific Advisory Board's concerns about the growing divide between the public and scientific institutions, this study addresses a critical gap in understanding trust dynamics in a region where scientific research and health communication are rapidly evolving.

At its core, the paper highlights the complex relationship between health consciousness, exposure to conflicting health information, and trust in both scientists and media. The authors emphasize that trust in science is foundational for effective public health interventions and adherence to health directives. However, this trust is increasingly challenged by the proliferation of conflicting information (CI) across traditional and social media platforms, which can lead to confusion, skepticism, and backlash among consumers.

The case of probiotic supplements, a growing industry in the Asia Pacific region, serves as a microcosm to explore these dynamics, revealing how despite conflicting messages, consumer interest and market growth continue, underscoring the nuanced nature of trust and information processing in health contexts.

The study's methodology involves a cross-sectional survey design, capturing data from diverse populations across the ASEAN region. While this approach provides valuable snapshots of attitudes and behaviors, the authors acknowledge limitations such as the inability to infer causality and potential biases from self-reported measures. The sample representativeness and the use of a single-item measure for exposure to conflicting information are also noted as constraints. These methodological considerations suggest that while the findings offer important insights, they are preliminary and call for more robust, longitudinal, and culturally nuanced research designs to deepen understanding.

Key findings from the paper include the recognition that health-conscious individuals tend to seek more health information and generally place greater trust in health experts. Yet, paradoxically, they may also exhibit increased skepticism towards health claims, particularly in emerging food categories like probiotics. The study further reveals that exposure to conflicting information varies by media source: television and websites are linked more to nutrition confusion, whereas social media and health experts sometimes contribute to nutrition backlash. This distinction underscores the differentiated roles media platforms play in shaping public perceptions and trust.

A significant contribution of the paper is its emphasis on the role of media in mediating trust. The authors discuss how the agenda-setting and framing functions of news media influence public processing of scientific information, particularly in controversial domains such as climate change and genetically modified foods. Social media's democratization of content creation, while expanding access to scientific information, also facilitates the spread of contradictory messages and misinformation, complicating the public's ability to discern credible sources. The paper illustrates this with examples of contentious debates among scientists during the COVID-19 pandemic and the polarized public attitudes towards GM foods in the region.

The paper also draws attention to regulatory challenges within ASEAN, noting inconsistencies in probiotic labeling and health claims across countries, which may further contribute to consumer confusion and mistrust. This regulatory fragmentation highlights the need for harmonized policies to support clearer communication and consumer protection in the region.

In terms of implications, the study offers several key messages for policymakers, researchers, and practitioners. First, understanding how conflicting information affects trust can inform the design of more effective public health communication strategies tailored to the ASEAN context. Second, recognizing the influence of health consciousness and media consumption patterns on trust can guide targeted interventions to enhance scientific literacy and critical engagement with health information. Third, the research underscores the importance of consistent, transparent, and culturally sensitive scientific messaging to maintain and rebuild public trust, especially as new health innovations emerge. Lastly, the media's responsibility in accurate and balanced reporting is emphasized as a cornerstone for fostering informed public discourse.

We propose a comprehensive agenda for future research to address the study's limitations and expand its scope. They recommend larger, more representative samples, longitudinal studies to track trust dynamics over time, and the inclusion of multiple health topics beyond probiotics to capture broader trust issues. Cross-cultural analyses are encouraged to account for the diverse socio-cultural landscapes within ASEAN, and the role of digital literacy is highlighted as a critical factor in how individuals interpret conflicting information online. Developing more sophisticated measurement tools for exposure to conflicting information and differentiated analyses of trust across various media types are also suggested to yield deeper insights.

In conclusion, this working paper makes a valuable contribution to the understanding of how conflicting health information impacts trust in media and scientists in a rapidly developing and diverse region. By focusing on probiotics as a case study, it sheds light on broader challenges in health communication and public trust that are globally relevant. The paper's findings and recommendations provide a foundation for enhancing health communication strategies, regulatory frameworks, and research methodologies to better navigate the complexities of information abundance and conflicting narratives in the digital age. This work is particularly significant given the increasing importance of trust in science for public health outcomes and the ongoing challenges posed by misinformation and disinformation worldwide.

Introduction

The United Nations Secretary-General's Scientific Advisory Board recently bemoaned the widening chasm between the public, scientists and scientific institutions (2024). Noting the influence of misinformation and disinformation in undermining the scientific enterprise, they highlighted the "erosion of evidence-based thinking". In doing so, the SAB called for, among other things, annual surveys of public trust in science in the media to comprehend mechanisms by which challenges in the information ecosystem could be better understood and tackled. Responding to this call, this working paper highlights key findings from a study of how exposure to *conflicting information* around nutrition mediates the relationship between health consciousness and trust in scientists and the media who play a critical role in dissemination of scientific evidence to the public. Taking the microcosmic exemplar of probiotic supplements which are known for their health benefits, we highlight critical challenges around information and communication facing nutrition policymakers in the ASEAN region and discuss implications for researchers, practitioners and policymakers.

Trust in Science & Media

Science plays an important role in generating evidence to help policymakers make decisions on critical areas of health governance. These include allocating resources, designing health systems, creating and evaluating health campaigns, and preparing and responding to health crises. Equally, individuals, communities and populations depend on science to make better informed decisions integral to health including the practice of preventive behaviors (e.g., contraception use or mask wearing), food consumption, physical activity, smoking cessation, and stress management. Trust is "the probability that [someone] will perform an action that is beneficial or at least not detrimental to us is high enough for us to consider engaging in some form of cooperation with [them]" (Gambetta, 1988: 217). Public trust in science is thus an important factor that shapes the performance of systemic health interventions from adopting evidence-based diets to ensuring adherence to public health directives during emergencies (Garza et al., 2019; Wray et al., 2012). Distrust of science, on the other hand, can be problematic as seen by the impact of widespread vaccine hesitancy in recent years (Razai et al., 2021). Despite the importance of trust in scientists to individuals and societies at large, the evidence around this dynamic is mostly West-centric. Minimal attention has thus far been paid to understand public attitudes towards scientists in regions like ASEAN (Association of Southeast Asian Nations) where scientific research has grown exponentially as a policy priority for countries like Malaysia, Vietnam, Thailand, and Indonesia (Ong, 2021). From the limited evidence available from a recent global survey, respondents from Indonesia (M=3.84) and Malaysia (M=3.58) reported moderately high levels of trust (Cologna et al., 2024).

Public trust in science is, however, intricately linked to media consumption behaviors. This is because the effects of the news media's tendency to set the agenda and use specific narrative devices to frame information around scientific developments has influenced the ways in which the public processes scientific information (Nisbet & Huge, 2007). The relationship between media consumption and scientific trust is especially pronounced in the case of controversial scientific issues like climate change and genetically modified (GM) foods (Bogert et al., 2024; Frewer et al., 2003). For instance, conservative media use has shown to be negatively associated with trust in science around climate change, while non-conservative media use is positively associated with trust in science (Hmielowski et al., 2014).

The arrival of social media has transformed public consumption of science in myriad ways, not least by widening the reach of educational resources about science. Scientists use social media to enhance the visibility of their work, engage with the public through a range of creative, interactive formats, and to involve the public in shaping research priorities (Van Eperen & Marincola, 2011). These engagements peaked during the COVID-19 pandemic as groups of scientists publicly debated with each other on social media platforms like X (formerly Twitter), challenging each other's perspective in an emotionally charged context (Biermann & Taddicken, 2024). The interactive features of social media fanned the flames with the public becoming an integral part of these exchanges that several times devolved into vitriol, abuse, and threats aimed at scientists. The democratic nature of creating, producing, and sharing content on these platforms has also meant that individuals with substantial following on social media are seeking to influence public opinion on scientific issues. The problems created by this phenomenon are felt in the realms of food, nutrition, and health as social media has now become a crucible for both – qualified and unqualified – experts to share contrasting perspectives, thereby creating an environment for conflicting information to proliferate (Rogers et al., 2022; Sabbagh et al., 2020).

Conflicting Information

Also referred to as contradictory, inconsistent, or mixed messaging, conflicting information (or CI) about health, science, and politics is rampant across media platforms. CI may be understood as “messages that offer information about a single behavior (e.g., drinking wine) producing two distinct outcomes (e.g., good for the heart, can cause cancer) (Nagler, 2014). CI infuses uncertainties in people's ability to make decisions and makes them averse to the original source of ambiguity. Exposure to CI is thus associated with detrimental cognitive outcomes such as nutrition confusion (perceived ambiguity about nutrition recommendations and research); and nutrition backlash (negative beliefs about nutrition backlash and research) (Nagler, 2014). The pathway to these negative cognitions is also dependent on the information source, as exposure to CI from TV and websites has been associated with nutrition confusion; whereas CI from social media and health experts has contributed towards backlash (Lee et al., 2018; Vijaykumar et al., 2021). An exemplar of how exposure to CI can shape public attitudes can be seen in the case of genetically modified (or GM) foods where campaigns by consumer groups raising questions about the safety of GM foods were in stark contrast to messages from governmental and scientific organizations advocating its healthfulness (Dean & Shepherd, 2007). The public skepticism is reflected in global consumer surveys, which reveal that a substantially more significant proportion of participants in Malaysia (45%) and Singapore (31%) rated GM foods as more unsafe than safe despite collectives of scientists attesting to their safety (Thigpen, 2020).

However, the case of probiotic supplements provides an intriguing contrast to that of GM foods. The World Health Organization and Food and Agriculture Organization define probiotics as “live microorganisms, which, when administered in adequate amounts, confer a health benefit on the host” (2006). Since the late 1990s, studies demonstrating its benefits to gut, immune, and respiratory health have inspired widespread media coverage of probiotic products in the mainstream media, translating into consumer interest and consumption (Nerlich & Koteyko, 2008). However, this rise in popularity has been concurrently marked by scientific findings highlighting that probiotic products may confer minimal or no benefits to those with a healthy gut and, in some instances, even harmful effects (Zmora et al., 2018). Consequently, commentators have called for tempering aggressive and misleading claims made on probiotic product labels by arguing that these are insufficiently backed by science (Freedman et al., 2020). Others offer a stronger critique by calling spending on probiotic products “money down the toilet”, and terming them “useless” (Abbasi, 2019; Gallagher, 2018). In a consensus statement, the International Scientific Association for Probiotics and Prebiotics (ISAPP) recommended that the only claim that may be used without being backed by rigorous scientific studies, like product efficacy trials, was “contains live and active bacteria (Hill et al., 2014). In addition, ISAPP also confirmed that these products could not be classified as probiotics. In the ASEAN region, Indonesia and Vietnam do not permit generic function claims, with experts highlighting the need for better harmonization in the region's regulatory control of probiotics labelling (Tee et al., 2021).

The controversies surrounding probiotic products and the conflicting information enshrined in them have been covered by international media organizations. However, in contrast to GM foods, it has failed to diminish the growth of the probiotics industry. The global probiotics market is worth 58.9 billion U.S. dollars in 2022 and is estimated to grow to 111.8 billion dollars by 2030, with a compounded annual growth rate of 8.3% in terms of revenue (Coherent Marketing Insights, 2023). Of these, Asia Pacific holds a significant 42% market value share, which is the highest among all regions globally, and it is also on track to meet

the projection of being the largest and fastest growing market for 2020-2025. These trends suggest that the population-level effects of exposure to conflicting information may vary across different types of food innovations and possibly even geographical contexts. Also, while researchers have previously explored effects of cognitive outcomes like nutrition confusion and backlash, the extent to which CI exposure affects trust in scientists and the media is less explored, especially in the ASEAN context, where consumers are becoming increasingly health-conscious.

Health Consciousness

Increased knowledge of health risks through greater exposure to health information on various media channels, health campaigns promoting screening and preventive health behaviors have prompted a shift in values towards prioritizing self-care. Health consciousness can thus be broadly understood as self-awareness about one's health and a willingness to engage in behaviors that promote one's health and wellness (Espinosa & Kadić-Maglajlić, 2018). Social scientists highlight how advertisements portray probiotic products in ways that appeal to a shift in consumer culture towards 'healthism' that prioritizes qualities like youth, vitality, and energy (Burgess Watson et al., 2009). Concerned about ageing, disease prevention, and recovery, young and health-conscious consumers in Asia are actively researching nutritional products before making purchase decisions but are susceptible to information from online influencers (Euromonitor International, 2024). These accounts from market research agencies are supported by research studies, which suggest that health consciousness leads to greater health information seeking behaviors, potentially motivated by a desire for better self-control over health decisions. In South Korea, for instance, increased health consciousness was associated with increased use of health apps (Cho et al., 2014). Accessing information from multiple sources could lead to exposure to conflicting information.

Equally, research has shown that health-conscious individuals tend to place greater trust in health experts like physicians, leading to better adherence to medical regimens (Espinosa & Kadić-Maglajlić, 2019). Other findings suggest that health-consciousness influences skepticism towards health claims in functional foods like probiotic products, which may drive a preference instead (Gineikiene et al., 2017). The informational complexity around probiotic products and controversies surrounding them to understand further their health claims commands us to further understand the relationship between health consciousness, exposure to conflicting information, and trust in science and media.

Research Questions

RQ1: Where do ASEAN consumers prefer to seek information about probiotic products?

RQ1a: To what extent do they trust the media and scientists to probiotics-related information?

RQ2: What is the relationship between health consciousness, exposure to conflicting probiotics, probiotic information, and trust in the media and scientists?

RQ3: How and where does exposure to conflicting information influence the relationship between health consciousness and trust in media and scientists?

Methodology

The above questions were examined through a quantitative, non-experimental, cross-sectional design. Participants were given access to the survey via a Qualtrics web link, confirming their consent after reading the participant information sheets and selecting 'I agree'. Participants were first asked a series of basic demographic questions before responding to a series of questions about probiotic products. After completion, participants were provided with a debrief sheet. Across Indonesia, Malaysia, the Philippines, Thailand, and Vietnam, participants took approximately 17 minutes to complete the survey.

Survey Instrument

Demographics

Demographic variables included country of residence, gender, age, ethnicity, employment status, annual household income, and pre-existing illness or disability (Table 1).

Consumer Trust in the Media & Scientists

Respondents’ trust in different stakeholders identified as influential in the probiotics industry was assessed using the ‘Trust in Actors’ scale (Lang & Hallman, 2005). Four statements were used to evaluate the honesty, competence, transparency, and public interest among news Media and scientists. Respondents were asked to rate the extent to which they agree with each statement on a 4-point Likert scale from 1 = “strongly disagree” to 4 = “strongly agree”. Each scale was distributed throughout the questionnaire to reduce response bias. The scales for trust in media (0.855) and trust in science (0.922) were found to be highly reliable.

Health consciousness

The Health Consciousness scale (HCS) was used to assess the extent to which an individual plays an active role in maintaining their health (Gould, 1988). Respondents rated four statements on a sliding numerical scale (0-100) based on how well they believed the statements described them (0 = not at all to 100 = very well). The HCS was shown to have good internal consistency in the current study ($\alpha = 0.88$).

Conflicting Information

Exposure to conflicting information was captured using a single question asking respondents to rate the frequency with which they come across conflicting news about probiotic products on a scale of 1 (all the time) to 4 (not at all).

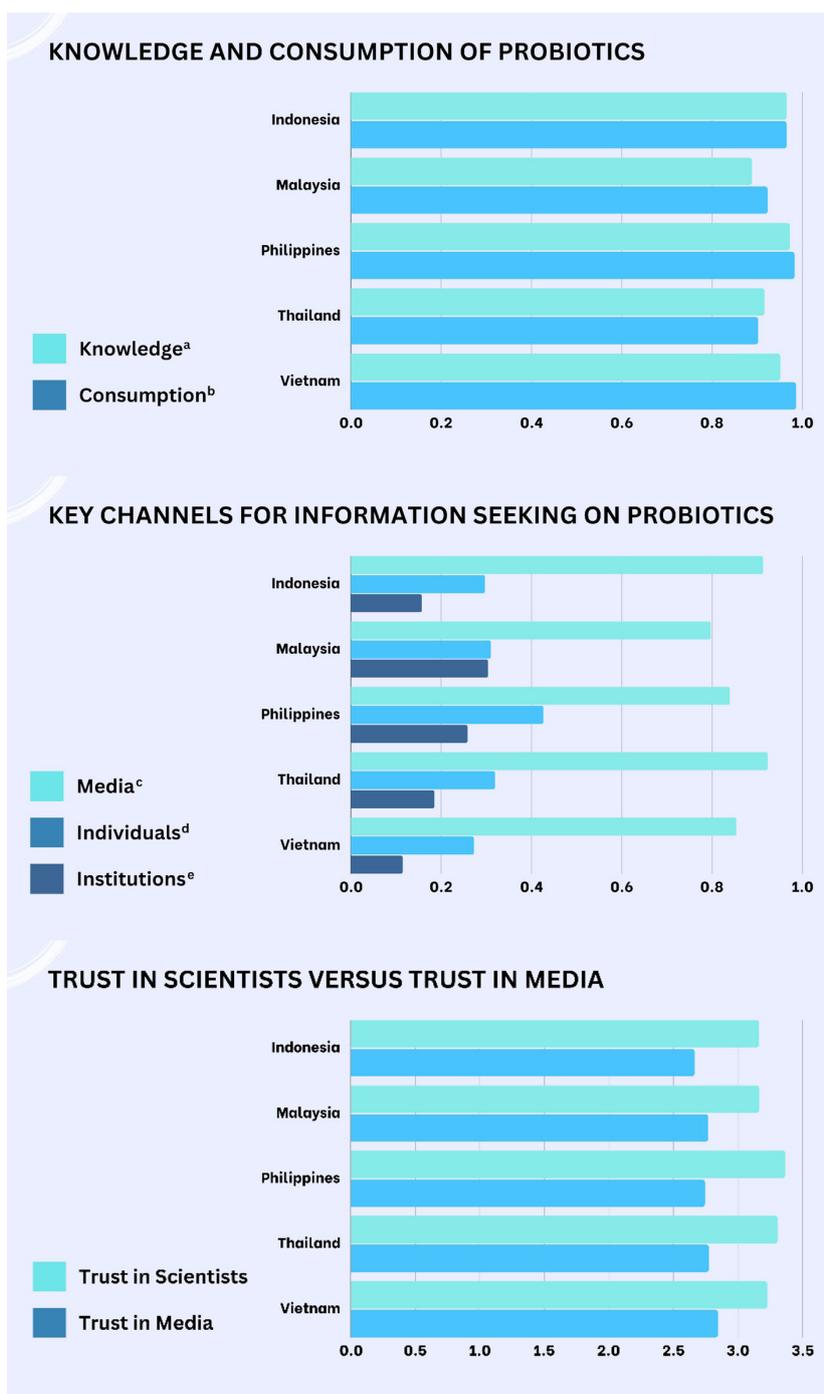


Figure 1: Participant profile of survey respondents across Indonesia, Malaysia, Philippines, Thailand, and Vietnam

Notes: A small sub-sample of n=92 participants from 41-44 years entered the study due to a technical error in the online survey platform. However, they were included in the final analysis as they were deemed not too divergent from the population of interest. There were 2 phases of data collection - from 31st August 2020 to 4th September 2020, and then a second data collection took place from 17th May 2021 to the 28th of May 2021.

Participants

N=1431 participants were recruited via the Qualtrics panel of respondents (Qualtrics, Provo, UT, 2018). Quota sampling for respondents' age, gender, and country of residence was used to ensure the sample was equally represented by each quota group. Based on consultations with regional experts, we decided to focus on participants between 20 and 40 years old living live in the Philippines, Indonesia, Malaysia, Vietnam, or Thailand. Participants did not need to have consumed or currently consume probiotic products to participate in this study. Demographic characteristics of the recruited sample can be found in Figure 1. No participants were excluded from data analysis.



Results

RQ1. Information Seeking and Stakeholder Trust.

Simple descriptive statistics around the key variables of interest are presented in Figure 2 and Table 1. Overall, participants were able to define the word probiotics and were active consumers of probiotic products.

Participants from all countries sought information on probiotics from different types of media channels rather than from individual or institutional sources. Within source categories, media channels were most preferred in Indonesia and Thailand,

Variable	Indonesia		Malaysia		Philippines		Thailand		Vietnam	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Health Consciousness	85.02	13.32	83.78	12.20	78.59	14.70	83.08	13.11	84.95	13.18
Conflicting Information	2.52	.97	2.69	.92	2.36	.85	2.40	.95	2.66	.91
Trust in Media	2.75	.72	2.66	.730	2.77	.70	2.85	.79	2.78	.62
Trust in Scientists	3.37	.82	3.16	.732	3.17	.74	3.23	.86	3.31	.57

Table 1. Mean scores for each key variable (N = 1431).

individuals most preferred in the Philippines, and institutions most preferred in Malaysia. Across countries, we found that participants consistently rated scientists as more trustworthy than the media. We found that consumers in all countries were highly health conscious with a minimum score of 78.59 on a 100-point scale. Moreover, they had been exposed to a medium level of conflicting information about probiotic products.

RQ2. Relationship between health consciousness, conflicting information, and trust in the media and scientists

The correlation matrix (Annex 1) reveals distinct patterns in how health consciousness, trust in media, trust in scientists, and exposure to conflicting information relate to one another across the studied ASEAN countries.

A positive association exists in all countries, indicating that higher health consciousness is linked to greater trust in media, with statistically significant correlations across the board. There is a strong, positive correlation between trust in these two sources in every country. This consistent finding suggests that people who trust one source (media or scientists) are likely to trust the other, particularly in Malaysia and Vietnam, where the correlation is highest. Exposure to conflicting information is negatively correlated with trust in scientists, particularly in Thailand. This suggests that conflicting messages may undermine trust in scientific sources. Health consciousness is positively correlated with exposure to conflicting information in all countries, indicating that health-conscious individuals may encounter or seek out more varied or contradictory health information. Regarding country-specific insights, Malaysia shows the highest correlation between trust in media and scientists, suggesting a strong interconnectedness between these information sources.

RQ3. Exploring whether conflicting information influences the association between health consciousness and trust.

Annex 1 shows Pearson's correlations exploring relationships between health consciousness, trust in the media, trust in scientists, and exposure to conflicting information across five ASEAN countries and in all five countries, there was a significant positive correlation between trust in media and trust in scientists, ranging from moderate ($r = 0.38$ in Thailand) to strong ($r =$

0.58 in Malaysia). Health consciousness shows consistent positive correlations with trust in media across all countries, with the most substantial relationship in Indonesia ($r = 0.27$) and the weakest in Malaysia ($r = 0.14$). The relationship between health consciousness and trust in scientists varies more widely. It is strongest in Thailand ($r = 0.35$) and Indonesia ($r = 0.33$), moderate in Vietnam ($r = 0.28$), weak in Malaysia ($r = 0.15$), and non-significant in the Philippines.

Health consciousness is positively correlated with exposure to conflicting information in four countries, with Malaysia showing the most substantial relationship ($r = 0.30$) and Thailand showing no significant correlation. Overall, the relationship between exposure to conflicting information and trust in media or scientists varies across countries. In the Philippines and Indonesia, there is a positive correlation with trust in media but no significant relationship with trust in scientists. In Thailand, there is a positive correlation with trust in media but a negative correlation with trust in scientists. Malaysia and Vietnam show no significant correlations between conflicting information and trust in either the press or scientists. The findings suggest that while some consistent patterns exist across the region, such as the positive relationship between trust in media and trust in scientists, there are also notable country-specific variations in how health consciousness and exposure to conflicting information relate to trust in information sources.

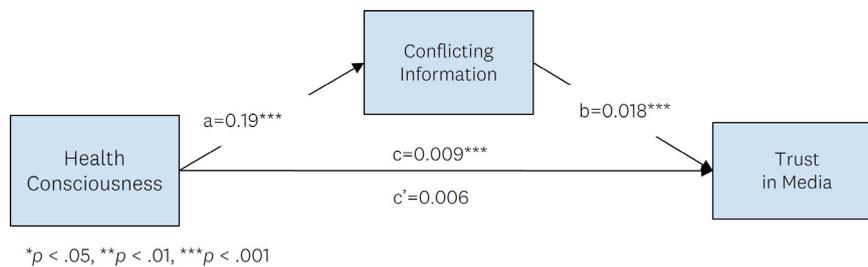


Figure 3. The mediating effect of conflicting information on probiotics on the relationship between health consciousness and trust in media in the Philippines. **c:** Total effect of health consciousness on trust in media/scientists. **c’:** Direct effect of health consciousness on trust in media/scientists while considering conflicting information. **a, b:** Indirect effect of health consciousness on trust in media/scientists with the impact of conflicting information on PP.

The mediating effect of conflicting information on the relationship between health consciousness and trust in scientists and the media were conducted for all five countries. For brevity, we report only those findings where mediation models were statistically significant.

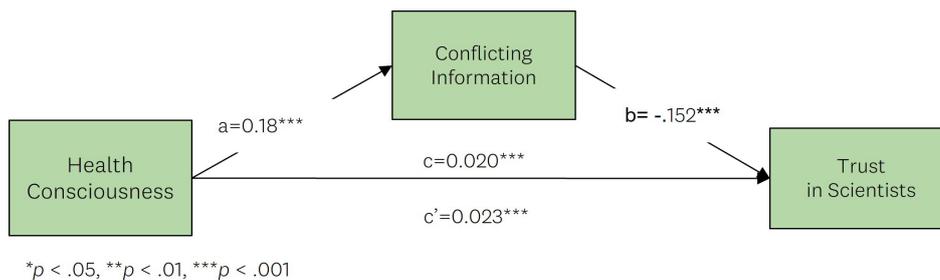


Figure 4. The mediating effect of conflicting information on probiotics on the relationship between health consciousness and trust in scientists in Indonesia. **c:** Total effect of health consciousness on trust in media/scientists. **c’:** Direct effect of health consciousness on trust in media/scientists while accounting for conflicting information. **a, b:** Indirect effect of health consciousness on trust in media/scientists with the impact of conflicting information on PP.

In the Philippines, conflicting information indirectly affects the relationship between health consciousness and trust in the media. This means that while conflicting information links these two factors, the direct connection between health consciousness and trust in the media is not significant (see Figure 3). Health consciousness increases exposure to conflicting information which, in turn, leads to higher trust in the media.

Box 1: Summary of Mediation Analysis at the regional scale

- Barring *Thailand*, being more health-conscious increases exposure to conflicting information in all countries.
- In the *Philippines*, conflicting information significantly influences the relationship between health consciousness and trust in the media. However, the direct relationship between health consciousness and trust in the media is not significant.
- In *Indonesia*, conflicting information partly explains how health consciousness relates to trust in scientists. More conflicting information leads to lower trust in scientists.

In Indonesia, conflicting information partially explains the link between health consciousness and trust in scientists. As shown in Figure 4, being more health-conscious increases exposure to conflicting information, and increased exposure to conflicting information is related to lower trust in scientists.

Key points

The study sought to understand the paradox between the growing popularity of probiotic products and scientific calls to temper the hype and health claim-related controversies. This problem was explored by focusing on the dynamic between health consciousness, exposure to conflicting information, and trust in media and scientists. Consumers in ASEAN were found to be highly health conscious and placed higher levels of trust in scientists than in the media. A higher level of health consciousness is associated with greater exposure to conflicting information and trust in media and scientists. Further, exposure to conflicting information was associated with greater trust in the media and lower trust in scientists. The strength of the above associations varied between countries. Below, we reflect on key points and findings in the context of existing state-of-science and present communication management implications and recommendations for policymakers and practitioners whose roles are situated at the intersection of science, media, and the public.

a) Association between Health Consciousness and Conflicting Information

The high correlation between health consciousness and exposure to conflicting information in Malaysia, the Philippines, Indonesia, and Vietnam is consistent with current narratives about shifting priorities around health among consumers in the region. In Malaysia, for instance, health consciousness drives the need to actively seek additional information as a second opinion beyond clinical advice (Jaafar et al., 2017). Filipino migrant workers employed in Hong Kong refer to multiple information sources including healthcare professionals, non-professionals, and the Internet (Bernadas & Jiang, 2016). Searching and scanning for health information from multiple sources increases the chances of encountering conflicting information. The assessment also revealed significant positive correlations between health consciousness and health information seeking around probiotics and information seeking and exposure to conflicting information. Given that the Internet especially serves as a hive for information in various shades of truth, health-conscious individuals may be at greater risk of being vulnerable to misinformation (Peng & Shen, 2024).

Compared to other ASEAN countries studied, Thailand's relationship between health consciousness and exposure to contradictory information is positive, but not statistically significant. This is not surprising as historically, Thais trust and learn about health information from experiences shared by families, friends, and peers through discussions and observations. Even as information seeking behaviors among millennials have evolved from accessing traditional to online sources, their motivation to intentionally participate in online fora (E.g., Facebook groups) may be driven by a need to minimize uncertainties about health topics like child feeding (Supthanasup et al., 2022). Thais value the social process of observing, contributing, and reinforcing information (whether conflicting or not), transferring the practice from trusted networks to online communities. Eventually, exposure to conflicting information becomes less relevant amongst Thais, as both uncertainty and a perceived shared identity, whether online or offline, are the drivers of norms in society, where even new group members are likely to adopt standard group practices through this continuous, reinforcing social process.

b) Influence of Conflicting Information on Trust in Media

In countries such as the Philippines and Thailand, exposure to conflicting information about probiotic products was significantly associated with greater trust in the media. In the Philippines, conflicting information indirectly influences this relationship. Health-conscious individuals who are more engaged with health content tend to encounter diverse and sometimes contradictory claims about probiotics. Interestingly, rather than reducing media trust, exposure to conflicting information, in this case, is associated with higher trust in media. At an individual level, exposure to diverse perspectives, albeit conflicting, may motivate greater engagement with content and implore them to evaluate its veracity more critically. This, in turn, may shape an appreciation of the media as a stakeholder playing a credible role in disseminating health information.

While counterintuitive, the findings can be considered in the context of Southeast Asia's current news media landscape. Of the five countries surveyed in this study, Thailand ranked at the top 100 (87th) of 180 countries for media freedom with the environment in Indonesia (111th.), Malaysia (107th), Philippines (134th), and Vietnam (174th) ranked much lower (Reporters Without Borders, 2024). Consequently, recent, large-scale surveys have revealed low levels of trust among news media consumers in the region. Commentators point to how industry ownership or governmental control of news media has meant that consumers are exposed to "boilerplate uniformity" in news content across media outlets, describing the situation as 'dim' (The Diplomat, 2024). Contrastingly, exposure to conflicting health information has been shown to reduce trust in media in Western contexts like the US (Yzer et al., 2024). It is possible that in regions like ASEAN, conflicting information may give audiences the impression of balanced reporting, even if the information appears contradictory, although this inference is beyond the scope of our study.

c) Influence of Conflicting Information on Trust in Science

In contrast, exposure to conflicting information negatively influences scientists' trust. This suggests that scientific credibility may suffer when audiences encounter contradictory messages about a single health behavior - in this case, consuming probiotic products. When scientific experts present conflicting or inconclusive findings—such as differing views on the health benefits of probiotics, the public may become skeptical of scientific authority on the topic possibly because it has an unsettling effect on their need for certainty (Jensen & Hurley, 2012). In Indonesia, conflicting information partially mediates the relationship between health consciousness and trust in scientific sources - meaning, that the pathway from health consciousness to trust in scientists goes through exposure to conflicting information (among other factors). This suggests that conflicting information may interfere with the positive attitudes that health-conscious individuals may have towards scientists, much like they do towards other health experts like doctors (Espinosa & Kadić-Maglajlić, 2019).

Box 2: Takeaways for the five countries surveyed.

- *Indonesia*: Highest levels of health consciousness and trust in science create enabling environment for nutrition communication interventions.
- *Malaysia*: An equally high preference for information seeking from individuals and institutions signals opportunities for peer and community-based initiatives.
- *Philippines*: A Greater focus on helping consumers navigate the health information system required, as conflicting information indirectly affects the link between health consciousness and trust.
- *Thailand*: The media could play a proactive role in alleviating the negative impact of exposure to conflicting information on trust in scientists.
- *Vietnam*: Need for trust-building measures in institutional information sources, even though consumers seem resilient to the conflicting information

The points reflected in this study also resonate with other research, which also suggests that conflicting evidence from the same expert may have particularly pernicious effects on public attitudes toward science (Iles et al., 2022). Equally, we build on previous work indicating how conflicting nutrition information triggers negative cognition like nutrition confusion and backlash which relates to resistance to advice from health experts. The iterative nature of the scientific process, which underlies the emergence of conflicting findings, has, and continues to be, a challenge from the standpoint of food and nutrition communication. From a regional perspective, these trends pose new questions for the scientific community that is steadfastly seeking to grow and establish its global footprint.

Regional Implications for Media and Scientific Practitioners

While exposure to conflicting information appears to affect the media and scientists differently, we believe future solutions to tackle this problem could still be synergized across stakeholders. Specifically, our study advances the argument in favor of transparent and objective reporting of scientific findings in the media. However, this effort needs to be scaffolded by greater engagement between scientists and journalists, with university public relations practitioners serving as conduits. In cognizance of the call by the Organization for Economic Co-operation and Development (OECD, 2023) to communicate science responsibly to foster public trust in science and promote evidence-based policymaking, the commitment to this multisectoral collaboration and greater engagement becomes even more crucial and timely. Digital transformation has perpetually changed the health communication landscape and will only continue to evolve. In the collectivist context of the ASEAN region, top-down communication by policymakers alone will yield minimal health impact. It may risk a lack of comprehension and understanding by the public and possibly contribute to further misinformation and/or perpetuate disinformation. The World Health Organization (WHO, 2004) in its Global Strategy on Diet, Physical Activity and Health calls for multi-stakeholder collaboration to promote and protect health, to reduce the risk of non-communicable diseases attributed to unhealthy diets and physical inactivity.

Implementation of government policies may be strengthened through citizen participation involving multisectoral and multistakeholder feedback, including media, academe, civil societies, and industry. In doing so, co-creating health communication models may provide a sense of engagement and agency to all stakeholders, and help strengthen people's intrinsic motivation to adopt healthier behaviors. An integral part of this process will be developing strategies that walk the tightrope between communicating science in simple language while acknowledging its underlying complexity and nuance.

While scientific literacy and science engagement have provided mediocre returns in the West, the unique cultural fabric of ASEAN may bolster the effectiveness of such interventions. In doing so, the scientific community may work towards co-creating media releases about their work through community collaborations; and, in the process, sensitizing a range of demographic groups to the inherent nature of the scientific process. As such, our results underscore the need for coordinated communication strategies between media and scientific communities to address the challenges posed by conflicting health messages. Arguably, if there is commitment to this co-creation and co-design model with trust not just from the community to the stakeholders involved but amongst the multi-stakeholders themselves, this regional model can be localized to fit into what local communities value most. For example, in Thailand, by focusing on the social process of observing, contributing and reinforcing within communities that they trust be it media scientists or family and friends, this can address the specific gaps in health misinformation and disinformation as these translate into common group practices which impact directly to health.

The findings of this study have significant regional implications for nutrition policymakers in the ASEAN region, particularly concerning the regulation and communication of probiotic products. While the strength of associations between health consciousness, exposure to conflicting information, and trust in media and scientists may vary across countries, the consistent direction of these relationships presents opportunities for coordinated regional interventions.

Media Policies and Scientific Reporting

One key area for policymakers to address is the promotion of fair, objective, and transparent reporting of scientific issues in the media. This approach could significantly bolster public trust in media sources. The study highlights the media's critical role in shaping public trust in science, emphasizing the need for responsible reporting of scientific information. Policymakers could consider:

- Developing regional guidelines for science journalism
- Encouraging collaboration between scientists and journalists
- Supporting fact-checking initiatives specific to health and nutrition claims

Strengthening Scientific Institutions

The commitment to establishing robust scientific institutions in the ASEAN region can be further enhanced through investments in regional capability and capacity building of nutrition scientists. The study underscores the importance of clear, consistent

scientific messaging to maintain public trust, especially in the context of emerging food innovations and supplements like probiotics. Policymakers could focus on:

- Fostering interdisciplinary research collaborations via research funding calls
- Investing in training programs for nutrition and health behavioral scientists at regional level
- Promoting innovative models of co-creation and co-design in scientific research towards facilitating knowledge exchange at the regional level

Harmonization of Health Claims and Advertising Policies

A critical finding from the study is the need for greater harmonization in the regulatory control of probiotics labelling in the region. Some countries, like Indonesia and Vietnam, do not permit generic function claims for probiotic products. To create a healthier marketplace where health-conscious individuals can make well-informed decisions, policymakers should consider:

- Developing standardized regulations for health claims on probiotic products across the ASEAN region
- Implementing stricter advertising guidelines to prevent misleading claims
- Enhancing consumer education initiatives about interpreting health claims on functional foods

Addressing Conflicting Information

The study reveals that exposure to conflicting information about health and science is prevalent across media platforms, potentially leading to nutrition confusion and backlash. To mitigate these effects, policymakers could:

- Develop strategies to address and clarify conflicting health information in the public sphere.
- Support research initiatives to understand the impact of conflicting information on consumer behavior in the ASEAN context.
- Promote digital literacy programs to help consumers navigate and critically evaluate health information online.

Leveraging Health Consciousness

The research indicates that increased health consciousness leads to more significant health information-seeking behaviors. Policymakers can leverage this trend by:

- Developing targeted health communication strategies for health-conscious consumers
- Supporting the development of reliable, science-based health information resources
- Encouraging partnerships between health organizations and trusted media outlets to disseminate accurate health information

By addressing these areas, ASEAN policymakers can work towards creating a more informed and health-conscious public that is better equipped to make decisions about functional foods like probiotics. This approach aligns with the United Nations' Sustainable Development Goal of promoting healthy lives and well-being, contributing to a healthier and more scientifically literate ASEAN region.

Limitations of the Study

This study provides insights into the implications of conflicting health information for trust in media and scientists in the ASEAN region. However, we acknowledge five main limitations.

First, the sample size and sampling method employed across the five ASEAN countries limit the generalizability of the findings. Second, study's cross-sectional nature restricts the ability to infer causal relationships between variables. Third, the reliance on self-reported measures for key variables, such as health consciousness and exposure to conflicting information, introduces the potential for bias. Participants' responses may be influenced by social desirability or recall issues, affecting the reliability of the findings. Fourth, using a single-item measure to assess exposure to conflicting information regarding probiotic products

also constitutes a limitation. A more robust, multi-item scale would offer a more reliable and nuanced measure of this complex construct. Additionally, while the study measures trust in the media generally, it does not differentiate between traditional and social media platforms. Lastly, the focus of this study on probiotic supplements may limit the scope of its conclusions. While this specific health topic was chosen to examine the relationship between conflicting information and trust, it may not fully capture the complexity of trust issues across other health topics.

Box 3: Summary of key points

- Trust in science and media is essential for effective health governance and individual health decisions, but is vulnerable to erosion by conflicting information.
- Exposure to conflicting health information is widespread across media platforms, with distinct impacts depending on the source (traditional vs. social media).
- Health-conscious individuals are both more engaged with health information and more skeptical, highlighting a complex relationship between awareness and trust.
- Regulatory inconsistencies in the ASEAN region contribute to consumer confusion and highlight the need for harmonized policies.
- Media plays a critical role in shaping public trust, necessitating responsible reporting and clear scientific communication.

Way Forward

This working paper makes a valuable contribution to understanding how conflicting health information impacts trust in the media and scientists in a rapidly developing and diverse region. By focusing on probiotics as a case study, we shed light on broader challenges in health communication and public trust that are relevant globally. The narrative provides a foundation for enhancing health communication strategies, regulatory frameworks, and research methodologies to better navigate the complexities of information abundance and conflicting narratives in the digital age. This work is particularly significant given the increasing importance of trust in science for public health outcomes and the ongoing challenges posed by misinformation and disinformation worldwide.

We call for expanding future research to include a broader range of health topics, which would provide a more comprehensive understanding of trust in science and media. Furthermore, a more nuanced analysis of cultural contexts across the region that ASEAN countries could shed light on how cultural differences shape individuals' trust in media and scientists. From an analytical perspective, we suggest that future research examine the potential interactions of the variables of interest to explore in depth on how they may shape individuals' trust in media and scientists. An equally critical consideration for stakeholders in the ASEAN nutrition information ecosystem pertains to the growing impact of generative AI technologies in shaping the nutrition information ecosystem.

Given the fading lines between truth and falsehoods, it is incumbent upon the nutrition information community to examine, on an ongoing basis, the stresses it may impose on people's relationship with food and those who shape the information ecosystem around it. It is important that the region adopt longitudinal, cross-cultural, and multi-topic approaches, incorporating digital literacy and improved measurement tools to understand trust dynamics better.

Overall, our insight offers a crucial step toward addressing the challenges of health misinformation and fostering greater trust between the public, scientists, and media in the ASEAN region and beyond.

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Annexes

Pearson’s correlations exploring relationships between health consciousness, trust in the media, trust in scientists and exposure to conflicting information.

Philippines				
	1	2	3	4
1. Health Consciousness	-			
2. Trust in Media	.162**	-		
3. Trust in Scientists	.062	.429**	-	
4. Conflicting Information	.256**	.215**	-.098	-
Indonesia				
	1	2	3	4
1. Health Consciousness	-			
2. Trust in Media	.267**	-		
3. Trust in Scientists	.332**	.428**	-	
4. Conflicting Information	.242**	.134*	-.100	-
Malaysia				
	1	2	3	4
1. Health Consciousness	-			
2. Trust in Media	.138*	-		
3. Trust in Scientists	.153**	.576**	-	
4. Conflicting Information	.298**	.061	-.047	-
Vietnam				
	1	2	3	4
1. Health Consciousness	-			
2. Trust in Media	.171**	-		

3. Trust in Scientists	.278**	.559**	-	
4. Conflicting Information	.149*	.045	.028	-
Thailand				
	1	2	3	4
1. Health Consciousness	-			
2. Trust in Media	.188**	-		
3. Trust in Scientists	.352**	.383**	-	
4. Conflicting Information	.014	.162**	-.153**	-

* $p < .05$, ** $p < .01$

Annex 1: Pearson's correlations exploring relationships between health consciousness, trust in the media, trust in scientists and exposure to conflicting information.

Path	Philippines (Trust in Media)	Indonesia (Trust in Scientists)
a	.019***	.018***
b	.138**	-.152***
c'	.006	.023***
c	.009**	.020***

* $p < .05$, ** $p < .01$, *** $p < .001$

Annex 2: Path coefficients for the mediation model in Philippines and Indonesia.

Implications of Conflicting Health Information for Trust in the Media and Scientists in the ASEAN Region

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