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A Novelty Method for Identifying Risk Factors of Sudden Food Safety Event

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Abstract: Food is the basic material basis for human survival. Sudden food safety event risks mainly derive from accidental or natural food safety risks, poor food storage environments, and inefficient government regulation policies. The factor identification of sudden food safety risks is the key to controlling such risks. Therefore, the efficient and scientific identification of risk sources and types will be very important in managing sudden food safety risks. In this study, 16 sudden food safety event risk factors were identified through a literature review, and their interactive relationships were clarified using an interpretive structural model (ISM). Then, the weights of influencing factors were calculated through the analytic hierarchy process (AHP), and the combined weight of indices was determined. Results show that the 16 sudden food safety event risk factors can be divided into four levels. The quality standard for food safety (S5) and food storage (S14) is at the bottom layer of risks of sudden food safety events (the first-layer index weight is 36.899%). The judgment matrices at the four levels passed the consistency check. The influence weight of the factor "whether it contains transgenic raw materials" (S9) ranks second (the total weight is 18.151%). This index system for sudden food safety event risk factors is highly effective, with good operability for managing sudden food safety event risks. The obtained conclusions are important reference values for identifying the factors influencing food safety risk management, determining the emphasis of food safety supervision, realizing food risk prevention and control, and strengthening and guaranteeing the food safety level.

Keywords: AHP; index system; ISM; risk identification; sudden food safety event

1 INTRODUCTION

Food safety has become a focus of attention with the improvement of people's living standards. People have gradually developed from simply solving the problem of food and clothing to pursuing healthier and safer food. Food safety is closely related to the physical health of general consumers and decides the national economic development, social harmony, political stability, and comprehensive image. However, the abuse of food additives and the disqualification of food supplies have resulted in disqualified raw materials, food production machines and equipment, non-standard food circulation and transportation, and imperfect safety auditing systems, all of which have led to increasingly frequent sudden food safety events. Such food safety events bring not only mental and physical damage to general consumers but also generate negative effects on the food industry and enormous economic losses, thereby endangering the normal production order of the food market. Due to sudden food safety events, consumers generate contradictory psychology toward products produced by Chinese food enterprises and are unwilling to purchase, which will certainly reduce the profits of related food enterprises and impede their development. As food safety has been comprehensively supervised in China in recent years, several food enterprises have started finding that food safety problems will have substantial effects on their business and have comprehensively improved the supervision and management level of food safety to reduce the occurrence of such events and relieve their effects.

Food is an important material basis for human society and significant material support for production and life. Food safety is related to immediate individual interests. China has comprehensively established various standards for food safety production. The Chinese government has strengthened supervision so that the occurrence frequency of food safety events presents a declining trend. However, food safety events will generate long-term effects and harm residents' mental and physical health for a long time. Therefore, to cope with sudden food safety events comprehensively, the government should establish a scientific and effective emergency management mechanism for sudden food safety events and integrate more information technologies into the management.

Nevertheless, the management of sudden food safety events is still subjected to various problems, such as weak emergency handling ability, poor experience in responding to such events, and the shortage of hardware facilities, and thus, the social influences and economic losses caused by sudden food safety events still cannot be underestimated. An important way to fundamentally reduce the occurrence frequency of sudden food safety events lies in scientifically identifying sudden food safety event risk factors. The accurate and objective risk evaluation of sudden food safety events must be based on a scientific and reasonable comprehensive index system. Thus, the analytic hierarchy process (AHP) and interpretive structural model (ISM) method commonly used in academic circles were used in this study to establish an index system for sudden food safety event risk factor identification. On this basis, the effectiveness and feasibility of indices were further tested, expecting to provide a theoretical foundation and decision-making reference for the follow-up management of sudden food safety event risks.

2 STATE OF THE ART

Studies on food safety from scholars outside China have an early start. In the 1970s, scholars outside China took the lead in defining the concept of "food safety". In recent years, typical food safety problems have taken place successively in various countries, triggering the high attention of scholars worldwide and deep research in this field. Meanwhile, research has also involved identifying and effectively supervising sudden food safety event risk factors. As for studies on food safety event risks, Tonsor et al. [1] stated that individual and indirect food safety experiences have considerable effects on risk perception. His research conclusions help decision-makers formulate more effective supply chain management strategies and public policies to establish or maintain consumers' confidence in food safety. According to Pagadala et al. [2], local effects, including the landform, land utilization, and adjacent industries, may be important factors promoting microorganism inputs into medium and small-sized farms in the Atlantic Ocean region. Neal, J. A. et al. [3] pointed out that the main factors influencing food safety risks are food safety standards, commitments made by work units to food safety, food safety training, food safety system infrastructure, and workers' food safety behaviors. Lobbet al. [4] concluded that people's attitudes toward food safety constitute the key factor deciding the willingness to buy broilers. The possibility of purchase will be reduced if the food safety information provided by the media is trusted. Mensah et al. [5] thought that food safety risks are induced mainly by unsanitary food production and processing practice, deliberate pollution, and unhealthy environmental factors, such as unsafe water, unsafe waste treatment, food exposure to insects and dust, and storage of uncooked food and long-term unfrozen cooked food. Beaussier et al. [6] showed that establishing the EU's emergent health event monitoring, preparation, and coping mechanism plays an increasingly greater role in coping with, monitoring, and coordinating emergent health events. Liu et al. [7] deemed that food safety risk evaluation is of great importance for improving consumer protection and promoting international trade using sound and scientific food safety policies, guidelines, and other suggestions, and discussed China's food safety risk evaluation systems. Theurich et al. [8] pointed out that food safety guidelines help prevent foodborne diseases among infants and young children. Food quality guarantees and scientific principles of safe and sanitary water are important for elevating the food safety level during emergencies. Gadaga et al. [9] thought that an effective food control system plays a significant role in controlling microbial hazards and inhibiting epidemic diffusion. Sun et al. [10] believed that mass meetings are very conspicuous activities, and the outburst of foodborne diseases can be reduced by strengthening the scientific management of assembly activities. Ma et al. [11] investigated about 40000 sudden events in China in the past decade and determined five different types of risk factors of such events using the 5W1H method, which is of important reference value for providing decision-making guidance regarding sudden events and promoting rapid risk coping. Pressman et al. [12] thought that foodborne infection could be easily incurred because of the food surface spread and food processing. Knight et al. [13] indicated that people's food safety knowledge and control level vary with risks, making it essential to enhance the importance of improving food safety. Rouviere [14] deemed that retailers can elevate their food safety level in the food supply chain when implementing their safety systems. Wang et al. [15] put forward a new risk evaluation method, performed a structured analysis of comprehensive food safety risks in the food supply chain using the fuzzy set theory and the concept of AHP, and established a comprehensive food safety risk index. Walls et al. [16] thought microbial risk evaluation is an important technique in food safety. The food nature and its treatment, storage, and processing modes will lead to a change in the microbial quantity in food, which is important factor influencing food safety. Wilson et al. [17] investigated the influence of residual drug standards on beef trades and formulated the trade effect coordinating international standards. Results show that some non-unified food standards are one of the factors influencing food safety. Patil et al. [18] considered the sensitivity analysis method useful for food safety hazard analysis and identification. Marvin et al. [19] adopted the Delphi method to analyze food safety risks and proposed the early-stage four-step procedure of determining food safety risks. Millstone [20] deemed that government public food supervision policies play a significant role in elevating the food safety level. Manning et al. [21] pointed out that a good food quality management system is the main factor influencing food safety hazards. Shukla et al. [22] thought that the main factors influencing food safety are food safety standards, stricter sanitary and plant sanitary requirements, and improved global product specifications. Powell et al. [23] stated the necessity of considering the dynamic conditions of microbial communities in food safety risk evaluation. According to Kaptanet al. [24], consumers' food risk perception gradually increased after food safety events. Rao et al. [25] deemed that private goods safety standards have developed into an important governance mechanism in the contemporary food supply chain, influencing the supply chain structure, market access, and efficiency of the food safety management system. Lu et al. [26] thought that the main factors influencing food safety risks are human resource education and training of excellent employees in the food industry and effective government regulation and supervision of the food industry. Current literature has shown that food safety is a major problem attracting high attention in each country. The influence of any food safety problem is non-negligible once occurring. Still, different countries vary in the supervision and management of food safety. Food supervision and management-related laws, regulations, frameworks, and management models have appeared in developed countries early, which are now developing perfectly. As for food safety management, the risk factors influencing food safety should be first identified. Food risk factors refer to potential factors or possible hazardous substances threatening human health and life safety in various aspects, such as food production, circulation, and catering services. Such factors include food transportation, warehousing, and policy factors like government regulation in addition to hazardous substances in food and illegally added hazardous substances and substances whose use is restricted. Therefore, an accurate and objective risk evaluation system is required to identify sudden food safety event risk factors, which should be established based on a scientific and reasonable comprehensive index system. Given this, the AHP and ISM methods commonly used in academic circles were used in this study to construct an evaluation index system for sudden food safety event risk factors. On this basis, the effectiveness and feasibility of indices were further tested, expecting to provide a theoretical foundation and decision-making reference for the follow-up management of sudden food safety events.

3 METHODOLOGY

3.1 ISM method

Watson [27] viewed ISM as a model quantitatively analyzing the mutual factor relationships in a system. By establishing a relationship matrix between factors, complex factor relationships are regionally and hierarchically divided, and the correlation between system factors is clearly expressed using digraphs. The ISM method, a research method in modern systems engineering, can establish a structured matrix according to the interrelated restrictive relations between factors in the multi-layer system and construct an interpretive multi-stage hierarchical structural model accordingly to clarify the system into structured and hierarchical. The ISM modeling steps are as follows [28]:

First, a factor table of the system was constructed. The investigated system factors were collected and processed to establish a detailed table S of system factors, as seen in Eq. (1).

$$S = \left(S_1, S_2, ..., S_n\right) \tag{1}$$

$S = \left(S_1, S_2, ..., S_n\right)$ represents n factors of the system.

Then, an adjacency matrix $\boldsymbol{A}$ was generated, as expressed by Eq. (2).

$$\boldsymbol{A} = \left(a_{ij}\right)_{n\times n} \tag{2}$$

In Eq. (2), if S_i has a direct influence on S_j, a_{ij} is taken as 1; if not, a_{ij} is set to 0. Afterward, the reachability matrix $\boldsymbol{M}$, which was iteratively generated by the adjacency matrix, was calculated based on Boolean operation rules as per Eq. (3).

$$\boldsymbol{M} = (\boldsymbol{A} + \boldsymbol{I})^r \tag{3}$$

In Eq. (3), $\boldsymbol{I}$ and $\boldsymbol{A}$ denote unit matrices of the same order, and r should be further calculated according to Eq. (4).

$$(\boldsymbol{A}+\boldsymbol{I}) \neq (\boldsymbol{A}+\boldsymbol{I})^2 \neq (\boldsymbol{A}+\boldsymbol{I})^3 \neq \cdots \neq (\boldsymbol{A}+\boldsymbol{I})^r = (\boldsymbol{A}+\boldsymbol{I})^{r+1} \tag{4}$$

Then, the system factors were divided into three zones, referred to as reachability set $R(S_i)$, antecedently set $A(S_i)$, and common set $C(S_i)$, in which the former is the set of all system factors influenced by the factor S_i, the middle is the set of system factors influencing the factor S_i. The latter is the intersection set between the first two sets, as seen in Eq. (5).

$$C(S_i) = R(S_i) \cap A(S_i) \tag{5}$$

Afterward, levels were divided. Specifically, system factor levels were divided, that is, the level where each factor was located was determined. First, the first-layer factors in the set were found. When $C(S_i) = R(S_i)$, S_i was determined as the first-layer factor. Then, the first-layer factors were removed, and the level of remaining factors was derived similarly until the level division of all factors was finished. The factor set at each layer was expressed, in descending order, as $L_1, L_2, ..., L_l$, where L_1 denotes the top layer. According to the level division results and mutual influencing relations between factors in the adjacency and reachability matrices, factors were distributed from higher to lower layers and connected using an arrow. Moreover, the bypassing relations between factors were removed to reflect their binary hierarchical structural relations.

3.2 AHP method

Saaty [29] thought that AHP is a widely applied multi-criterion decision-making method and a comprehensive decision-making method that decomposes decision-making objectives into different layers with qualitative and quantitative analyses combined. Based on paired comparisons, this method determines the weight of each criterion and the priority of alternatives in a structured manner, with structural features of "multiple criteria, multiple objectives, strong methodology, and highly systematic nature". The analysis process is described as follows [30]. First, a hierarchical model is established, and identified risks are divided into several groups to form different layers. In the hierarchical model, the bottom layer is generally a factor layer, in which identified fundamental risk factors serve as second-level risk evaluation indexes. The middle layer is the criterion layer, where risk factors are classified as first-level risk evaluation indices. The top layer is the objective layer, namely, decision-making objectives to be reached by risk quantification. Any complex problem can be divided into a general objective, sub-objective, criterion (or constraint factor layer), factor layers, and even more layers. After the evaluation objectives, plans, criteria, and indices are determined, a systematic hierarchical model can be constructed to identify and analyze risk factors comprehensively. Then, a judgment matrix is constructed. Specifically, every two factors are compared based on their importance levels according to the established hierarchical structure of risk factors. The quantity scale between such factors is marked according to the nine-point scaling method in Tab. 1, thereby obtaining a judgment matrix.

The product of the matrix element a_{ij} is calculated by rows to obtain a new vector $\boldsymbol{M}_i$, as seen in Eq. (6).

$$\boldsymbol{M}_i = \prod_{j=1}^{n} a_{ij} \, (i, j = 1, 2, 3, ..., n) \tag{6}$$

An n root is extracted from each element in the new vector $\boldsymbol{M}_i$ to obtain the vector $\boldsymbol{r}_i$, expressed as Eq. (7).

$$\boldsymbol{r}_i = \sqrt[n]{\boldsymbol{M}_i} \tag{7}$$

Subsequently, $\boldsymbol{r}_i$ is normalized to obtain the weight vector $\boldsymbol{W}_i$ as seen in Eq. (8).

$$\boldsymbol{W}_i = \boldsymbol{r}_i \Big/ \sum_{i=1}^{n} \boldsymbol{r}_i \tag{8}$$

Then, the consistency check is performed, the maximum eigenvalue $\lambda_{\max}$ of the judgment matrix is calculated, the consistency index T is solved, and the mean value K of the consistency index for the same-order random judgment matrices is obtained by referring to Tab. 2 (table of average random consistency index). The consistency proportion Q is calculated, as seen in Eq. (9) to Eq. (11).

$$\lambda_{\max} \approx \frac{1}{n}\sum_{i=1}^{n}\frac{\sum_{j=1}^{n}\left(a_{ij}\boldsymbol{W}_j\right)}{\boldsymbol{W}_i} \tag{9}$$

$$T = \left(\lambda_{\max} - n\right)/\left(n-1\right) \tag{10}$$

$$Q = T / K \tag{11}$$

According to the consistency check requirements, if Q < 0.1, the consistency check is passed, namely, the inconsistency between judgment matrices is in a permissible range. Otherwise, they are considered inconsistent, and experts should be consulted to adjust every two compared judgment matrices.

Table 1 Scale of judgment matrix

Scale	Meaning
1	Two factors have the same importance level.
3	For two factors, the former is slightly more important than the latter.
5	For two factors, the former is more important than the latter.
7	For two factors, the former is much more important than the latter.
9	For two factors, the former is extremely more important than the latter.
2, 4, 6, 8	Median of the abovementioned adjacent judgments.
Reciprocal	For two factors, the importance scale of the latter in comparison with the former.

Table 2 Average random consistency index

n	1	2	3	4	5	6	7	8	9	10	11	12	13
K	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46	1.49	1.52	1.54	1.56

In this study, qualitative and quantitative analyses were combined. The ISM-AHP combined technical method was adopted to finally obtain a structural model of sudden food safety event risk factors.

4 RESEARCH RESULTS
4.1 Construction of Index System

Sudden food safety event risk factors are generally constructed and designed based on practicability, independence, systematicness, scientificity, comprehensiveness, and hierarchy. This study's index system was constructed based on sufficient theoretical support. The pragmatic and scientific criteria were practically combined, expecting to solve practical problems and fit in with the current situation. The collected and summarized data related to sudden food safety event risk factors in China during 2018 - 2021 was comprehensively analyzed. By referring to domestic-related research contents, laws and regulations, platform operation safety, safety information contents, quality and safety of the masses, infrastructure safety, and information management safety were explored by combining the prominent features of sudden food safety event risk factors during production and processing. Specifically, risk influencing factors could be obtained by analyzing the vulnerability and threats of sudden food safety event risk management systems.

Moreover, preliminary evaluation indices could be established by combining practical event cases, among which main factors influencing sudden food safety event risks were combed. Furthermore, a survey was carried out through the Delphi method. Five professors, two associate professors, and three lecturers occupied in food safety management from Beijing, Wuhan, and Haikou were chosen by the study group to form an expert group. A total of 16 sudden food safety event risk factors were finally determined through deep interviews, as listed in Tab. 3.

4.2 ISM Results

Experts evaluated the mutual relations among the 16 sudden food safety event risk factors. According to Eq. (1) to Eq. (3), the established reachability matrix $\boldsymbol{M}$ was solved via MATLAB2017b, as seen in Tab. 4.

Table 3 Regression results

Factor No.	Influencing factor
S1	Food production permit registration.
S2	Inspection materials.
S3	Sanitary registration.
S4	Food product specifications.
S5	Quality standards for food production.
S6	Food inspection report.
S7	Food toxicological safety certificate.
S8	Food raw material proportioning specifications.
S9	Whether transgenic raw materials are contained.
S10	Hygienic test.
S11	Toxicological evaluation.
S12	Food safety education.
S13	Food procurement.
S14	Food storage.
S15	Food processing.
S16	Food sales.

After the reachability matrix $\boldsymbol{M}$ was calculated, it was decomposed continuously to analyze further the mutual influencing relations and levels between such factors. In such a processing way, the reachability set, antecedent set, and intersection set could be obtained, as seen in Tab. 5.

After the unit matrix was removed from the reachability matrix arranged in order of level, the hierarchical relations among factors could be observed to establish an ISM model of sudden food safety event risk factors, as shown in Fig. 1.

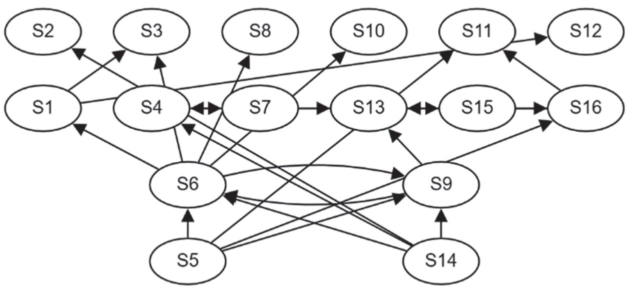

Figure 1 ISM model of sudden food safety event risk factors

Fig. 1 shows that the quality standard for food production (S5) and food storage (S14) were the bottom-layer risks influencing sudden food safety events because the quality standards for food safety in various countries are not the same.

Since the foundation of WTO in 1995, the risk analysis-based standard of the Codex Alimentarius Commission not only serves as a mark testing whether various countries conform to the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) and the Agreement on Technical Barriers to Trade (TBT) but also serves as a basis promoting international trades and settling trade disputes, which has aroused high attention from national governments.

Table 4 Reachability matrix

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
S1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
S2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S4	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	1
S5	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1
S6	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1
S7	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	1
S8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
S9	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1
S10	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
S11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
S12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
S13	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	1
S14	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
S15	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	1
S16	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	1

Table 5 Reachability set, antecedent set, and their intersection set

	Reachability set *R*	Antecedent set *Q*	Intersection set $A=R∩Q$
S1	1, 3, 12	1, 5, 6, 9, 14	1
S2	2	2, 14	2
S3	3	1, 3, 5, 6, 9, 14	3
S4	4, 7, 11, 13, 15, 16	4, 5, 6, 7, 9, 13, 14, 15, 16	4, 7, 13, 15, 16
S5	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16	5	5
S6	1, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16	5, 6, 9, 14	9,6
S7	4, 7, 11, 13, 15, 16	4, 5, 6, 7, 9, 13, 14, 15, 16	4, 7, 13, 15, 16
S8	8	5, 6, 8, 9, 14	8
S9	1, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16	5, 6, 9, 14	9,6
S10	10	5, 6, 9, 10, 14	10
S11	11	4, 5, 6, 7, 9, 11, 13, 14, 15, 16	11
S12	12	1, 5, 6, 9, 12, 14	12
S13	4, 7, 11, 13, 15, 16	4, 5, 6, 7, 9, 13, 14, 15, 16	4, 7, 13, 15, 16
S14	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	14	14
S15	4, 7, 11, 13, 15, 16	4, 5, 6, 7, 9, 13, 14, 15, 16	4, 7, 13, 15, 16
S16	4, 7, 11, 13, 15, 16	4, 5, 6, 7, 9, 13, 14, 15, 16	4, 7, 13, 15, 16

Notes: Arabic numerals in the box represent the serial number of factors.

China has adopted some internationally universal food standards, but some unexecuted standards may be lower than world unified standards. Meanwhile, the possibility for food to cause pollution during storage may exist extensively. Therefore, in sudden food safety events, more attention should be paid to food safety problems like livestock and poultry meat, fish and shrimp, eggs, and snacks, especially some food needing cold chain storage. Restricted by warehousing conditions, food is susceptible to degeneration, which triggers sudden food safety event risks.

4.3 AHP Results

The ISM model divided the influencing factors of sudden food safety event risks into four levels. Then, the influencing factors in four aspects were subjected to weight measurement through the AHP method. Finally, experts were invited to score such factors. The consistency of judgment matrices was checked, as seen in Tab. 6.

Tab. 6 shows that the CR value was always smaller than 0.1, indicating that the overall ranking levels passed the consistency check. Furthermore, the weights of all indices were calculated, as seen in Tab. 7.

Table 6 Consistency check of judgment matrices

Matrix layer	Maximum eigenvalue	CI value	RI value	CR value	Consistency check result
The first layer	4.144	0.048	0.89	0.054	Pass
The second layer	6.544	0.109	1.26	0.086	Pass
The second layer	6.343	0.069	1.26	0.054	Pass
The second layer	2	0	0	-	Pass
The second layer	2	0	0	-	Pass

Tab. 7 shows that in addition to the conclusion that the quality standard for food production (S5) and food storage (S14) was the bottom-layer risks influencing sudden food safety events, as evidenced by the ISM model, it could be known that "whether transgenic raw materials are contained" (S9) ranked second in the aspect of influencing weight. The main reason is that transgenic food refers to transgenic biological strains acquired through the transgenic biotechnology technique. Therefore, the food produced with transgenic organisms as direct food or raw materials is referred to as transgenic food. Furthermore, in China, the safety evaluation of transgenic food mainly targets the safety evaluation of neurology, toxicology, and sensitization; therefore, whether transgenic raw materials are contained in a hot food issue is a concern of the general public.

Table 7 Index weights

Influencing factor	First-layer index weight	First-layer index weight	Total weight
S2	15.540%	11.185%	1.738%
S3		15.328%	2.382%
S8		15.745%	2.447%
S10		19.467%	3.025%
S11		18.364%	2.854%
S12		19.911%	3.094%
S1	23.360%	9.684%	2.262%
S4		15.901%	3.714%
S7		17.290%	4.039%
S13		18.632%	4.352%
S15		18.425%	4.304%
S16		20.068%	4.688%
S6	24.201%	25.000%	6.050%
S9		75.000%	18.151%
S5	36.899%	33.333%	12.300%
S14		66.667%	24.599%

5 CONCLUSION

Sudden food safety events are important content influencing economic and social development. Therefore, food supervision units should perfect the evaluation structure, mechanism, and procedures. In this study, related food safety experts were interviewed, and an evaluation index system of food safety event risk factors was designed with the emphasis on critical links of food safety event response from aspects of efficiency, professionalism, and communication, which was of guiding significance to the criterion system for sudden event coping work. Moreover, the AHP method was combined with the ISM model, related scoring data were recorded based on various indices, and quantification standards were given. The main conclusions are shown; the 16 sudden food safety event risk factors could be divided into four levels. The quality standard for food production (S5), whether transgenic raw materials are contained (S9), and food storage (S14) were the primary factors influencing sudden food safety events. The sudden food safety event factors established in this study are of important supervising and guiding significance for improving the handling level of food safety events. Ensuring food safety and coping with sudden events constitute an important job content of supervision departments. At the same time, risk factor identification is a significant benchmark for evaluating the performance of relevant departments. Deep study can be carried out regarding establishing a sound food quality management system, strengthening food practitioner training, promoting food safety culture construction, and exerting the supervising effect of the public to reduce the potential risks of sudden food safety events.

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