

Research Article

Study on Evaluation of Food Safety for Basketball Player Based on Fuzzy Comprehensive Evaluating Method

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Abstract: In order to improve the physical ability and sport performance of basketball player, food safety problem of basketball player should be concerned and the high food safety level of basketball player can be ensured. Firstly, the main affecting factors of food safety for basketball player are discussed. Secondly, the fuzzy comprehensive evaluation model of food safety of basketball player is established. Thirdly, a case study of food safety evaluation of basketball player is carried out for a province and results show that the fuzzy comprehensive evaluating method is an effective method for evaluating the food safety level of basketball player.

Keywords: Basketball player, food safety, fuzzy comprehensive evaluating method

INTRODUCTION

Basketball is a comprehensive sports event with acute antagonism. During the procession of match and training, the sport strengthen of basketball player changes highly, the physical ability of basketball player consumes highly, therefore the basketball player should have comprehensive physical quality and high fitness level. For an excellent basketball player, he should not only has strong anaerobic capacity, but also has high aerobic capacity. The essential nutrients of basketball player conclude protein, fat, sugar, minerals, vitamin, water and food fiber, protein, fat and sugar are three major sources of energy and other nutrients are used to regulate the physiological function of human body. Basketball match generally lasts for a long time and the number of matches is much and the sport strength is big, therefore it is necessary to use rational diet for basketball player. Each meal of basketball player should conclude the following nutritional ingredient, 60-65% carbohydrates, 15-20% protein, 20-25% fat. Because all kinds of food concludes different sugar, therefore basketball player should choose the scientific food according to requirement of match, the sugar in food of basketball player should be rich and digestible. The protein of food should have high-quality. In addition, the basketball should eat fresh vegetable, fruit and the basketball player should add vitamin C and calcium, phosphorus, iron, zinc and electrolyte and water. The food safety problem is very critical for ensuring the sport performance of basketball player, the food pollution should be prevented and the food-borne

disease should be avoided, the food quality should be ensured based on effective measurement (Liu *et al.*, 2012).

In order to find out the food safety problem and ensure the food safety of basketball player, the advanced evaluation tool should be used. Fuzzy comprehensive evaluating method is established based on fuzzy transform principle and evaluation fuzzy system, the core content of it is to construct the membership degree function and describe the membership degree between events. Because “good” and “bad” of food safety quality of basketball player has big fuzziness, the limit of food safety level is difficult to be cleared, this phenomenon belongs to fuzzy problem and the fuzzy comprehensive evaluating method can be an effective method for evaluating the food safety of basketball player (Chen, 2012). This research is to evaluate the food safety of basketball player based on fuzzy comprehensive evaluating method.

Main affecting factors of food safety for basketball player: There are many factors affecting the food safety of basketball player, which are listed as follows.

Biotic pollution: The biotic pollution of food for basketball player concludes pollution of germ, bacterial virus, parasite and virus. The pathogenic microorganisms that are easy to cause the food poisoning of basketball player mainly conclude *e. coli*, golden color grape bacteria, salmonella and so on. The food poisoning events caused by pathogenic enterobacteria are frequently reported, some matches are

cancelled for the food poisoning. Although the scientific level has been developed in a certain degree in recent years, the food-borne disease has been controlled effectively. The basketball player should concern this food safety problem (McCartney, 2015).

Environmental pollution: The environmental pollution has become the new threat for food safety, for example, three industrial wastes concluding metallic poison are discharged to the rivers and lakes without procession and then the water supply, aquatic animal and plant and soil should be polluted. The bio-concentration of food chain can make the concentrations of these dangerous particles in human body high. According to the relative researches, if the heavy metal content of fish and shrimp exceeds the standard seriously, this kind of food can lead to the alimentary toxicosis, sometimes even lead to cancer.

Chemical pollution: Heavy use of pesticide not improves the crop yield but also cause the pesticide residue of environment and food, then food pollution will happen. The organophosphor is the insecticide with maximum usage, which belongs to nerve agent. Once it remains in the crops, the choline lipid enzyme activity in the organism can be restrained, which can lead to sweating, muscle tremor and heart rate. Serious situation may lead to the aberration of central nervous system. In food processing and manufacturing process, chemical substances beyond the applicable range in food regulations are added and used, which can be harmful for the body healthy of basketball player. The banned colorant citrine yellow and carminum do not permit to add in squish, use of chemical synthetic sweeteners exceeding the standard will threat the health of basketball player. The health foods developed according to basketball player concludes some banned substances, such as caffeine, appetite suppression agent and adrenal cortex hormone. The natural substance of traditional Chinese medicine health care products is IOC banned drug, these will lead to doping inspection positive (Ximo, 2011).

METHODOLOGY

Application of new technology: With application of food new technology, new material and new technology, a lot of products with high science and technology emerge ceaselessly. In recent years, the transgenesis cattle and sheep, fish and shrimp, fruit and vegetable has been thrown into the food market. The transgenesis food has the following potential risks: it can lead to acute, chronic poisoning of basketball player; the organism of basketball player can generate anaphylaxis and the immune system of basketball player can be damaged; nutrient value of food can reduce, trophic structure loses balance. Health care

products market is uneven, about half of the health care food is unqualified (Pontoniere and Martiradonna, 2012).

Counterfeit and shoddy food: The harm caused by counterfeit and shoddy food is not ignored. During the procession of food manufacturing, the inferior raw material or unqualified raw material is used to make food of basketball player. For example, the livestock and poultry died of disease is used to make cooked meat products, the cascophen is used to make marine products.

Fuzzy comprehensive evaluation model of food safety of basketball player: The food safety of basketball player is evaluated based on fuzzy comprehensive evaluation method and the corresponding algorithm procedure is listed as follows:

- Fuzzy comprehensive evaluation is used to evaluate the single factors of food safety of basketball player.
- The fuzzy evaluation results of single factors are integrated, the total food safety in each stage is evaluated and then the total food safety basketball player is evaluated.

The particular steps of evaluation are listed as follows:

- The comment set is constructed as follows. The comment set is expressed by:

$$C = (c_1, c_2, \dots, c_n) \quad (1)$$

where, c_i ($i = 1, 2, \dots, n$) is the degree of valuation, which ranks according to high and low.

- **The index set is constructed:** The index set uses each evaluation index as component. If the first grade is applied in evaluating, the index set of evaluation object can be defined by Mu *et al.* (2013):

$$I = (i_1, i_2, \dots, i_m) \quad (2)$$

where, i_i ($i = 1, 2, \dots, m$) is i^{th} evaluation index. The weight set of index set is defined by Xu and Liu (2005):

$$W = (w_1, w_2, \dots, w_n) \quad (3)$$

where, w_i ($i = 1, 2, \dots, n$) is the proportion of index i_i in I and the following equation is obtained as follows (Xue and Yang, 2014):

$$\sum_{i=1}^n w_i = 1 \tag{4}$$

If the multistage stage is applied in evaluating the food safety level of basketball player, the index set and weight index of factors are same as that of first grade model. The k^{th} second index of the factors is defined by Yang *et al.* (2012):

$$I_k = (i_{k1}, i_{k2}, \dots, i_{kl}) \tag{5}$$

where, i_{ki} ($i = 1, 2, \dots, l$) is the i^{th} evaluation index of k^{th} second index and the corresponding weight collection is defined by:

$$W_k = (w_{k1}, w_{k2}, \dots, w_{kn}) \tag{6}$$

where w_{ki} ($i = 1, 2, \dots, n$) is the proportion of index i_{ki} of I_k and the following equation should be satisfied:

$$\sum_{i=1}^l w_{ki} = 1 \tag{7}$$

- **The membership degree matrix of single index is established:** After the evaluation set and index set are established, the fuzzy mapping from I to F (C) can be obtained, which are expressed by:

$$f : I \rightarrow F(C), \forall i_i \in I \tag{8}$$

$$u_i \mapsto f(i_i) = \frac{r_{i1}}{v_1} + \frac{r_{i2}}{v_2} + \dots + \frac{r_{in}}{v_n} \tag{9}$$

where, $0 < r_{ij} < 1, 0 < i < n, 0 < j < m$. The membership degree of i^{th} evaluation index is computed according to the following equations (Xu and Liu, 2005):

$$r_{ij} = \begin{cases} 0, x_i \geq S_{i(j+1)} \\ \frac{S_{i(j+1)} - x_i}{S_{i(j+1)} - S_{ij}}, S_{ij} \leq x_i \leq S_{i(j+1)} \\ 1, x_i \leq S_{ij} \end{cases}, j = 1 \tag{10}$$

$$r_{ij} = \begin{cases} 0, x_i \geq S_{i(j-1)} \\ \frac{x_i - S_{i(j-1)}}{S_{ij} - S_{i(j-1)}}, S_{i(j-1)} \leq x_i \leq S_{ij} \\ \frac{S_{i(j+1)} - x_i}{S_{i(j+1)} - S_{ij}}, S_{ij} \leq x_i \leq S_{i(j+1)} \end{cases}, j = 2, 3, \dots, n-1 \tag{11}$$

When,

$$r_{ij} = \begin{cases} 0, x_i \leq S_{i(j-1)} \\ \frac{x_i - S_{i(j-1)}}{S_{ij} - S_{i(j-1)}}, S_{i(j-1)} \leq x_i \leq S_{ij} \\ 1, S_{ij} \leq x_i \end{cases}, j = m \tag{12}$$

The fuzzy relationship can be defined by f and the fuzzy matrix R is constructed, which is the evaluation matrix of single factor. (I, C, R) forms the comprehensive model.

If the first grade model is applied in evaluating the food safety of basketball player, the membership degree of food safety for basketball player can be obtained as follows (Liang *et al.*, 2013):

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix} \tag{13}$$

where, r_{ij} ($i = 1, 2, \dots, m, j = 1, 2, \dots, n$) is the membership of j^{th} level comment c_j to i^{th} evaluation index i_i .

If the multistage model is applied in evaluation, the membership degree of k^{th} sub factor of factor is defined by:

$$R_k = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{l1} & r_{l2} & \dots & r_{ln} \end{bmatrix} \tag{14}$$

where r_{ij} ($i = 1, 2, \dots, l, j = 1, 2, \dots, n$) is the membership of j^{th} level comment c_j to i^{th} evaluation index i_{ki} .

- **The weight set is established:** The weight set $W = (w_1, w_2, \dots, w_m)$ is the normalization weight value matrix of each index.
- **The comprehensive evaluation through matrix of calculating results is carried out:** The complex operation of fuzzy matrix is applied in membership degree matrix and weight set and the matrix of fuzzy comprehensive evaluation results are calculated according to the following expression:

$$B = W \cdot R = (b_1, b_2, \dots, b_n) \tag{15}$$

where,
 W = The weight set of food safety of basketball player
 R = The membership degree matrix of food safety of basketball player
 B = The matrix of fuzzy comprehensive evaluation results:

Table 1: Evaluation index system of food safety for basketball player

First grade index	Second grade index	Third grade index
Food safety of basketball player (V)	Biotic pollution (V ₁)	Germ (V ₁₁)
		Bacterial virus (V ₁₂)
		Parasite (V ₁₃)
		<i>E. coli</i> (V ₁₄)
	Environmental pollution (V ₂)	Waste water (V ₂₁)
	Exhaust gas (V ₂₂)	
	Slag (V ₂₃)	
Chemical pollution (V ₃)	Organophosphor (V ₃₁)	
	Colorant citrine yellow (V ₃₂)	
	Carminum (V ₃₃)	
	Caffeine (V ₃₄)	
Application of new technology (V ₄)	Transgenosis animal (V ₄₁)	
	Transgenosis plant (V ₄₂)	
Counterfeit and shoddy food (V ₅)	Livestock and poultry died of disease (V ₅₁)	
	Cascophen (V ₅₂)	

Table 2: Weight value of each evaluation index

Second grade index	Weight value	Third grade index	Weight value
V ₁	0.13	V ₁₁	0.14
		V ₁₂	0.32
		V ₁₃	0.26
		V ₁₄	0.28
V ₂	0.22	V ₂₁	0.22
		V ₂₂	0.47
		V ₂₃	0.31
V ₃	0.18	V ₃₁	0.12
		V ₃₂	0.29
		V ₃₃	0.25
		V ₃₄	0.34
V ₄	0.35	V ₄₁	0.42
		V ₄₂	0.58
V ₅	0.12	V ₅₁	0.38
		V ₅₂	0.62

$$b_i = \bigvee_{j=1}^n (a_i \wedge r_{ij}) \quad (16)$$

where, Λ is the minimum value of many values computed, \wedge denotes the maximum value of many values computed.

The normalization procession is carried out for matrix of results, which is calculated by the following expression:

$$b'_i = \frac{b_i}{\sum_{j=1}^m b_j} \quad (17)$$

where, b'_i is the normalization value of i^{th} element of matrix of fuzzy comprehensive evaluation matrix, the matrix of normalization results is defined by $(b'_1, b'_2, \dots, b'_n)$. Based on the matrix of results, the level of food safety of basketball player is evaluated according to the principle of maximum membership.

RESULTS AND DISCUSSION

According to the real situation of food safety of basketball player, the corresponding evaluation index system is constructed, which is shown in Table 1.

The comment set is divided into five levels, concluding excellent (I level), good (II level), normal (III level), bad (IV level) and very bad (V level).

The food safety of basketball player in a province is used as researching object and the weight vector of single index is obtained according to the expert evaluation method. Twenty experts of food safety of basketball player are invited to evaluate each index and the final evaluation results are listed in Table 2.

Based on algorithm procedure of fuzzy comprehensive evaluation model, the final evaluation results are listed as follows:

$$B = [0.12 \quad 0.24 \quad 0.26 \quad 0.15 \quad 0.31]$$

According to final results, the food safety level of basketball player in this province is normal.

CONCLUSION

In order to improve the sport performance of basketball player, the food safety problem of basketball player should be concerned. The fuzzy comprehensive evaluation method is applied in evaluating food safety level of basketball player and the evaluation results can grasp the food safety level of basketball player and the corresponding food safety controlling measurement can be put forward, then the perfect food safety monitoring mechanism is established finally.

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