

## Evaluation of a food safety education on knowledge, attitude and practice among 1300 college students of Henan province, China

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**Abstract.** Background: To investigate the knowledge, attitudes and practice of food safety among college students of Henan Province, China and to evaluate the effect of food safety education. Methods: We randomly selected 1,300 students by stratified and cluster random sampling methods, then conducted questionnaire survey on their knowledge, attitudes and practice on food safety. Results: The mean and standard deviation of food safety knowledge scores is  $62.6 \pm 14.6$ . The average score of girls ( $63.8 \pm 15.0$ ) and medical students are higher than that of boys ( $60.3 \pm 13.7$ ) ( $P < 0.01$ ) and non-medical students ( $56.0 \pm 11.4$ ) ( $P < 0.01$ ). 95.2% of the students very concerned about food safety issues. However, as encountering with unsafe food, only 0.39% of them chose to complain to the Consumers' Association. Conclusion: It is very necessary to carry out food hygiene education among college students to improve their knowledge level of food safety.

### Introduction

Food-borne illnesses affect millions of people each year [1], so food safety is not only the elementary guarantee of people's health but also the foundation of social stability and development of various undertakings. Along with the improved living standard, rational and healthy diet has gradually been appreciated. Besides, they are eager to have more dietary guidelines and food safety knowledge. College students are in the golden age of learning, good nutrition and health can enhance students' educational performance and learning [2]. So understanding college students' food safety knowledge and analyzing the influence factors are helpful in reducing food-borne illness. What's more, it is not only helpful to launching the corresponding health education, but also to spread knowledge of food safety, thereby to influence a broader population. Knowledge gain must precede behavior change, attitude, also a precondition for behavior change [3]. An attitude, whether positive or negative, is learned through the environment and can be used to describe mental readiness to act and predict the likelihood that a person will be motivated to move to action[4]. Therefore, in order to provide the basis for the research on food safety knowledge, attitude and

practice of college students, we conducted a food safety knowledge, attitudes and practice (KAP) questionnaire among the college students in Henan Province and evaluated the effect of the intervention.

## Methods

**Study subjects.** From October 2011 to November 2011, by using Multi-stage stratified cluster sampling, the 44 faculties of Zhengzhou University were divided into four majors: science, engineering, arts and medicine; Four faculties were randomly selected from each major, a total of 16 faculties were selected; According to the proportion of the students from different levels, faculties and grades, 1300 students were selected to participate in the food safety KAP investigation. In order to evaluate the effect of food safety education intervention, 258 students in Grade 2009 whose majors are oral medicine, iconography and laboratory medicine were viewed as the intervention group. They had received four weeks' food safety knowledge education as a required course in the school. Questionnaires were carried out after the education. Meanwhile, we considered the students in Grade 2009 from preventive medicine who did not receive the related education as the control group, and gave them the same questionnaire. The study was approved by the ethical committee Zhengzhou University.

**Questionnaire design and grading standards.** The questionnaire was self-administered based on the food safety KAP model, from the college text book of "Nutrition and Food Hygiene" textbook (People's Medical Publishing House, the Sixth Edition, China) and the related literatures [5-8], combined with the characteristics of college students in our school. Before the main survey, a small pre-survey was carried out. Based on the pre-survey, the questionnaire was discussed and revised. The final version of the questionnaire included basic information of respondents (college, major, grade, date of birth, place of birth, gender, ethnicity and monthly living expenses, etc.), 20 food safety knowledge questions (5 points for each), 6 questions about attitudes, 10 practice questions. We have released 1300 questionnaires in the scene and 1271 valid anonymous ones were fed back.

**Statistical treatment.** All the data were input using Epidata3.1 and the quality of the data were controlled by the double entry verification method. After that the data were analyzed by using SPSS13.0 version statistical software. Statistical analysis was done using the mean and standard deviation (SD) to summarize each student's age and score on nutrition knowledge. Frequency and proportion were calculated to describe gender, grades, majors, degree levels and attitudes towards food safety. Measurements of association were carried by Chi-square test and t test as appropriate. The Chi-square test for relativity was also used to examine the correlation between respondents' nutrition knowledge awareness and relevant behaviors. The right response for each question received a score of 1, with 0 for the wrong response. Logistic regression analysis was used to examine the correlations between gender, grade, education level, and major compared with food safety knowledge scores. In the Logistic regression analysis we concerned sex (male=1, female=2), Grade (Grade 2007=1, Grade 2008=2, Grade 2009=4, Grade 2011=5), academic level (postgraduate=1, undergraduate=2, junior college students=3), major (non-medical students=1, medical students=2) as independent variables, and considering food safety knowledge score as the dependent variable (below the average score =0, above the average score =1).

## Results

**General condition.** The average age of 1271 randomly investigation respondents was  $21.1 \pm 2.1$  age, the youngest was 17 years old and the oldest was 39 years old; the monthly average cost of living was  $562 \pm 202$  RMB, in which the minimum monthly living expenses was 100 RMB, and the highest monthly living expenses was 1800 RMB. The respondents covered different majors of liberal arts, science, medicine and engineering from different grades and different academic levels (postgraduate, undergraduate and junior college students) in Zhengzhou University; among them 443 were boys and 828 were girls.

**Knowledge.** The mean and standard deviation of food safety knowledge scores is  $62.6 \pm 14.6$ . The mean food safety knowledge score of the females ( $63.8 \pm 15.0$ ) is significantly higher than that of males ( $60.3 \pm$

13.7), There is a statistical significance difference ( $P < 0.01$ , ANOVA). Besides the food safety knowledge scores differed among their major, their academic levels and batches (Table 1).

Table 1. The comparison of food safety knowledge scores

Variable	Total	Mean scores of food safety knowledge	SD	t	P
Sex				-3.67	<0.01*
Male	443	60.3	13.7		
Female	828	63.8	15.0		
Major				285	<0.01*
Arts	344	56.6	12.3		
Science	134	56.1	11.1		
Engineering	171	55.2	10.8		
Medical	622	69.4	14.4		
Academic levels				73.7	<0.01*
Graduate	229	66.8	15.4		
Undergraduate	893	63.0	14.4		
Junior college	149	53.8	10.9		

\* $P < 0.01$ , there is a significant difference.

Multiple comparison of the scores of students from different batches showed that there was no significant difference between the scores of students from Grade 2007 and Grade 2009 and the scores of students from Grade 2008 and Grade 2011 ( $P > 0.01$ ), and there were significant differences among all other grade students' scores ( $P < 0.01$ , Table 2). And Person correlational analysis showed that there is no correlation between the university students' monthly living expenses and their food safety knowledge scores ( $P > 0.01$ ).

Table 2. Distribution of food safety knowledge scores of students from different batches

Grade I	Grade J	The mean difference (I-J)	SD	significance	95% CI	
					Lower	Upper
2007	2008	13.7*	1.69	0.00*	10.4	17.1
	2009	1.15	1.51	0.44	-1.8	4.11
	2010	8.10*	2.02	0.00*	4.1	12.1
	2011	14.7*	1.52	0.00*	11.7	17.7
2008	2007	-13.7*	1.69	0.00*	-17.1	-10.4
	2009	-12.6*	1.31	0.00*	-15.2	-10.1
	2010	-5.6*	1.88	0.00*	-9.35	-1.98
	2011	0.956	1.33	0.47	-1.65	3.56
2009	2007	-1.15	1.51	0.44	-4.11	1.80
	2008	12.6*	1.31	0.00*	10.0	15.1
	2010	6.95*	1.71	0.00*	3.6	10.3
	2011	13.57*	1.08	0.00*	11.4	15.6
2010	2007	-8.10*	2.02	0.00*	-12.1	-4.15
	2008	5.66*	1.88	0.00*	1.9	9.35
	2009	-6.95*	1.71	0.00*	-10.3	-3.60
	2011	6.62*	1.72	0.00*	3.3	9.99

\* $P < 0.01$ , there is a significant difference.

**Logistic.** Logistic regression analysis showed that there were correlations between gender, grade, education level, and major compared with food safety knowledge scores (Table 3).

Table 3. Logistic regression analysis

Independent variable	B	S.E,	Wals	Sig.	Exp (B)	95% CI	
						Lower	Upper
Gender	0.354	0.132	7.17	0.007*	1.42	1.1	1.84
Grade	-0.468	0.055	71.6	0.000*	0.626	0.562	0.69
Academic level	-0.907	0.118	58.7	0.000*	0.404	0.32	0.51
Whether medical students or not	-0.090	0.222	0.165	0.685	0.914	0.591	1.41

\* $P < 0.01$ , there is a significant difference.

**Attitudes towards food safety.** The majority of respondents concerned or very concerned the issue of food safety (95.1%) and that it was very important or important to develop healthy dietary habits (94.2 %). When asked "What they think of the food safety situation in China", most students thought that it was very poor (73.3 %), followed by good (25.1%) and very good (1.6%). There was statistically significant difference in respondents' attitudes towards all the six questions (Table 4).

Table 4. Distribution of college students' attitudes towards food safety

Variable	N (n=1271)	%	P
What is your attitude towards the issue of food safety?			0.000*
Very concerned	502	39.5	
Concerned	707	55.6	
Not concerned	62	4.9	
What do you think of the food safety situation in our country?			0.000*
Very good	20	1.6	
Good	319	25.1	
Very poor	932	73.3	
What do you think is the cause of numerous food safety problems at present?			0.000*
Driven by the interests of the production and sale of enterprises	780	61.4	
Lax enforcement of the law	342	26.9	
The competent departments are not clear about their responsibilities	141	11.1	
Unclear	8	0.6	
What measures do you think should be taken to ensure food safety?			0.000*
Strict enforcement of the law	641	50.4	
Strengthening national legislation	164	12.9	
Supervision by public opinion	61	4.8	
Improving the national awareness of food safety	405	31.9	
Do you accept food additives?			0.000*
Accept reluctantly	628	49.4	
Unacceptable	419	33.0	
Acceptable	224	17.6	
What food safety issues are you most worried about ?			0.000*
The use of food additives	555	43.7	
Pesticide residues	121	9.5	
Heavy metals and microbe Pollution	595	46.8	

\* $P < 0.01$ , There is significant difference.

**Practice towards food safety.** Regarding food consumption, 30.6% of the students chose to buy food from large supermarkets; 77.1% of the students have the experiences of buying unsafe food which has been proved to be potentially harmful to human health. From those having bought unsafe food, 54.5% of the students chose "to discard"; 4.17% of the students choose "to continue to eat"; and 18.2% of the students chose "to accept the bad luck"; the proportions of "to require the return of goods" and "to complain to the Consumers' Association" were respectively 22.6% and 0.39%. Concerning choosing food, the most attention seeking issues are the production date and shelf-life respectively (78.9%), the other sequent aspects including:

price (9.6%), the brand and appearance (6.2%), the food color (2.9%) and the certification mark (2.2%). In order to avoid the intake of unsafe food, if possible, 78.1% of the students chose "to eat at home"; 19.0% of the students liked "to eat at school cooked" and 2.91% preferred "to eat outside the school and home". Concerning about the expired food, 94.3% of the students selected "to discard"; 3.07% of the students selected "to warm to eat" and 2.6% selected "to continue to eat". Concerning frequency used to eat outside home in the week mentioned, 14.3% of the students said "never"; 25.3% said "once a week"; 15.8% said "twice or 3 times a week"; 36.5% said "4 times a week", and 7.95% said "almost every day". When talking about "Whether do you often order takeout?", most of the students, about 84.7% selected "4 times a week", 4.17% of the students selected "never"; 4.01% selected "once a week", 4.41% selected "twice or 3 times a week"; and 2.68% selected "almost every day". The other question of "Where do you often eat?", 73.3% of the students liked to eat "the market near the school"; 5.9% preferred to eat at "the restaurants in the city", and 21.4% chose "the dining room in the school". The reasons for using out of the home are: "to invite the guests" (49.1%), "to get better food" (30.9%), "when the canteen meals is off" (17.8%) and "feasting families" (2.12%).

**Evaluation of the effect of food safety education intervention.** The results of the survey showed that food safety knowledge score of the intervention group was significantly higher than that of the control group ( $P < 0.01$ ). Data were shown in Table 5.

Table 5. Evaluation of the effect of food safety education intervention

Group	Whether accept the food safety education	Number	Mean	SD	t	P
Intervention group	yes	258	69.3	15.1	4.92	0.00*
Control group	no	108	61.9	11.9		

\* $P < 0.01$ , there is a significant difference.

## Discussion

With the average score of  $2.60 \pm 14.6$ , the food safety knowledge score of the students is not satisfying. In the question of "What's your attitude towards the issue of food safety?" 39.6% of the students selected "very concerned"; 55.6% selected "concerned"; which indicates that although students have the desire to pay much attention to the food safety, the absence of systematic food safety education leading to cognitive deficits. Simultaneously, the survey showed that the girls' awareness of the issue was significantly higher than that of boys, which was not consistent with the report of Han [9] and Chen [10], but was consistent with the report of Ye [6] and Ma [11]. The reason for that is probably because the respondents were medical students in which girls have higher proportion (34.1%). Medical students' food safety knowledge score was significantly higher than the students in other majors, which is consistent with other domestic reports [6-10,12,13]. Medical students gave more attention to the learning of nutrition and health knowledge because of their major. Besides, they have more opportunities to access to the knowledge of nutrition and food hygiene than other non-medical students, so they could obtain relatively higher scores.

There was no association between the students' monthly living expenses and food hygiene knowledge scores, which is not consistent with the report of Chen [10]. The report showed that food safety knowledge is increasing with the level of consumption. There were significant differences between the food safety knowledge scores of students from different academic levels, and the questionnaire showed that postgraduates scored higher than undergraduates; undergraduates scored higher than junior college students. This is the comparison of the scores of the undergraduates from different grades: students in Grade 2009 scored ( $69.7 \pm 14.7$ ) > Grade 2010 ( $62.8 \pm 13.1$ ) > Grade 2011 ( $56.2 \pm 10.9$ ) ( $P < 0.01$ ). The higher the academic levels and the grades are, the more opportunities they have to get food safety education knowledge directly or indirectly, and the more rational and right understanding of food safety issues they have. The students who received medical training related to nutrition and food hygiene scored higher than those who did not. The intervention study we designed also showing that intervention group had higher scores than the control group, and therefore, carrying out some long-term and orderly food safety educational activities in colleges is necessary and feasible.

Because of the frequent occurrence of food safety incidents, university students in China are apparently lack of confidence in food safety. In the survey, 73.3% of the students thought that it is very worrying about Chinese food safety situation, 50.4% thought that we can ensure food safety through the "strict enforcement of the law". But when it comes to unsafe food, only 0.39% of the students chose to complaint to the Consumers' Association. On possible reason might because that they did not want to make trouble for themselves, on the other hand it might because of their weak awareness of the law of food safety. 31.8% of the students think that we should ensure food safety through "improving the national food safety awareness". There were only 2.2% of the students paying attention to certification mark when purchasing food. It also further proved that it is necessary to carry out food safety education for university students.

Food additives are compounds or natural substances put into food in order to improve food color, smell, taste and other quality of food. They are also used for embalming and food processing. Rational use of food additives is good for enriching food production and improving human health. Though food additive itself is safe, if you use properly, or they are other toxic and harmful substances illegally using in food, it could lead to food safety problems. In the varieties of food safety issues, illegal use of food additives is the most worried 43.6% of the college students were about. When referring to the question of "Do you accept food additives?", 17.6% of the students selected "acceptable"; 49.4% selected "barely acceptable" and 32.9% selected "unacceptable", which showed that there were some confusions about food additives among college students. On one hand it was related to media and food production enterprises using "without food additives" as a selling point, on the other hand it also suggested that we should strengthen college students' food safety knowledge education.

When mentioned to students' purchasing and consumption behavior, 84.7% of the students often ordered takeout (4 times a week averagely).The proportion of students who often go out to eat is also very high. Although college students are very concerning about food safety issues, 73.3% of the students chose bazaars near the college to dinner for the reason of entertaining guests, and improving their diet level and other reasons .It also indicated that their self-protection awareness is insufficient. In order to avoid the intake of unsafe food, 78.1% of the students chose to eat at home, if it is possible. It suggested that the food service and the quality of food are expected to be intrinsically improved by the dietary guarantee department of the college to attract more students to eat at school and eliminating food safety hazards, especially in the medical college.

## Conclusion

The findings of this study demonstrated that the food safety knowledge score of the students is low, medical students' score was higher than that of non-medical students. It is important to strengthen the non-medical students' food safety and health education to improve students' overall level of food safety knowledge for the universities. College students paid close attention to food safety issues, and more than half of the students thought that the food safety situation in China is serious, the government should strengthen the construction of the food safety, recovering the confidence in food safety. College students paid close attention to food safety issues, but they are lacking of adequate consciousnesses of food safety and exercising of rights for self-pervations. We recommend that universities carry out some long-term and orderly food safety education activities and some relevant campus cultural activities to improve students' food safety knowledge and develop good food habits of hygiene in their daily acknowledgment.

## Competing Interest

The authors declare that they have no competing interests

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