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Knowledge, Attitudes and Practices (KAP) Relating to Coarse Grains Intake Among Residents in Zhengzhou City, China: A Cross-Sectional Study

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Abstract

Objective: To investigate the relationship between coarse grains intake and the score of knowledge, attitudes and practices (KAP), and to detect the possible related factors for the KAP scores. Method: The information of the residents was obtained from trained investigators using face-to-face interviews, including residents' general characteristics, KAP related coarse grains. The data were entered into EpiData version 3.1 and analyzed by IBM SPSS Statistics 25.0. Result: 374 residents from 4 communities in Zhengzhou participated the study, in which 71.1%, 87.2%, 13.9% and 76.0% of the interviewees' total KAP score, knowledge score, attitude score and practices score were unqualified, respectively. Significant positive associations were found between total KAP score and whole grain intake, tuber intake and beans and their products intake (r_s = 0.402, r_s = 0.228, r_s = 0.216, respectively; P< 0.01). Multivariate logistic regression analysis showed that he KAP scores of coarse grain were significantly related to the age, education level and occupation (all P <0.05). Conclusion: The residents have a low level of nutritional knowledge and consumption practice. According to the relationship between coarse grain intake level and KAP scores, in view of the current nutritional status of the residents，the relevant departments should mainly guide the young residents on the nutrition of coarse grains, especially tubers，and in view of the long-term development for national health, they could add the knowledge of coarse grain nutrition to the curriculum of primary and secondary schools.

Keywords

Coarse Grains, Nutrition, Knowledge, Attitudes, Practices

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1. Introdution

Coarse grains refer to a nutrition food other than wheat and rice. They mainly include whole grains (corn, millet, red rice, black rice, purple rice, sorghum, barley, oats, wheat, etc.), miscellaneous beans (soybeans, mung beans, red beans, black beans, broad beans, peas, etc.), and tubers (sweet potatoes, yams, potatoes, etc.). Bran, germ and endosperm make up whole grains. The bran and germ contain many kinds of nutrients and phytochemicals, whereas the endosperm is largely starch and provides mostly energy. A refined grain contains only the endosperm and thus provides fewer nutrients and phytochemicals than the whole grain. [1] A systematic review showed that the risk of type 2 diabetes mellitus were reduced (*RR*=0.74, 95%*CI*: 0.69, 0.80), when subjects consumed whole grains over 48 g/d. [2] Whole grains intake could reduce the risk of colorectal cancer, [3, 4] and cardiovascular disease, [5, 6] as well as the risk of weight gain. [7] Soy is a nutritious food rich in calcium, iron, vitamin B_1,

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vitamin B_2 and vitamin E. Consumption of soy was significantly associated with decreased risk of breast cancer (*OR*=0.65, 95%*CI*: 0.43-0.99). [8] In addition, a large number of studies had shown that soybeans and their products with more intakes had protective effects on hyperlipidemia, [9, 10] hypertension, [11, 12] osteoporosis, [13] type 2 diabetes [14] and gastric cancer. [15, 16] Tubers are rich in nutrients, including carbohydrates, protein, fat, dietary fiber, minerals and various vitamins, of which vitamin C is the most abundant. Previous research showed that increasing tubers intake could reduce the risk of colorectal cancer [17, 18] and gastric cancer. [19].

The study by Shufa Du showed the great changes in food consumption in China from a diet dominated by coarse grains and carbohydrates to one in which refined rice and wheat carbohydrates have declined between 1949 and 1992. [20] According to the 2007 Chinese Dietary Guidelines, the intake of cereals had decreased year by year, and the status of cereals as a dietary subject had gradually declined. According to the results of the 2002 Survey of Nutrition and Health of Chinese Residents, the average daily intake of cereals per standard person had decreased by 108g in the 20 years since 1982. [21] A Chinese article showed that the awareness rate of the Chinese Dietary Guidelines for adults from 2004 to 2011 was still at a low level, and the level of basic nutrition knowledge was low. [22] However, there are few studies on the knowledge, attitudes, practices (KAP) related to coarse grains and possible related factors of coarse grains intake of Chinese residents.

The knowledge, attitudes and practices (KAP) model is one of the most used model in the research field. KAP surveys were first developed in the 1950s. [23] Compared with other social research methods, KAP research is more cost-effective and more resource-efficient, because it is tightly focused and limited in scope. [24] The KAP model suggests that people with a high positive attitude towards behavior and high knowledge will have an effective practice. A study proves that KAP Model is a useful model to predict practices from the perspective of attitudes and knowledge. [25] In this study, we used KAP model to investigate the intake of coarse grains and the possible related factors of residents in Zhengzhou, China.

2. Methods

2.1. Subjects

Inclusion criteria for respondents from randomly selected were individuals aged over of 18 years (regardless of religion), without mental illness, and willing to participate in this study, during the period from April 2018 to August 2018.

2.2. Methods

2.2.1. Investigation Method

The protocols were approved by Life Sciences of Institutional Review Board of Zhengzhou University Ethics, China. We randomly selected four areas, each of which chose a larger community. Therefore, we chose Xinyuan International City Garden in Erqi District, Shenghe Garden in High-tech District, Hualin City Garden in Jinshui District and Provence in HuiJi District. Finally, 374 subjects were randomly selected from four communities in Zhengzhou, who provided written informed consent. Questionnaire surveys conducted using self-designed questionnaires by trained investigators. The questionnaire consisted of five parts: basic information about residents, attitude towards coarse grains, knowledge about the coarse grain nutrition, practices about the coarse grain and specific intake levels of coarse grain. Food Frequency Questionnaire was used to get the specific intake of coarse grains for residents one year ago.

2.2.2. Questionnaire Score

Knowledge, attitudes and practices (KAP) have ten options in each section. Respondents who answered correctly scored 2 points, those who answered not completely correct scored 1 point, and those who answered incorrectly did not have points. Total KAP scores divided into three levels: unqualified (0 to 35 points), qualified (36 to 48 points), and excellent (49 to 60 points). In addition, knowledge, attitudes, and practices scores divided into three levels: unqualified (0 to 11 points), qualified (12 to 16 points), and excellent (17 to 20 points).

2.2.3. Quality Control

The questionnaire was designed by professionals, and we conducted a pre-survey in 120 subjects. All the investigators must accept the unified training, which mainly includes: standardizing the contents of the questionnaire, supervising and urging during the investigation, correcting errors and making up for defects in a timely manner. Entry, cleaning, and verification of the data were strictly handled, and the errors were discovered and corrected in time. 400 questionnaires were collected in this survey, including 374 valid questionnaires, and the effective response rate was 93.5%.

2.3. Reliability and Validity Test

We used Krenbach's formula for the alpha coefficient:

$$\alpha = [K/(K-1)]\,[1-(\sum Si^2)/(Sx^2)]$$

We tested the reliability of this questionnaire (α=0.71), and the result showed that the reliability was good. The correlation validity analysis of single item and sum was performed, and the correlation coefficient was significant (r_s>0.1, P <0.01), indicating that the validity was good.

2.4. Data Analysis

The completed questionnaires were check for completeness, edited sorted and entered into EpiData version 3.1 and exported to IBM SPSS Statistics 21.0. Quantitative variables were tested for normality distribution before statistical analysis. The intake levels of coarse grains were shown as medians (interquartile range) for the data being non-normally distributed. Mann-Whitney U Test were used for comparison between two groups, and Kruskal-Wallis H (K) was used for comparison among three or more groups. The Spearman Rank correlation was used for relationship between KAP scores and intake levels of coarse grains. Multivariate logistic regression was used to analyze the relationship between different groups and total KAP scores. The alpha level (two tailed) was set at 0.05 to determine statistical significance.

3. Results

3.1. General Demographic Characteristics

As shown in Table 1, the subjects consisted of 374 Chinese residents (aged 18 years and over). Most of subjects were between 25 and 45 (37%), followed by those aged 18-24 and over 60, accounting for 33% and 22%, respectively, while 46-59 was the least (8%). The majority of participants were female (63%) and had an educational level of secondary education or higher (93%). The most per capita monthly income of family was 2001 to 5000 RMB (49%).

Table 1. Principle characteristics of the study population (n=374).

Characteristic	Number of participants (n)	Percentage (%)
Gender		
Male	138	37
Female	236	63
Age (years)		
18-24	122	33
25-45	140	37
46-59	30	8
≥60	82	22
Education		
≤Primary school	28	7
Junior high school	176	47
≥College	170	46
Occupation		
Civil servant	76	20
Physical worker	81	22
Retired staff	63	17
Others	154	41
PCMIOF [a] (RMB)		
≤2000	127	34
2001-5000	183	49
≥5001	64	17

[a]PCMIOF: per capita monthly income of family.

3.2. The Intake Leves of the Cereal, Bean, Bean Product and Tuber

The intake levels of coarse grains were shown as medians (interquartile range) for the data being non-normally distributed (Table 2). The median of daily intake levels for wheat and rice by the subjects was 134 g/d and 100 g/d, respectively. The median of intake of bean curd pudding, soybean milk, sweet potatoes and potatoes exceeded 10g/d, and that of the intake of corn, millet, black rice, soy, green bean, red bean, tofu skin, yam were less than 10g/d. However, the median of the intake of sorghum, oat, buckwheat, glutinous rice, black bean, pea, kidney bean, taro, cassava and water chestnut were less than 0g/d.

Table 2. The intake levels of the cereal, bean, bean product and tuber.

Group	Food	Food Intake (g/d)
Cereal	Wheat	134.0 (100.0, 200.0)
	Rice	100.0 (42.9, 150.0)
	Corn	2.9 (0.3, 5.7)
	Millet	4.3 (1.4, 8.6)
	Sorghum	0.0 (0.0, 0.0)
	Black rice	0.3 (0.0, 2.1)
	Oat	0.0 (0.0, 1.0)
	Buckwheat	0.0 (0.0, 0.0)
	Glutinous rice	0.0 (0.0, 0.7)
Bean	Soy	0.7 (0.0, 2.9)
	Green bean	1.4 (0.2, 2.9)
	Black bean	0.0 (0.0, 1.4)
	Red bean	0.7 (0.0, 1.7)
	Pea	0. 0 (0.0, 0.2)
	Kidney bean	0.0 (0.0, 0.0)
Bean product	Bean curd pudding	32.3 (0.7, 42.9)
	Soybean milk (mL/d) [a]	62.6 (10.3, 85.7)
	Tofu skin	7.5 (0.0, 8.8)
Tuber	Sweet potato	13.3 (3.2, 28.6)
	Potato	28.6 (14.3, 64.3)
	Yam	3.3 (0.0, 14.3)
	Taro	0.0 (0.0, 0.5)
	Cassava	0.0 (0.0, 0.0)
	Water chestnut	0.0 (0.0, 0.0)

Data were shown as medians (interquartile range)
[a]The unit of soybean milk is mL/d.

3.3. The Results of Coarse Grain KAP

3.3.1. The Distribution of KAP Score

As shown in Table 3, 71.1% (266/374) of the interviewees' total KAP score toward coarse grain were unqualified, 87.2% (326/374) of knowledge score were unqualified, 13.9% (52/374) of attitude score were unqualified, and 76.0% (284/374) of practices score were unqualified.

Table 3. The distribution of KAP scores.

Group	Total KAP score		Knowledge score		Attitudes score		Practices score	
	n	%	n	%	n	%	n	%
Unqualified [a]	266	71.1	326	87.2	52	13.9	284	76.0
Qualified [b]	106	28.3	46	12.3	155	41.4	83	22.2
Excellent [c]	2	0.5	2	0.5	167	44.7	7	1.9
Total	374	100%	374	100%	374	100%	374	100%

[a]unqualified: The total KAP score is between 0-35 points. The knowledge score, attitudes score and practices score are between 0-11 points.
[b]qualified: The total KAP score is between 36-48 points. The knowledge score, attitudes score and practices score are between 12-16 points.
[c]Excellent: The total KAP score is between 49-60 points. The knowledge score, attitudes score and practices score are between 17-20 points.

3.3.2. The Relationship Between KAP Scores

Spearman Correlation coefficient between knowledge, attitudes and practices toward coarse grain intake were shown in Table 4. Significant positive associations were found between knowledge and attitudes (r_s = 0.299; p < 0.001), attitudes and practices (r_s = 0.377; p < 0.001) and knowledge and practices (r_s = 0.286; p < 0.001).

Table 4. Correlation coefficient between knowledge, attitudes and practices of coarse grain intake.

	Spearman (r_s [a])		
	Knowledge	Attitudes	Practices
Knowledge	—	0.299***	0.286***
Attitude	0.299***	—	0.377***
Practice	0.286***	0.377***	—

[a] r_s: Spearman correlation coefficient.
***Correlation is significant at the 0.001 level (two tailed), P<0.001.

3.3.3. The Relationship Between KAP Scores and the Intake of Coarse Grains

Spearman correlation coefficient between KAP score and the intake of coarse grains were shown in Table 5. Significant positive associations were found between total KAP score and whole grain intake, tuber intake and beans and their products intake (r_s = 0.402, r_s = 0.228, r_s = 0.216, respectively; P < 0.01). The study found the significant positive associations between knowledge score and whole grain intake, beans and their products intake (r_s = 0.160, r_s = 0.199, respectively; P < 0.05). Attitudes scores and whole grain intake were significant positive associations (r_s = 0.179, P <0.05). Significant positive associations were found between practices scores and whole grain intake, tuber intake and beans and their products intake (r_s = 0.587, r_s = 0.429, r_s = 0.461, respectively; P < 0.01).

Table 5. Correlation coefficient between KAP score and the intake of coarse grains.

Group	Spearman (r_s [a])		
	Whole grain	Tuber	Beans and their products
Total KAP score	0.402**	0.228**	0.216**
Knowledge score	0.160*	0.054	0.199**
Attitudes score	0.179*	0.033	0.028
Practices score	0.587**	0.429**	0.461**

[a] r_s: Spearman correlation coefficient.
*Correlation is significant at the 0.05 level (two tailed), P<0.05
**Correlation is significant at the 0.01 level (two tailed), P<0.01.

3.4. The Analysis of Related Factors for KAP Scores

3.4.1. Univariate Analysis of Related Factors for Total KAP Score

As shown in Table 6, significant differences were found among different ages, different occupations and different education level for the KAP scores (all P <0.05). Compared to the KAP scores of respondents 18-24 years old, there was significant difference in respondents aged 25-45 and greater than 60 (all P <0.001). And compared to the KAP scores of other occupation, the KAP scores of civil servant and retired staff were higher (P =0.01, P=0.02, respectively). The KAP scores of retired staff was higher than that of physical worker (P =0.023). The KAP scores of education level above college was higher than that of education level below primary school (P =0.41).

Table 6. Univariate analysis of related factors for total KAP score of coarse grains.

Group		Total KAP score		
		M (P_{25}, P_{75}) [a]	$\chi 2/Z$ [b]	P
Gender	Male	31. (21.0, 36.0)	-0.62	0.54
	Female	32. (27.0, 37.0)		
Age (years)	18-24	29. (24.0, 34.0)	21.8	<0.001
	25-45	33. (28.0, 37.0)*		
	46-59	35. (23.7, 39.3)		
	≥60	32. (27.8, 39.0)*		
Occupation	Civil servant	34. (29.0, 37.0)*	19.6	<0.001
	Physical worker	30. (26.5, 35.0)☆		
	Retired staff	35. (29.0, 41.0)*		
	Other	31. (25.0, 35.0)		
Educational	≤Primary school	28. (23.3, 32.8)	6.20	0.05

Group		Total KAP score		
		M (P_{25}, P_{75}) [a]	$\chi 2/Z$ [b]	*P*
PCMIOF [c] (RMB)	Junior high school	32. (27.0, 36.0)		
	≥College	32. (27.0, 37.0)*		
	≤2000	31. (26.0, 35.0)		
	2001~5000	32. (27.0, 37.0)	5.26	0.07
	≥5001	31. (27.0, 37.0)		

[a]Data were shown as medians (interquartile range).
[b]"Mann-Whitney U" was used for two independent sample rank sum test, and "Kruskal-Wallis H (K)" was used for three or more sample rank sum test;
[c]PCMIOF, per capita monthly income of family.
**P*<0.05 as compared to 18-24 years old, *P*<0.05 as compared to others, *P*<0.05 as compared to retired staff and *P*<0.05 as compared to ≤Primary school in their respective groups.
☆*P*<0.05 as compared to retired staff in occupation groups.

3.4.2. Multivariate Logistic Regression Analysis of Related Factors for Total KAP Score of Coarse Grains

As shown in Table 7, taking "aged 18-24"as the control group, the KAP scores of "aged 25-45", "aged 46-59" and "aged ≥60 groups" were higher. (OR=3.32, 95%*CI*: 1.47–7.51, *P*=0.004; OR=4.51, 95%*CI*: 1.54–13.25, *P* =0.006; OR=6.00, 95%*CI*: 2.00–17.97, *P* =0.001, respectively). Compared with the reference group (≤primary school), the KAP scores were higher for the respondents with Junior high school (*OR*=3.26, 95%*CI*: 1.08–9.81, *P* =0.04). At the same time, taking"occupation= physical worker"as the control group, the KAP scores of "occupation= civil servant" and "occupation=other" were higher. (OR=3.15, 95%*CI*: 1.24–8.00; OR=2.23, 95%*CI:* 1.01–4.88, respectively, all *P* =0.01).

Table 7. Multivariate logistic regression analysis of related factors for total KAP score of coarse grains.

Variable	Estimate	S.E. [a]	Wald	*P*	*OR* (95% *CI*) [b]
Gender					
Male	0[a]				1.000
Female	0.25	0.26	0.92	0.34	1.29 (0.77-2.16)
Age（year）					
18-24	0[a]	.	.	.	1.000
25-45	1.20	0.42	8.28	0.004	3.32 (1.47-7.51)
46-59	1.51	0.55	7.53	0.006	4.51 (1.54-13.25)
≥60	1.79	0.56	10.3	0.001	6.00 (2.00-17.97)
Educational					
≤Primary School	0[a]	.	.	.	1.000
Junior high school	1.18	0.56	4.43	0.04	3.26 (1.08-9.81)
≥College	0.90	0.60	2.24	0.13	2.46 (0.76-7.97)
Occupation					
Physical worker	0[a]	.	.	.	1.000
Civil servant	0.99	0.41	3.74	0.05	2.69 (1.19-6.05)
Retired staff	1.15	0.48	5.86	0.01	3.15 (1.24-8.00)
Others	0.80	0.40	6.07	0.01	2.23 (1.01-4.88)
PCMIOF [c] (RMB)					
≤2000	0[a]	.	.	.	1.000
2001-5000	0.29	0.33	0.78	0.38	1.33 (0.70-2.52)
≥5001	0.48	0.43	1.20	0.27	1.61 (0.69-3.77)

[a] S.E. standard error; [b] *OR*, indicates odds ratio; *CI*, confidence interval.
[c]PCMIOF, per capita monthly income of family.

3.4.3. KAP Score and Coarse Grain Intake

As shown in Table 8, the intake levels of whole grains were significantly different between different total KAP score, attitudes score and practices score (χ^2=36.1, *P* <0.001; χ^2 =16.3, *P* <0.001; χ^2=64.2, *P* <0.001, respectively). Except respondents in attitudes score group, who intake more whole grain with excellent score than those with unqualified score, respondents with qualified or excellent score intake more whole grain than those with unqualified score in total KAP sore and practices score group. In general, people with qualified or excellent score intake more tuber and beans and their products compared to those with unqualified score.

Table 8. Analysis of the relationship between KAP score and intake of coarse grains.

Group		Whole grain			Tuber			Beans and their products		
		M [a]	χ^2 [b]	*P*	M [a]	χ^2 [b]	*P*	M [a]	χ^2 [b]	*P*
Total KAP score	Unqualified	12.1	36.1	<0.001	54.0	13.3	0.001	18.4	24.9	<0.001
	Qualified	22.2*			87.7*			27.7		
	Excellent	60.4*			108.0			108.0*		
Knowledge score	Unqualified	13.5	5.42	0.07	62.5	1.53	0.47	19.9	10.7	0.005
	Qualified	16.8			63.8			28.5*		
	Excellent	34.8			37.5			31.3		
Attitudes score	Unqualified	10.0	16.3	<0.001	50.9	2.16	0.34	16.1	2.9	0.24
	Qualified	12.8			67.1			19.5		
	Excellent*	15.6*			62.1			21.7		
Practices score	Unqualified	11.6	64.2	<0.001	53.2☆	37.1	<0.001	17.9	44.3	<0.001
	Qualified	28.7**			104.0☆			31.4		
	Excellent	26.0**			135.0			49.4*		

[a] Using the median to indicate the food intake for the data being non-normally distributed
[b] "Kruskla-Wallis H (K)" was used for three or more sample rank sum test.
*p<0.05 as compared to unqualified in their respective groups.
**p<0.001 as compared to unqualified in practices score groups.
☆p<0.05 as compared to excellent in practices score groups.

4. Discussion

Our study found that the fine grain intake of Zhengzhou residents far exceeded the coarse grains (whole grain, tuber and soybean and its products) intake, which did not meet the dietary guidelines. International recommendations call for an increased consumption of whole grains together with a reduced consumption of refined grains. [26] This suggestion is the result of long-term accumulation of evidence that is good for people's health. A large body of evidence suggests that higher whole grain intake can reduce the risk of type 2 diabetes, [27] colorectal cancer, [28] and cardiovascular disease, [29] and the intake of more whole grains can better regulate body weight. [30] Fine grains taste better than coarse grains, but the nutritional ingredients of fine grains is lower than that of coarse grains, which is due to the refinement of fine grains.

However, the residents of Zhengzhou had a good attitude towards the intake of coarse grains, although their knowledge and practices were unsatisfactory, resulting in a high failure rate of KAP (over 70%). It was worth noting that the total KAP scores and practices scores significantly related to the intake of coarse grains. It is equally important that knowledge, attitudes and practices positively correlated with each other. It is not difficult to conclude that the higher the total KAP scores, the higher the intake of coarse grains. However, for the person with high scores of knowledge and attitudes, the corresponding tubers intake has not increased, which might because the people still do not really realize the nutritional value of tubers. There is no denying that the insufficient intake of coarse grains by most subjects was due to their poor knowledge of nutrition. In order to increase the coarse grains intake of residents, the relevant departments should carry out more publicity on nutrition knowledge.

The KAP scores of the elderly are generally higher than the young people, which probably because the old people no longer need to work after retirement, and pay more attention to the health. Compared with the person with primary education, the KAP score of the person with junior high school education was three times that of the former. However, the difference of KAP score between the person with primary education and university education is not observed, which might be due to the fact that the people with high education are often busy with their work, have no enough time to cook at home to select the coarse grains as stable food. According to classification by occupation, the study found that the total KAP scores of the retired staff was 3.152 times than that of the physical worker, and there is no statistical difference between physical worker and civil servant. It shows once again that most people are more concerned about their health after they retire from their work. The result showed that the KAP scores did not closely relate to their careers and income level.

This study still has a few methodological limitations. These limitations must be noted as they can affect the generalization of the study, including: (i) the limited sample (only 374 residents). (ii) cross-sectional study, it is difficult to explore the causal relationship between residents' KAP and coarse grain intake. However, the study has some advantages including: (i) innovation, the most advantage of this study is that, this is the first time to use the KAP model to study the related factors of coarse grains intake level in the population. (ii) guidance, the study analyzed the related factors of the KAP scores, which could effectively improve the coarse grains level for the population.

5. Conclusion

Overall, this study found that the residents of Zhengzhou have

a low level of nutritional knowledge, and their consumption practice of coarse grains needs to be improved, but their attitude is very positive. According to the close relationship between coarse grain intake level and KAP scores, in view of the current nutritional status of the residents，the relevant departments should mainly guide the young residents on the nutrition of coarse grains, especially tubers, so as to increase the intake of coarse grains. In addition, in view of the long-term development for national health, they could add the knowledge of coarse grain nutrition to the curriculum of primary and secondary schools.

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Conflicts of Interest

The authors declare no conflict of interest.

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