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University Students' Knowledge and Practices of Food Safety

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ABSTRACT This study aims to find out university students' knowledge and practices about food safety. Study group consisted of 582 students who either took or did not take dietetics, aged between 17- 30 at Gazi University in Ankara. At data collection stage, a questionnaire was applied to students about their knowledge and practices related to food safety. At the end of the statistical analyses it has been found that scores of those who took dietetics (5.4±2.40) were higher than those who did not take dietetics (2.7±2.23) about knowledge related to food safety and again scores of those who took dietetics (15.5±2.65) was higher than those who did not take dietetics (13.7±3.60) about practices related to food safety and the difference has been found to be statistically significant ($p<0.01$). Knowledge related to food safety has been found to be high by 37.3% in the group taking dietetics and by 7.4% in the group not taking dietetics while practices related to food safety have been found to be high by 57.0% in the group taking dietetics and by 39.7% in the group not taking dietetics. It has been concluded that gender and dietetics affect knowledge and practices of students in the study group. Inclusion of training on food safety at school curricula from time to time will contribute to solutions about health problems related to food.

INTRODUCTION

4.85% of Turkish population receives higher education (TSI 2011). University life is a critical period where individuals leave childhood and step into adulthood, learn how to live by themselves, their responsibilities increase and many of their habits have to change. Therefore, a university students is neither a child nor an adult. Being a student at a university requires living away from families in the city where the university is, coping with certain problems and finding correct solutions. On the other hand, it means making a budget, balancing social life and school life, and most importantly, being able to stay healthy. Healthy nutrition plays a crucial role in having a general well-being in physical, psychological and social aspects to be healthy. The main factor of healthy nutrition is adaquate and enough nutrition as well as paying attention on security rules from buying to consumption stages of food.

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Secure food is food which is physically, chemically and microbiologically ready to be consumed when prepared according to the purpose and has not lost its nutritional value. Food sometimes get physically, chemically and biologically dirty and turns into factors that affect our health. Basic rule in food safety is paying attention on rules at every stages from buying to consumption like personal hygiene, food hygiene, areas related to food and tool hygiene. Learning and practising these rules can be achieved with dietetics. Dietetics aims to educate society on how to develop adeaquate and enough consumption habits, remove malnutrition practices, prevent food from becoming unhealthy and use food more effectively and economically and improve nutritional status (Unsal 2007).

This study was carried out to search effects of dietetics on knowledge and practices of university students related to food safety.

MATERIAL AND METHODS

Model

Research sample of the study comes from 582 voluntary undergraduate students aged between 17-30, who were either taking dietetics (n=300) or not taking dietetics (n=282) at Gazi

University. Data were gathered by seniors who were at Family Economy and Dietetics Department as project work and were previously educated on how to apply a questionnaire with face-to-face interview in April-June in 2011. In order to evaluate students' knowledge and practices about food safety, the questionnaire developed by Turconi et al. (2008) and having 8 parts 71 questions in total. 17 questions found in the last two parts (*Food Safety Knowledge, Food Safety and Behavior in Hygiene Practices)* were used with the permission of the researcher and with the same rating system.

The Questionnaire

Food Safety Knowledge: It contained 10 questions, each with 4 response categories structured in different ways: This section focused on students' knowledge level regarding food safety. The score was 1 for the correct answer to each question and 0 otherwise. The total score of this section was 10. The total score (10) was divided into tertiles where the lowest one referred to "insufficient food safety knowledge", the medium one referred to "good food safety knowledge" and the highest one referred to "quite good food safety knowledge".

Food Safety Behavior in Hygiene Practices: It contained 7 questions, 7 of which present the following response categories: always, often, sometimes, never; the last one (section 2, question 6) had 4 different responses structured in different ways. This section aimed at investigating each student's behavior in hygiene practices related to food safety and its impact on health. The score ranged from 0 to 3, with the maximum score assigned to the healthiest behavior in hygiene practices. The total score of this section was 21. The total score (21) was divided into tertiles, where the lowest one referred to "inadequate behavior in hygiene practices"; the medium one referred to "partially adequate behavior in hygiene practices" and the highest one referred to "quite good behavior in hygiene practices".

Data Analysis

At the end of the research data were analyzed on Statistica Package for Social Sciences (SPSS) 12 program. In statistical analyses personal information was presented with percentage and frequency, scores of knowledge and practices relating food safety were presented with mean and standart deviation, in comparisons made according to gender and dietetics, chi-square (χ^2) and t-test were used. Statistical significance was set at a P value of <0.01.

Sample

The 51.2% of participants (n=298) are male while 48.8% (n=284) of them are female and mean of male students' age is 21.9±1.84 while mean of female students' age is 21.4±1.72. 53.5% of female students (n=152) and 49.7% of male students (n=148) take dietetics course. 49.3% of the students live in dormitories whereas 50.7% of them live at homes (friends, family, lonely or with relatives).

FINDINGS

When students' practices relating food safety are evaluated in terms of gender and taking dietetics course it has been found that male participants who take dietetics course and always do the practices of "looking at expiration date of packed food (46.6%)", "reading conditions of use and storage on food packages (36.5%)", "washing hands before touching food and before meal (51.3%)", "washing fruit before eating (73.0%)", "putting the can/bottle of milk into the fridge after drinking (64.8%)", "not consuming food kept outside for a long time (38.5%)" and agree with the practice "I immediately pour the milk when I realize that the milk is not kept in the fridge all night (76.3%)" has higher percantages compared to those not taking dietetics course. When the distribution of female students who either take or do not take dietetics course is examined, it has been found that the percentages of practices like "looking at expiration date of packed food (54.6%)", "reading conditions of use and storage on food packages (44.1%)", "washing fruit before eating (82.3%)", "putting the can/bottle of milk into the fridge after drinking (73.0%)", and "immediately pouring the milk when noticing that the milk is not kept in the fridge all night (77.0%)" are higher among female students who take dietetics course compared to those not taking the course.

It is remarkable that percentage of female students (53.8%) who always do the practice of "washing hands before touching food and before meal" and do not take dietetics course is

Table 1: Students' practices relating food hygiene according to gender and dietetics

The knowledge and practice of food safety	*Male*				*Female*				*Total*			
	Receiving dietetics (n=148)		*Not receiving dietetics (n=150)*		*Receiving dietetics (n=152)*		*Not Receiving dietetics (n=132)*		*Receiving dietetics (n=300)*		*Not receiving dietetics (n=284)*	
	S	*%*	*S*	*%*	*S*	*%*	*S*	*%*	*S*	*%*	*S*	*%*
Looking at Expiration Date While Buying Packed Food												
Never	2	1.4	12	8.0	5	3.3	8	6.1	7	2.3	20	7.1
Sometimes	24	16.2	52	34.7	17	11.2	28	21.2	41	13.7	80	28.4
Frequently	53	35.8	39	26.0	47	30.9	43	32.6	100	33.3	82	29.1
Always	69	46.6	47	31.3	83	54.6	53	40.2	152	50.7	100	35.4
Reading Conditions of Use and Storage on Food Packages												
Never	4	2.7	12	8.0	2	1.3	7	5.3	6	2.0	19	6.7
Sometimes	37	25.0	71	47.3	33	21.7	45	34.1	70	23.3	116	41.2
Frequently	53	35.8	36	24.0	50	32.9	43	32.6	103	34.3	79	28.0
Always	54	36.5	31	20.7	67	44.1	37	28.0	121	40.4	68	24.1
Washing Hands Before Touching and Eating Food												
Never	2	1.4	11	7.3	2	1.3	3	2.3	4	1.3	14	5.0
Sometimes	18	12.2	29	19.3	14	9.2	9	6.8	32	10.7	38	13.5
Frequently	52	35.1	54	36.0	51	33.6	49	37.1	103	34.3	103	36.5
Always	76	51.3	56	37.4	85	55.9	71	53.8	161	53.7	127	45.0
Washing Fruits Before Eating												
Never	2	1.4	7	4.7	-	-	7	5.3	2	0.7	14	5.0
Sometimes	7	4.7	14	9.3	2	1.3	10	7.6	9	3.0	24	8.5
Frequently	31	20.9	45	30.0	25	16.4	11	8.3	56	18.7	56	19.9
Always	108	73.0	84	56.0	125	82.3	104	78.8	233	77.6	188	66.6
Immediately Putting Milk Can/Bottle Into Fridge After Drinking												
Never	4	2.7	14	9.3	-	-	5	3.8	4	1.3	19	6.7
Sometimes	9	6.1	27	18.0	8	5.3	16	12.1	17	5.7	43	15.2
Frequently	39	26.4	44	29.3	33	21.7	24	18.2	72	24.0	68	24.2
Always	96	64.8	65	43.4	111	73.0	87	65.9	207	69.0	152	53.9
Pouring Milk When Realizing That Milk Bottle Was Not Kept in the Fridge During the Night												
I drink.	4	2.7	22	14.7	4	2.6	11	8.3	8	2.7	33	11.7
I put it into the fridge again.	22	14.9	26	17.3	22	14.5	32	24.2	44	14.7	58	20.6
I say it should be poured.	9	6.1	22	14.7	9	5.9	8	6.1	18	6.0	30	10.6
I immediately pour.	113	76.3	80	53.3	117	77.0	81	61.4	230	76.6	161	57.1
Not Consuming Food Kept Outside for a Long Time												
Never	57	38.5	43	28.7	69	45.4	57	43.2	126	42.0	100	35.5
Sometimes	73	49.3	53	35.3	66	43.4	54	40.9	139	46.4	107	37.9
Frequently	14	9.5	31	20.7	8	5.3	10	7.6	22	7.3	41	14.5
Always	4	2.7	23	15.3	9	5.9	11	8.3	13	4.3	34	12.1

higher than that of male students (51.3%) who take dietetics course. Again it is remarkable that in the practice of "not consuming food kept outside for a long time" the percentage of female students (43.2%) who do not take dietetics course is higher than that of male students (38.5%) who take dietetics course (Table 1).

Percentage of correct answers of students' knowledge relating food safety is found to be higher in dietetics in both genders. It is seen that the number of male students who know that hepatitis A is infected with contaminated food and take dietetics is more than those not taking dietetics course (χ^2=34.047; p<0.01), but the difference between the female students who give correct answers and either take or do not take dietetics has not been found to be significant (χ^2=1.589; p>0.01). Similarly, it has also been observed that knowledge of "Processes applied before consuming cooked food that are most responsible for food poisoning" does not make significant difference in terms of taking the course or not in both genders (Table 2).

Students who receive education on nutrition have higher scores (5.4±2.40) than those not re-

ceiving education on nutrition (2.7±2.23) in terms of knowledge about nutrition and the difference has been found to be statistically significant ($p<0.01$). Moreover, female students who receive education on nutrition have higher knowledge scores (5.6±2.32) than their male counterparts (5.1±2.47). When we look at the scores about students' practices relating food safety it is seen that students receiving education on dietetics have higher scores (15.5±2.65) relating knowledge of nutrition than those who do not receive education on nutrition (13.7±3.60) and the difference has been found to be statistically significant ($p<0.01$). Additionally, female students who receive education on nutrition have higher scores (15.8±2.37) in their practices relating food safety compared to their male (15.2±2.88) counterparts ($p<0.01$).

Percentage of male students who have low level knowledge of food safety and receive education on nutrition (29.1%) has been found to be higher than their female counterparts (21.1%). Percentage of male students who have low level practices of food safety and receive education on nutrition is 1.4%. However, there are no female students who have low level practices of food safety (Table 3).

DISCUSSION

In this study which was carried to search the effects of receiving education about nutrition on the food safety knowledge and practices of students at Gazi University in Ankara, it has been found out that gender and dietetics are effective. In various studies carried out to identify consumers' knowledge, attitude and behavior about buying food (Alpuguz 2009; Yaman and Ozgen 2007; Topuzoglu 2007; Sanlier and Seren 2005; Saglam et al. 1999), it was said that percentages of reading information on packages changed between 24.3%-72.0%, and the percentage of consumers who read information about the expiration date changed between 39.6%-93.8% (Ozdemir 2009; Topuzoglu 2007; Yaman and Ozgen 2007; Cinpolat 2006;). In this study it has been found that the percentage of students who always read the expiration date is higher in the group receiving dietetics (50.7%) than the one not receiving dietetics (35.4%). Likewise, percentage of female students (54.6%) is higher tha their male counterparts (46.6%) in terms of always reading the expiration dates. Erdogan and Sahingoz (2004) stated that only 10.5% of consumers who go to supermarkets to do shopping read storage conditions on package labels. In this study, percentages of students' always reading storage conditions on package labels in the group receiving dietetics (40.4%) are higher than those not receiving dietetics (24.1%). In light of findings it has been confirmed that dietetics plays a crucial role in reading information on package labels reltaed to expiration date and storage conditions.

In this tudy, the percentage of the students in the group receiving dietetics (53.7%), is higher than that of the group not receiving dietetics (45.0%) in terms of not touching food and always washing hands before meal. In a study (Sanlier 2009), it was stated that 74.3% of young consumers always wash their hands while preparing meal at home and before mal whereas 40.5% of them always wash their hands before eating at school canteens/restaurants. In a similar study carried out in the United Arab emirates (Afifi and Abushelaibi 2012) it was argued that 70% of people with higher education always wash their hands before and after eating.

It is known that frutis should be washed before being eaten for food safety. In our study percentage of students who always wash fruits before eating (77.6%) in the group receiving dietetics is higher than that of the group not receiving dietetics (66.6%).

Milk is an ideal environment for microorganisms to develop and multiply. To remove potential pathogenic microorganisms in raw milk and to protect nutritional value, thermal processes like pasteurization and UHT that are accepted internationally are applied. Food rich in protein quickly deteriorates in room temperature. Therefore, milk, egg, yoghurt and cooked meal shouldn't be kept outside for more than two hours in room temperature and should be kept in the fridge immediately. In this study percentage of students who almost always put milk can/bottle into the fridge after drinking (69.0%), in the group receiving dietetics is higher than that of the group not receiving dietetics (53.9%). In addition, percentage of students who pour milk after realizing not having put the milk can/bottle in the fridge during the night (76.6%) in the group receiving dietetics is higher than that of the group not receiving dietetics (57.1%). Percantage of the students who never consume food kept outside (42.0%) in the group receiving

Table 2: Students' case of receiving dietetics and their food safety knowledge according to gender

	Male						*Female*						*Total*					
Food safety knowledge	*Receiving dietetics (n=148)*		*Not receiving dietetics (n=150)*				*Receiving dietetics (n=152)*		*Not receiving dietetics (n=132)*				*Receiving dietetics (n=300)*		*Not receiving dietetics (n=282)*			
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*
	S	*%*	*÷²*	*%*	*÷²*	*p*	*÷²*	*%*	*S*	*%*	*÷²*	*p*	*S*	*%*	*÷²*	*%*	*÷²*	*p*
Food Poisoning Happens with Consumption of Contaminated Food Including Pathogenic Microorganisms	94	63.5	41	27.3	39.354	0.00	112	73.7	56	42.4	28.572	0.00	206	68.7	97	34.4	68.401	0.000
Food Poisoning Depends on the Type of Microorganism	30	20.3	15	10.0	6.129	0.013	29	19.1	20	15.2	0.763	0.382	59	19.7	35	12.4	5.650	0.017
Processes Applied Before Consuming Cooked Food that are Most Responsible for Food Poisoning	48	32.4	54	36.0	0.421	0.516	63	41.4	43	32.6	2.377	0.123	111	37.0	97	34.4	0.429	0.513
Egg and Cream are More Dangerous in Terms of Food Poisoning	81	54.7	42	28.0	21.959	0.00	102	67.1	47	35.6	28.107	0.00	183	61.0	89	31.6	50.609	0.000
Using The Same Knife For Raw and Cooked Food Causes Cross Contamination	91	61.5	32	21.3	49.592	0.0.0	99	65.1	30	22.7	51.243	0.00	190	63.3	62	22.0	101.223	0.000
Salmonella is Infected to Food by Touching Cooked Food After Touching Raw Meat and Egg	95	64.2	20	13.3	81.302	0.00	109	71.7	32	24.2	63.677	0.00	204	68.0	52	18.4	144.912	0.000
Most Proper Temperature For Bacterias To Grow Is 4-60 °C	82	55.4	52	34.7	12.947	0.0.0	102	65.0	48	36.4	26.791	0.00	184	61.3	100	35.5	38.943	0.000
Protecting Food at Low Temperatures Only Prevents Pathogenic Microorganisms in them from Multiplying	83	56.1	41	27.3	25.340	0.00	88	57.9	31	23.5	34.361	0.00	171	57.0	72	25.5	59.187	0.000
High Temperature (60 °C' and Over) Kills Microorganisms	80	54.1	34	22.7	31.071	0.0.0	82	53.9	35	26.5	21.946	0.00	162	54.0	69	24.5	52.961	0.000
Hepatitis A is Infected With Contaminated Food	74	50.0	27	18.0	34.047	0.00	70	46.1	51	38.6	1.589	0.207	144	48.0	78	27.7	25.489	0.000

Table 3: Average scores of students' food safety knowledge and practices according to gender and dietetics

	Male				*Female*				*Total*			
	Receiving dietetics (n=148)	*Not receiving dietetics (n=150)*	*t*	*p*	*Receiving dietetics (n=152)*	*Not receiving dietetics (n=132)*	*t*	*p*	*Receiving dietetics (n=300)*	*Not receiving dietetics (n=284)*	*t*	*p*
	X±SD	*X±SD*			*X±SD*	*X±SD*			*X±SD*	*X±SD*		
Food safety knowledge*	5.1±2.47	2.4±2.21	10.043	0.00	5.6±2.32	2.9±2.22	9.791	0.00	5.4±2.40	2.7±2.23	14.070	0.00
Food safety and behavior in hygiene practices**	15.2±2.88	13.1±3.66	5.404	0.00	15.8±2.37	14.4±3.41	3.970	0.00	15.5±2.65	13.7±3.60	6.758	0.00

*Minimun score is 0, maximum score is 10
**Minimun score is 0, maximum score is 24

tetics is higher than that of the group not receiving dietetics (35.5%).

In general, when students' practices relating food safety are examined in terms of gender, percentage of female students who do not touch food and always wash their hands before meal, wash fruits before eating, almost always put milk can/bottle in the fridge after drinking and never consume food kept outside for a long time has been found to be higher than that of male students. Percentage of female students who pour milk after realizing that milk can/bottle was not kept in the fridge during the night is found to be similar with that of male students (Table 1).

When Table 2 is examined it is remarkable that dietetics does not affect students' knowledge relating food safety like "Food poisoning symptoms depends on the type of the microorganism" and "Processes applied before consuming cooked food that are most responsible for food posoning." As for gender, effect of dietetics is seen on the knowledge of "Hepatitis A is infected with contaminated food" among male students ($p<0.01$) while this is not the case among female students ($p>0.01$). It is thought that this situation results from the fact that female students are more sensitive about issues related to health even though they do not receive education on dietetics.

As is seen in Table 3, male students' score of food safety knowledge is 5.1±2.47 out of 14 in the group receiving dietetics while this score is 2.4±2.21 in the group not receiving dietetics. As for female students, the score is 5.6±2.32 in the group receiving dietetics and 2.9±2.22 in the group not receiving dietetics. It is seen that receiving dietetics significantly effective on students' food safety knowledge and practices in both genders. Similarly, male students' score of food safety practices is 15.2±2.88 out of 24 in the group receiving dietetics while this score is 14.4±3.41 in the group not receiving dietetics. In a study by Sanlier (2009) about consumers' knowledge levels of food safety in Ankara, consumers' score of food safety knowledge was on average 5.81±1.43 out of 10 while their score of food safety practices was 28.85±7.06 out of 40. This finding is in parallel with the findings of this study.

When students' knowledge and practices of food safety are evaluated it has been detected that most of the group receiving dietetics have medium (37.7%) and high (37.3%) level of know-

ledge while most of the group not receiving dietetics have low (69.9%) level of knowledge; 57.0% of the group receiving dietetics have high level of correct food safety practices while 55.3% of the group not receiving dietetics have medium level of correct food safety practices. It has been stated that individuals have inadequate food safety knowledge in the studies on food safety knowledge (Giritlioglu et al. 2011; Osaili et al. 2011; Sharif and Al-Malki 2010; Sanlier 2009; Turconi et al. 2008; Byrd-Bredbenner et al. 2007; Unusan 2007.). In a study (Alyakut 2009) about Vocational High School of Tourism students' food safety knowledge and practices, it was found that students receiving dietetics have higher level of food safety knowledge compared to those not receiving dietetics and they have similar level of food safety practices. In another study (Memis 2009) it was found that in parallel with teachers' and students' increased interest in food safety knowledge, their achievements in food safety practices increase.

Moreover, as in similar studies on food safety (Memis 2009; Alyakut 2009; Turconi et al. 2008) in our study it has also been identified that female students have higher level of knowledge and practices than male students.

CONCLUSION

In this study it has been found that gender and dietetics are effective on university students' food safety knowledge and practices. Findings show that female students are more informed and sensitive about this issue than male students. This might result from the fact that females are more interested in food preperation and cooking. Even it has been proved that females who receive dietetics are more careful than females not receiving dietetics. At the end of the evaluations of students' food safety knowledge and practices most of the students receiving dietetics have medium or high level of knowledge while those not receiving dietetics have low level of knowledge. Food safety practices of more than half of the students are high in the group receiving dietetics while those not receiving dietetics have low level.

One of the important results of the study is that university students are more successful at food safety practices than theoretical knowledge. This shows that students do not carry out food safety practices intentionally but learn these from environment and these are general practices gained from experiences. It is a well-known fact that carrying out food safety practices consciously is important in terms of healthy nutrition and life. This can only be achieved with dietetics which will be applied within a framework and plan.

RECOMMENDATIONS

In light with these findings, it is thought that university students should be educated by professional educators about food safety for them to get adequate nutrition. In this way, at the end of introduction of food safety which is one of the important steps of adequate nutrition from family to society, many health problems can be prevented.

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