Pakistan Journal of Nutrition 10 (9): 871-878, 2011
ISSN 1680-5194

Determining and Addressing Food Plate Waste in a Group of Students at the University of Jordan

Hayder Al-Domi[1], Hiba Al-Rawajfeh[2], Fatima Aboyousif[1], Safa Yaghi[1], Rima Mashal[1] and Jumana Fakhoury[3]
[1]Department of Nutrition and Food Technology, Faculty of Agriculture, The University of Jordan, Amman 11942, Jordan
[2]King Hussein Medical Center, Amman, Jordan
[3]Department of Restaurants and Cafeterias, The University of Jordan, Amman, Jordan

Abstract: More than half of the food produced is wasted, lost, or discarded due to inefficiency in the human managed food chain; substantial amounts of food waste is avoidable if it had been better managed. To determine the proportions of Food Plate Wasted (FPW) by a group of students who dine at the Students' Restaurant at the University of Jordan (SRUJ). A random sample of 600 students was recruited from different faculties of the University of Jordan (UJ). A reliable and valid questionnaire was developed. The amounts of Food Plate Waste (FPW) were inspected and the proportions of FPW were calculated. Regardless of gender, of the 323.0 kg purchased food items, only 42.11 kg was wasted FPW was exceptionally limited; the proportion of students who wasted the whole amounts of all purchased food items was only 0.37%. Only 1.8% of females and 0.5% of males wasted their purchased meat ($p = 0.001$), whereas 0.3% of males and none of the females wasted their purchased rice ($p = 0.577$). The proportion of females who wasted half of their meat was significantly higher than that in males (8.6% and 2.6%, $p = 0.001$; respectively). About 60% of male and 47% of female students showed that food price was the main factor that influenced their decision to dine at the SRUJ ($p = 0.002$). The majority of students indicated that lunch was their main meal; about one third of them dine customarily at the SRUJ. Proportions of the amounts of FPW by the participants are substantially low. It seems that simple cost of food and low-income of students are decisive in constraining the amounts of FPW at the UJ.

Key words: Food waste, income, hunger, policy, Jordan

INTRODUCTION

Food produced nowadays is more than enough to feed the current world population. This however will require increasing by 70% to feed the projected 9.1 billion people by 2050 (International Fund for Agricultural Development, 2010). Yet, hunger is already a stark and painful reality for millions of people, including 300 million children; for the first time, the world's hungry numbered more than one billion. Furthermore, about 1.5 billion people are living today in extreme poverty, not less than two thirds of them dwell in rural areas of developing countries (International Fund for Agricultural Development, 2010). The recent drastic spiking of food prices has led to increasing concerns about global food shortage and the obvious need to increase food production (Nellemann *et al*., 2009; United Nations Environment Programme, 2009). This has forced more than 110 million poor people into hunger and 44 million people into the ranks of malnourishment (International Fund for Agricultural Development, 2010; Nellemann *et al*., 2009; United Nations Environment Programme, 2009).

Substantial amounts of food waste are avoidable and could have been eaten if it had been better managed (Knight and Davis, 2007; Waste and Resources Action Programme, 2008). More than a quarter of all food produced for human consumption goes to waste (Hall *et al*., 2009; Gilland, 2002) and more than half of the food produced is either wasted, lost, or discarded due to inefficiency in the human managed food chain (United Nations Environment Programme, 2009). Nevertheless, studies on foods supply never go beyond the production stage (Moore, 2010; Engstrom and Carlsson-Kanyama, 2004) and little discussion has been devoted to the issue of food waste (Hall *et al*., 2009). Approximately one third of 21.7 million tonnes of the purchased foods in United Kingdom are wasted (Knight and Davis, 2007; Waste and Resources Action Programme, 2008). Similarly in USA, about one third of all food is wasted every year; the value of the actual matter losses in USA are about US$ 100 billion per year. The household food losses are about 450 billion pounds (Knight and Davis, 2007; Waste and Resources Action Programme, 2008; Jones, 2004), in addition quarter of total post-harvest

Corresponding Author: Hayder Al-Domi, Department of Nutrition and Food Technology, Faculty of Agriculture, The University of Jordan, Amman 11942, Jordan

food cereals was wasted in many African countries (Food and Agricultural Organization, 2004) and about 10% of cereals and oil seeds produced in India was lost as well (Lundqvist *et al*., 2008). Food waste is the third largest portion of the U.S waste stream, yet the recovered portion rate remains just under 3% (Seijaparova and Pellekaan, 2004).

The number of younger generation who dine out is likely to continue rising, thus, the amount of food waste is likely to rise. It is worth to note that food waste is not just about high quality of food going to waste; but also the costs of wasted food is high and has serious environmental implications, which will in return affect the food produce. About 25% of the world food production may become unavailable due to global warming (Nellemann *et al*., 2009). Hence, policy makers have to set measures to counteract possible substantial effect that food losses may have on feeding the hungry as well as serious impact on the environment (Engstrom and Carlsson-Kanyama, 2004).

Information on food losses including storage losses, preparation losses, serving losses, leftovers and food plate waste is scarce in Jordan. Therefore, findings of this study may shed light on food losses in Jordan and therefore provide grounds for further national studies on food plate waste and food losses in Jordan. This could also provide a preliminary model to address food waste and food losses issues in developing low-middle income countries. The objective of this study was to determine the proportions of food plate waste by a group of students at the University of Jordan, Jordan and to address factors that may influence their decision not to waste food.

MATERIALS AND METHODS

Design and setting: A pilot cross-sectional study was conducted at the Students' Restaurants of the University of Jordan (SRUJ), Restaurants and Cafeterias Unit, the University of Jordan (UJ), Jordan, during the academic year 2008-2009.

Human participants: A random sample of 600 students (63% males and 37% females) (Oveson, 2006) was recruited from students who chose to have their lunch meal at the main SRUJ. Participants were categorized according to their respective faculties into five groups; (group 1) Faculty of Medicine (29%), (group 2) Faculty of Science (40.8%), (group 3) Humanitarian Faculty (16.7%), (group 4) Faculty of Agriculture (5.9%) and (group 5) Faculty of Graduate Studies (7.6%). SRUJ is limited to the students of the university and is open to students on a nutritionally adequate dinning meal plan developed by nutritionists at the Restaurants and Cafeterias Unit, UJ. Further, the serving size of food items being served is predetermined and prices are subsidized by about 30% by the management of the UJ (University of Jordan, 2008).

Study tool: The study tool was developed based on available nutritional data and the cultural understanding of food and food waste among the students of the UJ. The study tool consisted of three main groups of questions: (1) demographic and socioeconomic data, (2) factors influencing the decision of the students to dine at the SRUJ and (3) type and amount of consumed food items. Participants were asked to hand over their remaining Food Plate Waste (FPW) if present right after their meal. This was considered the FPW. The researchers inspected the proportions of the FPW and then measured the amount of the FPW. The proportions of FPW were calculated with reference to the standard weight of each of the purchased food items by each student. The portion size of cooked meat (red meat, chicken and fish), cooked rice, cooked vegetables, fruits, salads and desserts was standardized by the Restaurants and Cafeterias Unit at the UJ (University of Jordan, 2008) as 200 g, 250 g, 250 g, 100 g, 150 g and 150 g respectively. Furthermore, prices of food items served to students are subsidized by the UJ by about 30% (University of Jordan, 2008). Prices were 0.55, 0.20, 0.20, 0.25, 0.20 and 0.30 Jordanian dinars (JOD), respectively. The current exchange rate for the JOD is set at a rate of one United States dollar equal to 0.7082 JOD.

Validity and reliability: To assess the content validity, a Panel of Academics, Nutritionists, Food Scientists and Arabic literature revised the survey and their respected comments were taken into consideration. To standardize the tool of the study and to measure its reliability, students from each faculty were randomly selected. The estimated value of internal consistency and reliability of the tool of the study was 0.86.

Ethical approval: Participants were briefly informed about the objectives of the study and verbal consent to their participation was obtained. Participants were asked to read the survey carefully and were assisted by the researchers in answering the study tool.

Statistical analysis: Data were analyzed using the Graduate Pack SPSS 17.0 for Windows 2008. Differences among participants were examined using Analysis of Variance (ANOVA) for continuous variables and chi-square tests for categorical variables. Data was presented as mean ± Standard Deviation (SD) and frequency distribution. The degree of internal consistency of ordinal scales was determined by Cronbachs' alpha statistics. All p-values less than 0.05 were considered statistically significant.

RESULTS

Table 1 shows the general characteristics of female and male participants. Mean age of female and male participants was 21.4±3.1 years and 21.6±2.6 years,

Table 1: General characteristics of female and male participants

Description	Female (N = 222)	Male (N = 378)	p-value[+]
Age (years)	21.4±3.1	21.6±2.6	0.325
Family size	7.5±2.4	7.5±2.6	0.983
Gross family monthly income (JOD)*	801.9±686.0	965.7±916.1	0.003
Student's daily pocket money (JOD)	4.3±2.4	5.6±3.6	0.000
Student's daily expenses (JOD)			
Food	1.9±1.7	2.2±1.6	0.398
Transportation daily	1.6±1.5	1.6±1.5	0.133
Cellular telephone	1.7±1.6	1.6±1.5	0.270
Stationary	2.1±2.1	1.7±1.5	0.034
Miscellaneous	1.7±1.5	1.8±1.3	0.566

*The current exchange rate for the Jordanian Dinar (JOD) is set at a rate of one United States dollar equal to 0.7082 JOD.
[+]Data is presented as mean±SD and frequency (%) and is considered statistically significant at p<0.05

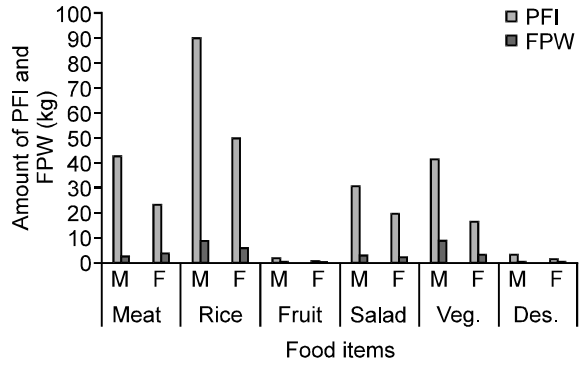

Fig. 1: Total amounts of different Purchased Cooked Food Items (PFI) and Food Plate Wasted (FPW) by Male (M) and Female (F) participants at the Students' Restaurants of the University of Jordan*[+]. *The portion size of cooked meat (red meat, chicken and fish), cooked rice, cooked vegetables, fruits, salads and desserts was 200g, 250g, 250g, 100g, 150g and 150g; respectively. [+]Data is presented as (kg) and frequency (%), is considered statistically significant at p<0.05. Veg. = Vegetable, Des. = Dessert

p = 0.325, respectively. Gross family income of male participants was significantly higher than that of females with great variation within each group (p = 0.003). Male students enjoyed more pocket money than females did (5.6±3.6 and 4.3±2.4, p = 0.000; respectively). While all students spent an equal amount of money on their food (p = 0.398), female students spent about 45% of their pocket money on food and male students spent about 40% on their food.

Figure 1 illustrates that of the 323.0 kg purchased cooked food items by female and male students, only 42.11 kg was wasted (13%). There was no significant difference between female and male students with regard to amounts of purchased food items and amounts of food plate waste. Compared to all other food items purchased, the amount of rice purchased by female and male students was the highest (50.0 and 89.8 kg; respectively), of which the amount of FPW was 6.2 kg and 9.0 kg; respectively (p = 0.650). While female students purchased less amount of 23.4 kg meat compared to 42.8 kg purchased by males, female students wasted more meat than male students with no significant difference between groups (4.00 kg and 3.00 kg; respectively, p = 0.720). Vegetables were the third highest food item selected by participants. While the amount of vegetables purchased by male students was 3 folds higher than that purchased by female students, vegetables wasted by male students were 3 folds higher than that wasted by female students.

Table 2 exemplifies that there was a significant difference between female and male students in respect of purchased cooked food items (p = 0.039). The proportion of students who wasted the whole amounts of all purchased food items was very limited (0.37%). More than 90% of female and male students had rice for their lunch, of them about 60% ate the whole amount (p = 0.577), whereas none of the female and 0.3% of male students wasted their purchased rice (p = 0.577). While more than a half of all students purchased meat, the proportion of meat wasted by females was significantly higher than that in males (p = 0.001). Only 1.8% female and 0.5% male students wasted their purchased meat (p = 0.001) No significant difference was observed between female and male students in respect of the proportion of food waste of all other food items. Fruits and desserts were the least food items selected by participants and the wasted proportion of fruits was the lowest among all other food items.

Figure 2 illustrates that low food prices was the main factor that influenced the decision of the participants to have their meal at the SRUJ, there was significant difference between male and female students (60.3% and 47.7%, respectively, p = 0.002). In addition, time availability was the second most important factor, with no significant difference between groups. Female students (30.6%) were more concerned than males (17.5%) with the nutritive value of the food they purchased (p = 0.000).

Figure 3 shows that regardless of gender, about 90% of both female and male participants indicated that they

Table 2: Proportions of amounts of Food Plate Wasted (FPW) by Male (M) and Female (F) participants at the Students' Restaurants of the University of Jordan

Purchased food items	Gender	SWPTFI (N = 600)	p-value+	Percentages of amounts of FPW for each of the purchased food items* None	25%	50%	75%	100%	p-value+
Meat	M	214 (56.6)	0.039	174 (46.0)	26 (6.9)	10 (2.6)	2 (0.5)	2 (0.5)	0.001
	F	117 (52.7)		76 (34.2)	14 (6.3)	19 (8.6)	4 (1.8)	4 (1.8)	
Rice	M	359 (94.9)		247 (65.3)	72 (19.0)	36 (9.5)	3 (0.8)	1 (0.3)	0.577
	F	200 (90.2)		134 (60.4)	37 (16.7)	25 (11.3)	4 (1.8)	0.0	
Fruits	M	21 (5.5)		16 (4.2)	3 (0.8)	2 (0.5)	0.0	0.0	0.298
	F	7 (3.3)		5 (2.3)	1 (0.5)	0.0	1 (0.5)	0.0	
Salads	M	206 (54.5)		153 (40.5)	26 (6.9)	16 (4.2)	9 (2.4)	2 (0.5)	0.753
	F	131 (59.1)		89 (40.1)	22 (9.9)	13 (5.9)	6 (2.7)	1 (0.5)	
Vegetables	M	166 (44.0)		88 (23.3)	37 (9.8)	17 (4.5)	21 (5.6)	3 (0.8)	0.217
	F	67 (30.3)		31 (14.0)	19 (8.6)	12 (5.4)	5 (2.3)	0.0	
Desserts	M	24 (6.4)		18 (4.8)	2 (0.5)	3 (0.8)	1 (0.3)	0.0	0.436
	F	11 (5.0)		8 (3.6)	0.0	1 (0.5)	2 (0.9)	0.0	

*The portion size of cooked meat (red meat, chicken and fish), cooked rice, cooked vegetables, fruits, salads and desserts was 200 g, 250 g, 250 g, 100 g, 150 g and 150 g; respectively. SWPTFI = Students who purchased the food item (N = 600).
#Percentages of food plate waste was calculated with reference to the amount of various food items purchased by students.
+Data is presented as frequency (%) and is considered statistically significant at p<0.05

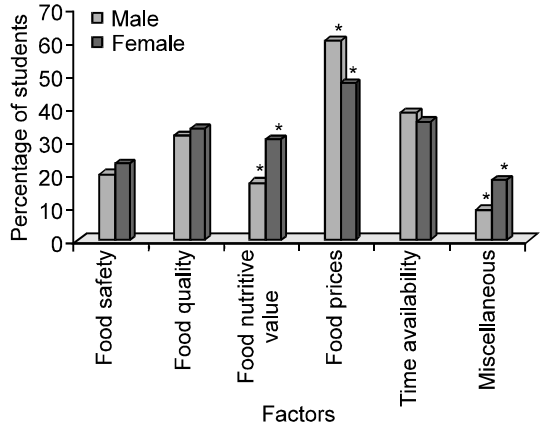

Fig. 2: Factors that influenced the decision of male and female student to dine at the Students' Restaurants of the University of Jordan*. *Data is considered statistically significant at p<0.001

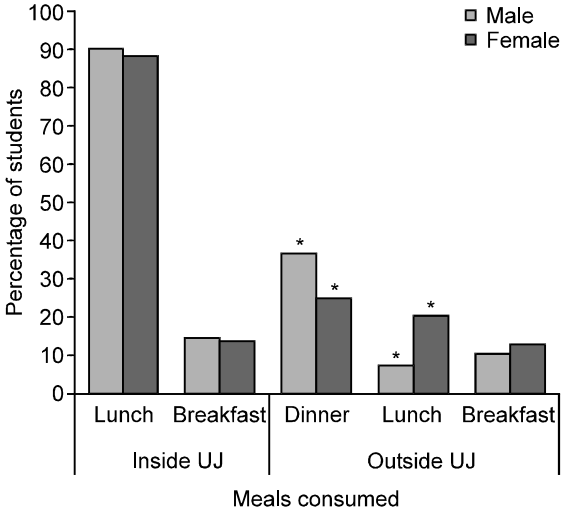

Fig. 3: Meals consumed regularly by students inside and outside the University of Jordan (UJ)*. *Data is considered statistically significant at p<0.05

used to have their lunch meal regularly at SRUJ (p = 0.310). The proportion of females who had their lunch outside the UJ was significantly higher than that of male students (20.7% and 7.4%; respectively, p = 0.000), whereas, the proportion of male students who had their dinner outside the UJ was significantly higher than that of female students (36.8% and 25.2%; respectively, p = 0.007). About 14% of all students stated that they had their breakfast at the SRUJ (p = 0.757), compared to about 10% of males and 14% of female students had their breakfast outside the UJ (p = 0.282). Figure 4 exhibits that the proportion of male students who dine daily at the SRUJ was significantly higher than female students (34.9 and 23.4%; respectively, p = 0.004). Whereas the proportion of female students who visited the SRUJ for the first time was significantly higher than that of male students (p = 0.004). There was no significant difference between groups with regard to both weekly visits and leisure time visits (p = 0.951 and 0.674; respectively).

DISCUSSION

Rising population, water shortages, climate change and the growing costs of fossil fuel-based fertilizers represent a serious threat to food production in the near future. Growing populations and pressures on agricultural production have meant increasing food insecurity around the globe. If this situation persists, policy makers must address the issue of how humanity will feed its growing numbers. Although there is reasonable existing literature on food waste, studies on Jordan are rare. Thus, the current study is an effort to

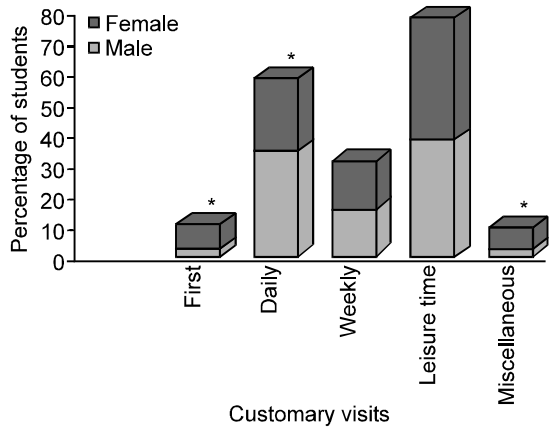

Fig. 4: Customary visits of male and female participants to the Students' Restaurants of the University of Jordan. *Data is considered statistically significant at p<0.01

determine the proportions of the amount of food plate waste and to address factors that influence the amount of food losses among a group of the students of the UJ, Jordan. This will provide initial baseline data for researchers and will shed light on the existing international debate on food waste in developed countries compared to that in developing populations. Unlike Sweden and USA, the findings of the current study demonstrate that less than five percent of all participating female and male students wasted only a part of purchased food items. The proportions of FPW in certain Swedish schools and food service institutions (Engstrom and Carlsson-Kanyama, 2004) and in American schools, food service institutions and households (Getlinger *et al*., 1996; Kantor *et al*., 1997) were higher than that in the students of the UJ by almost two and five to seven folds, respectively.

It has been demonstrated that there are large differences in the levels of food losses between high and low income countries; food losses in low-income countries is lower than that in high-income countries. Thirty to sixty percent of the food available for consumption may be lost in high income countries (Getlinger *et al*., 1996; Kantor *et al*., 1997; Ohio University, 2010). The findings of this study indicated that money available to spend on food as well as food prices are two main factors that influenced the students' decision not only to have their subsidized breakfast and lunch meals at the SRUJ, but also to control the proportions of their FPW. In contrast, it seems obvious that the prices of foods may not be among the determining factors that influence the amount of food losses in schools and universities in developed countries such as Sweden and USA.

Average total food losses in food service institutions in Sweden was about 20% (Engstrom and Carlsson-Kanyama, 2004), compared to 26% of edible food losses in American food service institutions and households (Kantor *et al*., 1997; Ohio University, 2010). Even though different methods were used, total food losses have not changed in different food service institutions (Engstrom and Carlsson-Kanyama, 2004). Hence, the findings of this study provide further evidence indicating that subsidized foods and food portion size may substantially limit the amount of FPW among students from low-middle income country (United Nations Development Programme, 2010). This appears in accordance with the conclusion of the Audits of the Ohio University (2008 and 2009), which indicated that controlling the portion size of food items as well as inconveniences in the serving food plates may draw attention to how much food was being taken from food stations and therefore may limit the amount of FPW (Ohio University, 2010).

Jordan is a low-middle income country with limited resources. Approximately 15% of the Jordanian population of about six million lives below the poverty line and up to two-thirds of these poor people is concentrated in urban areas (United Nations Development Programme, 2010). The percentage of Jordanians living below the poverty line increased from 13% in 2006 to 13.3% in 2008 and reached 21.3% in 2009 (International Monetary Fund, 2010a,b). The poverty line, based on 2008 figures, was 57 JOD per person per month and 3,876 JOD per household of 5.7 persons. Hence, in order to consume a certain number of calories that meets the adequate nutritional requirements, the household income should not be less than the 3,876 JOD per year (Mansur, 2008).

People living in poverty or undernourishment spend up to 80% of their daily income on food (Nellemann *et al*., 2009). Jordan is a low-middle income country with 21% of its population below the 57 JOD (US$ 81) per capita per month poverty line. The Gross Domestic Per Capita in Jordan is 3881.4 JOD (International Monetary Fund, 2010a,b; Mansur, 2008; International Monetary Fund, 2010a,b). Food and fuel prices will continue to negatively impact the current Jordan account position and a significant deficit will likely persist (International Monetary Fund, 2008), thus the economic activity in Jordan has slowed down and adversely affected by the worldwide economic downturn (Mansur, 2008), which has caused a considerable risk for many Jordanians to fall under the poverty line (United Nations Development Programme, 2010)

The original standard for the definition of the poor was thrice the food expenditure as it was known that poor families spend one third of their expenditure on food. American families that spend more than one third of its income on food are deemed poor and therefore entitled for food stamps (Gonsalves, 2007). This is consistent with the findings of the current study, which show that

pocket money per month of female and male students is as twice as the income of people under the poverty line. About 45% of the daily allowance of female and 40% of male students was spent on food, moreover students are less concerned with the nutritive value or the safety of their food; students are rather more anxious about securing only one main meal a day for the available money. Thus, high food expenditure provides evidence on the impact of limited daily allowances on the amounts of FPW among the poor; they simply cannot afford to waste any of their purchased food. Households should have an income of above the poverty line in order to consume a certain amount of calories required to meet the basic nutritional needs (Mansur, 2008). Food shortage or food scarcity are not the primary cause of hunger and malnutrition; it is rather a matter of having adequate income that enable people either to produce or buy nutritionally adequate food (Windfuhr, 2007).

Time available to eat was the second most important factor that influenced the decision of the participants to dine at the SRUJ, where the students enjoy the atmosphere with their most available time to finish their food resulting to a limited food plate waste. This appears in accordance with the findings of Getlinger and Colleagues (1996), which reported that food waste in American elementary children schools was from 34.9-23.4% when recess was scheduled before lunch meal, which explains that schoolchildren were having enough time to finish their meal and thus, the amount of food waste was limited. Teachers observed that recess after lunch caused stomach discomfort and dizziness, which may contribute to high food waste.

Increasing demand for food by the growing populations and the changes in dietary practices may have implications for food production worldwide. This caused the rising food consumed per capita, which may have caused the substantial increase in the quantity of food wasted (Henningsson *et al*., 2004). Although, it is estimated that the food losses of the Americans and Europeans could feed the world three times over (Idun, 2008), understanding where and how much and why food is lost is an important step in reducing food losses and increasing the efficiency of food recovery efforts (Kantor *et al*., 1997). Providing knowledge and raising awareness on the right to food as a basic human right (United Nations Human Right, 2011; Food and Agricultural Organization, 2009) and adopting the concept of adequate nutrition could be one of the main factors that help to reduce the amount of food losses and therefore promoting economic growth, decreasing poverty and combating hunger (International Fund for Agricultural Development, 2010; United Nations Environment Programme, 2009; United Nations Development Programme, 2010; Al-Domi *et al*., 2007). Furthermore, composted, food waste could be a resource to combat poverty and minimize the environmental breakdown (Seijaparova and Pellekaan, 2004; Carlsson-Kanyama and Gonzalez, 2009). Finally, Jones (2004) suggested that American policy maker should be aware of the fact that people have been away from the farm for long time and have lost the touch with food, which may contribute to increase amounts of food lost (Jones, 2004).

Two limitations need to be acknowledged and addressed regarding the present study. The first limitation concerns that the population sample was limited to the UJ and the second limitation has to do with the extent at which the study findings can be generalized beyond our sample population. However, the UJ has about 34,000 students who are immensely diverse. As the University is public, it is bound to admit students from all over the country. The admission policies make it a must for all public universities to accept students through a quota system that is based on free competition. This system allows students from the less privileged regions to be admitted to the various faculties and departments throughout the Kingdom including major cities, smaller towns, villages and the desert areas. Therefore, researchers and policy makers can benefit from this study. Further studies, however, are needed to replicate the findings in different contexts and surroundings.

Conclusion: This study shows that the proportions of the amounts of food plate wasted by the participants are substantially low. It seems that simple cost of food is decisive in constraining the amounts of FPW among low-income students at the UJ. Hence, as they conceive preventive measures to controlling local and global food losses, hunger and malnutrition, policy makers are encouraged to consider establishing national studies to determine the amount and cost of food losses in Jordan and identify further factors that may reduce the amounts of food lost.

ACKNOWLEDGEMENTS

The authors would like to thank the students for their time and determination to participate in this study. The authors also wish to acknowledge the help of Ms. Elham Al-Darawish in data collection and analysis. Special thanks go to Ms. Narcisa Tayab, Prof. Khalaf Al-Delaimy and Prof. Ahmad Faqih for the care with which they reviewed the original manuscript.

REFERENCES

Al-Domi, H., A. Faqih and S. Habeeb, 2007. Balanced diet: A key factor in the face of poverty. In: Proceedings of The Seventh Economic Conference of Small Enterprises: An effective tool to address poverty, The Economics Department in collaboration with Queen Rania Center for Jordanian Studies and Community Service, Yarmouk University, Irbid, Jordan; 29-31 July 2007, pp: 16-26.

Carlsson-Kanyama, A. and A.D. Gonzalez, 2009. Potential contributions of food consumption patterns to climate change. Am. J. Clin. Nutr., 89: 1704S-1709S.

Engstrom, R. and A. Carlsson-Kanyama, 2004. Food losses in food service institutions examples from Sweden. Food Policy, 29: 203-213.

Food and Agricultural Organization (FAO), 2004. The State of the food insecurity in the world 2004. FAO, Rome. Available at: ftp://ftp.fao.org/docrep/fao/007/y5650e/y5650e00.pdf . Access 5/12/2010.

Food and Agricultural Organization (FAO), 2009. Guide on legislation for the right to food. Rome, Italy: FAO. Available in October 4, 2010, from: http://www.fao.org/catalog/inter-e-htm.

Getlinger, M.J., C.V.D. Laughlin, E. Bell, C. Akre and B.H. Arjmandi, 1996. Food waste is reduced when elementary-school children have recess before lunch. J. Am. Diet. Assoc., 96: 906-908.

Gilland, B., 2002. World population and food supply. Can food production keep pace with population growth in the next half-century?. Food Policy, 27: 47-63.

Gonsalves, C., 2007. From international to domestic law: the case of the Indian supreme court in response to Esc rights and the right to food. In: Food and human rights in development, Eide, W.B. and U. Kracht, (Eds.). Volume II, Antwerpen-Oxford., pp: 215-236.

Hall, K.D., J. Guo, M. Dore and C.C. Chow, 2009. The progressive increase of food waste in America and its environmental impact. PloS One, 4: e7940. Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2775916/pdf/pone.0007940.pdf. Access 15/12/2010.

Henningsson, S., K. Hyde, A. Smith and M. Campbell, 2004. The value of resource efficiency in the food industry: A waste minimization project in East Anglia, UK. J. Cleaner Prod., 12: 505-512.

Idun, Y.N.A., 2008. Waste management in Jordan: Any lessons for moving ahead?. Available at: http://www.articlesbase.com/environment-articles/waste-management - in - jordan - any-lessons-for-moving-ahead-673992.html#ixzz12EHqvYss. Access on 14/8/2010.

International Fund for Agricultural Development (IFAD), 2010. The rural poverty report 2011, International Fund for Agricultural Development. Available at: http://www.ifad.org/rpr2011/report/e/print_rpr2011.pdf. Access 9/12/2010.

International Monetary Fund (IMF), 2008. Jordan: Selected Issues. August 2008. Country Report No. 08/291. 2008 Available at: http://www.imf.org/external/pubs/ft/scr/2008/cr08291.pdf. Access 23/12/2010.

International Monetary Fund (IMF), 2010a. Executive board concludes 2010 article IV consultation with Jordan PIN No. 10/131, 2010. Available at: http://www.imf.org/external/np/sec/pn/2010/pn10131.htm. Access 12/10/2010.

International Monetary Fund (IMF), 2010b. World economic and financial surveys. World Economic Outlook Database. Available from http://www.imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx. Access 23/12/2010.

Jones, T., 2004. What a waste! Interview: The Science Show 2004. Available at: http://www.abc.net.au/rn/scienceshow/stories/2004/1256017.htm. Access 16/12/2010.

Kantor, L.S., K. Lipton, A. Manchester and V. Oliveira, 1997. Estimating and addressing America's food losses. Food review. Available at: http://www.ers.usda.gov/Publications/FoodReview/Jan1997/Jan97a.pdf. Access 10/10/2010.

Knight, A. and C. Davis, 2007. What a waste! Surplus fresh foods research project. Available at: http://www.veoliatrust.org/docs/Surplus_Food_Research.pdf. Access 7/12/2010.

Lundqvist, J., C. de Fraiture and D. Molden, 2008. Saving water: From field to fork-curbing losses and wastage in the food chain. SIWI Policy Brief. SIWI 2008. Available at: http://www.siwi.org/documents/Resources/Policy_Briefs/PB_From_Filed_to_Fork_2008.pdf. Access 15/12/2010.

Mansur, Y., 2008. Comprehensive guide to civil society organizations in Jordan. Poverty in Jordan. Available at: http://www.civilsociety-jo.net/en/index.php?option=com_content&view=article&id=1769:poverty-in-jordan&catid=62:articles&Itemid=94. Access 16/10/2010.

Moore, S.W., 2010. How is Food Waste Adding to Global Warming and Poverty?. Available at: http://EzineArticles.com/?expert=Stephen_William_Moore. Access 5/8/2010.

Nellemann, C., M. MacDevette, T. Manders, B. Eickhout, B. Svihus, A.G. Prins and B.P. Kaltenborn, 2009. The environmental food crises. United Nations Environmental Programme, GRID-Arendal. Available at: http://www.grida.no/publications/rr/food-crisis/. Access 10/12/2010.

Ohio University, 2010. Food waste audits. Available at http://www.ohio.edu/sustainability/FoodWasteAudits.htm. Access 16/12/2010.

Oveson, M., 2006. Sample size determination for survey design [E-text type]. Retrieved November 16, 2007, from http://marketing.byu.edu/download/marketingresearch/Determining%20Sample%20Size.doc.

Seijaparova, D. and J.W.H. Pellekaan, 2004. An evaluation of World Bank assistance for poverty reduction, health and education a country assistance evaluation. The World Bank. Washington, DC.

United Nations Development Programme (UNDP), 2010. Poverty in Jordan 2010. Available at: http://www.undp-jordan.org/index.php?page_type=projects&cat=1&page_id=473&templateID=0. Access 15/10/2010.

United Nations Environment Programme (UNEP), 2009. Green Revolution with a Capital G is needed to feed the World. Available at: http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=562&ArticleID=6084&l=en. Access 5/10/2010.

United Nations Human Right (UNHR), 2011. What are human rights?. Available in March 25, 2010, from: http://www.ohchr.org/EN/Issues/Pages/WhatareHuman rights.aspx.

University of Jordan, 2008. Department of Restaurants and Cafeterias Department. Available at: http://www.ju.edu.jo/units/restaurantunit/Pages/Home.aspx#. Access 10/6/2009 (in Arabic).

Waste and Resources Action Programme (WRAP), 2008. Food waste report 2: The food we waste. WRAP, U.K. Available at: http://www.wrap.org.uk/downloads/The_Food_We_Waste_v2__2_.d3471041.5635.pdf. Access 5/12/2010.

Windfuhr, M., 2007. Experiences from case related right to food work: lessons learned for implementation. In: Food and human rights in development, Eide, W.B. and U. Kracut, (Eds.). Volume II, Antwerpen-Oxford., pp: 331-358.