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Deanship of Graduate Studies

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Solid Waste Management and Its Effects on Environment and Health: A KAPP Study on Al-Quds University Students

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Table of contents

ABSTRACT

Background: Universities solid waste, such as papers, containers, scrap metal, ground wastes, books, appliances, toner cartridges, transparencies, diskettes and enveloped, was increasing tremendously in the past 10 years. This is due to the increased number of students and employees. The usual method to manage university solid waste is dumping, but recycling is becoming now more popular as an approach to manage the solid waste, for those recyclable. This study investigated knowledge, attitudes, perceptions and practices (KAPP) of Al-Quds University students towards domestic and university waste and their effect on health and environment.

Methods: A cross-sectional study was done on a sample of 509 students, who filled in a structured questionnaire.

Descriptive statistics using frequencies, means and standard deviation was done for the independent variables; i.e. participants' year of study, type of faculty, type of house, place of residency, and region of residency. ANOVA test was used to test the association between the independent variables with each of the KAPP variables. The researcher develop a "positive- negative" scoring system using the Blooms' criteria for the KAPP variables. After scoring of KAPP variables indicators, chi-square test was conducted to test the association between the independent variables and KAPP scores.

Results: Most participants (76.6%) had a high level of knowledge about solid waste and its separation; 74.1% had positive attitude, 37.1% had good practices and 82.9% had a positive perception of SWM.

In the analysis of the scoring of KAPP; students' faculty ($p=0.018$), year of study ($p=0.036$) and students' place of residence ($p=0.023$) were significantly associated with the scoring of students' knowledge about solid waste management. But, students' faculty ($p=0.027$) was the only factor that was significantly associated with the scoring of students' attitude towards solid waste management and its effect on health and environment. Students in the science department had much better attitude towards SWM and this could be related to their concern about human health and environment. For the scoring of students' practices, the type of house was the only factor that significantly determined their practices ($p=0.03$). Participant lived in apartment shown higher level of practices of SWM than who lived in their own houses. In addition, students' year of study

was significantly associated with the scoring of students' perception of solid waste management ($p=0.01$). Participants in the third; fourth and fifth year shown more positive perception of SWM than participants who were in the first and second year of study.

Conclusions: Waste management is an important issue in Palestine and is a very critical problem in waste disposal. Therefore, working on having good attitude and high level of belief that determined peoples' behavior towards SWM will influence the success of any future separation of solid waste initiative, whether at the university or community level. Therefore, this study results support literature findings on attitude, belief, and behavior model towards solid waste management SWM.

Recommendations: Study researches recommend that universities should start solid waste separation and recycling so it can be a model for all communities. Students also should try their best to instil the separation habit among themselves. At the universities policy makers' level, more action-oriented projects should be organized for students, in addition, to providing proper facility for solid waste management. In addition, the role of the community in sharing the responsibility of solid waste management will be an asset to help in controlling such a problem. Finally, future studies on solid waste management at the universities and community levels are still immature and study designs such as intervention studies will help in setting programs to control this problem.

إدارة النفايات الصلبة وأثرها على الصحة والبيئة: دراسة حول معارف, سلوكيات, اتجاهات ومواقف الطلبة في جامعة القدس حول إدارة النفايات الصلبة وأثرها على الصحة والبيئة

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ملخص الدراسة

مقدمة: في السنوات العشر الاخيرة، تزايدت كميات النفايات الصلبة في الجامعات مثل الورق والكرتون، المعادن والمخلفات العضوية، الكتب والاجهزة، خراطيش الحبر والورق الشفاف، الاقراص المرنة والمغلفات والذي تواكب مع الزيادة المطردة في اعداد الطلبة والموظفين.

ما زالت طرق التخلص من النفايات الصلبة في الجامعات تتم بالطرق التقليدية وذلك بطرحها في مجمع النفايات العام، مع العلم ان الطرق الحديثة تعتمد على فصل النفايات ثم إعادة تدويرها. لذا، تهدف هذه الدراسة إلى تقييم معرفة وتوجهات وسلوكيات ومدى إدراك طلبة جامعة القدس تجاه النفايات الصلبة المنزلية والجامعية وطرق التخلص منها واثراها على الصحة والبيئة.

منهجية الدراسة: تم إجراء دراسة مقطعية في جامعة القدس على عينة من 509 طالب والذين قاموا بتعبية استمارة اعدت لتحقيق اهداف الدراسة.

تم استخدام الإحصاء الوصفي، والانحراف المعياري لوصف متغيرات الديموغرافية للدراسة، المستوى السنه الدراسية للطالب، نوع الكلية، نوع السكن، مكان الإقامة، ومنطقة الإقامة للطلاب المشاركين في الدراسة. وايضا تم استخدم اختبار تحليل التباين الاحادي ANOVA لوصف العلاقات ما بين المتغيرات الديموغرافية و معرفة وتوجهات وسلوكيات وادراك الطلبة نحو فصل النفايات الصلبة وأثرها على الصحة والبيئة. قامت الباحثة بتطوير نظام "ايجابي–سلبي" باستخدام تصنيف بلوم لعوامل

المعرفة ، والتوجهات، والسلوكيات، والادراك. واخيرا تم استخدام "مربع كاي" لاختبار العلاقات بين المتغيرات المستقلة و غير المستقلة في هذه الدراسة.

النتائج: أظهرت نتائج الدراسة بأن معظم الطلاب(76.6%) لديهم مستوى مرتفع من المعرفة حول النفايات الصلبة و فصلها في حين أظهر (74.1 %) من المشتركين اتجاهات ايجابية حول عملية الفصل، بينما (37.1%) منهم كانت لديهن سلوكيات جيدة حول عملية الفصل

في حين أظهرت النتائج في تحليل نظام تجميع النقاط بأن كلية الطالب (α=0.018) وسنة الدراسة (α=0.036) ومكان السكن(α=0.023), كان هناك ارتباط بين كل عامل منها مع معارف الطلبة حول عملية فصل النفايات الصلبة. ولكن كلية الطالب (α=0.027) كانت العامل الوحيد المرتبط مع مواقف الطلبة تجاه إدارة النفايات الصلبة وأثرها على الصحة والبيئة. حيث أظهر الطلاب في الكليات العلمية والصحية اتجاهات أفضل نحو عملية فصل النفايات الصلبة أكثر ممن هم في الكليات الأدبية. في حين أظهرت النتائج بأن نوع المنزل(α=0.03) الذي يقطنه الطلاب كان العامل الوحيد المرتبط مع سلوكيات الطلبة نحو عملية فصل النفايات الصلبة. حيث أظهر الطلاب اللذين يقطنون شقق سكنية مستوى أعلى في سلوكهم نحو عملية فصل النفايات الصلبة ممن هم يقطنوا في بيوت مستقلة. بالإضافة الى ذلك أظهرت النتائج بأن سنة الدراسة (α=0.01) كانت مرتبطة مع ادراك الطلبة لعملية فصل النفايات الصلبة. حيث كان الطلبة في السنوات الثالثة والرابعة والخامسة من الدراسة أكثر إدراكا لعملية فصل النفايات الصلبة ممن هم في السنة الأولى والثانية.

الاستنتاجات: إن إدارة النفايات الصلبة ذات اهمية في فلسطين وتشكل تحديا في عملية التخلص من النفايات، وبالتالي فإن العمل على إيجاد مستوى مرتفع من المواقف والتصورات التي تحدد سلوكيات الافراد تجاه إدارة النفايات الصلبة تؤثر على نجاح مبادرات مستقبليه لفصل النفايات الصلبة، سواء

في الجامعة أو على مستوى المجتمع. ان نتائج هذه الدراسة تدعم نتائج الدراسات السابقة حول مواقف ومعتقدات وسلوك طلبة الجامعات نحو إدارة النفايات الصلبة .

التوصيات: من خلال هذه الدراسة أوصت الباحثة بأن على الجامعات أن تتخذ عملية فصل النفايات طريقة متبعة دائمة لإدارة النفايات الصلبة بحيث تصبح نموذجا دائما في كل المجتمعات . أيضا، يجب على الطلاب أنفسهم بذل قصارى جهدهم لغرس هذه المبادرة فيما بينهم. على مستوى صانعي القرار في الجامعات أوصت الباحثة بحثهم على تنظيم مشاريع أكثر دقة لعملية فصل النفايات الصلبة والتخلص من النفايات وتوفير الامكانيات لإدارة النفايات الصلبة. وبالإضافة إلى ذلك، فإن دور المجتمع في تقاسم مسؤولية إدارة النفايات الصلبة قد يكون الدور الاهم في عملية السيطرة على هذه المشكلة. في النهاية أشارت الباحثة للحاجة إلى مزيد من الدراسات البحثية على مستوى الجامعات والمجتمعات بالإضافة إلى الحاجة إلى دراسات التدخل في إدارة النفايات الصلبة التي قد تساعد في وضع برامج للسيطرة على هذه المشكلة.

CHAPTER ONE: INTRODUCTION

1.1Introduction

Solid waste are things which we throw away and which embrace things and commonly describe as garbage, refuse and trash (Davis & conwell,2008). While solid waste is non-liquid waste arising from domestic, trade, or industrial services and activities, it may also be defined as unwanted material disposed by man, which can neither flow into streams nor escape immediately into the atmosphere, thus polluting water, air and soil (Tchobanoglous et.al., 1977).

There are many sources from which the solid waste comes as all living things create waste. In the ecosystem, trees, animals and other organisms contribute to waste. Humans create waste as they alter natural systems through extraction, processing and use of natural resources. Municipal solid waste (MSW), industrial waste, hazardous waste, hospital waste, construction and demolition waste, waste from electrical and electronic equipment (WEEE) and agricultural waste are all types of solid waste (Ying, 2010).

Solid waste management is the process of analysis of waste materials, collection, transport, recovery and recycling of disposal. It usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health and/or the environment. Waste management is also carried out to recover resources from the waste itself. Waste management can involve solid, liquid, gaseous and radioactive substances, with different methods for each one (Tchobanoglous et. al., 1993).

Management of solid waste is a major challenge these days for the administrators, engineers and planners. Huge volumes of solid wastes are generated and need to be collected, transported and finally disposed of. These operations have to be carried out speedily and efficiently without incurring excessive cost or damage to environment. Unfortunately in many developing countries, the system for managing waste is primitive and cannot cope with the huge volumes of wastes being generate (Al-Yousfi, 2004).

In developing countries, it is common to find large heaps of garbage festering all over the city. The problem becomes further complicated due to large population and the obsolete techniques employed for waste management (Mbuligwe, 2012). The solid waste is

considered to be one of the dangerous causes of pollution; therefore this problem has to be treated in a wise manner to protect our environment (Yaqout et. al., 2002).

Different methods are available for solid waste management including, minimization, composition, energy recovery, disposal and recycle or separation (Porta et al., 2009).

Serious health problems arise due to improper collecting and managing of solid waste thus leading to several adverse health effects, including many infectious diseases. In general and according to the National Science and Technology Center (NSTC) report, there are various effects due to exposure to waste. Chemical poisoning through chemical inhalation, increase in hospitalization of diabetic residents living near hazard waste sites; cancer; mercury toxicity from eating fish with high level of mercury; newborn low birth weight; newborn congenital malformation; nausea and vomiting, and many other adverse health effects were seen among individuals exposed to these wastes (NSTC, 2008).

Chemicals generated from solid waste can enter the body in different ways; ingestion, inhalation and adsorption, which cause adverse health effects including poisoning from toxic substances such as; cadmium, arsenic nickel and dioxins which are also considered to be carcinogenic (Rushton, 2003). In addition, many of these substances can produce toxicity on the central nervous system, liver, kidneys, heart lungs and skin, depending on exposure level and duration. Other health problems associated with solid waste are investigated by different studies, including respiratory problems, irritation of the skin, nose and eyes, gastrointestinal problems, fatigue, headaches, psychological problems and allergies.

The impact of solid waste on environment refers to its effect on land, air and water due to improper disposal and managing of solid waste. The most serious environmental problem of solid waste is the emission of greenhouse gases, especially methane gas. In addition, solid waste causes ground and surface water contamination (Mcmichael, 2002).

Dumping sites in the West Bank are not designed as sanitary landfills. These sites lack ground lining or leachate collection system to protect ground water. These sites are open and management is restricted to frequent burning of waste piles (Al-Khatib et. al., 2006). In general, in developing countries dump sites are managing solid waste by burning, which cause the releasing of heavy metals and chemicals like lead, toxic gases causes air pollution (Medina, 2012). According to the Agency for Toxic Substances and Disease Registry 1998, many chemicals which generated from waste disposal are: Lead (79%),

Trichloroethylene (66%), Benzene (64%), Arsenic (60%), Chromium (57%), Cadmium (52%), Tetrachloroethylene (49%), Toluene (45%), Di-2-ethylexyl Phthalate (43%) (Lewis et. al., 1998) .

Waste generation differs according to national income, socioeconomic conditions, social developments and cultural practices. According to the World Bank (1999), solid waste generated is classified into 8 types of wastes. In this study we are very concerned with two major types; the residential waste which is the household waste such as food and fruit peels, rubbish, ashes etc. and the institutional waste which originates in schools, hospitals, research institutions and public buildings (World Bank, 2012).

1.2 Problem statement

Solid waste separation is one of the most critical issues we face in Palestine due to the rapid development of the country in population and economic. Similar situation is happening at the universities, in which tons of solid wastes been produced by the students which is the case of Al-Quds university.

Most of the solid waste produced at universities contains papers, household waste, glass, plastic materials, in addition to the hazardous wastes that are produced by laboratories.

In December 2012, the university started its first activity for solid waste separation at the University campus of Abu Dis (see picture 1). There are special containers that consist of several containers with different colours and labels. However, if you do a walk through the university you well find the bins empty. At the same time, you can still see the old system of solid waste containers, in which you do not need to separate the waste present in its place as it is (picture 2). The main reason for the non-response among these students might be related to the lack of awareness of sustainable and environmental issue. They are not informed about the benefit of solid waste separation in the university and they are not playing an active role to take initiative to reduce the solid waste and separate it.

management, results shown that there was a significant differences between students' year of study and their perception of solid waste management (p=0.010), since participants in the fourth and third year of study (78.2%, 72.5 respectively), shown more positive perception of solid waste management than who were in the first (54.4%) and second (56.5%) year of study. Participants in the advanced years (3rd 4th and 5th years) reported more positive perception of solid waste management than participants in the first, second or third year of study. This can be related to the fact that students were in the first and second year of study did not understand their roles and responsibilities in health and environment protection. Moreover, participants were in the 3rd , 4th and 5th year of study may get more information about solid waste management and disposal, so the shown more positive perception of solid waste management than participant in the first and second year of study. This study agree with a case study of a university in Malaysia by Asmawati (2009), which indicate that students' year of study was significantly associated with students perception of SWM (P<0.05).

6.5 Conclusions

As a conclusion, the six objectives of this study are achieved. Respondent's knowledge of solid waste management and its effect on health and environment was good. They understand the definitions of solid waste management separation and recycling. They also believe in the effect of solid waste on health and environment. In term of attitudes toward SWM , half of the respondents' cared about SWM such as reducing or recycling it. Regarding student's practice, the majority of participants using the public SW containers in their neighbourhood. Students perceived SWM to have a positive effect on health and environment. Regarding the accessibility to the solid waste management information and services, the majority of the respondents got this information from schools.

Many factors such as gender, student' faculty, student's year of study, student's kind of house, place of residency and region of residency have significant differences or association with one or more of student's knowledge, attitude, practice and perception toward solid waste management and its effect on health and environment.

Regarding the factors influencing students' knowledge, attitude practices and perception toward SWM, there was significant difference between student's faculty and their attitude toward solid waste management and its effect on health and environment. While student's

kind of house was significantly associated with student's practice toward solid waste management, also there is a significant difference between students region of residency (north, south or middle) and their knowledge towards solid waste management. Analysis showed that there is a significant difference between students' year of study and their knowledge of solid waste management, and student's year of study was significantly associated with student's perception of solid waste management and its effect on health and environment. The variable student's faculty was significantly associated with student's knowledge and attitude toward solid waste management and its effect on health and environment.

knowledge of students is good but still not as desired since the scores of its indicators showed that the majority of student got information about solid waste management and they have good level of knowledge and scores of indicators also shown that students' perception toward solid waste management was positive but it did not help to transfer this knowledge and their perception into actions since their practices toward solid waste management was not good. This means we need to work on such parameters at the schools or at university level.

Regarding the accessibility to the household waste management information and services, almost all respondents got information about solid waste management from schools, university, TV shows or other sources, which highlights the importance of these resources in changing behavior and attitudes toward SWM.

6.6 Recommendations

There are several suggestions and recommendation that are based on the analysis of the results of study. These recommendations are classified into four areas.

6.6.1 Recommendations for universities and university students

- Universities should start solid waste separation and recycling so it can be a model for all communities.
- Awareness campaigns should start from universities to involve the community for SWM.

- Besides authority enforcement, students' willingness to participate plays a very important role. Students should bear the responsibility to take the action to separate solid waste as well.
- Students who have knowledge about the importance of solid waste management, such as those of science colleges and those in advanced years (3^{rd} and 4^{th}) are encouraged to have a part in increasing the awareness of their colleagues about this demanding topic. Also, students themselves should try their best to instil the separation habit among themselves, after the facilities are prepared, for the students to use.

6.6.2 Recommendations for university policy makers

- **More action oriented projects:** More action oriented projects should be organized for students. These projects should focus on increasing student's practices toward solid waste management and its effect on health and environment. Through these projects on solid waste management, student can have more in-depth insight of solid waste management, and could start to take action in solid waste separation or recycling.
- **Provide facility for solid waste management:** It is recommended to increase the number of separation bins in the university, to include all the area at the university. The existence of the separation bins would encourage the students think twice when they discard their waste. They will choose the separation bins instead of the traditional rubbish bins.

6.6.3 Recommendations for community leaders

- Advocacy campaign should be initiated by the community to enforce the governmental sector to work on solid waste management, in particular the hazardous waste.
- Provision of proper facilities for collection, storage and disposal of hazardous waste (including exporting such waste to other countries for treatment) are recommended.
- Public awareness campaigns should seek to inform the public about proper waste management, change consumption patterns and lifestyles, and encourage participation in the management of wastes (such as sorting and recycling).

6.6.4 Recommendations for future research

- This study was done on university students. Community studies have been done in studies that were concerned with household waste but did not concentrate on the health effects. Therefore, we recommend to carry out a study at the community that assesses KAPP of SWM and its effect on health
- A KAPP study on school children need to be conducted since it is the age when attitudes and behaviour change are more sustainable for any interventions afterwards.
- Also, we need a study of the community level, since separation of SW is very important at the household level, schools, and health agencies, governmental and non-governmental organization.
- Intervention studies should be done to see the gaps in implementing the solid waste separation. And since there is a student initiation project for solid waste separation, this project should be evaluated.
- There should be comparative studies between Al-Quds university and other universities and colleges to compare the students' knowledge, attitude, practice and perception about solid waste management.

6.7 Study limitations

There are certain limitations to this study which include:-

- This study was done at Al-Quds University only and so the findings could not be generalized to the whole Palestinian population.
- This study showed the knowledge, attitude practice and perception toward SWM in general. The findings might not be exactly the same with assessing KAPP of management of specific waste disposal.
- Other limit is that this survey developed its analysis based mainly on respondent's self-reported behaviour which may yield reporting bias. Qualitative studies using focus group, discussions or face-to-face interviews may provide additional information which we might lose using structured questionnaires as done in this study.