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Assessment of Polythene Wastes Generation and Disposal in University of Maiduguri Campus, Maiduguri, Borno State, Nigeria

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ABSTRACT

This study is a survey which assesses generation and disposal of polythene wastes in the University of Maiduguri Campus. The population of this study comprises all the quarters or units in the University of Maiduguiri Campus. Data were generated through questionnaire, oral interview, personal observation, Global Positioning System (GPS), photographs and documents. Samples drawn purposively were made from four units comprising student hostels, residential, academic and commercial areas of the University. Big polythene bags were used to collect the polythene wastes in each unit or area for one week, the collected wastes were measured with weighing scale. One hundred copies of questionnaire were also administered to the respondents to capture polythene wastes disposal methods. Analysis of Variance (ANOVA) was adopted to find out the variance among the six items on public perception of the impact of polythene materials. The study establishes that student hostels and commercial areas generate higher quantity of polythene wastes than the residential and academic areas. It also reveals that almost half of the polythene wastes were generated in the students' hostels. Keeping wastes for collection by the environmental units of the campus or direct disposal in designated places were the main methods of polythene wastes disposal in the campus, though, polythene wastes were collected irregularly. It also reveals that there is no significant difference among some selected items on the impacts of polythene wastes in the environment. The study recommends among others that as much as practicable, dust bins should be provided in designated places in the campus, which are expected to be collected daily for final disposal.

Keywords: *Polythene, wastes generation, wastes disposal, wastes management*

INTRODUCTION

Polythene is a plastic and non-biodegradable (Bioplastics Guide, 2016). Due to this

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fact, it is a waste which if not disposed properly, can constitute a menace and an environmental hazard (Bioplastics Guide, 2016). As the name implies, polythene is chemically synthesized from molecules that contain long chains of ethylene, a carbon-based monomers. According to SMC (2017), the first laboratory creation of polythene occurred in 1898 by accident at the hands of "Hans Von Pechmann" while applying heat to another compound the German chemist previously discovered it is diazomethane. They conclude that ironically, the synthesis of polythene via extreme heat and pressure in an industrial setting was again made by accident, but 35 years later. SMC (2017) also reports that a few years later, another chemist employed by the same England-based chemical company devised a method to consistently produce polythene under the same conditions. As a result, polythene became the primary source of Low Density Polythene (LDPE) production in 1939. They assert that while polythene is essential to the economic health of the plastics industry, most consumers readily recognized the role it plays in everyday life. In fact, polythene materials are found in many household items such as food wrap, ice skating rings among others.

Polythene is used in greater volume worldwide than any other plastic, because it is disposable after use. That they are non-biodegradable make them difficult to be decomposed by microorganisms. This allows them to be in the environment for a long time. Their light weight makes them easy to be blown by wind from place to place thus seriously littering the environment. They hold water, thus acting as a breeding ground for mosquitoes and other disease vectors. Polythene littering around is also an eyesore (SMC, 2017).

Unlike some Universities that operate multi-campus system, University of Maiduguri is a single campus University which housed the academic, residential and the commercial areas. One would then imagine the environmental problems of the campus, when the huge student population, staff (academic and non-academic) as well as the traders who based mainly in the commercial areas of the University and the extended family member who reside with their parents and relations in the University quarters (senior, intermediate and junior staff quarters) are taken into consideration. Due to this large population in a single campus that engages in various routine activities that involve buying and selling of materials such as stationeries, food items, household ware and which make use of mainly polythene materials for wrapping and packaging of their items. The campus is no doubt, bound to be littered with polythene wastes.

Furthermore, most people in Nigeria today depend largely on sachet water as the major source of their drinking water, University of Maiduguri is not exempted. The University has a sachet water company that produces an average of 1800 bags of sachet water (each containing 20 pieces) daily but yet unable to meet the demand (Fieldwork 2017). Hence, sachet water companies outside the University, such as

Hauwa water, Madube water and Peace water also supplement demand by supplying at daily basis to many commercial shops and households. Since sachet water are all packaged with polythene materials, the campus is also expected to be heavily littered with the materials. The cleaning of the environment of the University campus was contracted out to some private companies such as Mariyo cleaners, which collectively engage themselves into the removal of these polythene wastes with other solid wastes daily, yet, we still find some parts of the University littered with polythene, blocking some drainages meant for controlling water flow within the University campus. It is therefore necessary to investigate the generations and management of polythene wastes in the University campus so as to have an insight of environmental problems and subsequent planning and management in the University.

Study Area

University of Maiduguri is located between latitude $11^0$47' 7.68"N and $11^0$47' 49.92"N and longitude$13^0$11'12.48"E, $13^0$12' 43.2"E (Fig.1). Ikusemoran and Jimme (2014) report that Maiduguri is about 320m above sea level. In the University of Maiduguri Handbook (2013), the University is situated along Bama Road in Maiduguri, bounded in the north by Jere Local Government and south by Konduga Local Government Area. The University of Maiduguri took off in April 1976. It inherited the facilities of the North East College of Art and Science (NECAS) when the college was taken over by the Federal Government. The facilities such as laboratories, lecture theatres, library, office blocks, staff and other supporting service taken over from the NECAS formed the nucleus of the University and made it possible for it to commence degree programmes in three faculties, namely Arts and Education, Social Science and Law, and Science in October the same year. As at 2017, the University has 12 faculties namely Agriculture, Arts, Dentistry, Education, Engineering, Law, Management Science, Social Science, Veterinary Medicine, Pharmacy and the College of Medical Sciences. There are a total number of 75 Departments with a student population of about 35,000 at both undergraduate and postgraduate levels. The University has about 935 academic and 1800 non-academic staff. It caters for students from all over Nigeria as well as many other countries such as Cameroon, Chad, Niger, Sierra Leone and The Gambia (University of Maiduguri Handbook (2013).

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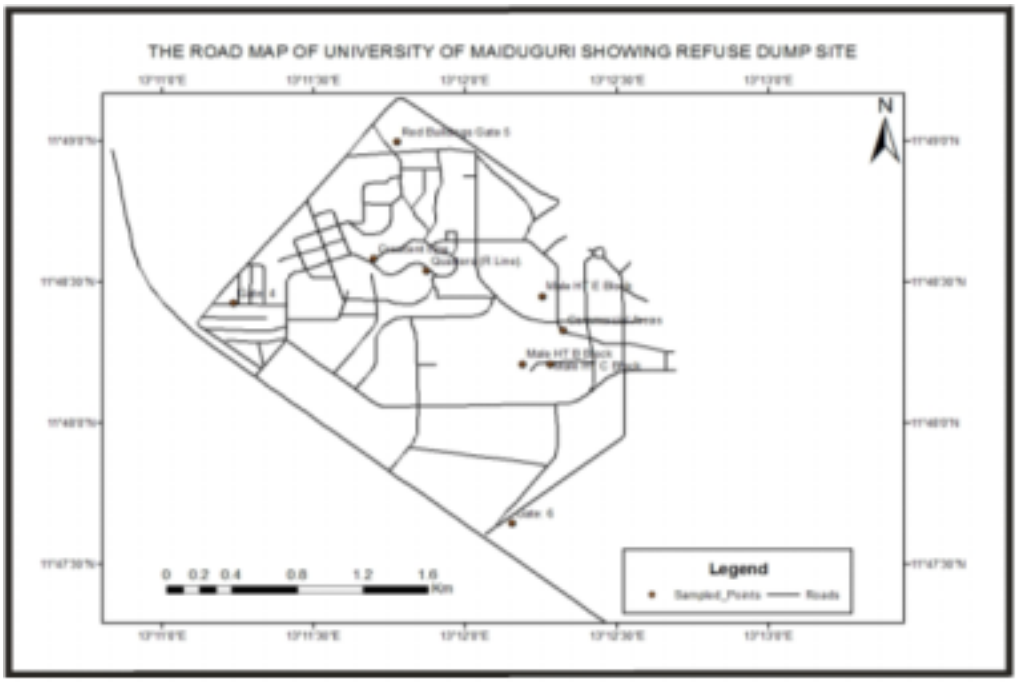

Fig.1: *The Study Area.*
Source: *Digitized from Google Earth Pro (2018)*

METHOD

This study is a field survey. A general reconnaissance of the campus was undertaken between 26 and 27 May, 2017; accompanied with German Global Positioning System (GPS) for capturing the actual position of waste deposit sites as well as the use of a hand-held camera for capturing each site at the time of visit. This field survey was carried out in order to have first-hand information and the spatial distribution of the polythene wastes deposit sites in the campus.

The collection and weighing of polythene wastes was adopted in order to obtain useful information on the actual quantity of polythene wastes in each of the units in the campus; that is, the hostels, academic, commercial and the residential areas (Table1). Purposive sampling technique was adopted in sampling each of the units. Data collected for the study were presented on tables and analysed using simple percentage and frequency count. Also, Analysis of Variance (ANOVA) was adopted to find out the variance among the six items on public perception of the impact of polythene materials.

Table 1: Sampled Units in the Campus where Polythene Wastes were obtained

Campus Units	**Samples**
Academic area	**Two Sampled Departments**
	i) Biological Science
	ii) Geography
Commercial	**6 Sampled Shops**
	i) 2 Food canteen shops
	ii) 2 Business centre shops
	iii) 2 Ingredient shops
Residential	**6 Sampled Households**
	i) 2 Junior Quarters
	ii) 2 Intermediate quarters
	iii) 2 Senior staff quarters
Hostels	**2 Sampled Hostels**

Source: Fieldwork, 2017

Big polythene bags were given to each of the sampled offices, shops or households. Residents of each sampled areas were to drop their polythene wastes in the bag for the period of one week, that is, Monday 7th to Sunday 13th August 2017. The researchers visited all the sampled points daily to observe and monitor the deposit of the polythene materials. After one week, all the bags were collected and sorted accordingly, into the 4 units of academic, commercial, hostel and residential. Each of the 4 units was weighed by the use of weighing machines (Plate.1) in order to determine the quantity of the polythene wastes that were generated from each unit.

Plate 1: Weighing of Polythene Wastes.
Source: Fieldwork, 2017

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RESULTS AND DISCUSSION

Table 2 shows that 38% of the respondents keep their refuse bin for collection by the environmental officers and 36% of them deposit at wastes deposit sites. This percentage is encouraging and a great achievement towards reducing the menace which polythene wastes can cause when dumped indiscriminately. This finding contradicts the work of Orajekwe (2011) that most frequent method used for the disposal of the polythene materials by the respondents is by throwing it away which has about 58.3%. This shows that there is a good response from the University management towards reducing the menace of polythene waste by providing a central collection point for dumping these wastes by the environmental officers. However, it was discovered that some places in the campus were still littered by polythene materials as shown in Plates 2 and 3.

Table 3 shows that 36.84% of the respondents' wastes are collected weekly; the same percentage is the case for respondents who have no specific period for the collection of their wastes by the collection officers. This implies that the environment is posed with the challenges of persistent degradation due to the wide interval or no specific periods for the collection and disposal of polythene wastes and therefore, should be adequately addressed by the appropriate authorities of the University. The total weight and quantity of deposited polythene wastes in University of Maiduguri Campus collected from the selected sample areas from four unit of the University Maiduguri is shown in Table 4.

From Table 4, it is glaring that students' hostels occupy the largest portion of the total percentage of sample polythene wastes collected with whopping percentage of 43.57, which is almost half of the total sample collected indicating that polythene wastes are highly generated by the students than the other units in the University campus. This is however contrary to the work of Amori, Fatile, Ihuoma and Omoregbee (2013) that the total quantity of wastes generated from the halls of resident in the institution estimated at 4373.4 kg/day with nylon/polythene materials constituting the second highest proportion (13%) of the wastes. The high quantity of nylon bag (predominantly pure water sachets) further confirms the work of Ihuoma (2011) that most students in the hall of residents patronize sachet water because they believe that their water supply is not suitable for drinking. The commercial unit samples generated a significant collection of polythene wastes after that of students' hostels which is in accordance with Ikudayisi and Aribisala (2012) that "nylon materials (a type of polythene) was the major component of the wastes generated within the commercial areas". This implies that its demand and consumption is almost uniform throughout the year. Ukpong, and Peter, Chamberlain (2011) report similar finding for Ibadan. They note that among the non-biodegradable

solid wastes generated, cellophane is mostly affected by seasonality. Under the academic areas, two sample Departments were selected that is, Biological Sciences and Geography. Both account for 1.54% of the total polythene wastes collected, with the Department of Biological Sciences a bit higher than that of the Department of Geography relatively due to its higher number of staff and students than that of the Department of Geography (University of Maiduguri Students Handbook, 2013). This implies that little polythene wastes are generated in academic areas.

The commercial areas sampled consisted of three sub-units. These were food canteens, business centres and ingredient shops. Two shops were randomly sampled from each of the three (3) units. Hence, six (6) shops were sampled altogether. The food canteens and business centres accounted for greater portion of the total percentage of polythene wastes generated (14.63 and 13.31% respectively). This may not be unconnected to the high patronage of food canteens and business centres over ingredient shops within the University campus as observed in Table 4. It is also similar to the work of Ikudayisi and Aribisala (2012) that it is the canteen that generates less paper but high components of Nylon.

Generally, in this part of the world, more individuals are attached to the category of low income earners and ironically, these low income earners tend to have more members of household than the medium and high income earners (Laurence, 2015). This has purely reflected in the above table where the percentage of the collected polythene wastes sample of junior staff quarters distinctly outweighs that of intermediate staff quarters and senior staff quarters. That is to say, there could be a higher concentration of individuals in the junior staff quarters than either the intermediate or senior staff quarters as indicated by the 11.16% of the total polythene wastes generated in the campus. This finding is however contrary to the finding of Amori, Fatile, Ihuoma and Omoregbee (2013) that households' wastes generated in the junior and senior staff quarters of Federal Polytechnic, Ogun State ranges from 3.504kg/day to 5.844kg/day, which implies that senior staff quarters generate more waste than the junior staff quarters.

The result (Appendix A) reveals that the six items are all significant, with no one being superior to the other. Hence, polythene materials reduce the aesthetic beauty of the campus, which might be breeding grounds for some diseases, block drainages and so on as shown in Plates. 4 and 5. This findings on the lithering of polythene waste materials on the campus also corresponds to the findings of Sofoluwe and Bennett (1995) that unsanitary disposal of waste of any kind can lead to spread of diseases and misuse of sanitary facilities and equipment equally predispose people to infection of various magnitudes. Also Orajekwe (2011) reports that polythene dispose refuge can lead to infestation by flies and cockroaches, as well as rats. Rats, insects and birds

are known to be carriers of diseases under certain circumstances. Oluwande (1997) concludes that accumulation of polythene materials that have been poorly handled often serve as breading places for vermin, as well as produce bad odour and unsightly dumps.

Table 2: Methods of Disposal of Polythene Wastes

Methods of Polythene Wastes Disposal	**Frequency**	**Percentage**
Burning	16	16
Keeping for collection by the environmental officers	38	38
Deposit them in drainage during rainfall	8	8
Deposit at wastes deposit sites	36	36
Others	2	2
Total	**100**	**100**

Source: Fieldwork 2017

Plate 2: Deposit of polythene materials along the walk ways of C Block and Girls Hostel

Plate 3. Deposit of polythene materials around the commercial

Table 3: Frequency of Collection of Wastes by Environmental Officers

Frequency of Collection of Polythene Wastes	**Frequency**	**Percentage**
Daily	6	15.79
Weekly	14	36.84
Two to three times weekly	4	10.53
No specific period	14	36.84
Total	38	100

Source: Fieldwork 2017

Table 4: Quantity of deposited polythene wastes in each unit in University of Maiduguri Campus

Units	Sample Area	Weight (kg)	Total Weight (kg)	Percentage
Academic	Department of Geography	0.8		
	Dept. of Biological Sciences	1.8	2	1.54
Commercial	Food canteen/shops	19		
Areas	Business centres	17.3		
	Ingredient shops	11.3	47.6	36.64
Residential	Junior staff quarters	14.5		
Areas	Intermediate staff quarters	5.1		
	Senior staff quarters	4	23.6	18.17
Student	Titanic (Male Hostel)	23.3		
Hostels	Aisha (Female Hostel)	33.3	56.6	43.57
Total		**129.9**	**129.9**	**100**

Source: Fieldwork, 2017

Table 5: Public Perception of the Impact of Polythene Materials on the Environment

Ranking	**1**	**2**	**3**	**4**	**5**	**6**
It reduces the aesthetic beauty of the campus.	16	7	3	5	10	7
It results into breeding ground for some diseases.	8	16	8	8	6	2
It blocks some drainages and sewages.	8	6	7	10	5	6
The burning results into air pollution.	9	13	12	8	4	3
It reduces the soil fertility of the farmed land.	3	5	5	11	17	7
It kills some domestic animals.	6	3	15	8	8	25

Source: Fieldwork, 2017

Fig. 4: Polythene dump site near B Block opposite Jumat Mosque

Fig. 5: Blocked Drainage by Waste Polythene wastes in the University Staff Quarters Crescent Line

Plate 6: Pollution point from burning of polythene materials in the University dumping site at Gate 6

CONCLUSION AND RECOMMENDATIONS

Assessments of the generation and disposal of polythene waste materials in University of Maiduguri campus has been carried out. Polythene is a plastic and non-biodegradable material. Due to this fact, it is a waste which if not disposed properly, can constitute a menace to man and the environment. Polythene is used in greater volume worldwide than any other plastic, because it is light and easily disposable after use. That they are non-biodegradable make them difficult to be decomposed by micro-organisms. These materials continue to reflect its negative impact on the environment which could be blown by wind from place to place thus seriously littering the environment. They hold water, thus acting as a breeding ground for mosquitoes and other diseases vectors. University campuses all over the world should not just be known for their well-structured and academic excellence but should also be known for their aesthetic beauty and clean environment

In view of the aforementioned, the following recommendations are hereby made to ensure proper management of polythene wastes in the University of Maiduguri campus.

i. Disposal facilities should be provided at strategic locations for ease of waste disposal. This will enhance proper disposal of wastes, particularly polythene wastes especially in the students' hostels and commercial centres.
ii. Daily collection of wastes by the environmental officers as against the current weekly collection (as found in this study) should be encouraged

iii. Clubs and associations in local projects should be involved in increased awareness on proper polythene wastes disposal.

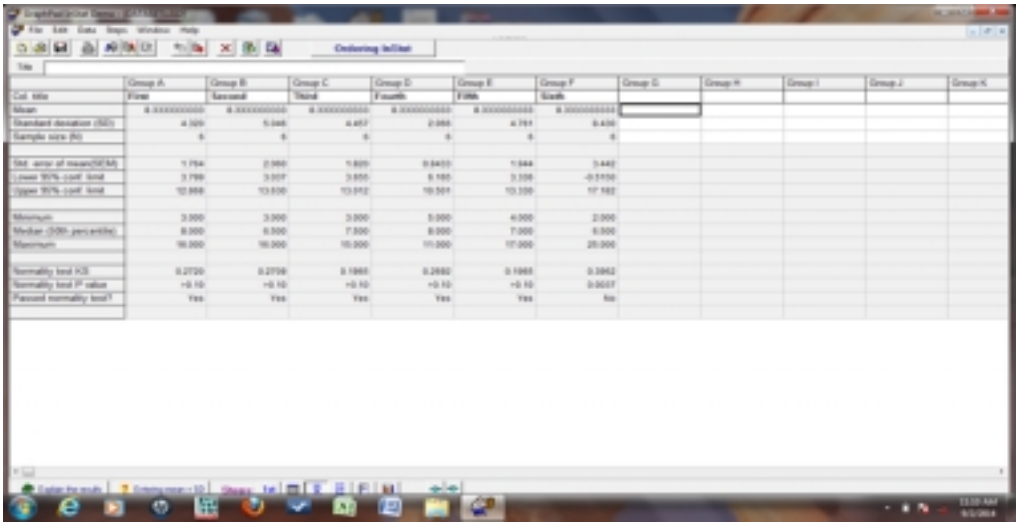
iv. Appropriate policies and laws should be enacted by the authority against improper deposit of wastes within the University campus. Also, sanctions should be imposed on defaulters of indiscriminate polythene materials.

v. Individuals and groups should take it upon themselves to sanitize the environment and embrace proper polythene wastes disposal.

vi. Wastes should be sorted out into different categories by the households based on composition e.g. biodegradable and non-degradable, recyclable and non-recyclable before deposit so as to ease the collections and disposals.

APPENDIX I

RESULT OF THE ANALYSIS OF VARIANCE



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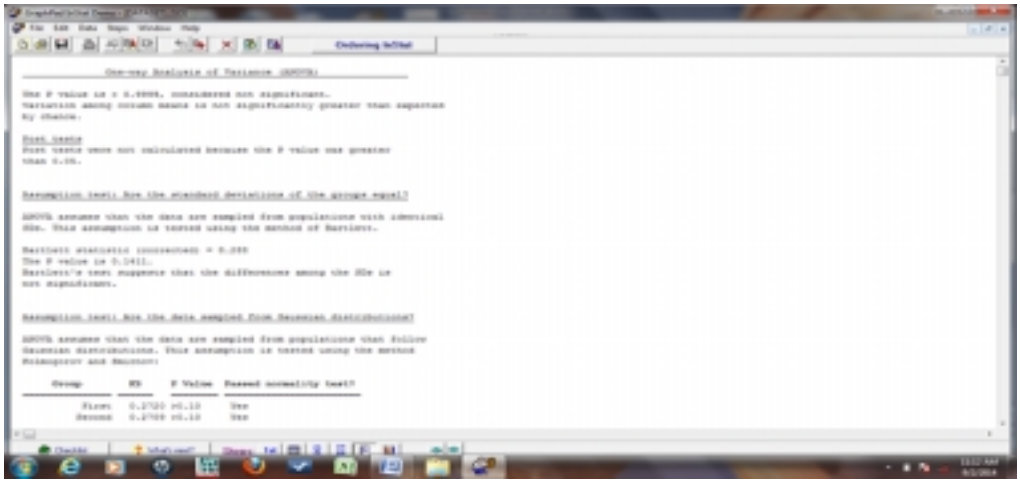

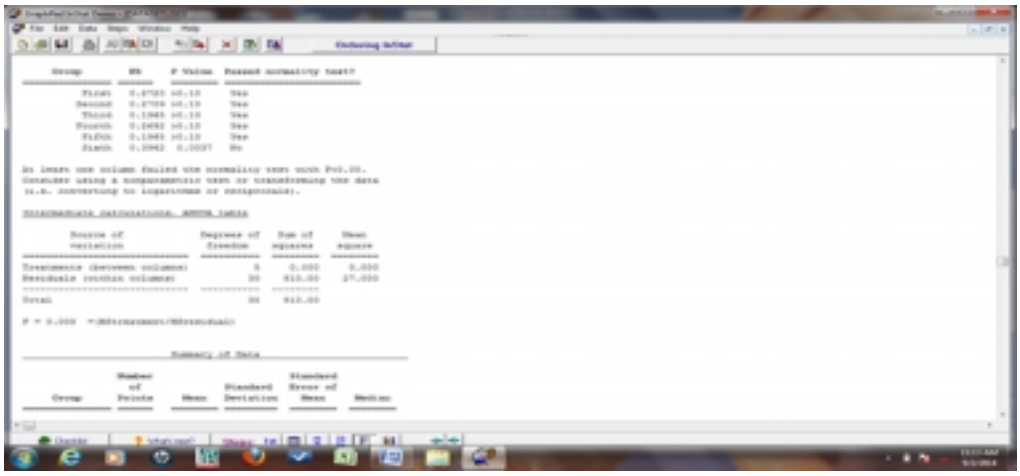

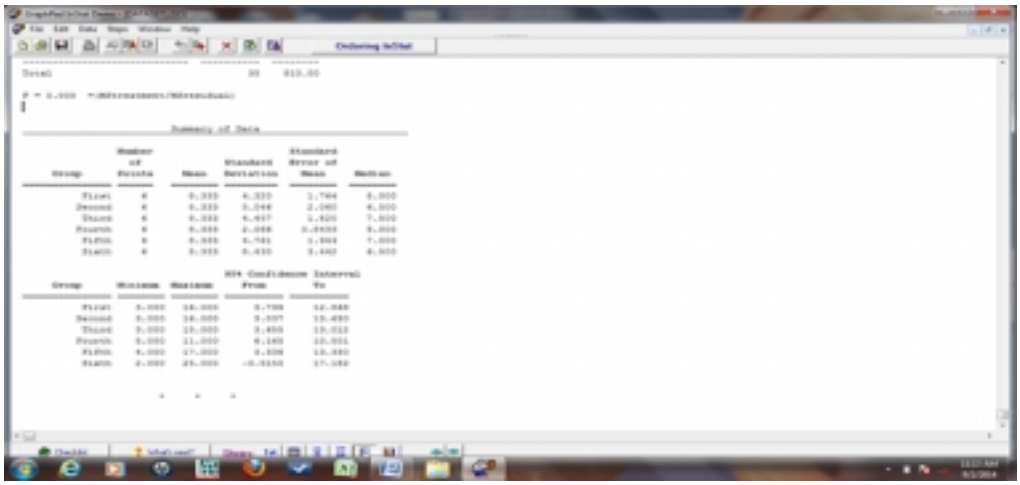

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