Consumer motivation and willingness to pay for 'safer' vegetables in Ghana

1. Introduction

Food quality and safety standards have become a major concern in Sub-Sahara African countries. Although, Food and Agriculture Organisation (FAO) in collaboration with the World Health Organisation (WHO) established a commission (Codex Alimentarius Commission) in 1967 to safeguard consumers' health through food quality and safety (Saunyama, 2001), its achievement in Ghana has been unsatisfactory (Abdulai et al., 2011). Majority of food producers in Ghana have limited training in food quality and safety standards. In addition, a greater proportion of the consuming public is not aware of food safety risks, and tends to consume foods on the market without paying attention to quality and safety implications (Saunyama, 2001). Over the past two decades vegetable production using wastewater has become an important enterprise for income generation for the urban poor in most Ghanaian cities. The growth in the use of untreated wastewater for vegetable production in urban areas of the country is driven by high urban population growth and its resultant demand for fresh vegetables for food as well as increased water scarcity and degradation (WHO, 2006). But this method of irrigation has huge health implications for consumers since wastewater used is heavily polluted and not appropriate for crop irrigation (Keraita et al., 2008 and Abdulai et al, 2011). Juxtaposing the growing demand for fresh vegetables for urban consumption and the attendant public health risks associated with wastewater use, it is critical that urban vegetable producers adopt safer irrigation practices. It is however obvious that adopting safer irrigation options will result in increased vegetable prices for the final consumer. It is therefore imperative to consider consumers' willingness to pay for safer vegetables if the adoption of safer irrigation options will be sustainable.

The health promoting and protecting properties of vegetables cannot be over emphasized but its safety and the cost burden for safer option continues to be a concern of consumers and public health agencies in Ghana. The agro-food sector in Ghana, especially vegetable marketing is one of the under developed sectors in the economy. Prices of vegetables are determined by demand and supply without safeguards to quality.

There is increased awareness of the health promoting and protecting properties of vegetables because it provides significant amount of beta carotene and mineral salts such as iron, calcium and zinc in daily diets. For a good health and vitality, a minimum amount of daily vegetable intake of 400g is recommended (WHO, 1990, FAO/WHO, 2004). According to Smith and Pablo (2007), vegetables are part of the daily diets in the form of soups and sauces accompanied by carbohydrate diets in Africa.

Based on World Health Organization's initiative on fruit and vegetable consumption, a framework that proposes ways to promote increased production, availability and access, and adequate consumption of vegetables was developed. The framework is to guide in the development of a cost-efficient and effective intervention for the promotion of adequate consumption of vegetables at the national and sub-regional levels (WHO 1989, 2006). Vegetables in sub-Saharan Africa especially Ghana, are produced in the urban and peri-urban cities by using wastewater from streams and drains (Mensah et al., 2001).

Studies carried out in Accra, Kumasi and Tamale show that, both faecal coliforms and helminthes contamination of vegetables (lettuce, cabbage and spring onions) produced and marketed in the various cities using wastewater, exceeded the WHO recommended levels (Mensah et al. 2002, Obuobie et al., 2006). Lack of certification regime coupled with the difficulty of consumers to spot unwholesome vegetables on the market predisposes them to the health risks associated with the wastewater use in urban and peri-urban agriculture.

Several management practices (non-treatment options of wastewater use) have been developed and tried based on the new WHO guidelines on wastewater use to help reduce health risk associated with vegetables produced from using wastewater in urban and peri-urban Ghana (Parish et al. 2003, FAO, 2012). Vegetables produced by using non-treatment options of wastewater use in Urban and Peri-Urban Agriculture (UPA) are found to be "safer" and have advantages such as reduced pathogen and faecal content on vegetables and minimal environmental hazards (Sonou, 2001, Mensah et al., 2003). These positive effects notwithstanding, the increased production cost of safer vegetable production using non-treatment options will translate into high vegetable price for consumers.

Fundamental questions that arise are: 1) What are the factors driving consumer concerns and need for safer vegetables? 2) Are Ghanaian consumers' willingness to pay for the benefits associated with the non-treatment options of wastewater use in urban/peri-urban vegetable production? 3) What socio-economic factors influence consumer willingness to pay for safer vegetables from the non-treatment options of wastewater use in urban/peri-urban vegetables production? The direct relationship between consumers' perception of risk and their willingness to pay for safer options has been established in academic research (see Niens et al., 2004, Zhifeng et al., 2014, Doherty and Campbell, 2014, Echeverria et al., 2014, Anderson and Mirosa, 2014). For example, Niens et al., (2014) reported that parents sampled for the study in Germany were willing to pay a premium to protect their children´s health against mycotoxins, and Echeverria et al., (2014) found that Chilean consumers were willing to pay premium price for sustainable products.

The paper is structured into five sections. The next section covers the theoretical foundation and literature review on choice experiment approach. This is followed by the research methodology. The study results and discussions based on the data analyses are fully detailed. Conclusions drawn are then presented, followed by recommendations and areas for further research.

2. Theoretical foundation and the Choice experiment approach

The basic economic framework of individual preferences is the standard microeconomic consumer theory of maximizing utility (Baron, 2004). It is worth noting that Miljkoviv and Effertsz (2008) has challenged the notion of the existence of a single acceptable behavioural model; for example rationale choice and goes on to suggests further research to delineate when rationality is useful for estimating behaviour and when it should be totally replaced with a different theory. In the context of maximizing utility, an individual consumer chooses a consumption bundle based on personal budgetary considerations. Thus, the consumer will exhibit a rational behavior; choosing the bundle which is at least as good as any other among all the bundles. The individual is assumed to have a set of preferences over goods and services that can be ordered in a logical and consistent manner (Hanley and Splash, 1993, Baron, 2004).

This preference ordering restricts an individual's demand for different consumption bundles. Utility function therefore serves as an index for the preference ordering. Thus, the most preferred consumption bundle is expressed by the highest level of utility. Changes in consumption bundles which lead to increase in utility are measured as consumer surplus commonly referred to as consumers' willingness to pay for the improved quality (Hanley *et al*., 1997). Health risk (pathogen reduction) in the context of this study is classified as risk of illness (morbidity) and risk of death (mortality). Hence, in the context of this study, Willingness To Pay (WTP) is therefore defined as an individual's WTP for health reduced risk (pathogen reduction) of illness.

Economic variables associated with health benefits and environmental qualities are challenging because they are usually not traded in the market (Hanley *et al*., 1997, United Nations Environment Programmes, 2004). In view of this, two routes have been taken in the development of non-market environmental valuation technique, namely: 1) the revealed preference technique and 2) the stated preference technique (Stale and Pruckner, 1997). The demands for non-market valuation have not been satisfied by the use of the revealed preference techniques; the travel cost method and the hedonic pricing technique (Randall, 1994, Bockstael and McConnell, 2007). This is because preference revealed in the past may be of little interest where new circumstances are expected to emerge (in this case safer vegetables from the non-treatment options of wastewater use). More so, there are only limited numbers of cases where non-market values exhibit a quantifiable relationship with a marketed good. Considering these limitations, a better approach is the estimation of the 'total economic value' of the environmental impact which include the use value and the non-use value (Bennet and Blamey, 2001), and hence the development of stated preference technique.

The stated preference technique is commonly used to elicit consumers' willingness to pay (WTP) for reduced health risk and an improved environmental quality, includes the use of choice experiment (CE), contingent valuation (CV) and contingent ranking and rating methods (Hanley and Splash, 1993, Diaz et al., 2010). However, contingent valuation and contingent ranking and rating methods have validity, bias and ranking limitations (Hanley et al., 2001). To overcome these limitations, this study employs the use of choice modeling (experiments) which is consistent with random utility theory in economics (Bennet and Blamey, 2001).

3. Methodology

3.1 The Choice Experiment Approach

Choice experiment (CE) method has been used to measure the value of safety in food products under varied contexts (see Morkbak and Christense, 2010 for its use to measure safety features in pork; Goldberg and Roosen, 2007 for reduced risk of salmonella and campylobacter, and Kontoleon and Yabe, 2003 for pesticide free products). The underpinning principle of choice experiment method is an amalgamation of Lancaster's consumer theory (Lancaster, 1966) and the random utility theory (McFadden, 1974).

Choice experiments are samples of choice sets or choice scenarios drawn from the universe of all possible choice sets adduced to in the Lancaster's consumer theory. This is done according to statistical design principles such that, the overall choice experiment consists of a set that satisfy a specified estimation requirements. It enables the probability of an alternative being chosen to be modelled in terms of the attributes used to describe the alternatives. Hence, it is expected that, the higher the level of a desirable attribute in an alternative, "*ceteris paribus*" the higher the utility associated with that option, and more likely for a respondent to choose it (Bennet and Blamey, 2001).

The principles behind the assessment of economic value for non-treatment options of wastewater use in urban and peri-urban vegetable production to bring about a change in human health risk reduction and environmental impact (soil and ground water contamination levels) is that its monetary value would reflect in consumers' behavior (Hanley *et al*., 1997). Hence, this study seeks to analyze consumers' preferences regarding the choice of alternative scenarios of non-treatment options of wastewater use at both the market and the farm levels.

The choice experiment approach is used in this study because it allows a wide array of different possible choice scenarios (in this case different non-treatment options of wastewater use) to be estimated. Table 1 and 2 show the choice scenarios and attributes used in the choice experiment respectively.

<Insert Table 1>

<Insert Table 2>

3.2 Empirical estimation of mean WTP

The market share approach was used to estimate the consumers' willingness to pay for safer vegetables. This approach considered the number of consumers who chose to support an option based on the attributes of that option. The percentage of the total number of individuals who would support that option was calculated with the inbuilt household expenditure.

The willingness to pay by each individual consumer was calculated by using the formula expressed as equation (1):

WTP = % of hhexp on food x avmnt / month..... (1)

where;

WTP_i= individual willingness to pay,

hhexp= household expenditure on food, and

avmnt= household expenditure on vegetable per month.

Hence, for each option, *j*, the individual WTP was estimated as in equation (2) below;

$$WTP_{ij} = \%\ of\ \ hh\exp_{ij} \times avmnt / month \quad \text{..... (2)}$$

where *j* can be options A, B, C, D or E.

The average WTP for each option is then calculated as in equation (3) below;

$$WTP_{ij} / \sum (option_{ij} = 1) \quad \text{..... (3)}$$

where;

$Option_{ij}$= individuals who responded yes to option *j*

WTP_{ij} = an individuals WTP for option *j*

3.3 Estimation of effects of socio economic characteristics on WTP

The paper used the Ordinary Least Squares (OLS) method to estimate the effects of the socio-economic variables of consumers on their individual willingness to pay for "safer" vegetables. The OLS model is as shown in equation 4 below:

$$WTP_i = \sum \beta_i X_i + \varepsilon_i \quad \text{..... (4)}$$

Where;

X_i is a vector of the socio-economic and choice variables,

β_i represents a vector of the estimated coefficient of the socio-economic and choice variables,
ε_i represents the error term, and
WTP_i represents an individual's willingness to pay.

The relationship between the explained variable (WTP) and the explanatory variables (socio-economic and choice variables) in the model was tested using the R^2 and the t-statistic of the coefficients of the individual explanatory variables in the model. The socio-economic and choice variables used in the equation above are each defined as in Table 3.

<Insert Table 3>

3.4 The Survey Design, Sampling Methods and Data

The two largest cities in Ghana (Accra and Kumasi) were selected for this study because of their relatively large urban and peri-urban vegetable consumer markets and the existence of well established vegetable producers who use wastewater in their production. A sample size of 650 households in these two cities was used in the study. The sample was obtained by using multistage sampling method; suburbs (areas) were stratified into the three income groups (low, middle and high) based on the materials used for their houses and their road networks. Random sampling method was used to obtain the participating areas for the study. Systematic random sampling technique was used to obtain the houses which contained one or more households. The sample for each income category was obtained using proportionate sampling method. The study used a household as the basic unit for analysis and the individual respondent was the person who was directly responsible for the purchase and/or cooking in the household. Table 4 shows the number of respondents selected from communities within the two cities.

<Insert Table 4>

4. Results and Discussions

4.1 Descriptive statistics of socio-economic variables

The sample of 650 households is made up 87.9% females and 12.1% males. The high percentage of females is due to the fact that, our target respondent was the person in charge of food purchasing and preparation in the household, which is a feature of most West African societies. This confirms that females are mostly in charge of food purchasing and preparation in Ghana. The average age of respondents for the sample is 33.7 years with a minimum age of 18 years and a maximum age of 76 years. The average age suggests that most of the sample is within the age bracket of 22 to 46 years.

In education, 45.3% of the respondents had junior high school/middle school education; 22.9% of the respondents had senior high school education, 12.0% had tertiary education; 11.1% of respondents had primary education; 8.0% of the respondents had no education and 0.6% of the respondents had vocational training. The results on educational levels with majority attaining the junior high school (averagely 7 years of education) is comparable to the National average in Ghana of 5 years of education with a standard deviation of 5.4 as in the Ghana living standard survey (2008). Table 5 shows the summary statistics of the variables used in the study.

<Insert Table 5>

The sample average household size is 5.7 members per household with a minimum of one (1) member and a maximum of 20 members. The household size is comparable with the national average of 5.5 members per household (Ghana Statistical Service, 2000). The average household income per month is GH¢ 262.90 with a minimum of GH¢ 9.00 and a maximum of GH¢ 2650.00. This high variation in income levels shows the disparity between the rich and poor. The Gini index for income distribution in Ghana according to World Bank (2004) is 30.0. This indicates disparity in Ghana as suggested by the study. The average amount a household spends on vegetables is found to be GH¢ 4.8. Table 6 shows the sample averages from the survey.

<Insert Table 6>

4.2 Estimates of consumers' WTP

The results of consumers' choice and willingness to pay presented in Table 7 revealed that Ghanaian consumers' are willing to pay for "safer" vegetables from the non-treatment options of wastewater use in urban and peri-urban vegetable production. On the average consumers are willing to pay an average of GH¢ 4.70 ($2.40) per month to move from the status quo. The results further indicate that 16 consumers representing 2.5% of the sample are not willing to pay any extra for the health benefit and the environmental improvement of the non-treatment options of wastewater use. This shows that a minority of consumers are not willing to pay any extra on the average amount of GH¢ 4.8 on vegetables per month. They prefer to maintain the status quo. These consumers indicated that they can properly treat vegetables by thorough washing without necessarily paying extra to enjoy the reductions that are likely to come with the new technologies.

<Insert Table 7>

It was also found that 10.1% of respondents opted for the improved use of watering cans (options B). Based on the 5% household expenditure, the average willingness to pay to access the health benefit and the environmental improvement that comes with that option (Opt. B) is GH¢ 4.40 ($ 2.23). The majority of consumers' who chose this option belong to the low income category (GH¢ 50 to GH¢ 100). They also constitute the majority who had attained Junior high school education. On cessation of irrigation to allow pathogen die-off, 60% of the consumers' sampled opted for that option (Opt. C) and was ready to commit an average of 7% extra of the household expenditure on vegetables per month to obtain the benefits this non-treatment option comes with. It was realized that, with the 7% extra household expenditure on vegetables, consumers average willingness to pay to enjoy the health benefit and environmental improvement associated with this non-treatment option is GH¢ 4.70 ($ 2.40).

As many as 74.6% consumers opted for the use of the drip kits which is one of the non-treatment options (Opt. D) with the highest pathogen and soil contamination reduction. This is associated with a corresponding extra increment in the household expenditure on vegetables of about 9%. With the 9% extra household expenditure on vegetables, the average willingness to pay by the consumers who opted for this option is GH¢ 4.90 ($ 2.50). This attests to the fact that consumers are aware of the safety concerns of vegetables and are willing to pay for high quality vegetables and environmental quality improvement. The majority of consumers who opted for this option are a part of the group who had junior high education (JHS), senior high education (SHS) and tertiary

education. They also belong to the middle income category who earn an average monthly income of GH¢ 250 and fall within the age group of 20 to 40 years.

Market washing of each vegetable with clean water, for example, washing each bulb of cabbage with clean water is another non-treatment option at the market level. For a consumer to be able to access the benefit associated with this option, he/she has to spend about 6% extra of the household expenditure on vegetables. The study revealed that 26 consumers representing 4.0% of the sample opted for this option, and they are willing to pay an average of GH¢ 4.40 ($ 2.23) to move from the status quo.

4.3 Estimates of effects of socio economic characteristics on WTP

The direct effect of the socio-economic variables (explanatory variables) on consumers' willingness to pay (explained variables) for "safer" vegetables and environmental quality improvement was estimated by using OLS method. The results as in table 8 show that the overall ability of the explanatory variables to contribute to explain the variation of the consumers' WTP is 91.9%.

<Insert Table 8>

The results also revealed that gender has a positive impact on individual's willingness to pay for "safer" vegetables. The positive sign was not expected and being significant at 5% indicates that male consumers are more willing to pay high premiums than female consumers. This results appears to point to the fact that male consumers who are normally responsible for the overall livelihood of the entire household, a feature which is a typical characteristic of a Ghanaian home would be willing to pay a bit more to keep the household healthy from any vegetable borne diseases. However, it could also be due to the fact that female respondents who are very likely to be married may have been constrained by the fact that they do not make the final decision regarding food expenditure. They are also very likely to prefer non-financial options such as thorough cleaning of vegetables rather than spending more in comparison to their male counterparts. The latter point is more plausible when 1 in 8 of the sample was females and 55% of them were married as well.

The expected positive signs of income and experience of suffering from vegetable borne diseases coefficients were confirmed by the results, with both significant at 1%. This shows that households with higher incomes are willing to pay more for safer vegetables than households with lower incomes. The results further show that consumers who have experienced vegetable borne diseases are willing to pay for safer vegetables than consumers without such an experience. Obviously, the higher income group can afford to pay more but the motivation could arise from their health concerns. Hence, they are more willing to pay for the health benefits and the environment quality improvement associated with safer vegetables. Obviously, consumers who have suffered from vegetable borne diseases in the past are likely to be willing to pay more because the opportunity cost of treating themselves in the hospital and/or reduced income due to loss of man hours due ill health will be to pay a bit more for safer vegetables.

The significance effects of the gender, income and experience of consumers with vegetable borne diseases on consumers' willingness to pay for safer vegetables is consistent with exiting studies. The finding that male consumers are willing to pay for health risk (pathogen) reduction conforms to Akgungor et al., (1999). The positive effects of income and experience of vegetable borne

disease have been reported in willingness to pay studies literature (see Boccaletti and Nardella, 2001; Waibel et al., 2006 and Mukhopadhaya et al., 2004). The result also supports the economic theory that willingness to pay is an increasing function of the income level (Eckert and Leftwich, 1988).

The result also revealed mixed findings for the impact of the choice options (see Table 1) on consumers' willingness to pay for safer vegetables. The results indicate that apart from the coefficient of the status quo option (Option A) which is negatively related to WTP, the rest (Option B, Option C, Option D and Option E) are all positively related to willingness to pay. However, only the coefficients of Option A and Option D are significant at 5% and 1% respectively.

The significance of option A to willingness to pay at 5% means that, as consumers' choice increases for option A, their willingness to pay for that option decreases. This can be attributed to the inability of that option to reduce the pathogen content on vegetables. The significance of option D at 1% level to willingness to pay confirms consumers' awareness of safety concerns associated with vegetable consumption. Therefore, consumers' choice for option D is directly related to their willingness to pay for safer vegetables.

5. Conclusions, recommendations and areas for further research

Ghanaian vegetable consumers' are aware of the health risks associated with vegetables produced by urban and peri-urban vegetable producers using wastewater and hence are concerned of the health risk of the vegetables sold in the markets. A majority of them are willing to spend a bit more of their household expenditure on vegetables for technology changes in urban and peri-urban vegetable production which will result in the reduction of pathogens and environmental quality improvement. It was found that on the average, a Ghanaian consumer is willing to pay GH¢ 4.70 ($ 4.61) to move from the current water application methods used, to improved technologies (non-treatment options of wastewater use) with their associated health and environmental benefits.

Gender (*GENDER*), income (*INCOME*), and experience of suffering from vegetable borne diseases (*SDSE*) have positive impact on consumers' willingness to pay. Hence gender, income, and experience of suffering from vegetable borne diseases are the key determinants of consumers' willingness to pay for safer vegetables. In general, the choice of the non-treatment option (*OPTION D*) with high percentage of pathogen, soil and groundwater reduction has direct positive impact on individual willingness to pay, whiles the status quo option (*OPTION A*) has negative impact on individual willingness to pay.

Findings of the study have implications for urban/peri-urban vegetable production, government legislation, the role of producer cooperatives, marketing as well as public health policy in Ghana. The absence of allotment plan creates the lack of assurance of continuing land use (tenure insecurity) for urban vegetable production. As such, urban vegetable producers are not motivated to explore irrigation systems like wells or on-farm wastewater treatment that can improve product safety (Obuobie, et al. 2003), even at a very minimal cost. This situation brings into focus the role that urban vegetable producers' cooperatives formation could play to among other activities promote land tenure negotiations and also undertake joint low cost safer irrigation options. Cooperative contribution has proven positive in the cocoa producing villages in Ghana in terms of marketing, essential service provision, social development, health status and income (Calkins and Ngo (2005). Encouraging urban and peri-urban vegetable producers to form cooperatives could potentially help build vegetation production capacity and enhance product safety.

Any effort at improving vegetable safety at the producer level ought to be promoted in tandem with government legislation that seeks to sanction the use of polluted water for urban vegetable irrigation. This is an area where stakeholder commitment is critical because legal provisions regarding safe use of wastewater in agriculture in Ghana are not synchronized, and institutional responsibilities are also not coordinated across government ministries and local administrative offices (Abdulai et al., 2011). For example, although the city authority – Accra Metropolitan Authority (AMA) has since 1995 passed a by-law; which states: "No crops shall be watered or irrigated by the effluent from a drain from any premises or any surface water from a drain which is fed by water from street drainage" (Local Government Bulletin, 1995). However, the prevalence of growing vegetables with wastewater in Accra is ample evidence that these by-laws are not enforced for reasons including lack of trained personnel and finance.

In terms of public health policy, certification of produce from the non-treatment options should be promoted to both urban/peri-urban vegetable producers and sellers such that consumers' can differentiate among different vegetables produced with the respective options. This will provide the needed choice for consumers and further justify investment into the production of safer vegetables. Supporting such a policy will invariably create a niche market for safer vegetables produced by non-treatment options of wastewater use.

Another key area where the findings of the study could potentially influence positively is public education on the safety of vegetables. Investment in educational campaigns to highlight the risks associated with vegetables produced without using the non-treatment options of wastewater in urban and per-urban vegetable production is highly recommended. Campaigns to create awareness of the benefits of the yet to be introduced technologies running parallel to the safety concerns campaign is also recommended. The general population is a good target for this campaigns but special emphasis should be placed on reaching the youth who showed positive WTP for safer vegetables.

Future studies considering the impact of the combinations of the various non-treatment options on pathogen reduction on vegetables is highly recommended. Furthermore, research on the financial viability of each of the non-treatment options are recommended to compliment the findings of this study on consumers' willingness to pay for "safer" vegetables and environmental quality improvement for an efficient and cost-effective implementation of the technologies.

Table 1: Choice scenarios used in the choice experiment

Choice scenario	Description
OPTION A	Status quo; the normal watering by using open buckets without any conscious effort to reduce pathogen levels
OPTION B	Improved use of watering cans; using watering with the cap on and at a height <1m
OPTION C	Cessation of irrigation allowing pathogen die-off; stopping the normal watering by the use of open buckets for between 2-5 days before harvest
OPTION D	Use of drip kits; this is a home garden micro-irrigation kits fitted with micro-tube emitters
OPTION E	Market washing with clean water; normal irrigation practice with the use of open buckets for watering and washing each vegetable produce with clean water

Source: Authors

Table 2: Definition of Variables and Hypotheses

Variables	Definition	Measure	Hypotheses
WTP	The extra amount a consumer is ready to add to enjoy the pathogen reduction and environmental improvement.	Ghana cedis (GH¢)	Ghanaian consumers are willing to pay for pathogen reduction and environmental improvement.
INCOME	Total household income per month	Ghana cedis (GH¢)	Positively related to WTP
EDU	Educational level of respondent	Years of education	Positively related to WTP
SDSE	Experience of suffering from vegetable borne disease	1. Yes 0. No	Positively related to WTP
AGE	Age of respondent	Years	Negatively related to WTP
HH	Household size	Number of members	Negatively related to WTP
MARISTAT	Marital status of respondent	1. Married 0. Otherwise	Negatively related to WTP
MAJOCCUP	Occupation of the household head.	1.Salaryworker 0. Other wise	Negatively related to WTP
GENDER	The sex of respondent	1. Male 0. Otherwise	Negatively related to WTP
OPTION A	Status quo	1. Yes 0. No	Negatively related to WTP
OPTION B	Improved use of watering cans	1. Yes 0. No	Positively related to WTP
OPTION C	Cessation of irrigation	1.Yes 0. No	Positively related to WTP
OPTION D	Use of drip kits	1.Yes 0. No	Positively related to WTP
OPTION E	market washing of vegetables with clean water	1.Yes 0. No	Positively related to WTP

Source: authors

Table 3: The attributes used in the choice experiment

Attribute	Description	Level
Percentage(%) of HH expenditure On vegetables	The % of HH income on vegetables the consumer is willing to add to the benefits	None in OPT A 5% in OPT B 7% in OPT C 9% in OPT D 6% in OPT E
Reduction in contamination levels	Reduction of faecal coliform and Helminthes contamination on vegetables	None in OPT A Low in OPT B High in OPT C Very high in OPT D Medium in OPT E
Reduction in soil and ground water contamination	Pathogen reduction levels In soil and ground water	None in OPT A Low in OPT B High in OPT C Very high in OPT D Very low in OPT E

Source: Authors

Table 4: Number of Households – HH (Respondents) and their income category selected from sampled communities in Accra and Kumasi.

City	Community	Income category	Sample
KUMASI (415)	Bomso	high income	40 HH
	Nhyieso	high income	41 HH
	Amakom	middle income	41 HH
	Pankrono	middle income	53 HH
	Ashanti New Town	middle income	41 HH
	Asawasi	low income	53 HH
	New Tafo	low income	42 HH
	Gyinyasi	low income	52 HH
	Asuoyeboa	low income	43 HH
ACCRA (235)	North Kaneshie	high income	23 HH
	Achimota	middle income	43 HH
	Labadi	middle income	43 HH
	Jametown	low income	42 HH
	Chorkor	low income	42 HH
	Sukura	low income	42 HH

Source: Authors

Table 5: Descriptive statistics of socio-economic characteristics

Variable	Options	Frequency	Percentages (%)
Educational level of respondent (EDU)	1. Primary	72	11.1
	2. JHS/Middle sch.	295	45.3
	3. SHS	149	22.9
	4. Tertiary	78	12
	5. No education	52	8
	6. Vocational educ.	4	0.6
Gender of respondent	1. Male	78	12.1
	2. Female	572	87.9
Marital status	1. Married	562	55.6
	2. Single	236	36.3
	3. Divorced	32	4.9
	4. Widowed	21	3.2
Occupation of HHH	1.Salaried worker	213	32.7
	2. Non salary worker	437	67.3

Source: field survey, *HHH – Household Head*

Table 6: Sample averages of variables in the study

Variable	Sample average (Mean)	Standard deviation
AGE	33.7	4.99
INCOME	GH¢ 262.90	299
Household size (HH)	5.7	2.8
WTP	GH¢ 4.70	4.99
Average amonnt spent on vegetables/ month (Avmnt/mnth)	GH¢ 4.8	4.97

Source: Authors

Table 7: Consumers' choice and willingness to pay

Variable	Frequency	Percentage	Average WTP/month.
STATUS QUO			
1. Yes	16	2.5	GH¢ 0.00
0. No	644	97.5	
IMPROVED USE OF WATERING CANS			
1. Yes	66	10.1	GH¢ 4.40 ($ 2.23)
0. No	584	89.9	
CESSATION OF IRRIGATION			
1. Yes	60	9.2	GH¢4.70 ($ 2.40)
0. No	590	90.8	
USE OF DRIP KITS			
1. Yes	485	74.6	GH¢ 4.90
0. No	165	25.4	($ 2.50)
MARKET WASHING WITH CLEAN WATER			
1. Yes	26	4	GH¢ 4.40
0. No	624	96	($ 2.23)

Source: Field survey

Table 8: Results of OLS estimates of determinants of WTP

Variable	Coefficient	z-statistic
Constant	3.781	0.67
GENDER	1.880**	2.083
AGE	-0.024	-0.98
H H	-0.041	-0.388
EDU	-0.307	-1.195
MARISTAT	-0.216	-0.527
MAJOCCUP	0.729	1.105
INCOME	0.080***	77.55
SDSE	3.899***	3.25
OPTION A	-8.727**	1.924
OPTION B	1.581	0.356
OPTION C	5.68	1.298
OPTION D	10.976***	2.489
OPTION E	3.464	0.743
R^2	0.92	
Adjusted R^2	0.918	
F-test	560.92***	

Where ** and *** represents, 5% and 1% significant levels respectively.
Source: Field survey

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