Relationship between School Gardening and Self-Efficacy on Weekly Fruit & Vegetable Intake

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Abstract

Background: The study was designed to understand the relationship between school gardens and student's self-efficacy and its effect on weekly intake of fruits and vegetables. The survey used two Ugandan secondary schools; one having a well established school garden with all students having equal opportunities to participate in the growing, harvesting and consumptions of fruits and vegetables.

Methods: The study followed a cross-sectional study design employing quantitative research methods. The target population comprised of late adolescents 18–25 years attending the two-selected secondary school; one in Kampala and another in Luwero districts. The school in Luwero district engaged students in gardening activities while the school in Kampala did not. Self-administered structured questionnaire was given to students to answer questions in line with the specific objectives. Quantitative data was analyzed by *t-test*, Mann Whitney U test, Pearson Rank Correlation, Odds ratio and Chi-square.

Results: The students exposed to gardening had a higher self-efficacy ($p = 0.03217$) towards weekly consumption of fruits and vegetables with slightly higher scores of fruits and vegetable weekly intake as compared to those not exposed (OR = 1.0370). However, the weekly consumption of fruits and vegetables was low among both groups as compared to the World Health Organization (WHO), Food and Agricultural Organization (FAO) and United States Department of Agriculture (USDA) recommendation of ≥ 35 servings per week (≥ 5 servings per day) for both fruits and vegetables. The students in the exposed group were more confident in consuming fruits and vegetables rather than a snack ($p = 0.008$), ice cream ($p = 0.004$), three times a day ($p < 0.0001$) compared to the control group.

Conclusion: School garden based intervention can significantly improve student's self-efficacy towards fruit & vegetable dietary intake increasing the weekly consumption of fruits and vegetables.

Introduction

Inadequate fruit and vegetable consumption accounts for 6.7 million deaths globally (Lim et al. 2012) increasing the incidence of non-communicable diseases like diabetes, hypertension and osteoporosis, in adults with history of un healthy eating early in life (Neumark-Sztainer et al. 2011). Increased fruit and vegetable consumption plays a significant protective role in the prevention of cancer and chronic diseases, such as cardiovascular disease and diabetes, and is also positively related to overall health status (Ganann et al. 2014).

Self-efficacy as a key determinants of weekly dietary intake of fruits and vegetables among school going adolescents has also been reported by Davis & Spaniol, (2015), Morgan et al., (2010), Jaenke et al., (2012), Kothe et al. (2012), Sondra et al. (2009), Ratcliffe, Merrigan, Rogers, & Goldberg, (2011), & Laurie, Faber, & Maduna, (2017). Consequently, any intervention targeting self-efficacy as a determinant of health

promotion practice is paramount in improving weekly fruit and vegetable consumption (Thunfors, Hanlon, & Collins, 2009, Robinson-O'Brien, Story & S Heim 2009 Jennifer, L., Staub, D. & Colby, S., 2018).

Students' confidence towards the weekly intake of fruits and vegetables can be enhanced by hands activity through getting involved in gardening activities. Davis & Spaniol (2015), Oxenham, King (2010) reported that school gardens increase the confidence of adolescents in the easting of fruits and vegetables and ultimately increases the weekly dietary intake of fruits and vegetables. The choice of food and dietary habits are shaped early in life (Neumark-Sztainer et al. 2011) and hence, hands on activities during school times will largely contribute to the confidence later in life to take fruits and vegetables. Heneman et al. (2008) established that incorporating agriculture into schools links school, family and community activities. Students in intervention groups have been observed to set up urban potted fruit and vegetable gardens even when space is inadequate because of the motivation for intake of fruits and vegetables (Heneman et al. 2008).

Exposure to a wider range of vegetables and fruits through gardening activities has been observed to increase student's self-confidence/self-efficacy (Heneman et al. 2008). Students are attracted to fruits because of their color, scent and (Davis & Spaniol, 2015). School gardens have also been reported elsewhere as an engaging and innovative strategy to improve the students' self-efficacy towards weekly intake of fruits and vegetables. Jennifer, L., Staub, D. & Colby, S., (2018) reported improoved self efficacy towards the intake of fruits and vegetables among the gardening group than the control group.

However, Morgan et al., (2010), Jaenke et al., (2012) and Kothe et al. (2012) did not establish the relation between enhanced self-efficacy and gardening activities in improving weekly dietary intake of fruits and vegetables. On the other hand, Ding et al., (2012) and Gannan et al., (2014) reported that home food and vegetable environment such as accesibility, availability and variety are the key determinants of the self-efficacy towards routine fruit and vegetable intake rather than school gardening activities. Similarly, Pearson et al., (2009) established that it was home environment in terms of parental encauragement, family rules, parental consumption of fruits and vgetables that had a strong bearing on self-efficacy of the child's weekly intake of fruits and vegetables. Pearson also observed a positive association between the parent's level of education and the child's self-efficacy towards intake of fruits and vegetables.

Thus, the role of the school gardens in enhancing the self-efficacy towards weekly consumption of fruits and vegetables by the students is not fully understood even in parts of the world where extensive research has been conducted in this field. Consequently, these contradictions in literature regarding the role of the school garden in enhancing the self-efficacy of students in order to improved weekly dietary intake of fruits and vegetables guarantee more studies to give a plausible relationship between efficacy and eating of fruits and vegetables.

In Uganda there is scanty information in literature assessing the role of school gardens in improving the self-confidence of school going children towards dietary consumption of fruits and vegetables. Most of

the published data is from Europe, Asia and America with gross differences in socio-cultural and economic environment from our set. Thus the present study sought to understand the relationship between school garden and self-efficacy of students towards in improvement of weekly fruit and vegetable consumption. The socio-ecological model informed our study from which the objectives were derived that guided the design of the data collection tools and discussion of our results (Figure. 1).

Figure 1: The Socio- Ecological Model (Adopted from CDC, 2015)

Methods And Materials

Study design

This was a descriptive cross sectional study employing quantitative methods of data collection and analysis.

Area of Study

The study was carried out from two Ugandan secondary schools; one with students actively involved in school gardening activities while another not. The school with students participating in school garden is located in Bombo central ward, Bombo town council sub-county, Katikamu South constituency in Luwero district. The school with no school garden is located in the central division of Kampala, Kampala central constituency. The two setting were selected purposely because they are quite similar since they are both constrained by space, are universal day public schools with about the same enrollment. The students attending both schools come from low social economic status families

Study Population

The survey used high school students in the selected schools with and without school gardens aged between 18-22 years.

Sampling procedures

Inclusion and Exclusion Criterion

Advanced level students in the two schools aged 18-22 years were included in this study while advanced level students in the two schools below 18 years and all ordinary level students regardless of the age were excluded from the study. The participants gave written informed consent to participate in the study and any participant was free to turn down his/her participation even though met the inclusion criterion.

Sample size

For the quantitative arm, the sample size, *n*, was calculated using the formula described by Cochran, W. G. (Cochran, 1963). A proportion of 50% fruit and vegetable intake was used giving a sample size of 355 late adolescents from both schools.

Sampling Techniques

Purposive sampling was done for the selection of the two schools used in the study because of the similarity of the two schools in terms of social economic status of the parent, both are constrained by space and both are under the universal secondary education. The survey used 355 high school students in the selected schools with and without school gardens that were selected randomly by stratified sampling using the class lists as the sampling frames. A random sample of 170 and 185 respondents was drawn from the school with and without gardening activities respectively.

Data collection Methods and Instruments

Self-administered questionnaire with four sections to collect data on all the four objectives was used. All the questions were obtained from validated questions used in food intake related questionnaires and were approved by the Mild May Uganda Research and Ethics Committee (MUREC)

The data on weekly intake of vegetables was collected by using the section of the questionnaire called the food and vegetable frequency questionnaire (FVFQ). The questions in this section were adopted from Rockett et al., 1995 with slight adjustments.

The previously validated tool for self-efficacy related to fruits and vegetable consumption for adolescents aged 11-19 by Hagler et al., 2005, Bandura, 2006, and Sharma et al., 2014 was adopted after it was optimized to meet the local fruits and vegetables. This was called the fruit and vegetable efficacy questionnaire (FVEQ). The survey on the assessment school gardens in influencing fruit and vegetable intake efficacy was adopted from the scale developed by Sunette M, 2017. This was designated the influence of gardening activities on fruit/vegetable intake at school questionnaire (FVSQ)

Quality control methods

For internal reliability, the questions within each questionnaire were tested for internal reliability using Cronbach's alpha. All sections of the questionnaire gave values of $\alpha>0.7$ which signifies a good internal reliability. To control quality of responses, all questionnaires with vague responses were rejected during the analysis. For example, a respondent ticking the same column for all questions, such a questionnaire was not included in the analysis.

Data management and processing

The Likert scale was used to grade the response depending upon the level of agreement with the question asked. The data was entered in Excel 2016 and the mean ± standard deviation was calculated. For analysis the data was exported to SPSS version 20 which was used to calculate the statistical parameters of Student's t-test, Mann Whitney U test, F test for ANOVA and the spearman Rank Correlation R. All analyses were done at 95% level of significance and a $P<0.05$ was considered statistically significant.

Data analysis

Descriptive statistics means ± standard deviations were used for the fruit and vegetable frequency questionnaire (FVFQ). The mean intake of fruits and vegetables consumed by the students per week were calculated from the responses given by students in section B of the FVFQ.

The frequency of fruits taken in on a weekly basis was determined by pooling the daily and weekly intakes. For example, if the fruit or vegetable was eaten twice for every two weeks, then the conversion was a half intake of fruit per week. If it was consumed 3times a day, the it was consumed 21 times a week. The total fruit consumption for every week was calculated by adding all the scores for questions from the questionnaire on FVFQ. The same procedure was used for the vegetables consumed on a weekly basis by summing up all the codes for questions on vegetable intake in the FVFQ.

For any unanswered question, the response was assumed to be zero intake per week. This is the common procedure in food frequency questionnaire which implies that if someone does not answer the question, it means he/she does not eat that food item (USDA, 2015).

The mean frequencies of fruit and vegetable intake per week for the exposed and unexposed provided a variable for analysis. Due to outliers in the intake of both fruits and vegetables, the variable was not normally distributed. Hence the results were reported using means while the analysis was done by using the non parametric of t-test called the Mann Whitney U test and the odds ratio. The odds ratio was calculated to show the strength of association between gardening and frequency weekly intake of fruits and vegetables. All analyses were done at 95%CI and a $P<0.05$ was considered statistically significant.

Self-efficacy for eating fruits was assessed using FVEQ and FVSQ questionnaires. All questions in section C of the questionnaire (FVEQ) were coded as follows: definitely I can=5, I think I can=4, maybe I can=3, not sure I can=2 and don't think I can=1, and the answers for each question were added together and divided by the number of questions to obtain a Self-Efficacy Mean Score (SEM score). The SEM score were tested for internal reliability using Cronbach's alpha giving a value of 0.82 with 7 items (n=355).

The difference in means of SE scores between the two groups of students with and without school gardens was tested for statistical significance by using Mann Whitney U test. The influence of gardening activities attributable to fruit consumption was assessed by questions in section D (FVSQ).

All the questions were coded as follows: Very much=3, sometimes=2, a little bit=1 and not at all=0. The answers for each question were added divided by the number of questions to obtain the Gardening Attributable Mean Score (GAMS). The scores were tested for internal validity using Cronbach's alpha giving a value of 0.72 with 6 items (n=355).

The differences in means of GAMS score between the two groups of students with and without school gardens were tested for statistical significance by using Mann Whitney U test statistic. To establish the conditions that would influence student's efficacy related to intake of fruits and vegetables attributable to gardening activities, the questions were correlated on gardening activities with self-efficacy questions using Spearman Rank correlation at 95% significance level and $p<0.05$ was considered significant.

Multi-variant analysis was done using ANOVA to assess the difference in mean scores on the self-efficacy, attitude and knowledge to study groups had on fruits and vegetables. All analyses were done at 95% significance level and a $P<0.05$ was considered statistically significant.

3.9 Ethical Statement

The Institutional Review Board of Mild may Uganda approved the research project (REC REF 0103-2019). The school of post graduate studies, Uganda Martyr's University also the approved the study (Appendix VI). This study was conducted according to the guidelines laid down in the Declaration of Helsinki.

Results

Demographics

The mean ages of the girls and boys in the school exposed to gardening activities were 19.10±1.4 and 19.2±2.86 respectively while those for students in the unexposed school were 18.62±1.21 and 19.11±1.29 respectively (Table.1)

Table 1: Demographic characteristics for the exposed and unexposed students to the gardening program

Characteristic	unexposed	Exposed	Total
Sample size, n	170	185	355
Gender,			
Boys, n (%)	93(54.7)	107(57.8)	200(56.3)
Girls, n (%)	77(45.3)	78(42.2)	155(43.7)
Age, Mean ±SD			
Boys	19.11±1.29	19.2±2.86	
Girls	18.62±1.21	19.10±1.4	

Weekly consumption of fruits and vegetables

To understand the influence of school garden on the weekly consumption of fruits and vegetables, we compared the daily intake of fruits among the exposed and the unexposed students to gardening activities from which the weekly consumption was computed. The weekly consumption was generally higher among the exposed than the unexposed students with fruits having higher scores than vegetables. (Table 2)

Table 2: The 2x2 Table showing the distribution and analysis of weekly consumption of fruits and vegetables among the exposed and unexposed students to school gardening program using Odds Ratio.

	Fruit intake	Vegetable intake	Total	OR	P-value	95%CI
Unexposed	8	6	14			
Exposed	9	7	16			
Total	17	13	30	1.037	0.9607	0.2267 to 4.1018

The mean difference in weekly intake of fruits and vegetables was analyzed for statistical significance; OR=1.0370, p=0.9607 (95% CI; 0.2267 to 4.1018) (Table.2). From our analysis, gardening was associated with increased weekly intake of fruits and vegetables (OR>1)

Relationship between gardening activities and the self-efficacy of students towards weekly consumption of fruits and vegetables

Overall, students exposed to gardening had higher self-efficacy scores on the Likert scale than the control. They were 75.8% confident of weekly health eating compared to 61.9% confidence level of weekly health eating among the unexposed (P=0.0511). Students exposed to gardening activities had high self-efficacy scores related to weekly intake of fruits and vegetables (Table.3). They were 92%, 72.8%, 73.4% and 87% confident that they can eat fruits/vegetables rather than a snack, ice cream, 3 times a day (21 times a week) and every breakfast (7 times a week) respectively. On the centrally, the unexposed students to gardening activities were only 60%, 56.4%, 52% and 63.4% confident that they can eat fruits and vegetables rather than a snack, ice-cream, 3 times a day (21 times a week) and every breakfast (7 times a week) respectively (P<0.05).

Table 3: Mean scores (% mean score) on the self-efficacy of students towards weekly consumption of fruits and vegetables among the exposed and unexposed students to school gardening program

	Unexposed (n=170)	Expose (n=185)	P-value
	Mean score (%)	Mean score (%)	
I can eat a F/V instead of chips as a snack	3.01 (60%)	4.58 (92%)	**0.00804**
I can eat a F/V instead of ice-cream as a desert	2.82 (56.4%)	3.64 (72.8%)	**0.0042**
I can eat a F/V 3 times a day	2.60 (52%)	3.67 (73.4%)	**<0.001**
I am sure I can eat F & V every breakfast	3.17 (63.4%)	3.90 (87%)	**0.00338**
I am sure I can eat F & V every lunch	3.19 (63.8%)	3.81 (76.2%)	0.05118
I am sure I can eat F & V every dinner	3.45 (69%)	3.85 (77%)	0.06724
I can eat a F/V 2 times a day	3.43 (68.6%)	3.09 (61.8)	0.1074
Total mean score (%)	**3.09 (61.9%)**	**3.8 (75.8%)**	**0.0511**

Assessing self-efficacy and self-confidence towards eating fruits and vegetables in the school with no gardening activities when dichotomized by gender, girls had higher fruit and vegetable intake efficacy scores than boys (Table. 4). Girls were 72% confident that they can engage in health eating behaviors compared to 66% confidence of boys as regards health heating. Similarly, girls exposed to gardening had higher efficacy scores than boys. Girls were 74% confident that they can engage in health eating behaviors compared to the 68% confidence of boys as regards health heating.

Table 4: Mean scores (% scores) on the self-efficacy towards weekly intake of fruits and vegetables among the students exposed and unexposed to school gardening activities by gender.

Self-efficacy item	Exposed		Unexposed	
	Female	Male	Male	Female
	Mean ±SD	Mean ±SD	Mean ±SD	Mean± SD
Eating of fruits/vegetable rather than a snack	3.5 (70%)	4.0 (80%)	3.0 (60%)	4.0 (80%)
Eating of fruits/vegetable rather than an ice cream	3.7 (74%)	4.1 (83%)	2.8 (56%)	3.6 (72%)
I can eat FV for break fast	3.7 (74%)	3.2 (64%)	3.9 (78%)	3.2 (64%)
I can eat FV for lunch every lunch	3.7 (74%)	3.0 (60%)	3.2 (64%)	3.8 (76%)
I can eat FV for every dinner	3.8 (76%)	2.8 (56%)	3.5 (70%)	3.9 (78%)
I can eat FV at least twice a day	3.9 (78%)	3.3 (66%)	3.4 (68%)	3.1 (62%)
Total average mean score ±SD	3.7 (74%)	3.4 (68%)	3.3 (66%)	3.6 (72%)

Analysis of student’s self-efficacy towards weekly fruit and vegetable intake related to gardening

The difference in mean total scores on the student’s self-efficacy and self-confidence towards weekly fruit and vegetable intake was analyzed for statistical significance (Table.5). The chi-square test of independence was performed to examine the relationship between gardening activities at school and the self-confidence and self-belief to eat fruits and vegetables rather than junk.

Table 5: The 2x2 table showing the mean percentage scores for the Chi-square test for the analysis of student’s self-efficacy towards weekly consumption of fruits and vegetables among the exposed and unexposed to school gardening program

	Self-efficacy (%)	No Self-efficacy (%)	Total	X^2
Exposed	76	24	100	
Unexposed	62	38	100	4.5816
Total	138	62	200	

The relationship between these variables was significant, X^2 (1, N=355) =4.5816, p=0.032317. Students exposed to gardening were more confident than their unexposed counterparts in the intake of fruits and vegetables.

The difference in mean total scores on the student's self-efficacy and self-confidence towards weekly fruit and vegetable intake by gender was analyzed for statistical significance (Table.6). The chi-square test of independence was performed to examine the relationship between gardening activities at school and the self-confidence and self-belief to eat fruits and vegetables rather than junk by gender

The chi-square test of independence showed that there was no significant association between gender and self-confidence, belief and efficacy towards intake of fruits and vegetables among the exposed, X^2 (1, N=355) =0.8742, p=0.349792 and the non-exposed, X^2 (1, N=355) =0.8415, p=0.358964.

Table 6: The 2x2 table showing the mean percentage scores for the Chi-square test for the analysis of student's self-efficacy towards weekly consumption of fruits and vegetables among the exposed and unexposed to school gardening program by gender

		Self-efficacy	No self-efficacy	X^2
	Female	74	26	
Exposed				
	Male	68	32	0.8742
	Female	66	34	
No exposed				0.8415,
	Male	72	28	

Correlation between self-efficacy scores related to gardening

In order to establish the conditions that would influence student's efficacy related to weekly intake of fruits and vegetables attributable to gardening activities, we correlated questions on gardening activities

with self-efficacy questions using Spearman Rank correlation (Table. 7). Students were more confident that they could eat fruits and vegetables rather than a chip as a snack because they grow fruits and vegetables at school (p=0.04776), are involved in gardening (p=0.034084) and their desired fruits are present in the school garden (P=0.01785).

Table 7: Correlation between self-efficacy scores towards weekly intake of fruits and vegetables attributable to the gardening program

Gardening activities	I can eat fruits and vegetables rather a chip as a snack	I can eat Fruits and Vegetables 3times a day	I can eat fruits and vegetables every dinner
We grow fruits & vegetables at school			
	R=0.15	R=0.21	R=0.205
	R2=0.0214	R^2= 0.044	R2= 0.042
	P=0.04776	p=0.004399	p=0.005223
I am involved in gardening			
	R=0.1559	R=0.1935	R=0.1335
	R^2=0.0243	R^2=0.0374	R2=0.0178
	p=0.034084	p=0.008314	p=0.070047
My desired fruits are present in the school garden			
	R=0.174	R=0.2057	R=0.1632
	R^2=0.0303	R^2=0.0423	R2=0.0266
	P=0.01785	p=0.005123	p=0.026445

Similarly, students were more confident that they could eat fruits and vegetables 3 times a day (21 times a week) because they grow fruits and vegetables at school (p=0.004399), are involved in gardening (p=0.008314) and their desired fruits are present in the school garden (p=0.005123). Students were more confident that they could eat fruits and vegetables be every dinner (7 times a week) because they grow fruits and vegetables at school (p=0.005223) and their desired fruits are present in the school garden (p=0.026445).

Discussion

Overall, from the survey questionnaire results, students expressed low intake of fruits and vegetables in both settings although students exposed to gardening activities had higher weekly intake of both fruits and vegetables. These findings have been reported elsewhere by Kim et al. (2014) and Kimmons et al. (2009) who reported 9 & 7 servings of fruits and vegetables per week respectively. Our participants did not meet or exceeded the WHO and FAO recommended intake of fruits and vegetables because of inadequate supply. The school that exposed students to gardening activities and served students with fruits and vegetables had higher weekly fruit and vegetable intake scores consistent with the constructs at the meso-level of the socio-ecological model informing our study. This finding is not surprising as it was reported elsewhere by Arcan et al. (2007) who established that serving fruits and vegetables during meals enhances the adolescent's intake of fruits and vegetables.

The low intake of fruits and vegetables has also been explained by Ying-Ying et al. (2009) who reported low self-efficacy among students regarding health eating. In our study, students exposed to gardening had higher weekly vegetable intake than the control group. Sondra et al. (2009) established that exposure to hands on gardening activities to grow fruits and vegetables, generally are associated with their increased consumption as it builds a sense of self-confidence towards health eating.

According to socio-ecological mode that underpinned our study, self-efficacy and self-confidence are key individual intrapersonal attributes at micro level as a valid determinant of fruit and intake by late adolescent which in turn influence health behaviors. This has been reported in studies by Pedersen et al. (2015) and Fitzgerald et al. (2013). In their case-control study they established that the interventional group in the schools which served fruits and vegetables as part of the school menu was more confident than the control group and had higher weekly intake of fruits and vegetables.

The complex multi-layered socio-ecological model constructs at various levels explain the interaction between the setting and intrapersonal factors and, how they influence health behaviors. In our study, students exposed to gardening activities (setting) had high self-efficacy scores (intrapersonal influence) related to weekly intake of fruits and vegetables. They were more confident that they could eat fruits/vegetables rather than a snack, ice cream, 3 times a day (21 times a week) and fruit/vegetable every breakfast (7 times a week) as compared to the unexposed group.

According to the socio-ecological model, self-regulation and Self-confidence influence behavioral change such as better health promotion practice. Fruit and vegetable intake every dinner (7 times a week), 3 times a day (21 times a week) and as snack rather than chips were positively related to gardening activities at school. These findings are consistent with earlier reports that highlighted the importance of self-efficacy

in improved weekly fruit and vegetable intake (Thompson et al. 2007, Pedersen et al. 2015 and Fitzgerald et al. 2013).

However, many studies have reported contradictory findings. Keyte et al. (2012) did not find an association between gardening at school and increased self-efficacy towards the dietary intake of fruits and vegetables. However, the differences in the age of the learners and the setting could explain the differences in the results. The study by Keyte and co-workers used pre-adolescents but our study and Bere's study used adolescents as the study subjects.

Similarly, the study by Philip et al. (2009) on the impact of nutrition education with and without a school garden on self-efficacy found no differences in weekly fruit or vegetable intake. This was consistent with the studies by Jaenke et al. (2012) who reported no changes in weekly fruit and vegetable intake as a result of a school gardening program and Kothe et al. (2012), who examined the efficacy intervention on weekly fruit and vegetable consumption but did not see behavior change related to weekly fruit and vegetable consumption among students in schools with or without the school garden.

The discrepancy in these studies may be due to the young age of participants investigated (mid adolescents) but might also be due to the methodological differences. Philip et al. (2009) used 24-hour recalls to measure weekly fruit, vegetables or combined weekly fruit and vegetables consumption, Kothe et al. (2012) used a three day food diary while Jaenke et al. (2012) used teacher-child based intervention. The teacher's willingness to teach the intervention and own beliefs in the importance of gardening could have introduced bias into these results. Most importantly however, the study by Philip et al. (2009) was conducted in Australian regions, where fruit and vegetables can be grown all year round which is not universally true in our setting and elsewhere. In the current study, it was the opinion of the students as regards the intake of fruits and vegetables. This difference may then explain the discrepancy between their studies and our study.

The influence of the school gardening activities in improving the student's self-efficacy towards weekly fruit and vegetable intake has been reported by Davis & Spaniol (2015) and Oxenham, E.; King (2010) who reported that school gardens increase the confidence of students in the eating of fruits and vegetables. Neumark-Sztainer et al. (2011) reported that the choice of food and dietary habits are shaped early in life and hence, hands on activities during school life will largely contribute to the self-confidence later in life to take fruits and vegetables consistent with the findings of the current study. Heneman et al. (2008) highlighted that self-efficacy can be increased by providing hands-on learning experiences and effective problem-solving skills.

Heneman et al. (2008) reported that exposure to a wider range of vegetables and fruits through gardening activities increase students' self-confidence/self-efficacy to enhance weekly vegetable and fruit consumption. The higher efficacy to intake of fruits than vegetables observed in the current study has been explained elsewhere. Davis & Spaniol (2015) reported that students have higher self- efficacy for weekly intake of fruits than vegetables because of their color, scent and hence more attractive. However, Morgan et al., (2010), Jaenke et al., (2012) and Kothe et al. (2012) did not establish the relation between enhanced self-efficacy and gardening activities.

Generally, students in our study had higher self- efficacy and higher self-confidence towards weekly intake of fruits than vegetables. This finding has been reported in previous studies. Learners are attracted to fruits because of their color, scent and attractiveness (Davis JN, Spaniol MR 2015). Fortunately, the color of the fruit has been reported to indicate nutrient richness. Specifically, red and orange fruits are rich in vitamin A and carotenes, which act as anti-oxidants (USDA. 2015).

According to the socio-ecological model, age and gender operating at the micro-level are important intrapersonal factors influencing behavioral change. In our study age was controlled by recruiting only late adolescents while gender was an intervening variable between the independent variables and the dependent variables. The results show a clear trend that gender is an intervening variable regarding the intake of fruits and vegetables. In the exposed school, girls had higher weekly intake of both vegetables and fruits than the boys while in the exposed school girls had higher weekly intake of fruits only. This has been reported elsewhere by Sandra et al. (2018) who reported that girls consume more fruits and vegetables than boys and were more likely to reach the WHO and FAO recommendations of 5 daily servings (35 weekly servings) than the boys. The boys in the exposed school to gardening activities consuming more vegetables than the girls has also been reported by Sandra et al. (2018) who observed servings of ≥3 vegetables for boys daily (21 weekly servings) than for girls.

Rasmussen et al. (2006) in their review on differential intake of fruits and vegetables among adolescents by gender in several developing countries found out that 55% of the studies reviewed reported girls having higher daily fruit and vegetable intake consistent with the results of the current study. Gender differences in student's daily/weekly intake of fruit and vegetable have also been reported by Carine et al. (2015) in their survey of fruit and vegetable intake trends among students from 2002 to 2010 in 33 countries with girls having higher intake than boys across all countries.

The difference in the weekly intake of fruits and vegetables along the gender divide has been explained elsewhere. Bere et al. (2007) implicated the difference on differential preference for fruits and vegetables by boys and girls with girls having higher preference for fruits and vegetables than boys. In addition to difference in preference, Bere et al. (2007) have attributed gender differences in fruit and vegetable intake to accessibility of fruits and vegetables at home. Cooke & Wardle (2005) associated the higher weekly

fruit and vegetable intake among girls with high self-efficacy than boys to consumption of fruits and vegetables.

Gender based differences in self-efficacy towards weekly fruit and vegetable intake by adolescents in our study are not surprising since they have been reported elsewhere. Bere, Brug, & Klepp, (2007) found out that girls consume more fruits than boys because of the stronger intentions and self-efficacy compared to boys because of a stronger importance females attach to diet compared to males. This is consistent with the findings of the current study.

Wardle et al., (2004) also reported gender based differences in health behaviours as have been reported in our study. They reported that women were more conscious about dieting by avoiding high fat foods, eating fruits and fibres and limiting salt. Gender differences in food choices therefore appear to be partly attributable to women's greater weight control and their stronger self-efficacy in health eating which manifest early in life (Wardle et al. 2004).

Limitations of the study

The questions in the survey commonly combined the fruits and vegetables for example how often do you eat fruits and vegetables? The responses may differ if two surveys were used; one for fruits only and another for vegetables. This could have caused discrepancies in our findings.

Again, clustering the fruits as for example hand fruits like bananas, apples, grapes could have biased the results because this could have reported a false frequency due to inclusion of bananas yet apples and grapes are rarely consumed by our participants. The study used respondents of age 18 years and above. The results may differ if young students are used.

Conclusions

Overall, the intake of fruits among our study participants was low with servings per week less than the recommended serving by United State Department of Agriculture (USDA), Food and Agricultural Organization (FAO) and World Health Organization (WHO).

Generally, self-efficacy significantly influenced the weekly consumption of fruits and vegetables. Thus students had significantly high self-efficacy and self-confidence to eat fruits and vegetables weekly. Their efficacy was increased by the involvement in gardening such that, they had the confidence that they can eat fruits and vegetables in place of ice cream, a snack or three times a day attributable to gardening. There was a significant correlation between school gardening activities and consuming fruits and vegetables 3 times a day and, for a desert rather than the snack or ice cream

Declarations

Ethics approval and consent to participate

The study was conducted according to the guidelines laid down in the Declaration of Helsinki. The participants gave written informed consent to participate and withdraw from the study was voluntary. The research and ethics committee (REC) of Mild May Uganda approved the research project under the reference number of REC REF 0103-2019.

Consent for publication

The consent form had a section that requested participants to approve the publication of the findings of the study. Thus participants gave written informed consent to publish the report.

Availability of data and material

The datasets used and/or analyzed during the study are available from the corresponding author on reasonable request.

Competing interests

The authors of the paper do not have any financial or personal relationship with the other people or organization that could inappropriately influence or bias the content of the paper. The authors therefore declare that they have no competing interests.

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Author's contributions

Hussein Mukasa Kafeero (HMK) contributed to the conceptions of the idea, design of the study, data analysis, drafting and writing of the manuscript. David Kavuma (DK) contributed to the design of the study and data analysis. Scovia Mbabazi (SM) made the final proof reading and editing.

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Figures

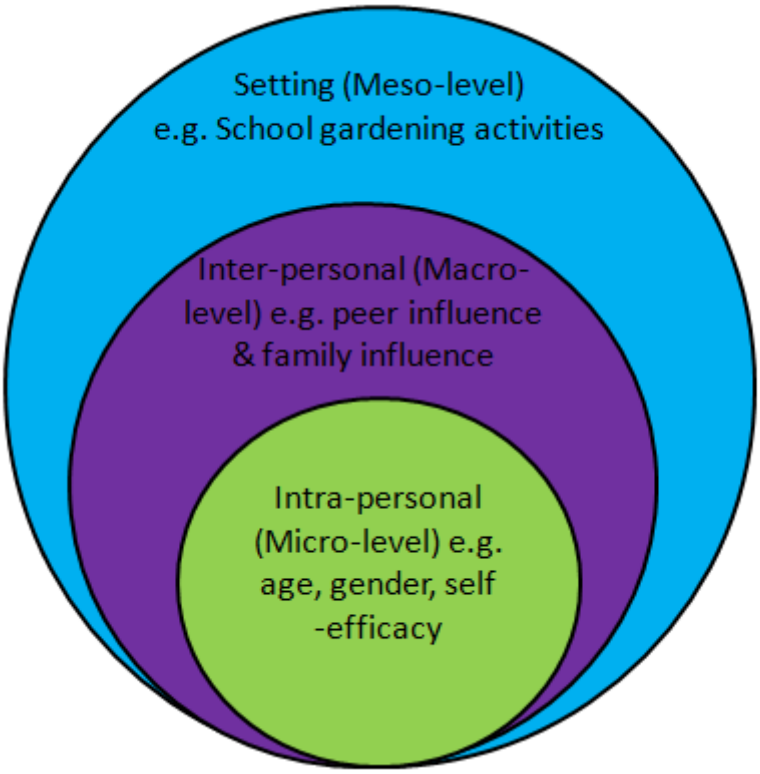

Figure 1

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