



## Relationship Between School Gardening and Self-Efficacy Towards Weekly Fruit & Vegetable Intake



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### ABSTRACT

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, another not. The study followed a cross-sectional study design employing quantitative research methods. The target population comprised of late adolescents 18-22 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. Data was analyzed by using Mann Whitney U test, Pearson Rank Correlation, Odds ratio and test of proportion. The mean ages of the girls and boys in the school exposed to gardening activities were  $19.10 \pm 1.4$  and  $19.2 \pm 2.86$  respectively while those for students in the unexposed school were  $18.62 \pm 1.21$  and  $19.11 \pm 1.29$  respectively. The study had more males (56.3%) than females (43.7%). Neither group met the World Health Organization (WHO), Food and Agricultural Organization (FAO) and United States Department of Agriculture (USDA) recommendation of  $\geq 35$  servings per week ( $\geq 5$  servings per day) for both fruits and vegetables consumption. However, the exposed students had more weekly servings of fruits and vegetables ( $P > 0.05$ ) and had higher self-efficacy towards dietary intake of fruits and vegetables ( $P = 0.007$ ). School garden based intervention can significantly improve student's self-efficacy towards fruit & vegetable dietary intake increasing the weekly consumption of fruits and vegetables. The findings of the study will inform policy makers on the role of school gardens in enhancing fruit and vegetable intake by in-school adolescents as they develop the Uganda's school health policy.

**Keywords:** Self-efficacy, School gardening, Fruit & vegetable.



## 1 Introduction

Suboptimal fruit and vegetable intake may increase chances of development of obesity, increased risk of type II diabetes mellitus (T2DM), increased visceral fat, liver fat, and insulin resistance [1]. Moreover, inadequate fruit and vegetable consumption accounts for 6.7 million deaths globally from non-communicable diseases [2] in adults with history of unhealthy eating early in life [3]. 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 [4].

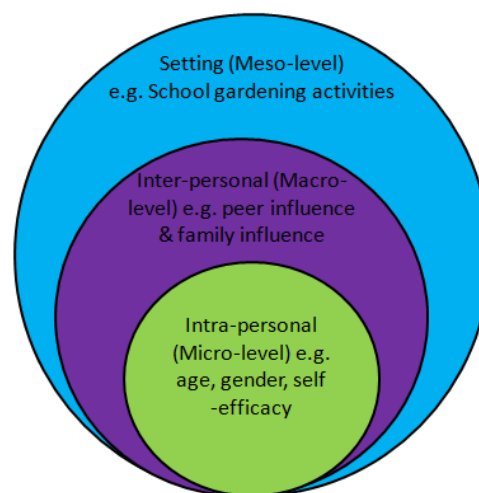
Self-efficacy as a key determinants of weekly dietary intake of fruits and vegetables among school going adolescents has also been reported by Landry BS *et al.*, [5], Davis & Spaniol [6] and Laurie, Faber, & Maduna [7]. Consequently, any intervention targeting self-efficacy as a determinant of health promotion practice is paramount in improving weekly fruit and vegetable consumption [8].

Students' confidence towards weekly intake of fruits and vegetables can be enhanced by hands on activity through getting involved in gardening activities. Landry BS *et al.*, [5] reported that school gardens increase the confidence of eating vegetables and ultimately increases the weekly dietary intake of fruits and vegetables. The choice of food and dietary habits are shaped early in life [5] and hence, hands on activities like cooking and gardening during school times will largely contribute to the confidence later in life to take fruits and vegetables. Increases in gardening behaviors significantly predicts increased dietary fiber intake [5]. Exposure of students to vegetables and fruits through their preparations including gardening and cooking increases students' self- efficacy, motivation and attitude towards their daily fruit and vegetable intake [9].

Exposure to a wider range of vegetables and fruits through gardening activities has also been observed to increase student's self-confidence/self-efficacy towards routine fruit and vegetable consumption [10]. Students are attracted to fruits because of their color, scent [6]. 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 [11] reported improved self efficacy towards the intake of fruits and vegetables among the gardening group than the control group.

However, Landry M] *et al.*, [1] 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, ealier studies by Ding *et al.*, [12] and Gannan *et al.*, [4] 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. Moreover, home environment in terms of parental encouragement, parent's level of education, family rules, parental consumption of fruits and vgetables that had a strong bearing on self-efficacy of the child's routine intake of fruits and vegetables [13].

Although accesibility, availability, parental encouragement, home environment, cooking, have been reported to influence dietary intake of fruits and vegetables among children and youth [13, 14, & 15], the influence school gardening on the adolescents' self-efficacy towards dietary intake of fruits and vegetables has been reported with concordances and contradictions. Thus, the present study sought to understand the relationship between school garden and self-efficacy of students towards 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

## 2 Materials and Methods

### 2.1 Study subjects and methods

The descriptive cross-sectional study conducted between June 2019 and February 2020 used a random sample of 355 high school students (185 exposed to gardening and 170 unexposed to gardening) aged 18-22 from two Ugandan secondary schools purposively selected; one with students actively involved in school gardening activities while another not. Students below 18 years 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.

### 2.2 Data collection Methods and Instruments

Self-administered questionnaire with four sections; first on demographic characteristics, second on self-efficacy, third on influence of home and school on the efficacy towards intake of fruits and vegetables and fourth on weekly intake of fruits and vegetables was used to collect data. Students were given a period of 30-45 minutes to answer the questions independently under the supervision of the researcher. After this time the questionnaires were collected from the participants and kept until further use during analysis. 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.*, [16]. The previously validated tool for self-efficacy related to fruits and vegetable consumption for adolescents aged 11-19 by Hagler *et al.*, [17], Bandura, [18], and Sharma *et al.*, [19] was adopted. 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 [20]. This was designated the influence of gardening activities on fruit/vegetable intake at school questionnaire (FVSQ) (Table 1)

**Table 1:** Outcome variables, questionnaire items, response options and ranges

Outcome variable	Questionnaire item	Response options	Actual range
Fruits/vegetables daily/weekly intake	How often do you eat vegetable salads of any type?	Never=0,	0-35 times
	How often to eat cooked/steamed greens?	Once a day=1,	
	How often do you eat raw vegetables e.g. carrot or cucumber?	Thrice a day=3,	
	How often do you eat beans?	5times a day=5,	
	How often do you eat Tropical fruits e.g. guava, mango, pineapple?	Once a week=7,	
	How often do you eat berries e.g. straw, raspberries, & blue berries?	Thrice a week=21,	
	How often do you eat hand fruits e.g. bananas, apples, grapes?	5times a week=35	
	How often do you eat citrus fruits e.g. oranges, tangerines		
	How often do you eat avocados?		
	How often do you eat melons?		
General Self efficacy	rather than chips as a snack	I don't think=0	0-4
	rather than ice cream as a dessert	Not sure=1	
	three times a day	May be=2	
	every breakfast	I think=3	
	every lunch	Definitely I can =4	
	every dinner fast		
"I think I can" eat F & V	at least 2 times a day		0-4
	rather than chips as a snack because We grow F&V at school		

Self efficacy and school gardening  “I think I can” eat F & V	rather than chips as a snack because I’m involved in gardening at school	Strongly agree=4 Agree=3 Uncertain=2 Disagree=1 Strongly disagree=0
	rather than chips as a snack because my desired fruits and vegetables are available in the school garden	
	3 times a day because We grow F&V at school	
	3 times a day because I’m involved in gardening at school	
	3 times a day because my desired fruits and vegetables are available in the school garden	
	every dinner because We grow F&V at school	
	every dinner because I’m involved in gardening at school	
	every dinner because my desired fruits and vegetables are available in the school garden	

### 2.3 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.

### 2.4 Data management, processing, analysis and ethical issues

The Likert scale was used to grade the response depending upon the level of agreement with the question asked. The weekly intake ranged from 0-35 times a week from which the weekly intake was computed for the two groups. The continuous data was presented as mean  $\pm$  standard deviation whereas categorical data was presented as frequency as well as percentage. For analysis the data was exported to Medcalc software which was used to calculate the statistical parameters of Mann Whitney U test and the spearman Rank Correlation R and the test of proportion. The closeness of the data to normality was tested for using Shapiro-wilk test. All analyses were done at 95% level of significance and a  $P < 0.05$  was considered statistically significant. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all the participants gave written informed consent with voluntary participation.

## 3 Results

### 3.1 Demographics

The mean ages of the girls and boys in the school exposed to gardening activities were  $19.10 \pm 1.4$  and  $19.2 \pm 2.86$  respectively while those for students in the unexposed school were  $18.62 \pm 1.21$  and  $19.11 \pm 1.29$  respectively. There were more boys exposed and unexposed to gardening (57.8% and 54.7% respectively) than girls in the respective cohorts (42.2% and 45.3% respectively) (Table.2)

**Table 2:** 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 $\pm$ SD			
Boys	$19.11 \pm 1.29$	$19.2 \pm 2.86$	
Girls	$18.62 \pm 1.21$	$19.10 \pm 1.4$	

Continuous data is presented as Mean  $\pm$  SD. Categorical data is presented as frequency (%).

### 3.2 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 3)

**Table 3:** Mean weekly consumption of fruits and vegetables among the exposed and unexposed students

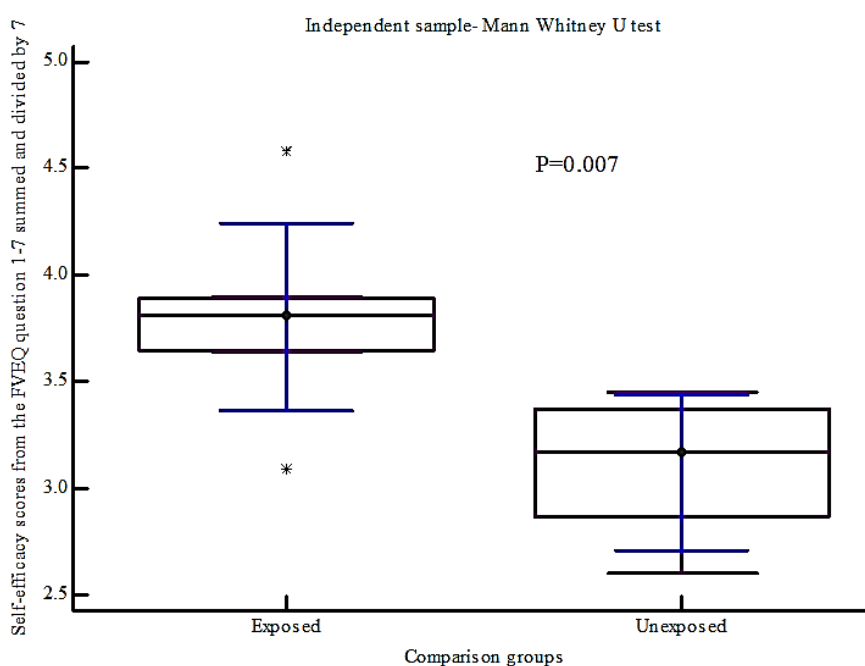
	Mean Fruit intake	Mean Vegetable intake	Total	OR	P-value	95%CI
Unexposed	8	6	14			
Exposed	9	7	16			
Total	17	13	30	1.037	0.9607	0.2267 to 4.1018

OR: Odds ratio; CI: Confidence Interval

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)

### 3.3 Self-efficacy and dietary intake of fruits and vegetables

Analysis of the overall differences in the mean self-efficacy scores among the students exposed to gardening was done Man Whitney U test. Our results reported higher mean self-efficacy scores pertaining weekly fruit and vegetable intake among the exposed students than those who are not exposed ( $P=0.007$ ) (Figure 2)



**Figure 2:** Mean self-efficacy scores on weekly consumption of fruits and vegetables among the exposed and unexposed students to gardening program

On analysis of the participants' responses on self-efficacy statements pertaining fruit and vegetable intake, of the 185 exposed students, 102 (55.1%) of the exposed group had higher self-efficacy in consuming a fruit or a vegetable as a dessert rather than ice cream compared to 70 (41.2%) unexposed students who would choose an ice cream as a dessert at the expense of the fruit/vegetable ( $P=0.009$ ). Moreover, 56 (30.3%) of the students in the exposed group were confident that they would eat a fruit/vegetable every breakfast compared to 30 (17.6%) with a similar intention in the unexposed group ( $P=0.005$ ).

**Table 4:** Self-efficacy of students towards weekly consumption of fruits and vegetables

Self-efficacy	I don't think			I think			Definitely I can		
	Exposed, n (%)	Unexposed, n (%)	P value	Exposed, n (%)	Unexposed, n (%)	P value	Exposed, n (%)	Unexposed, n (%)	P value
I can eat F/V rather than chips as a snack	59 (30.3)	75 (44.1)	0.007*	27 (14.6)	18 (10.6)	0.259	97 (52.4)	77 (45.3)	0.182
I can eat F/V rather than ice cream as a dessert	56 (30.3)	67 (39.4)	0.072	26 (14.1)	33 (19.4)	0.181	102 (55.1)	70 (41.2)	0.009*
I can eat F/V 3 times a day	89 (48.1)	93 (54.4)	0.236	31 (16.6)	30 (17.7)	0.784	64 (34.6)	46 (27.1)	0.128
I am certain I can eat F/V every breakfast	87 (47.0)	90 (52.6)	0.293	41 (22.2)	36 (21.2)	0.819	56 (30.3)	30 (17.6)	0.005*
I am certain I can eat F/V every lunch	95 (51.4)	112 (65.9)	0.006*	23 (12.4)	10 (5.9)	0.035	66 (35.7)	47 (27.6)	0.102
I am certain I can eat F/V every dinner	94 (52.4)	115 (67.6)	0.004*	42 (22.7)	25 (14.7)	0.055	59 (32.9)	30 (17.6)	0.001*
I can eat F/V 2 times a day	70 (37.8)	91 (53.5)	0.003*	39 (21.1)	29 (17.1)	0.340	75 (40.5)	50 (29.4)	0.003*

\*Significant at  $< 0.05$ , Categorical data is presented as frequency (%).

Again, 59 (32.9%) of the exposed students were confident that they could eat a fruit/vegetable every dinner as opposed to 30 (17.6%) in the unexposed group ( $P=0.001$ ). Similarly, 75 (40.5%) in the exposed school were confident that they eat fruits/vegetables a day compared to 50 (29.4%) in the unexposed school ( $P=0.003$ ) (Table 4).

Similarly, of the 170 unexposed students to gardening activities at school, 75 (44.1%) of the students would go for chips rather than the fruits and vegetables whereas only 59 (30.3%) in the exposed group could opt for chips rather than a fruit or vegetable as opposed ( $P=0.007$ ). Additionally, 115 (67.6%) of the unexposed students were not confident whether they could eat fruits/vegetables every dinner as opposed to only 94 (52.45%) in the exposed group who lacked the corresponding confidence (0.004). Finally, 91 (53.5%) of the unexposed students were not confident whether they could eat fruits/vegetables two times a day as opposed to only 70 (37.8%) in the exposed group ( $P=0.003$ ) (Table 4).

### 3.4 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. 5). 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 5:** 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
	P=0.048*	p=0.004*	p=0.005*
I am involved in gardening	R=0.156	R=0.1935	R=0.133
	p=0.034*	p=0.008*	p=0.070
My desired fruits are present in the school garden	R=0.174	R=0.205	R=0.163
	P=0.018*	p=0.005*	p=0.026*

\*Significant at &lt; 0.05, R: Pearson's Rank Correlation Coefficient

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 ( $P=0.004$ ), are involved in gardening ( $P=0.008$ ) and their desired fruits are present in the school garden ( $P=0.005$ ). 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 ( $P=0.005$ ) and their desired fruits are present in the school garden ( $P=0.026$ ). Though the correlations are weak, they were all positive correlations suggesting that eating fruits and vegetables rather than a snack like chips, three times a day or every dinner were positively correlated with growing fruits and vegetables at school, being involved in gardening as well as presence of desired fruits and vegetables in the school garden ( $P<0.05$ ). The exception to the general trend was the involvement in the school garden and eating fruits and vegetables every dinner ( $P>0.05$ ).

#### 4 Discussion

This investigation of over 350 high school students aged 18-22 provides evidence on gardening experience and self-efficacy towards weekly fruit and vegetable intake. To the authors' knowledge, this is the first report to examine the association between gardening experience and students' self-efficacy towards weekly FV in Uganda. Interestingly, despite the cross-sectional nature of this investigation, findings are largely consistent with those of long-term, intervention-based studies among adolescents elsewhere [13, 21 and 22]. Our participants did not meet or exceeded the World Health Organization (WHO) and Food and Agricultural Organization (FAO) recommended intake of fruits and vegetables [39]. The school that exposed students to gardening activities and served students with fruits and vegetables had higher mean 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. [23] who established that serving fruits and vegetables during meals enhances the adolescent's intake of fruits and vegetables.

Overall, students exposed to gardening activities were more confident and had higher self-efficacy than the control group pertaining weekly fruit and vegetable intake ( $P=0.007$ ). Self-efficacy is the confidence an individual has for behavioral change to achieve a desired outcome and it is an important variable in the study of behavioral changes [24]. According to socio-ecological model 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 children which in turn influence health behaviors [25]. Seon-Ok Kim & Sin-Ae Park [25] also established that those children with high dietary self-efficacy for fruit and vegetable identification skills and exposure are more likely to consume fruits and vegetables more frequently than their counterparts without exposure to gardening activities. This has also been earlier reported in studies by [26, 27] in their case-control study when 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. Students exposed to gardening activities in our study were more confident of consuming fruits and vegetables as a dessert rather than ice cream ( $P=0.009$ ), eating a fruit/vegetable every breakfast ( $P=0.005$ ), every dinner as opposed to ( $P=0.001$ ) and twice a day ( $P=0.003$ ) as opposed to the gardening naïve group. Moreover, the students in the unexposed school to school gardening activities had lower self-confidence and lower self-efficacy towards weekly fruit and vegetable intake and would go for chips rather than the fruits and vegetables ( $P=0.007$ ), were not confident whether they could eat fruits/vegetables every dinner ( $P=0.004$ ) and two times a day ( $P=0.003$ ) as opposed to those exposed to gardening activities. According to the socio-ecological model, self-regulation and Self-confidence influence behavioral change such as better health promotion practice.

These findings are consistent with earlier reports that highlighted the importance of self-efficacy in improved fruit and vegetable intake [26, 28]. However, the study by Landry M] *et al.*, [1] did not establish a significant relationship between enhanced self-efficacy and gardening activities in improving dietary intake of fruits and vegetables. Similarly, Keyte *et al.* [29] did not establish 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 [29] used pre-adolescents but our study and Bere *et al.*'s study [40] used adolescents as the study subjects. Again, the study by Philip *et al.*, [30] on the impact of nutrition education with and without a school garden on knowledge, vegetable intake and self-efficacy found no differences in fruit or vegetable intake. This was also in agreement with the studies by Jaenke *et al.*, [31] who reported no changes in fruit and vegetable intake as a result of a school gardening program. A related study by Kothe *et al.*, [32], who examined the efficacy intervention on fruit and vegetable consumption did not discover behavior change related to 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.*, [30] used 24-hour recalls to measure fruit, vegetables or combined fruit and vegetables consumption, Kothe *et al.*, [32] used a three day food diary while Jaenke *et al.*, [31] 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.*, [30] 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 adolescent's self-efficacy towards weekly fruit and vegetable intake was also investigated in our study. Our findings showed that students exposed to gardening had higher self-efficacy towards weekly intake of fruits and vegetables. This is consistent with findings reported by Davis & Spaniol [6] and Oxenham, E.; King [33] who reported that school gardens increase the confidence of adolescents towards weekly eating of fruits and vegetables. Neumark-Sztainer *et al.*, [3] reported that the choice of food and dietary habits are shaped early in life and hence, hands on activities during adolescence will largely contribute to the confidence later in life to take fruits and vegetables consistent with the findings of the current study. Heneman *et al.*, [34] highlighted that self-efficacy can be increased by providing hands-on learning experiences and effective problem-solving skills.

Cockroft *et al.*, [35] 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 self-efficacy to intake of fruits and vegetables observed in the current study has been explained elsewhere. Davis & Spaniol [6] reported that adolescents have higher self-efficacy for weekly intake of fruits and vegetables because of their color, scent and hence more attractive. However,



Morgan *et al.*, [36], Jaenke *et al.*, [31] and Kothe *et al.* [32] did not establish the relation between enhanced self-efficacy and gardening activities. Moreover, the color of the fruits and vegetables has been reported to indicate nutrient richness. Specifically, red and orange fruits and vegetables are rich in vitamin A and carotenes, which act as anti-oxidants [37].

Empowerment of adolescents through gardening activities improves their skills and knowledge to grow fruits and vegetables which is a key motivator of change in self-efficacy of adolescents [38]. Landry BS *et al.*, [5] reported a strong correlation between having a direct experience with growing food and the children's understanding of food as well as its relationship to health. This has been explained elsewhere [6] who highlighted the potential of student's hands on during garden activities in enhancing their knowledge, having a positive attitude and a high self-efficacy towards health eating and is in agreement with our study. Consequently, the phobia on fruit and vegetable intake by children can be demystified through hands on activities like school gardening which have a profound potential to improve the students' self-efficacy towards eating fruits and vegetables. The lack of statistical significance in the correlation between involvement in the school garden and eating fruits and vegetables every dinner ( $P > 0.05$ ) can be explained by the lack of exposure to fruits and vegetables by students at home because all our students were day students as recently explained by Landry BS *et al.*, [5]. Finally, Uganda has just launched her new curriculum for secondary schools with emphasis on student-centered learning. Thus, there is hope for the better in line with improvement of the learners' capacity to consume fruits and vegetables if school gardens are launched to expose learners to fruits and vegetables in subjects like Biology, Agriculture, Food science and nutrition among others.

## 5 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, Food and Agricultural Organization (FAO) and World Health Organization (WHO) of  $\geq 35$  servings per week. However, students engaged in gardening had relatively higher weekly intake than their counterparts. Generally, school gardening improves the confidence of students towards routine dietary intake of fruits and vegetables. Thus students exposed to gardening were more confident that they could eat fruits and vegetables rather than snacks, every breakfast, every dinner and three times a day. Moreover, students not exposed to gardening lacked self-confidence towards eating fruits and vegetables at the expense of ice cream, every breakfast and every dinner. To the best of our knowledge, this is the first study in Uganda to evaluate the effect of school gardening activities in enhancing the student's self-efficacy towards fruit and vegetable intake. Unfortunately, in Uganda most of the attention in schools has been focused on achieving good academic scores and school gardening activities have been ignored since they are perceived as a waste of time. No wonder, many children in urbanized areas of our country are obese due to increased consumption of junk food both at home and at school which are rarely supplemented with dietary fibers. The findings of our study should act as an eye opener to all policy makers teachers, school heads and students to orientate some efforts towards gardening at school no matter whether space constrained or not but working within each school's reach using concepts of urban farming. This comes at a time when the school health policy in Uganda is under discussion. Consequently, health promotion practices like school gardening activities particularly in areas of horticulture should be incorporated in the policy to enhance health eating.

## 6 Declarations

### 6.1 Study Limitations

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.

## 6.2 Acknowledgments

We are grateful the staff of the faculty of science Uganda Martyrs University for the technical support.

## 6.3 Ethical Approval

The research and ethics committee (REC) of Mild May Uganda approved the research project under the reference number of REC REF 0103-2019.

## 6.4 Informed Consent

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.

## 6.5 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.

## 6.6 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. Kavuma David (**KD**) and Scovia G. Mbabazi (**SGM**) made the final proof reading and editing.

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