



ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

CENTER FOR FOOD SCIENCE AND NUTRITION

Effectiveness of selling fruits in pieces or in bulk in improving fruit consumption of high-school students: A cluster randomized controlled trial in urban setting of Ethiopia

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OCTOBER, 2019
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ABSTRACT

Background: Diets high in fruits and vegetables are widely recommended for healthier life. Fruits have historically held a place in dietary guidance because of their concentrations of dietary fiber, vitamins, minerals, electrolytes; and more recently phytochemicals, especially antioxidants. However, fruit consumption in Ethiopia is very low. The barriers and enablers affecting consumer behavior towards fruits consumption including price, preference, quality, safety and access are largely undocumented; hence, making it difficult to design effective interventions that improve consumption of fruits. For example, fruits are sold around some schools, but the minimum amount that one can buy is half a kilogram. This may discourage students from buying fruits as a snack and may contribute to the purchase of sweets and biscuits that are more affordable to them.

Objective: The objective of this study was to evaluate whether selling fruits in pieces improves consumption and volume of sale than the current practice of selling fruits in bulk (kilogram).

Methodology: A cluster randomized controlled trial was conducted from April through June 2019 in selected schools of Addis Ababa, Ethiopia. A double population proportion for cluster randomized trial was employed to calculate the sample size. After adding 5% non-response rate, the total sample size was estimated to be 369. Data were collected on socio-demographic information, fruit consumption pattern, volume of sale per day and other variable that determine fruit consumption pattern by using semi structured and pre tested tool. EPI data version 4.2.0 was used to code, enter and clean the collected data. Data were analyzed using SPSS version 20 and SAS version 9.4. Descriptive statistics were used to describe variables in relation to the outcome. Mixed-effect linear regression was employed to see the impact of intervention. We used unstructured variance matrix structure to estimate the parameters of the random intercept. All tests were two-sided and $P < 0.05$ was considered statistically significant. We report the parameter estimates with 95% CI and standard errors (SE).

Result: Out of 157 participants in the intervention group 80 (51%) and 77 (51%) were male and female respectively. In the control group, 65(37.6%) and 108 (62.4%) were male and female respectively. The mean (SD) age of intervention and control group was 15.9 (1.2) and 17 (1.06) respectively. With regards to a one-week recall fruit consumption, Banana consumption was 82% in the intervention group when compared with 65% of control ($P < 0.001$). Water melon and

mango consumption was also higher in intervention group with proportion of 12.7% and 61.1% in comparison with 4% and 44.5% ($P<0.001$ and $P=0.003$) of intervention VS control group respectively. The mixed effect linier regression output showed that there was a statistically significant difference in fruit consumption between intervention and control group ($\beta=0.853$, $p=0.001$). But the intervention has the same impact throughout the time of intervention ($\beta=-0.138$, $p=0.371$) and ($\beta=-0.04$, $p=1.00$) in round one and two. More over pocket money has no interaction with the effect of the intervention ($\beta=0.145$, $p=0.686$). Volume of sale in intervention arm was around 22 kg per day compared to 16 kg in control arm at the final observation.

Conclusion: Selling fruit in pieces has showed a significant increment in overall fruit consumption of high school adolescents. In addition, the study revealed that consumption of fruits like banana, orange, mango and strawberry has showed improvement in the intervention arm. The study also showed that there was a change in volume of sale in the intervention arm than the control group. However, fruit consumption based on a 24-hour recall fruit frequency data didn't bring a statistically significant effect among adolescents.

Key words: Fruits, Adolescent, Market intervention, Randomized trial, Addis Ababa

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Abbreviation/ Acronyms

A4NH: Agriculture for Nutrition and Health

AAU: Addis Ababa University

CSA: Central Statistical Agency

DASH: Dietary Approaches to Stop Hypertension

DID: Difference in Difference

ETB: Ethiopian Birr

FGD: Focused Group Discussion

F&V: Fruits and Vegetables

IRB: Institutional Review Board

MND: Micronutrient Deficiencies

NCDs: Non-Communicable Diseases

USD: United States Dollar

WHO: World Health Organization

1. Introduction

1.1 Background

Fruits and vegetables (F&V) are important components of a healthy diet. Reduced fruit and vegetable consumption are linked to poor health and increased risk of non-communicable diseases (NCDs). A diet rich in vegetables and fruits can lower blood pressure, reduce the risk of heart disease and stroke, prevent some types of cancer, lower risk of eye and digestive problems, and have a positive effect upon blood sugar, which can help keep appetite in check. Eating non-starchy vegetables and fruits like apples, pears, and green leafy vegetables may even promote weight loss. Their low glycemic loads prevent blood sugar spikes that can increase hunger. According to a global study on F&V consumption, an estimated 5.2 million deaths worldwide were attributable to inadequate fruit and vegetable consumption in 2013 (Slavin *et al.*, 2012)

In addition to including fruits and vegetables as part of the daily diet to reduce the risk of some NCDs, evidences suggest that when consumed as part of a healthy diet low in fat, sugars and salt/sodium, it may also help to prevent weight gain and reduce the risk of obesity, an independent risk-factor for NCDs. Moreover, fruits and vegetables are rich sources of vitamins and minerals, dietary fiber and a host of beneficial non-nutrient substances including plant sterols, flavonoids and other antioxidants and consuming a variety of fruits and vegetables helps to ensure an adequate intake of many of these essential nutrients (Melaku *et al.*, 2016) (Bazzano *et al.*, 2002). At least nine different families of fruits and vegetables exist, each with potentially hundreds of different plant compounds that are beneficial to health. Eating a variety of types and colors of produce in order to give your body the mix of nutrients it needs. This not only ensures a greater diversity of beneficial plant chemicals but also creates eye-appealing meals (Melaku *et al.*, 2016) (Slavin *et al.*, 2012).

In addition to having significant contribution to the prevalence on NCDs in adults, diet that doesn't contain F & V (diet having low concentration of vitamin and mineral) contribute for significantly higher deficiency disorder during childhood. Micronutrient deficiencies (MND) in children are known to have short term impacts that lead to serious long-term complication when they become adult. This impact highly affects not only the health of the population but also the

economy, growth potential and social function of the country and the region as a whole (Melaku *et al.*, 2016) (Wieser *et al.*, 2013).

This high prevalence of MND as a result of poor-quality diet could be due to different factors like poor knowledge on the importance of food diversity that affect the preference of the household, the income level and the market price and many more factors. Childhood and adolescence are at unique periods of growth and development. In spite of this, they are major group of the population that are affected by MNDs. In addition to maturing physically, children and adolescents begin to make independent choices about when, where, and what they eat. Good nutrition during childhood and adolescence plays a key role in ensuring adequate growth and development, preventing the long-term risk of obesity and other chronic disease, and enhancing overall health and well-being (Martin, 2009) (McLean *et al.*, 2008) (Wieser *et al.*, 2013).

1.2 Statement of the problem

Diets high in fruits are widely recommended for healthier life (Just *et al.*, 2012). Fruits have historically held a place in dietary guidance because of their concentrations of dietary fiber, vitamins, minerals, electrolytes; and more recently phytochemicals, especially antioxidants (Slavin *et al.*, 2012). Due to these health promoting constituents, fruits and vegetables play an important role in the prevention of chronic diseases such as cancer, type 2 diabetes, and cardiovascular diseases (Melaku *et al.*, 2016). However, fruit and vegetables consumption in Ethiopia is very low. In 2011, the average household consumed 45 kg of F&V per adult equivalent (Worku *et al.*, 2017). This level is among the lowest in sub-Saharan Africa (Ruel *et al.*, 2005) and is far from meeting the World Health Organization (WHO) recommendation of 146 kg per year.

Despite current recommendations and the apparent health related benefits, the National food consumption survey showed that children have intakes below the recommended amounts of vitamins and minerals such as vitamin A, zinc, calcium, and in just children: iron (EPHI, 2013). According to the 2016 Ethiopian demographic and health survey significantly higher proportion of children are affected by micro nutrient deficiency (CSA, 2016). This is also supported by a study conducted in Kemkem and Fogera Districts, Amhara Regional State to determine the nutritional status of the population. According to this study, more than two thirds of the school-aged children (79.5%) had at least one MND and 40.5% had two or more coexisting micronutrient deficiencies. The most prevalent deficiencies were of zinc (12.5%), vitamin A (29.3%) and vitamin D (49%). Majority of which is mainly due to low intake of fruits and vegetable (Herrador *et al.*, 2014)

Several studies have shown that children's intake of fruit and vegetable tracks into adolescence and that those food preferences and eating habits established in childhood and adolescence tend to be maintained into adulthood. Therefore, interventions aiming at fruit and vegetable promotion in adolescents may be an effective way for reducing the burden of chronic disease. This makes increasing fruit and vegetable consumption among children and adolescents an important public health issue (Gosliner, 2014) (Ishdorj *et al.*, 2013) (Namenek *et al.*, 2013) (Taylor *et al.*, 2013).

Fruit consumption is far lower than the recommended amount due to poor knowledge, preference of the household, income level and most importantly the market price. The barriers and enablers affecting consumer behavior towards F&V consumption including price, preference, quality, safety and access are largely undocumented; hence, making it difficult to design effective interventions that improve consumption of F&V (Ishdorj *et al.*, 2013) (Melaku *et al.*, 2016). However, one key barrier could be the way fruits are sold around the city. For example, fruits are sold around some schools, but the minimum amount that one can buy is half a kilogram. This may discourage students from buying fruits as a snack and may contribute to the purchase of sweets and biscuits that are more affordable to them. Furthermore, whether selling fruits by piece increase the consumption of fruits in schools remains unknown. Therefore, the objective of the present study was to evaluate whether selling fruits in pieces improves fruit consumption and volume of sale than the current practice of selling fruits in bulk/kilograms.

1.3 Rationale of the study

Despite low F&V consumption and associated adverse health related outcome (Melaku *et al.*, 2016), associated factors affecting consumer behavior towards F&V consumption are largely undocumented. Due to this reason sustainable food-based intervention strategy that consider cost factor which will encourage consumption has to be adopted. Thus, cost-effective approaches to help large and diverse segments of the population to eat more fruits and vegetable are needed. To improve this best intervention is to look into different market strategy.

Moreover, the study focused on adolescents due to the fact that food habits are still developing during childhood and adolescence. For this reason, it is important to help young people adopt healthy eating behaviors in order to improve longer term health outcomes. Although individual factors such as food preferences play an important role, there is an increasing awareness that children's eating behaviors are influenced by environmental factors as well. In addition to the home environment and parental influence, the school environment is recognized as contributing to the eating habits of children (Ishdorj *et al.*, 2013) (Namenek *et al.*, 2013). Considering most children and adolescent spend the majority of their weekdays at school and obtain, on average, more than one-third of their daily caloric intake from foods consumed at school during the

school year, schools are a natural place to implement policies that promote healthy eating habits (Ishdorj *et al.*, 2013) (Namenek *et al.*, 2013 (14-17) (Taylor *et al.*, 2013).

1.4 Potential impact of the study: This study explored potential market strategy that will increase fruit consumption of adolescents which will in turn results healthier life. Consumption of fruit and vegetable reduce the prevalence of Micronutrient deficiency and future risk of NCD.

2. Objective

2.1 General objective

- ❖ To evaluate whether selling fruits in pieces improves fruit consumption of adolescents and volume of sale than the current practice of selling fruits in bulk (kilograms).

2.2 Specific Objectives

- ❖ To investigate if piece selling of fruits around school has an effect on fruit consumption of high school adolescents.
- ❖ To explore if piece selling of fruit and vegetable could improve volume of sale than the current practice of selling fruits in bulk/kilograms.

3. Literature review

3.1 Role of fruits

The earliest definition of a fruit was “any plant used as food,” and a vegetable was a “plant, as opposed to an animal or inanimate object”. Botanically speaking, fruit is a seed-bearing structure that develops from the ovaries of a flowering plant, whereas vegetables are all other plant parts such as root, stem and leaves. The outlook is totally different in culinary terms, however. A lot of food that are (botanically speaking) fruits, but which are savories rather than sweet are typically considered vegetables by chefs. Diets high in fruits and vegetables are widely recommended for their health-promoting properties. Fruits and vegetables have historically held a place in dietary guidance because of their concentrations of vitamins, especially vitamins C and A; minerals, especially electrolytes; and more recently phytochemicals, especially antioxidants. Additionally, fruits and vegetables are recommended as a source of dietary fiber (Slavin *et al.*, 2012).

WHO report on global strategy on diet, Physical Activity and Health reported that approximately 16.0 million (1.0%) disability adjusted life years (DALYs, a measure of the potential life lost due to premature mortality and the years of productive life lost due to disability) and 1.7 million (2.8%) of deaths worldwide are attributable to low fruit and vegetable consumption. Adequate consumption of fruit and vegetables reduces the risk for cardiovascular diseases, stomach cancer and colorectal cancer (WHO, 2017). There is convincing evidence that the consumption of high levels of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity compared to low-energy foods such as fruits and vegetables (GBD, 2015).

Low fruit and vegetable intake is among the top 10 risk factors contributing to attributable mortality, according to evidence presented in World Health Report 2003. Fruits and vegetables as part of the daily diet could help prevent major non communicable diseases (NCD). Moreover, eating a variety of vegetables and fruits clearly ensures an adequate intake of most micronutrients, dietary fibers and a host of essential non-nutrient substances (WHO, 2009). More over low consumption of F&V is associated with micro nutrient deficiencies which are especially relevant in children since they are in a growth and development phase and have nutritional requirements that vary according to the stage of growth and that are greater and

clearly differentiated from those of adults (UNICEF, 2004). This high prevalence of MND as a result of poor-quality diet could be due to different factors like poor knowledge on the importance of food diversity that affect the preference of the house hold, the income level and the market price and many more factors. The findings from the large-scale price dataset collected monthly by the Central Statistical Agency (CSA) of Ethiopia in 116 urban retail markets across the country shows that the price of fruits and vegetables has risen by 40 percent (Worku *et al.*, 2017).

A recent WHO/FAO expert consultation report on diet, nutrition and prevention of chronic diseases, sets population nutrient goals and recommends intake of a minimum of 400 g of fruits and vegetables per day for the prevention of chronic diseases such as heart diseases, cancer, diabetes and obesity. The report states that there is convincing evidence that fruits and vegetables decrease the risk for obesity, and evidence that they probably decrease the risk of diabetes. Further, there is convincing evidence that fruit and vegetables lower the risk for CVD. (The report specifies that the tubers, e.g. potatoes, cassava, should not be included in fruits and vegetables) (WHO, 2017)._Most countries have their own dietary recommendations that include fruit and vegetables and health administrations, scientist and nutritionists all agree on the potential health benefits of daily servings of fruits and or vegetables in the prevention of a range of chronic diseases such as obesity, diabetes type II and cardiovascular ailments (Biró *et al.*, 2015). The recommended quantities vary from country to country. The actual intake is closely linked to socio-economic status and educational level. Some guidelines are based on food groups, whereas others provide recommended nutrient intakes, sometimes including nutrient supplementation (McLean *et al.*, 2008).

3.2 Fruit consumption and adolescence

Nutritional habits and food frequency consumption should be assessed in adolescents in school age. During this period of life, the adolescents usually stop listen to parents and teachers. They also change nutritional habits and select the food which is usually unhealthy. A study conducted by Wołowski and Jankowska in 2007 reported that adolescents do not frequently eat fruit and vegetables. Assessed students from Gdansk declared that 10 % of them have eaten fruit or drink fruit juice for breakfast. 67 % of students have eaten fruit as the snack and only 15.7 % consumed vegetables (Biró *et al.*, 2015).

Another study done by Urbańska and Czarniecka-Skubina in 2007 assessed the possibility of buying healthy food products in grocery shops located in schools (primary schools, secondary and high schools). They have found that in many shops' students could not buy fresh fruit or vegetables. It was seen that during the break's students consumed soft drinks, chocolate bars, and salty snacks. A study by Dzielska et al, performed under the program "Health Behavior in School-aged Children: A WHO Cross-National Collaborative Study" in years 2002-2006, with students in age 11-15 years found that consumption of fruit and vegetables decreased with age of children. Frequency of consumption of these products has depended also on economic status of family. Adolescents from families with lower income consumed fruit and vegetables rarely than students from families with higher incomes ((Dzielska *et al.*, 2008).

3.3 Prevalence of fruit consumption

A study on availability, affordability, and consumption of fruits and vegetables in 18 countries across income levels among 143 305 participants who reported plausible energy intake in the food frequency questionnaire showed that the mean fruit and vegetable intake was 3.76 servings (95% CI 3.66–3.86) per day. Mean daily consumption was 2.14 servings (1.93–2.36) in low-income countries (LICs), 3.17 servings (2.99–3.35) in lower -middle-income countries (LMICs) (Miller *et al.*, 2016).

According to the national food consumption survey report of Ethiopia, the overall fruit consumption is much less than 5%. The prevalence of fruit consumption in Addis Ababa was 3.8% and 10.1% for vitamin A rich and other fruits respectively (EPHI, 2013). Another community-based cross-sectional survey based on the WHO, NCD Stepwise approach which was conducted in the 9 regions and two city administrations (Addis Ababa and Dire Dawa) in Ethiopia among 10,260 study participants showed that the prevalence of fruit and/or vegetable consumption in Ethiopia was found to be (1.5%). The study also showed that more female than male ate fruit and vegetable in Ethiopia. When adjusted for included demographic and residence confounders (age, sex, location, income, education), those in rural area of residence ate ≥ 5 servings of fruits and vegetable [OR and (95% CI) [2.77 (1.60, 4.80)] than their counterparts (Gelibo *et al.*, 2017). Another study conducted in 9 regions of Ethiopia regarding availability and consumption of F&V also showed that overall, 38.1% and 36.5% of the Children studied did not eat vegetable and fruit in the week preceding the survey, respectively ((Demissie *et al.*, 2010). A

cross-sectional national population-based survey conducted in Kenya to determine the prevalence and social determinants of fruit and vegetable consumption among adults showed that overall, 38.1% and 36.5% of the children studied did not eat vegetable and fruit in the week preceding the survey, respectively (Pengpid *et al.*, 2018).

Fruit and vegetable consumption trends among adolescents from 2002 to 2010 in 33 countries showed that there was a positive trend in daily fruit and vegetable consumption among adolescents across most countries, but there is still room for improvement. It was recommended that a review of fruit and vegetable policies and initiatives across countries could help to explain the changes documented and help guide future strategies to increase fruit and vegetable intake among adolescents (Vereecken *et al.*, 2015).

A study conducted among Azerbaijan school adolescent on the prevalence and determinant of fruit and vegetable consumption showed that only one third (30.3% and 34.6%) of adolescents had the optimal consumption of fruit and vegetables, respectively. Compared to boys, girls recorded high level of fruits (35.7 % *versus*. 24.6%) and vegetables (36.2 % *versus*. 32.8%) intake. Male gender (OR =2.03, 95% CI= 1.04-2.52, P=0.030), employed mothers (OR= 2.11, 95% CI=0.92-3.88, p=0.083), high-fat foods (OR= 2.11, 95% CI=1.01-4.21, p=0.045), perceived emotional family support (OR=1.10, 95%CI= 1.01-1.15, p=0.014) and practical family support (OR=1.04, 95% CI =1. 10-1.11, p=0.029) showed significant relationship with low consumption of fruits and vegetables (Shokrvash *et al.*, 2010).

3.4 Barriers and enablers of fruit consumption

Current evidence regarding factors affecting fruits and vegetable consumption revealed that income, price and availability, consumer preference, home production and intra household decision making are important predictors of F&V consumption. Children and adolescent are among the population affected highly by low F&V consumption (Melaku *et al.*, 2016) (Slavin *et al.*, 2012) (Wieser *et al.*, 2013) (Ruel *et al.*, 2005).

Many barriers prevent adequate consumption of fruits and vegetables including lack of knowledge about health benefits, availability, cost, individual taste preferences, social support, preparation skills, and time available for preparing food. Studies also show disparities in access to fruits and vegetables as measured by type of stores, geographic distance, or store

concentration. Choosing healthy foods is difficult in environments where retail establishments are comprised mainly of convenience stores and fast food restaurants or for individual's dependent on public transportation for supermarket access (BCH TA manual, 2008).

A study conducted in Australia to determine whether socio-economic groups differ in their fruit and vegetable consumption, and the variety eaten, and whether socio-economic differences are similar for adolescents and adults. The study also examined whether socio-economic groups vary in their reported desire to increase the amount of fruit and vegetables consumed, and the perceived barriers to achieving this. According to this study among adolescents and adults, fruit and vegetable consumption was positively related to income (Giskes *et al.*, 2002).

A review of the literature on determinants of fruit and vegetable consumption among children and adolescents showed that factors like age, gender, socio-economic position, preferences, parental intake, and home availability/accessibility are determinant to fruit and vegetable consumption. According to these many studies in the review, girls and younger children tend to have a higher or more frequent intake than boys and older children. Socio-economic position, preferences, parental intake, and home availability/accessibility are all consistently positively associated with intake (Rasmussen *et al.*, 2006).

A study conducted to assess food environment and fruit and vegetable intake in urban population in Brazil showed that higher fruit and vegetables intake scores were observed in neighborhoods with higher density of healthy food outlets and higher income. Lower scores were observed in neighborhood with higher density of unhealthy food outlets. These associations were adjusted by individual variables such as gender, age, physical activity, sugar sweetened beverages consumption, education level and smoking ((Pessoa *et al.*, 2015).

Another study conducted to determine fruit and Vegetable Intake in Adolescents: Association with Socioeconomic Status and Exposure to Supermarkets and Fast Food Outlets showed the same findings. High fast food outlet exposure was marginally significant for low fruit intake in low social class children only. Children from middle and low social class backgrounds attending schools with combined high fast food outlet/low supermarket exposure were most likely to report infrequent fruit intake (OR 1.60; CI: 1.02–2.45; OR = 1.40; CI: 1.03–1.90) (Svastisalee *et al.*, 2012).

A study conducted to assess attitudes toward fruit and vegetable consumption and farmers' market usage among Low-Income North Carolinians among 341 eligible individuals from 14 counties showed that the most commonly cited barriers to eating F&V were cost (26.4%) and not having time to prepare F&V (7.3%). Facilitators included access to affordable locally grown F&V (13.5%) and knowledge to quickly and easily prepare F&V (13.2%) (Leone *et al.*, 2012).

3.5 Interventions to improve fruit consumption

The CDC Guide to Strategies to Increase the Consumption of Fruits and Vegetables include 10 strategies. Strategy one is to promote food policy councils as a way to improve the food environment at state and local levels. The second one is improving access to retail stores that sell high-quality fruits and vegetables or increase the availability of high-quality fruits and vegetables at retail stores in underserved communities. Third strategy is to start or expand farm-to-institution programs in schools, hospitals, workplaces, and other institutions. The fourth is start or expand farmers' markets in all settings. Fifth, start or expand community supported agriculture programs in all settings. Sixth, ensure access to fruits and vegetables in workplace cafeterias and other food service venues. Seven is to ensure access to fruits and vegetables at workplace meetings and events. The eighth strategy is to support and promote community and home gardens. Ninth is to establish policies to incorporate fruit and vegetable activities into schools as a way to increase consumption. The last and the 10th is to include fruits and vegetables in emergency food programs (CDC, 2011).

A study conducted to evaluate Cost-Effectiveness of Interventions to Promote Fruit and Vegetable Consumption showed that intervention that consider price of fruit in to consideration and intervention that target large population segments are effective in improving fruit and vegetable consumption (Cobiac *et al.*, 2010).

Another study which is a multilevel approach to increase fruit and vegetable intake in low-income housing communities: final results of the 'Live Well, Viva Bien' cluster-randomized trial evaluating the efficacy of 'Live Well, Viva Bien' (LWVB), a multi-component intervention that included discount, mobile fresh F&V markets in conjunction with nutrition education. In this study fifteen subsidized housing sites in Providence County, Rhode Island (8 intervention and 7 control sites) were randomized using a random number generator. A total of 1597 adult housing site residents (treatment n = 837; control n = 760) were enrolled. A year-long multi-component

intervention including mobile F&V markets plus nutrition education (e.g. campaigns, DVDs, newsletters, recipes, and chef demonstrations) was implemented at intervention sites. Physical activity and stress interventions were implemented at control sites. Follow-up occurred at 6 and 12 months. The main outcome measure was F&V consumption measured by National Cancer Institute's 'Eating at America's Table All Day Screener'. The finding showed that that from baseline to 12 months, the intervention group increased total F&V intake by 0.44 cups with the control group decreasing intake by 0.08 cups ($p < .02$). Results also showed an increased frequency of F&V eating behaviors compared to the control group ($p < .01$). There was a clear dose response effect of the F&V markets with participants who reported attending all or most of the markets increasing F&V intake by 2.1 cups and 0.86 cups, respectively compared with less than half cup increases for lower levels of market attendance ($p < .05$). Use of the DVDs, recipes and taste-testing was also associated with greater increases in F&V intake; however, use of other (Gans *et al.*, 2018)

Another Cluster randomized controlled trial of a mobile market intervention to increase fruit and vegetable intake among adults in lower-income communities in North Carolina showed that among 142 participants who completed the follow-up, baseline F&V intake was 3.48 cups/day for control and 3.33 for intervention. At follow-up, adjusted change in F&V consumption was 0.95 cups/day greater for intervention participants ($p = 0.005$) but was attenuated to 0.51 cups per day ($p = 0.11$) after removing extreme values. Mobile market customers increased their F&V consumption by 0.41 cups/day ($n = 30$) compared to a 0.25 cups/day decrease for 111 non-customers ($p = 0.04$). Intervention participants did not show significant improvements in perceived access to fresh F&V, but increased their self-efficacy for working more F&V into snacks ($p = 0.02$), making up a vegetable dish with what they had on hand ($p = 0.03$), and cooking vegetables in a way that is appealing to their family ($p = 0.048$) (Leone *et al.*, 2018).

Intervention targeting children and adolescent to increase their fruits and vegetable consumption should be developed. Among different interventions, creating healthier school food environments is among the intervention which is found to be effective to increase fruits and vegetable consumption. One way to do so is finding some smart ways to market fresh fruit and vegetable which will encourage consumers to learn about and buy health food (Melaku *et al.*, 2016) (Slavin *et al.*, 2012) (Wieser *et al.*, 2013) (Ruel *et al.*, 2005).

4. Methodology

4.1 Study setting

The study was conducted in selected schools in Addis Ababa, capital city of Ethiopia. It is found within altitude of 2355 meter above sea level and located at 9° 0' 19.4436" North latitude and 38° 45' 48.9996" East longitude with subtropical highland climate. Projected from Central Statistical Agency (CSA) report of 2007, Addis Ababa has a total population of 3,384,569 in 2016 with annual growth rate of 3.8% (42). The study was conducted in two randomly selected sub cities (Lafto and Gulele) 4 randomly selected schools.

4.2 Study design and period

A cluster randomized controlled trial was conducted from April through June 2019. The study was employed by considering school catchment areas as clusters and a unit of randomization after they are stratified by sub-cities. Children/ adolescents living in a catchment area of a specific school usually attend their school in the same catchment area; creating more room for information contamination between arms. Considering ethical issues, feasibility and management in addition to information contamination, cluster randomized control trial was a choice of appropriate design for this study targeting the intervention at the cluster level.

4.3 Population

4.3.1 Source population

All adolescents in Addis Ababa who were at high school in 2018/2019 academic year.

4.3.2 Study population

All high school adolescents in randomly selected schools (cluster) of Addis Ababa in 2018/2019 academic year.

4.3.3 Study unit

All randomly selected students within the cluster who were included in the follow up.

4.4 Sample size determination and sampling technique

The sample size was calculated for the main outcome “fruit consumption” using open Epi. A double population proportion for cluster randomized trial was employed. Since there was no previous study on the prevalence of fruit consumption in Ethiopia, the following assumptions were used: 0.3 effect size, 1 to 1 intervention to control ratio was recruited to achieve 80% power at 5% significance level. After adding 5% non-response rate, the total sample size was estimated to be 369. Random assignments were made to classify the cluster into intervention and control group.

4.5 Intervention

Intervention arm: In the intervention group, fruits were sold in piece. The seller will be told to only sell in piece. Before intervention starts, the sellers were trained to advertise their mobile shop that they only sell in piece. They also labeled the price of each single fruit as advertisement.

Control arm: Around the control school, the sellers were allowed only to sale in bulk (in kilograms).

4.6 Data collection tool and quality control

Data were collected on socio-demographic information, fruit consumption pattern, volume of sale per day and other variable that determine fruit consumption pattern by using semi structured and pretested tool. The tool was developed by modifying the 24-hour recall and one-week recall food frequency questioner and reviewing literatures. The questionnaires were first developed in English and were translated into local language (Amharic) and were translated back to English. Review was made by Amharic and English language experts and nutrition professionals for consistency of translation of the language. Before actual data collection, data collection instrument was pre-tested on 5% of the sample size at Holy trinity secondary school. Pre-test was used to check for language clarity, appropriateness of data collection tools, estimate time required and the necessary amendments was done.

Training was given concerning the data collection tool, data collection process and ethical aspect for both data collectors and supervisors. Data was collected using face to face interview methods. Close supervision was carried out by supervisors and investigator to ensure the quality of the data. Finally, all the collected data was checked by supervisor and investigator for its completeness and consistency.

4.7 Data collection procedure

Data were collected after the intervention in both groups. To see if there was any progress over time, repeated measure was taken on fruit consumption pattern of adolescents. The following parameters were collected.

Socio-demographic characteristics

Barriers and enablers for fruits consumption:

- Anthropometric measurement and body image perception
- Student's access to pocket money and their spending characteristics
- School food environment assessment regarding fruit access

Dietary information (Fruit frequency questionnaire (FFQ), 24-hour recall and one-week recall which is modified based on food frequency questioner) were used to collect fruit and diet related data. An open-ended recall and fruit frequency questioner were used to collect dietary data.

Among fruit seller, a quantitative data was collected to see if there is any change in selling portion per day.

Volume of fruits sold/day and the number of buyers: The volumes of fruits were estimated every morning and the left-over measured at the end of the day to estimate the amount (volume) sold. In addition, the number of buyers was counted to estimate the reach.

Price of fruits: As price is a key determinant and a co-founder it was routinely monitored

4.8 Follow up protocol

In round one of the data collection, participants were told that they were required to give information for 3 repeated times. In order to do that contact addresses were collected from each adolescent during round one data collection. Full name including Grade and section was registered. We were able to trace children using their contact details and remind them for their appointment date for repeated round data collection. Efforts were made to find children who were missed from the follow up.

4.9 Data management and analysis

EPI data version 4.2.0 was used to code, enter and clean the collected data. Data were analyzed using SPSS version 20 and SAS version 9.4. For continuous variable (mean and standard deviation) was calculated while frequency distribution was used for looking the distribution of categorical variables. For analysis of an outcome variable which is fruit frequency, those respondents who ate any on the eight listed fruit was given a yes (which is a score of 1) and those who didn't consume was given a no (which was given a score of 0). After that, we added the score to compute fruit frequency score. Then mixed effect linear regression analysis was used to see the impact of the intervention.

Mixed effect model analyses

As the repeated measurements of fruit consumption scores taken from each subject over time are correlated, the commonly used method like linear regression is not appropriate. There is a need for models which can take the correlation into account, combining both the fixed and random effects. Because the study was cluster randomized trial, observations are clustered within the clustering unit, which was school for this study.

To examine differences fruit consumption score within individual subjects over the follow up period, a mixed effect (fixed effects and random effects) model with a random intercept and a random slope was fitted with restricted maximum likelihood estimation method using the procedure 'proc mixed' in SAS 9.4. The fixed effects describe a population intercept and population slopes for a set of covariates, which included exposures. Assuming that individual fruit consumption score within school is more correlated because of the clustering, we included

school as random effect in the model. By considering individual random slopes and intercepts, this model allows to examine the influence of covariates on the change in fruit consumption score overtime.

In the mixed model, we used fruit consumption score as a dependent variable and time (round of follow-up), School name, sex, age of the participant, grade level, BMI, perceived body image, attempt to change weight were used as covariates in the mean structure.

To determine the effect modification of having pocket money on the impact of the intervention on fruit consumption, we included an *interaction* term of pocket money (**yes or no**) with the intervention. Similarly, to evaluate the whether the intervention had an additive/multiplicative impact of the intervention overtime, we included an *interaction* term of **round** of follow up with the intervention.

Because of the correlated nature of the data, a correlation structure was specified for the measures within individuals. Some commonly used structures, namely, compound symmetric and unstructured, were used to model the covariance structure of repeated measures within subjects. We used unstructured variance matrix structure to estimate the parameters of the random intercept. All tests were two-sided and $P < 0.05$ was considered statistically significant. We report the parameter estimates with 95% CI and standard errors (SE). Finally, results are presented in the form of description, tables and graphs.

4.10 Ethical consideration

Ethical clearance was obtained from Institutional Review Board of the College of Natural Sciences (IRB-CNS) of Addis Ababa University. The purpose of the study was explained to school officials and permission was sought before starting data collection. Informed consent was obtained for adolescents aged 18 and more. For children less than 18 years of age, consent was obtained from their parents, and they were also asked for their assent.

4.11 Dissemination plan

The findings of this study will be presented to Addis Ababa University, Center of Food Science and Nutrition. In addition, it will be disseminated to Addis Ababa Education bureau, Addis Ababa Health bureau and other concerned body. Attempt will be made to publish the paper in reputable international peer reviewed journal.

5. Results

A total of 369 adolescents from 4 high schools were selected to participate in the study, of which 330 actually completed the follow up which gives $\approx 90\%$ response rate.

5.1 Socio-demographic characteristics

Among the total 330 participants who had completed the study 157 were in the intervention and 173 were in the control group. Out of 157 participants in the intervention group 80 (51%) and 77 (51%) were male and female respectively. In the control group, 65 (37.6%) and 108 (62.4%) were male and female respectively. Among intervention group 102 (65%) were between 14-16 years of age and the remaining 55 (35%) were between 17-19 years of age. From control group 44 (25.4%) and 129 (76.4%) were between 14-16 and 17-19 respectively. The mean (SD) age of intervention and control group was 15.9 (1.2) and 17 (1.06) respectively.

With regard to religion majority of the study participants 132 (84.1%) and 136 (78.6%) were orthodox Christian from both intervention and control group respectively. In the intervention group 14 (8.9%) and from control 19 (11%) were protestant. In addition, majority of the study participant 127 (80.9%) from intervention group and 115 (66.5%) from control group live with their both parents. Regarding grade level 84 (53.5%) and 49 (28.3%) were grade 9 in the intervention and control group (**Table 1**).

Table 1. Socio demographic characteristics of study participant among high school adolescents of intervention and control group, Addis Ababa, Ethiopia, 2019

Variable	Category	Intervention	Control
		Frequency (Percentage)	Frequency (Percentage)
Age	14-16	102(65.0%)	44(25.4%)
	17-19	55(35.0%)	129(74.6%)
Sex	Male	80(51.0%)	65(37.6%)
	Female	77(49.0%)	108(62.4%)
Religion	Orthodox	132(84.1%)	136(78.6%)
	Muslim	7(4.5%)	17(9.8%)
	Protestant	14(8.9%)	19(11.0%)
	Catholic	4(2.5%)	1(0.6%)
Household family size	≤5	100(63.7%)	111(64.2%)
	>5	57(36.3%)	62(35.8%)
Father educational status	can't read and write	-----	4(2.3%)
	Can read and write	8(5.1%)	14(8.1%)
	Primary school	1(0.6%)	36(20.8%)
	Secondary school	22(14.0%)	66(38.2%)
	Some college/ technical school	14(8.9%)	4(2.3%)
	College graduate or above	96(61.1%)	36(20.8%)
	I don't know	12(7.6%)	6(3.5%)
	Father is not alive	4(2.5%)	7(4.0%)
Mother educational status	can't read and write	2(1.2%)	23(13.3%)
	Can read and write	8(5.1%)	19(11.1%)
	Primary school	5(3.2%)	42(24.3%)
	Secondary school	43(27.4%)	45(26.0%)
	Some college/ technical school	13(8.3%)	11(6.4%)
	College graduate or above	74(47.1%)	23(13.3%)
	I don't know	12(7.6%)	6(3.5%)
	Mother is not alive	----	4(2.3%)
With whom do you live	With both of my parents	127 (80.9%)	115(66.5%)
	With my mother only	13(8.3%)	16(9.2%)
	With my father only	3(1.9%)	8(4.6%)
	With brothers/sisters	6(3.8%)	10(5.8%)
	With grandparents	5(3.2%)	3(1.7%)

	With cousins	2(1.3%)	15(8.7%)
	With mother/father and a stepfather or stepmother	---	1(0.6%)
	Others	1(0.6%)	5(2.9%)
Grade level	9 th	84(53.5%)	49(28.3%)
	11 th	73(46.5%)	124(71.7%)

5.2 Anthropometric measurement, perceived body image and related characteristics

As presented in **table 2** weight, height, perceived body image and other related variables were assessed. From the intervention group 55 (33.1%), 94 (59.9%) and 11 (7.0%) were underweight, normal and overweight respectively. Among control 61 (35.3%), 105 (60.7%) and 7(4%) were underweight, normal and overweight respectively. Out of 157 participants in intervention group 105 (66.9%) and among 173 controls 121(69.9%) perceive their body size as normal. With regard to attempt to change weight now or in the past, 88 (56.1%) and 63 (36.4%) attempted to change weight from intervention and control group respectively.

Table 2. Anthropometric measurement and body image perception among high school adolescents of intervention and control group, Addis Ababa, Ethiopia, 2019

Variable	Category	Intervention	Control
		Frequency (Percentage)	Frequency (Percentage)
BMI	Underweight	52(33.1%)	61(35.3%)
	Normal	94(59.9%)	105(60.7%)
	Overweight	11(7.0%)	7(4.0%)
Perceived body Image	Lean	36(22.9%)	41(23.7%)
	Normal	105(66.9%)	121(69.9%)
	Overweight	16(10.2%)	11(6.4%)
Are you Satisfied about your body image?	Very Satisfied	21(13.4%)	64(37.0%)
	Satisfied	100(63.7%)	84(48.6%)
	Neutral	15(9.6%)	6(3.5%)
	Unsatisfied	20(12.7%)	19(11.0%)
	Very Unsatisfied	1(0.6%)	----
Have you ever attempted to change weight	Yes	88(56.1%)	63(36.4%)
	No	69(43.9%)	110(63.6%)

5.3 Access to pocket money and spending characteristics

Adolescents were also asked about their access to pocket money and their spending characteristics. According to the study 116 (73.9%) of the intervention group and 99 (57.2%) of the control usually had access to pocket money to spend. From those who had access to pocket money more than 85% of both intervention and control group got more than 10 birr per day. Around half 65 (56%) from the intervention and 49 (49.5%) from controls had a habit of buying snack with their pocket money. Among which 32(49.2%) and 29 (59.2%) of the intervention and control group bought fruit as a snack respectively but majority 52(80%) and 41 (83.7%) of both groups bought French frizz as a snack. (Table 3)

Table 3. Student's access to pocket money and their spending characteristics among high school adolescents of intervention and control group, Addis Ababa, Ethiopia, 2019.

Variable	Category	Interventio	Control
		n Frequency (Percentage)	Frequency (Percentage)
Do you usually have pocket money?	Yes	116(73.9%)	99(57.2%)
	No	44(26.1%)	74(42.8%)
If yes, how much money do you averagely have each day?	<10 Birr	13(11.2%)	11(11.1%)
	10-20 Birr	46(39.7%)	52(52.5%)
	>20 Birr	57(49.1%)	36(36.4%)
How do you spend your pocket money?	Buy snack	65(56.0%)	49(49.5%)
	Watch movie at cinema	4(3.4%)	3(3.0%)
	Saving for a special game/ event	24(20. %7)	18(18. 2%)
	Others	23(19.8%)	29(29.3%)
If Answer to the above question is buying snack, what snack do you usually buy?	Biscuits	23 (35.4%)	26(53.1%)
	Burger	42(64.6%)	33(67.3%)
	Cake	43(66.1%)	35(71.4%)
	Fruit	32(49.2%)	29(59.2%)
	French frizz	52(80.0%)	41(83.7%)
	Sweet beverage	24(36.9%)	26(53.1%)
	Others,	26(40.0%)	16(32.6%)
	Buy snack	35(30.2%)	30(30.3%)
If you are given two or three times larger cash than your pocket money, what will you do with it?	Watch movie at cinema	20(17.2%)	7(7.1%)
	Saving for a special game/ event	48(41.4%)	36(36.4%)
	Others	13(11.2%)	26(26.3%)
	Buy snack	16(38.1%)	23(31.1%)
If no to Q#301, How will you spend it if you are given 10-20 birr each day?	Watch movie at cinema	3(7.1%)	5(6.8%)
	Saving for a special game/ event	12(28.6%)	26(36.1%)
	Others	11(26.2%)	20(27.0%)

5.4 School food environment

School food environment in relation to fruit access was assessed. Out of 157 students in the intervention group 100 (63.7%) and out of 173 students in the control group 168 (97.1%) reported that there is a cafeteria inside their school. Even though there is a cafeteria only 4 (4%) from intervention and 4 (2.4%) of control participants had reported that they had been served fruit in any form. About availability of fruit vendors around the school 113 (72%) and 139 (80%) of intervention and control group had reported that there are fruit vendors around the schools respectively. Among those who reported that there are fruit vendors around the school, 44(38.6%) and 43 (30.9%) had a habit of buying fruits from them in both intervention and control group respectively. More than half of those who reported that there are fruit vendors around the school but didn't buy any fruit from them reported that high cost was the reason for not buying.

Table 4. School food environment assessment regarding fruit access among high school adolescents of intervention and control group, Addis Ababa, 2019

Variable	Category	Intervention	Control
		Frequency (Percentage)	Frequency (Percentage)
Is there a cafeteria in the school?	Yes	100(63.7%)	168(97.1%)
	No	57(36.3%)	5(2.9%)
Does the school cafeteria serve fruits: All fresh, frozen, canned, and dried fruits and fruit juices (oranges and orange juice, apples and apple juice, bananas, grapes, melons, berries, and raisins)?	Yes	4(4.0%)	4(2.4%)
	No	96(96.0%)	164(97.6%)
Are fruits vendor available around school?	Yes	113(72.0%)	139(80.3%)
	No	44(28.0%)	34(19.7%)
If yes, how far distances are fruit vendors available around the school (In Km or walking distance)?	<50 meter	20(17.7%)	36(25.9%)
	50-100 meter	24(21.5%)	13(9.4%)
	100-200 meter	28(24.8%)	39(28.1%)
	>200 meter	41(36.3%)	51(36.7%)
Do you buy fruit from fruit vendors around school?	Yes	44(38.6%)	43(30.9%)
	No	70(61.4%)	96(69.1%)
If no, what is the reason for not buying?	It is expensive	47(67.0%)	59(61.5%)
	I don't like eating fruits	6(8.7%)	2(2.1%)
	It's far from the school	6(8.7%)	6(6.2%)
	Others	11(15.9%)	29(30.2%)

5.5 Dietary habit related to fruit consumption

5.5.1 Fruit consumption based on 24-hour recall data

The result of this study showed that the 24-hour recall fruit consumption pattern of the study participants were not significantly different between intervention and control group for most of the fruits (both in chi square test and mixed effect linear regression). But there was a small difference in some fruit consumption. In round one of observation there was no significant difference in all fruit consumption. In round two, mango and apple consumption were higher in the intervention group than the control. Mango was consumed by 26.8% of the intervention group in comparison with only 14.5% of the control. The proportion difference was significant with Pearson chi square ($P=0.05$). In addition, the proportion difference of apple was significant ($P=0.002$). In round three none of fruit has a significant proportion difference based on the consumption pattern of intervention and control arms. But there was difference based on a simple proportion. Apple was consumed in 8.3% of intervention when compared with only 3.5% of controls. Watermelon was consumed in 5.7% compared to only 2.9%.

Table 5. 24-hour recall fruit consumption pattern among high school adolescents of intervention and control group, Addis Ababa, Ethiopia 2019

Variable	Category	Observation 1		Observation 2		Observation 3	
		Control	Intervention	Control	Intervention	Control	Intervention
Banana	Yes	52(30.1%)	62(39.5%)	68(39.3%)	67(42.7%)	81(48.6%)	81(51.6%)
	No	121(69.9%)	95(60.5%)	105(60.7%)	90(57.3%)	92(53.2%)	76(48.4%)
Orange	Yes	21(12.1%)	25(15.9%)	22(12.7%)	31(19.7%)	31(17.9%)	35(22.3%)
	No	152(87.9%)	132(84.1%)	151(87.3%)	126(80.3%)	142(82.1%)	122(77.7%)
Apple	Yes	3(1.7%)	8(5.1%)	5(2.9%)	18(11.5%)	6(3.5%)	13(8.3%)
	No	170(98.3%)	149(94.9%)	168(97.1%)	139(88.5%)	167(96.5%)	144(91.7%)
Watermelon	Yes	1(0.6%)	15(9.6%)	2(1.2%)	8(5.1%)	5(2.9%)	9(5.7%)
	No	172(99.4%)	142(90.4%)	171(98.8%)	149(94.9%)	168(97.1%)	148(94.3%)
Mango	Yes	30(17.3%)	35(22.3%)	25(14.5%)	42(26.8%)	33(19.1%)	40(25.5%)
	No	143(82.7%)	122(77.7%)	148(85.5%)	115(73.2%)	140(80.9%)	117(74.5%)

Strawberry	Yes	11(6.4%)	16(10.2%)	14(8.1%)	17(10.8%)	9(5.2%)	16(10.2%)
	No	162(93.6%)	141(89.8%)	159(91.9)	140(89.2%)	164(94.8%)	141(89.8%)
Pineapple	Yes	6(3.5%)	7(4.5%)	4(2.3%)	7(4.5%)	9(5.2%)	3(1.9%)
	No	167(96.5%)	150(95.5%)	169(97.7%)	150(95.5%)	164(94.8%)	154(98.1%)
Others	Yes	30(17.3%)	35(22.3%)	29(16.8%)	39(24.8%)	32(18.5%)	45(28.7%)
	No	143(82.7%)	122(77.7%)	144(83.2%)	118(75.2%)	141(81.5%)	112(71.3%)

5.5.2 Fruit consumption based on one-week recall data

With regards to one-week recall fruit consumption, there was a significant difference between intervention and control group in most of the fruits (both in chi square and mixed effect linear model). In round one of the measurements significantly higher consumption was observed in the intervention group. Banana consumption was 82% in the intervention group when compared with 65% of control ($P < 0.001$). Apple was consumed in 31.8% of intervention than 27% control ($P = 0.004$). Watermelon and mango consumption was also higher in intervention group with proportion of 12.7% and 61.1% in comparison with 4% and 44.5% ($P < 0.001$ and $P = 0.003$) of intervention VS control group respectively.

In round two and three similar finding was observed in the same fruit as round one observation but with slight significance level difference of Pearson chi square P-value. In the last round measurement of fruit frequency of the study participant based on week recall data, there was a proportion difference between intervention and control group. Banana was consumed by 86% participants than 65.3% controls. Mango was consumed by 66.9% of interventions than 37.6% of controls (both $P < 0.001$).

Table 6. One-week recall fruit consumption pattern among high school adolescents of intervention and control group, Addis Ababa, Ethiopia, 2019

Variable	Category	Observation 1		Observation 2		Observation 3	
		Control	Intervention	Control	Intervention	Control	Intervention
Banana	Yes	113(65.3%)	130(82.8%)	99(57.2%)	131(83.4%)	113(65.3%)	135(86.0%)
	No	60(34.7%)	27(17.2%)	74(42.8%)	26(16.6%)	60(34.7%)	22(14.0%)
Orange	Yes	47(27.2%)	50(31.8%)	41(23.7%)	67(42.7%)	56(32.4%)	75(47.8%)
	No	126(78.2%)	107(68.2%)	132(76.3%)	90(57.3%)	117(67.6%)	82(52.2%)
Apple	Yes	7(4.0%)	20(12.7%)	10(5.8%)	20(12.7%)	7(4.0%)	21(13.4%)
	No	166(96.0%)	137(87.3%)	163(94.2%)	137(87.3%)	166(96.0%)	136(86.6%)
Watermelon	Yes	7(4.0%)	24(15.3%)	4(2.3%)	15(9.6%)	8(4.6%)	18(11.5%)
	No	166(96.0%)	133(84.7%)	169(97.7%)	142(90.4%)	165(95.4%)	139(88.5%)
Mango	Yes	77(44.5%)	96(61.1%)	65(36.6%)	101(64.3%)	65(37.6%)	105(66.9%)
	No	96(55.5%)	61(38.9%)	108(62.4%)	56(35.7%)	108(62.4%)	52(33.1%)
Strawberry	Yes	13(7.5%)	30(19.1%)	24(13.9%)	39(24.8%)	22(12.7%)	38(24.2%)
	No	160(92.5%)	127(80.9%)	149(86.1%)	118(75.2%)	151(87.3%)	119(75.8%)
Pineapple	Yes	13(7.5%)	19(12.1%)	10(5.8%)	14(8.9%)	14(8.1%)	15(9.6%)
	No	160(92.5%)	138(87.9%)	163(94.2%)	143(91.1%)	159(91.9%)	142(90.4%)
Others	Yes	52(30.1%)	58(36.9%)	54(31.2%)	63(40.1%)	55(31.8%)	56(35.7%)
	No	121(69.9%)	99(63.1%)	119(68.8%)	94(59.9%)	118(68.2%)	101(64.3%)

5.6 Fruit Volume of sale

In this study the volume of sales of fruits showed no difference at the first few days of measurement. But gradually, the intervention arm volume of sale had showed progressive increment as the intervention progresses. Gradually, the control group showed a slight decrement and then it stays in almost constant range. In the intervention group volume of sale had showed progressive increment as the intervention progresses then it gets almost similar after 16th measurement day. Volume of sale in intervention arm was around 22 kg per day compared to 16 kg in control arm at the final observation.

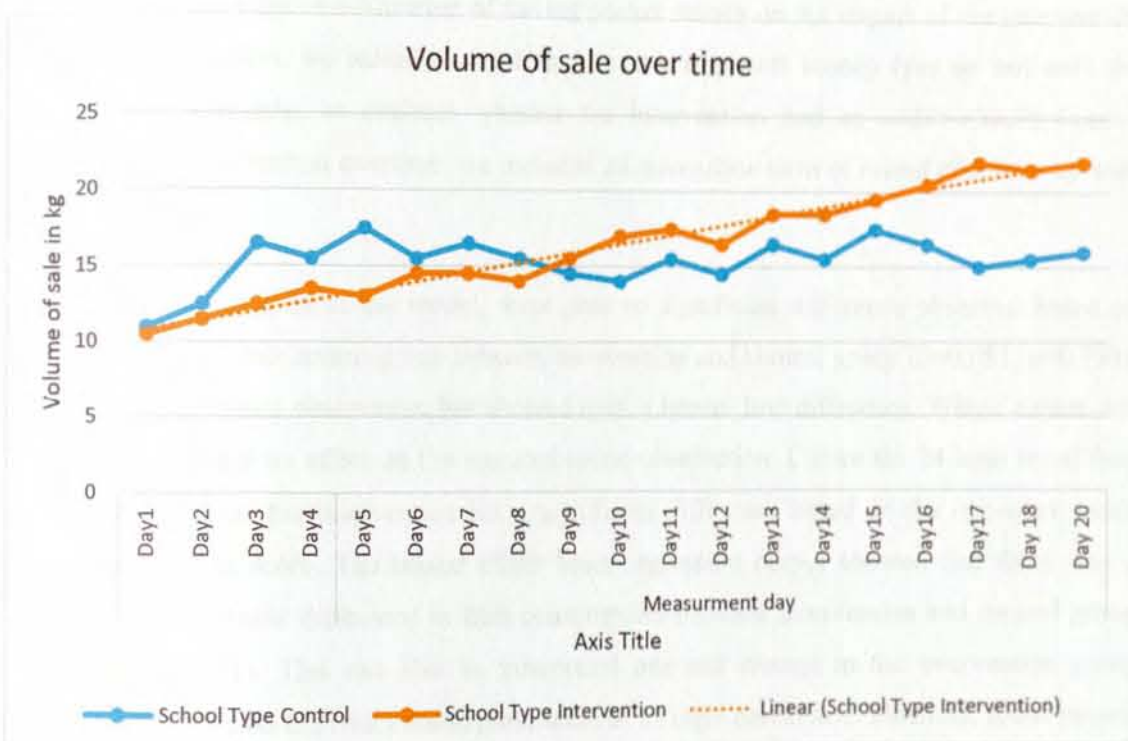


Figure 1. Trend in fruit volume of sale in intervention and control group in selected high school of Addis Ababa, Ethiopia, Addis Ababa, Ethiopia, 2019

5.7 Mixed effect model Analyses (Analysis of repeated clustered data) out put

For analysis of an outcome variable which is fruit frequency, those respondents who ate any on the eight listed fruit were given a yes (which is a score of 1) and those who didn't consume was given a no (which was given a score of 0). After that, we added the score to compute fruit frequency score. Then mixed effect linear regression analysis was used to see the impact of the intervention. In the mixed model, we used fruit consumption score as a dependent variable and time (round of follow-up), School name, sex, age of the participant, grade level, BMI, perceived body image, attempt to change weight were used as covariates in the mean structure.

To determine the effect modification of having pocket money on the impact of the intervention on fruit consumption, we included an *interaction* term of pocket money (**yes or no**) with the intervention. Similarly, to evaluate whether the intervention had an additive/multiplicative impact of the intervention overtime, we included an *interaction* term of **round** of follow up with the intervention.

After fitting the data in to the model, there was no significant difference observed based on the 24-hour recall fruit consumption between intervention and control group ($\beta=0.081$, $p=0.793$). In addition, the round observation has showed only a border line difference. Which means that the intervention has no effect on the repeated round observation. Unlike the 24-hour recall fruit consumption patten, the intervention has a significant difference based on the one-week recall fruit consumption score. The mixed effect linier regression output showed that there was a statistically significant difference in fruit consumption between intervention and control group ($\beta=0.853$, $p=0.001$). This can also be interpreted one-unit change in the intervention group results 0.853 score on the fruit consumption score of a single participant. Meaning, if one person is taken from the control to the intervention group, the fruit frequency score will change by 0.853. But there was no difference across round of observation. Which means the intervention has the same impact throughout the time of intervention ($\beta=-0.138$, $p=0.371$) and ($\beta=-0.04$, $p=1.00$) in round one and two. Moreover pocket money has no interaction with the effect of the intervention ($\beta=0.145$, $p=0.686$).

Table 7. Mixed effect linear regression output table for 24-hour fruit consumption score among intervention and control group, 2019.

Effect	Estimate	SE	95%CI	P-Value
Intercept	1.567	0.213	1.151-1.988	<0.0001
Intervention	0.0811	0.3089	-0.526-0.689	0.793
Control	0			
Pocket money	-0.264	0.136	-0.531- -0.0037	0.053
Intervention 1*visit	-0.243	0.101	-0.441-0.046	0.016
Intervention 2*visit	-0.085	0.101	-0.283-0.112	0.396
Intervention 3*visit	0			
Control 1*visit	-0.298	0.0949	-0.485- -0.119	0.0018
Control 2*visit	-0.2105	0.09493	-0.3936 -0.02412	0.027
Control 3*visit	0			
Pocket money*Intervention	0.176	0.211	-0.238-0.597	0.403
Pocket money*control	0			

Table 8. Mixed effect linear regression output table for one-week fruit consumption score among intervention and control group, 2019.

Effect	Estimate	SE	95%CI	P-Value
Intercept	2.27	0.273	1.733-2.807	<0.001
Intervention	0.859	0.397	0.0786-1.639	0.0311
Control	0			
Pocket money	-0.345	0.178	-0.695-0.0046	0.0531
Intervention 1*visit	-0.138	0.0928	-0.320-0.044	0.1371
Intervention 2*visit	-0.048	0.0928	-0.182- 0.182	1.000
Intervention 3*visit	0			
Control 1*visit	0.122	0.0875	-0.0490- 0.294	0.1610
Control 2*visit	0.046	0.0875	-0.179- 0.179	1.0000
Control 3*visit	0			
Pocket money*Intervention	0.145	0.275	-0.396- 0.69	0.5985
Pocket money*control	0			

6. Discussion

This cluster randomized controlled trial tried to evaluate the effectiveness of selling fruit in pieces in improving fruit consumption of high school adolescents. In addition, the trial tries to investigate if selling fruit in pieces improves volume of sale than the current practice of selling fruits in kilograms. Selling fruit has showed a significant increment in overall fruit consumption of high school adolescents. In addition, the study revealed that consumption of fruits like banana, orange, mango and strawberry has showed improvement in the intervention arm. Moreover, there was a change in volume of sale in the intervention arm than the control group. However, fruit consumption based on a 24-hour recall fruit frequency data didn't bring a statistically significant effect among adolescents.

According to this study the new marketing approach for selling fruit which is selling fruit in piece near school environment has showed a significant increment in overall fruit consumption of high school adolescents. The mixed effect linier regression output showed that there was a statistically significant difference in fruit consumption between intervention and control arm. The intervention has effect in fruit consumption score in the intervention arm ($\beta=0.853$, $p=0.001$). This can also be interpreted as one-unit change in the intervention group results in 0.853 score on the fruit consumption score of a single participant. Meaning, if one person is taken from the control to the intervention group, the fruit frequency score will change by 0.853.

The above finding was supported by a market intervention study conducted in lower-income communities in North Carolina. In the study they implemented cluster randomized controlled trial of a mobile market intervention to increase fruit and vegetable intake among adults. According to the study, in the intervention arm an adjusted change in F&V consumption was 0.95 cups/day greater compared with control arm ($p = 0.005$) ((Leone *et al.*, 2018). Another multi-component intervention that included discount, mobile fresh F&V markets in conjunction with nutrition education conducted in low income communities in Rhode Island also similar finding. In the study the intervention group increased total F&V intake by 0.44 cups with the control group decreasing intake by 0.08 cups ($p < 0.02$) (Gans *et al.*, 2018). Other study conducted to evaluate Cost-Effectiveness of Interventions to Promote Fruit and Vegetable Consumption showed supporting finding. According to the study intervention that consider price

of fruit into consideration and intervention that target large population segments are effective in improving fruit and vegetable consumption (Cobiac *et al.*, 2010).

The similarities in our study and previous work discussed above could be explained by the fact that intervention that focuses on children and adolescent to increase their fruits consumption are shown to be effective and are recommended by different guidelines. Among different interventions, creating healthier school food environments is one of them which is found to be effective. One way to do so is finding some smart ways to market fresh fruit which will encourage students to learn about and buy health food like fruit (Melaku *et al.*, 2016) (Slavin *et al.*, 2012) (Wieser *et al.*, 2013).

Despite the above finding the study also showed that there was no significant difference across round of observation. Which means the intervention has the same effect throughout the time of intervention ($\beta=-0.138$, $p=0.371$).

With regard to a 24-hour recall fruit consumption score, the intervention has no effect in improving fruit consumption of high school adolescents $\beta=0.0811$ (95% CI -0.526, 0.689) with P-value=0.793. This finding was in contrary with the study conducted in low income community of North Carolina where there was a significant increase in daily consumption of F & V (Leone *et al.*, 2018). The difference could be explained by the fact that in the above study F & V consumption was measured together which could overestimate the effect of the intervention. In our intervention lack of effect in the 24-hour recall fruit consumption score could be due to the fact that fruits are not consumed on a daily base (it is consumed irregularly) due to this reason considering 24-hour recall to asses' fruit consumption doesn't give a representative data.

In this study background characteristics including pocket money were assumed to be equally distributed in both intervention and control arm. To see if those characteristics have effect modification effect on the outcome, they were entered the mixed effect model. But none of the variable has affected the outcome. This means the intervention has a positive impact regardless of background characteristics. For example, pocket money has no interaction with the effect of the intervention ($\beta=0.145$, $p=0.598$). This indicates that having pocket money didn't affect fruit consumption in our study. This means the intervention has impact regardless of pocket money or

it can also be explained as the intervention has impact to influence fruit consumption than having pocket money.

School children and adolescents usually have pocket money to spend but it is very limited. They spend the money in buying snack. Given the fact that they have little money, most of it spent in buying cheap snacks like French frieze, biscuit and sweets. In the face of limited amount of pocket money and there is also limited access to healthy foods including fruits around school. The reason behind limited access to fruit market around school is low volume of sale because of affordability. Meaning that sellers' wants to sell fruit in bulk to sell large volume per day to get more benefit, but this can't be achieved given the fact that student can't afford to buy fruit in bulk. This encourages students to go for affordable and accessible foods like sweets and biscuits. To address this problem our new intervention tried to consider both problems: cost from the student perspective and volume of sell from seller side. As a result of the intervention there was a significant progress in both consumption and volume of sale. Fruit consumption score was increased by approximately 0.9 and volume of sale has progressed to around 22 kg per day compared to 16 kg in control arm. The reason behind this increment could be, when favorable market conditioned is arranged it will encourage adolescents to choose healthy diet.

In this study the volume of sales of fruits showed no difference at the first few days of measurement. But gradually, the intervention arm volume of sale had showed progressive increment as the intervention progresses. This could be due to the increase in the consumption of fruit around the intervention arm where fruit is sold in pieces. This showed that the intervention encouraged more students to buy fruit with the limited pocket money they have which increase the total volume of sale.

Regarding generalizability, it might be possible to infer the changes of our study to the city of Addis Ababa as most school in Addis Ababa shares similar characteristics. But it will be better if a large trial (including many school and students) is conducted for more generalizability as this study included only 4 schools.

Nevertheless, our same intervention might bring about different results of fruit consumption pattern among high school adolescents living in rural parts of Ethiopia where the setting, socio economic status, availability, cost of fruit, and culture of the population is different than those in the capital city. In addition, high school adolescents in Addis Ababa might be more sensitive to changes in practice due to their access to different sources of information which might bring about higher effects.

7. Strength and limitation

Strength

This study has several strengths. First our study blinded high school adolescents, data collectors and supervisors, and collecting data repeatedly to see if there was progress overtime. Another strength is we used cluster randomized control trial study design which is appropriate to address the research question. In addition, as far as literature search showed this research is the first in its kind in the study area. Furthermore, we provided the same incentive for fruit sellers in both arms to reduce bias.

Limitation

One of the limitations of the study was lack of standard to measure level of fruit consumption. Due to this reason we developed the concept of fruit consumption score which we assume is the best method. Another limitation is that the study outcome can be confounded by many external variables. We tried to reduce the impact of possible confounder on the effect of intervention at the study design stage (blinding, randomization, and having control). Another limitation could be the weekly fruit consumption assessment questions used in our study might introduce recall biases as adolescents might not be able to recall accurately. We also faced a short fall of literatures in related issue that makes it difficult to compare the real effect of our intervention in comparison with other study.

8. Conclusion and recommendations

Conclusion

As a result of the intervention selling fruit has showed a significant increment in overall fruit consumption of high school adolescents in Addis Ababa. In addition, the study revealed that consumption of fruits like banana, orange, mango and strawberry has showed improvement in the intervention arm. The study also highlighted that, even though there was a change in fruit consumption over time in the intervention period it was not statistically significant to declare that the intervention has effect over time. The study also showed that there was a change in volume of sale in the intervention arm than the control group. However, fruit consumption based on a 24-hour recall fruit frequency data didn't bring a statistically significant effect among adolescents.

Recommendation

Based on the above finding we forward the following recommend to concerned bodies.

- ❖ Ministry of health, Ministry of education and Ministry of Agriculture to work in collaboration to encourage fruit venders to sell fruit in pieces around school as it was proven to benefit both sellers to sell more and adolescents to increase fruit consumption.
- ❖ Fruit venders need to be encouraged by the town administration concerned body and Ministry of health to sell fruit in pieces to reach those who can't afford to buy in bulk. And of course, to increase their income.
- ❖ We recommend further studies to evaluate the effectiveness of selling fruit in pieces in other environment to see if it can improve fruit consumption in other population segments.
- ❖ We also recommend duplication of the study in wider range in Addis Ababa, Ethiopia to by incorporating many school and large study subjects to see if the intervention has the same effect.

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ANNEX I: English Version Questioner

Annex 1: Informed Consent and/or Ascent Form (English version)

Addis Ababa University, College of Natural science, Center of food science and nutrition.

Subject Information Sheet

Hello,

My name is _____ I am here on behalf of Bereket Gebremichael, from Addis Ababa University College of Natural science, Center of food science and nutrition. He is conducting a research on “Effectiveness of selling fruits in pieces or in bulk in improving fruit consumption of high-school students: A cluster randomized controlled trial in urban setting of Ethiopia”. He received permission from Addis Ababa University, College of Natural science, Center of food science and nutrition and the respected sub city education bureau to conduct this study.

You are selected to participate in this study because you are currently attending in one of the selected schools for the study purpose. Your participation is purely based on your willingness. You have the right to choose not to take part in this study. If you choose to take part, you have the right to stop at any time. If you are willing to participate or refuse or decide to withdraw later, you will not be subjected to any ill-treatment.

If you agree to participate in the study, you will be interviewed about your dietary habit every three week for four continuative times that could be associated with healthy lifestyle. The interview will take about 10-15 minutes.

The study could provide base line data for policy makers and relevant stakeholders for designing and implementing effective market strategy to increase the consumption of fruit among adolescents. The information that you provide will be kept confidential by using only code numbers and locking the data. Your name will not be written on the questionnaire. No one will have access to the non-coded data except the principal investigator and the data will not be used for purposes other than the study. Your willingness and active participation are very important for the success of this study.

Informed Consent and/or Ascent Form

Based on the understanding of the above information, are you willing to participate in this study?

A) Yes

B) No

If yes, continue and

If no, skip to next participant after writing the reasons of refusal _____

Respondent (For both under and above 18 years old)

Signature _____ Date _____

Respondents Parent (for those under 18 years old)

Signature _____ Date _____

Name of the person obtaining parental permission _____

Interviewer

Name _____ Signature _____

Questionnaires ID number _____

Date of interview _____ Starting time _____ Completed _____

Result of interview

A) Completed

B) Not completed

C) Partially completed

D) Refused

Checked by Supervisor: Name _____ Signature _____

For further explanation, use the Principal Investigator's Address;

Name: Bereket Gebremichael

Email: bdpapi3@gmail.com

Cell phone: +251 912 66 01 25

Annex 2: Survey Questionnaire (English Version)

Questionnaire ID Number _____

Addis Ababa University College of Natural science, Center of food science and nutrition
Survey Questionnaire to Determine effectiveness of selling fruits in pieces or in bulk in
improving fruit consumption of high-school students

Survey Questionnaire (English Version)

Respondent's Identification	
Name of School	
Date of interview	_____/DD/_____/MM/_____/YR/
Time started	_____/Hr./_____/Mins./
Time ended	_____/Hr./_____/Mins./
Interviewer	Name _____ signature _____
Checked by Supervisor	Name _____ Signature _____

Addis Ababa University College of Natural science, Center of food science and nutrition

Survey Questionnaire to Determine effectiveness of selling fruits in pieces or in bulk in improving fruit consumption of high-school students

Part1. Background information

No.	Questions	Responses	Skip
101	Age of respondent	_____	
102	Sex of respondent	1. Male 2. Female	
103	What is your religion?	1. Orthodox 2. Catholic 3. Protestant 3. Muslim 4. Other (Specify) _____	
104	How much is your household family size including you?		
105	What is your father's educational Status?	1. Illiterate (can't read and write) 2. Can read and write 3. Primary school (grade 1-8) 4. Secondary school (grade 9-12) 5. Some college or technical school 6. College graduate or above 7. I don't know 8. Father is not alive	
106	What is your mother's educational status?	1. Illiterate (can't read and write) 2. Can read and write 3. Primary school (grade 1-8) 4. Secondary school (grade 9-12) 5. Some college or technical	

		school 6. College graduate or above 7. I don't know 8. Mother is not alive	
107	With whom do you live?	1. With both of my parents 2. With my mother only 3. With my father only 4. With brothers/sisters 5. With grandparents 6. With cousins 7. With mother/father and a stepfather or stepmother 8. With my friends 9. Others (specify) _____ _____	
108	Which grade are you now?		

Part II Anthropometric Measurement Body image perception, satisfaction with body image and attempts to change weight.

No	Question	Answer	Remarks
201	Height	_____	
202	Weight	_____	
203	Perceived body Image	A. Lean B. Normal C. Overweight	
204	Are you Satisfied about your body image?	A. Very Satisfied B. Satisfied C. Neutral D. Unsatisfied E. Very Unsatisfied	
205	Have you ever attempted to change weight	A. Yes B. No	

No	Questions	Choice	Remark
301	Do you usually have pocket money?	A. Yes B. No	
302	If yes, how much money do you averagely have each day?	_____ETB	
303	How do you spend your pocket money?	A. Buy snack B. Watch movie at cinema C. Saving for a special game/ event D. Others _____ —	
304	If Answer to Q#303 is buying snack, what snack do you usually buy?	A. Biscuits B. Burger C. Cake D. Fruit E. French frizz F. Sweet beverage G. Others, specify _____	
305	If you are given two or three times larger cash than your pocket money, what will you do with it?	A. Buy snack B. Watch movie at cinema C. Saving for a special game/ event D. Others _____ —	
306	If no to Q#301, How will you spend it if you are given 10-20 birr each day?	E. Buy snack F. Watch movie at cinema G. Saving for a special game/	

		event H. Others _____ _____	
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Questioner ID _____

Part III. The following question asks about student's access to pocket money and their spending characteristics.

Part IV. School food environment assessment regarding fruit access

No	Question	Choose	Remark
401	Is there a cafeteria in the school?	1. Yes 2. No	
402	Does the school cafeteria serve fruits: All fresh, frozen, canned, and dried fruits and fruit juices (oranges and orange juice, apples and apple juice, bananas, grapes, melons, berries, and raisins)?	1. Yes 2. No	
403	Are fruits vendor available around school?	1. Yes 2. No	
404	If yes, how far distance are fruit vendors available around the school (In Km or walking distance)?	_____	
405	Do you buy fruit from fruit venders around school?	1. Yes 2. No	
406	If no, what is the reason for not buying?	1. It is expensive 2. I am not interested in	

		eating fruits 3. It's far from the school 4. Others, specify _____ _____	
--	--	---	--

Part V. Dietary information (Fruit frequency questionnaire, 24-hour recall)

The next questions ask about fruits that you eat. As you answer these questions, please think of the fruit you consumed starting from the same time since yesterday (the last 24 hours) until now.

No.	Food items	Frequency of consumption					Skip
		Yes (1)	No (0)	Estimated portion size	If yes to any of the list, please indicate the place of consumption. Home (1), school (2), Friends house (3), Café/ restaurant (4)	If place of consumption was school, please indicate place of access. Home (1), Fruit vendor (2), school café (3)	
501	Banana						
502	Orange						
503	Apples						
504	Watermelon						
505	Mango						
506	Strawberry						
507	Pineapple						

508	Other fruit (fruits consumed at home)							
-----	--	--	--	--	--	--	--	--

Part VI. Dietary information (Fruit frequency questionnaire, one week recall)

The next questions ask about fruits that you eat. As you answer these questions, please think of the fruit you consumed starting from the same time since last week (the last seven days) until now.

No.	Food items	Frequency of consumption						Place of access Home (1), school (2), Friends house (3), Café/ restaurant (4)	Remark
		Yes (1)	No (0)	Twice a day or more	Once a day	Twice a week	Once a week		
601	Banana								
602	Orange								
603	Apples								
604	Watermelon								
605	Mango								
606	Strawberry								
607	Pineapple								
608	Other fruit (fruits consumed at home)								List the fruits here

Part VIII. Volume of sale and price of each fruit measure (The following variables will be assessed every other day)

Date	Fruit type	Amount at morning	Leftover amount	Price per peace and/or in kilogram	Remark

ANNEX II: Amharic Version Questioner

Informed Consent and/or Ascent form (Amharic version)

አዲስ አበባ ዩኒቨርሲቲ የተፈጥሮ ሳይንስ ኮሌጅ የምግብ ናየምግብ ምርምር ማዕከል

የተጠያቂው / መላሾች የመረጃ ቅፅ

ጤና ይስጥልን እንደምን ነዎት

ስሜ——————ይባላል። የመጣሁት አዲስ አበባ ዩኒቨርሲቲ የተፈጥሮ ሳይንስ ኮሌጅ የምግብና የምግብ ምርምር ማዕከል ተማሪ የሆነውን በረከት ገብረሚካኤልን ወክዬ ነው። ፍራፍሬን በቸርቻሮ ወይም በጅምላ መሸጥ የትኛው የሁለኛ ደረጃ ተማሪዎችን የፍራፍሬ አመጋገባቸውን ይጨምራል በሚል ርዕስ ጥናት እያደረገ ሲሆን ከአዲስ አበባ ዩኒቨርሲቲ፣ አ/አ ት/ት ቢሮና ከተመረጡት ትምህርት ቤቶችም ፍቃድ አግኝቶአል።

እርስዎ በዚህ ጥናት ላይ እንዲሳተፉ የተመረጡት ለዚህ ጥናት አላማ ከተመረጡት ት/ትቤቶች በአንዱ ውስጥ ስለሚሆኑት። የእርስዎ ተሳትፎ ሙሉ በሙሉ በእርስዎ ሙሉ ፍቃደኝነት ላይ የተመሰረተ ነው። በጥናቱ ላይ ያለመሳተፍ ሙሉ መብት አለዎት። ለመሳተፍ ፈቃደኛ ከሆኑ በኋላም በፈለጉት ጊዜ ማቆም ወይም ማቋረጥ ይችላሉ። በጥናቱባለመሳተፎ የሚደርስባቸውንም አይነት ግርዛድ አይኖርም።

በጥናቱ ለመሳተፍ ከተስማሙ ከጤናማ አመጋገብ ጋር ሊያያዙ የሚችሉ every 21 days for ሶስት ተከታታይ Gize የነበሮትን የአመጋገብ ሁኔታ በተመለከተ ቃለ-መጠይቅ ይደረግሎታል። ቃለ-መጠይቁ ቢያንስ ከ 10 እስከ 15 ደቂቃ ይወስዳል።

ይህ ጥናት ፖሊሲ አውጪዎችና የሚመለከታቸው አካላት ጎረቤቶች የፍራፍሬ ፍጆታቸውን ለመጨመር የሚያስችል የገበያ ሁኔታ እንዲቀርፁና እንዲተገብሩ እንደመነሻ ይሆናል የሚል ፅኑ እምነት አለን።

በመጨረሻም ከእርስዎ የምንሰበስበው መረጃ ከእርዎስም ጋር አይያያዝም። ስምዎት እንደሚይጠቀስና ለማንም አካል አልፎ እንደሚይደሰጥ ልናረጋግጥ እንወዳለን። ይህን መረጃ ከተመራማሪው በቀር ማንም እንዲያገኘው አይደረግም እንዲሁም ለጥናቱ መረጃነት ከመዋሉ በቀር ለሌላ አላማ አይውልም። የእርሶ ፈቃደኝነትና ንቁ ተሳትፎ ለጥናቱ ስኬታማነት በጣም ጠቃሚ ነው።

የስምምነት መጠየቂያ/ማረጋገጫ ቅፅ

ከላይ በሰጠዎት መረጃ መሰረት በጥናቱ ላይ ለመሳተፍ ፍቃደኛ ነዎት?

- 1. አዎ
- 2. አይደለሁም

ፍቃደኛ ካልሆኑ ምክኒያቱን ፅፈው ወደ ሚቀጥለው ተሳታፊ ጸላፍ _____

የተሳታፊ ፊርማ (ከ 18 አመት በታችም በላይ ምላሉ ልጆች) ፊርማ _____

ቀን _____

የተሳታፊ ቤተሰብ ፊርማ (ከ 18 አመት በታች ለሆኑ ልጆች)

ፊርማ _____ ቀን _____

የቤተሰብ ፍቃድ ያገኘው ልጅ ስም _____

የመረጃ ሰብሳቢ

ስም _____ ፊርማ _____

የመጠይቁ ቁጥር _____

መጠይቁ የተካሄደበት ቀን _____ የተጀመረበት ሰዓት _____ ያለቀበት ሰዓት _____

የቃለመጠይቁ ውጤት

- 1. ሙሉ በሙሉ የተሞላ
- 2. በከፊል የተሞላ
- 3. ምንም ያልተሞላ

በተቆጣጣሪዎች ተረጋግጧል: ስም _____ ፊርማ _____

ለተጨማሪ ማብራሪያ የዋና አጥኚውን አድራሻ ይጠቀሙ

ስም: በረከት ገብረሚካኤል

ኢሜይል: bdpapi3@gmail.com

ስልክ +25191266 01 25

Survey questionnaire (Amharic version)

የመጠይቁ መለያ ቁጥር _____

በአዲስ አበባ ዩኒቨርሲቲ የተፈጥሮ ሳይንስ ኮሌጅ የምግብና የምግብ ምርምር ማዕከል

ፍራፍሬን በቸርቻሮ ወይም በጅምላ መሸጥ የትኛው የሁለኛ ደረጃ ተማሪዎችን የፍራፍሬ አመጋገብ

ይጨምራል በሚል ርዕስ የተዘጋጀ የጥናታዊ ፅሁፍ መረጃ መሰብሰቢያ መጠይቅ

የተጠያቂው ስም	
የት/ቤቱ ስም	
መጠይቁ የተሞላበት ቀን	/ቀን/ /ወር/ /ዓ.ም/
የተጀመረበት ሰዓት	/ሰዓት/ /ደቂቃ/
ያለቀበት ሰዓት	/ሰዓት/ /ደቂቃ/
ጠያቂ	ስም _____ ፊርማ _____
በተቆጣጠረው ተረጋግጦአል	ስም _____ ፊርማ _____

በአዲስ አበባ ዩኒቨርሲቲ የተፈጥሮ ሳይንስ ኮሌጅ የምግብና የምግብ ምርምር ማዕከል

ፍራፍሬን በቸርቻሮ ወይም በጅምላ መሸጥ የትኛው የሁለኛ ደረጃ ተማሪዎችን የፍራፍሬ አመጋገባቸውን

ይጨምራል በሚል ርዕስ ለተዘጋጀ ጥናታዊ ፅሁፍ መረጃ መሰብሰቢያ የተዘጋጀ መጠይቅ

ክፍል 1. መሰረታዊ መረጃን የተመለከቱ ጥያቄዎች

ተ.ቁ	ጥያቄ	መልስ	ወደሚቀጥለው ጥያቄ ይሂዱ
101	ዕድሜዎ/ሽ ስንት ነው?		
102	ፆታ	1. ወንድ 2. ሴት	
103	ሐይማኖትዎ/ሽ ምንድን ነው?	1. ኦርቶዶክስ 2. ካቶሊክ 3. ፕሮቴስታንት 4. ሙስሊም 5. ሌላካለይጠቀስ _____	
104	በምትኖርበት/ሪበት ቤት ውስጥ አንተን/ቺን ጨምሮ የቤተሰብ ብዛት ስንት ነው?		
105	የወላጅ አባት የትምህርት ደረጃ?	1. ያልተማረ (ማንበብና መፃፍ የማይችል) 2. ማንበብና መፃፍ የሚችል 3. የመጀመሪያ ደረጃ (ከ1ኛ-8ኛክፍል) 4. ሁለተኛ ደረጃ (ከ9ኛ-12ኛ) 5. የተወሰነ የኮሌጅ ወይም ቴክኒክናሙያት/ትያለው 6. ኮሌጅ ያጠናቀ ወይም ከዛ በላይ	

		<p>7. አላውቅም</p> <p>8. አባቴ በህይወት የለም</p>	
106	የወላጅ እናት የትምህርት ደረጃ?	<p>1. ያልተማረች (ማንበብና መጻፍ የማትችል)</p> <p>2. ማንበብና መጻፍ የምትችል</p> <p>3. የመጀመሪያ ደረጃ (ከ1ኛ-8ኛክፍል)</p> <p>4. ሁለተኛ ደረጃ (ከ9ኛ-12ኛክፍል)</p> <p>5. የተወሰነ የኮሌጅ ወይም የቴክኒክና ሙያ ት/ት ያላት</p> <p>6. ኮሌጅ ያጠናቀቀች ወይም ከዛ በላይ</p> <p>7. አላውቅም</p> <p>8. እናቴ በህይወት የለችም</p>	
107	ከማንጋር ነው የምትኖረው/ረው?	<p>1. ከእናትና ከአባቴ ጋር</p> <p>2. ከእናቴ ጋር ብቻ</p> <p>3. ከአባቴ ጋር ብቻ</p> <p>4. ከእህቶቼ/ወንድሞቼ ጋር</p> <p>5. ከአያቶቼ ጋር</p> <p>6. ከአክስቴ/አጎቴ ልጆች ጋር</p> <p>7. ከእናቴና ከእንጀራ አባቴ ወይም ከአባቴ እና ከእንጀራ እናቴ</p> <p>8. ከጓደኞቼ ጋር</p> <p>9. ሌላ ካለ ይገለፅ _____</p> <p>—</p>	
108	ስንተኛ ክፍል ነህ/ሽ?		

ክፍል 2: ተሳታፊዎችን በመጠየቅ የተገኘ የሰውነት ልኬት፣ ስለ ራስ አካል/ተክለሰውነት ያለ ግንዛቤ/አረዳድ አንዲሁም

ስለ ራስ ተክለ ሰውነት/አቋም ያለ እርካታና የሰውነት ክብደትን ለመለወጥ የሚደረግ ሙከራን በተመለከተ

ተ.ቁ.	ጥያቄዎች	ምርጫ	ምርመራ
201	ቁመት (በመጠየቅ)	_____	
202	ክብደት (በመጠየቅ)	_____	
203	ስለ ራስ አካል/ሰውነት ያለግንዛቤ/አረዳድ	<ol style="list-style-type: none"> 1. ቀጭን 2. ትክክለኛ/ጤናማ 3. ከልክ ያለፈ /አላስፈላጊ ክብደት 	
204	ባለሀ /ሽ ተክል ሰውነት ደስተኛነህ/ሽ?	<ol style="list-style-type: none"> 1. በጣም ደስተኛ 2. ደስተኛ 3. ገለልተኛ/መካከለኛ 4. ደስተኛ አይደለሁም 5. በጣም ደስተኛ አይደለሁም 	
205	የክብደት መጠንህን/ሽን ለመለወጥ ሙከራ /ሽታውቃለህ/ያለሽ	<ol style="list-style-type: none"> 1. አዎ 2. የለም 	

የመጠይቁ መለያ ቁጥር

ክፍል 3: የሚቀጥሉት ጥያቄዎች ስለተማሪዎች የኪስ ገንዘብና ስለ ወጪ ባህሪያቸው ይጠይቃል

ተ.ቁ.	ጥያቄዎች	ምርጫ	ምርመራ
301	የኪስ ገንዘብ በአብዛኛው ይኖርሃ/ሻል/ ታገኛለህ/ሽ?	1. አዎ 2. የለም/አላገኛም	
302	መልሱ አዎ ከሆነ ፣ በአማካይ በቀን ስንት ብር ታገኛለህ/ሽ?	_____ ብር	
303	የኪስ ገንዘብህን/ሽን በምን ታጠፋዋለህ/ታውለዋለህ/?	1. ቁርስ/መቅሰስ/መቆያ አገዛበታለሁ 2. ሲኒማ ፊልም አይበታለሁ 3. ለተለዩ ጫዋታ/ጉዳይ/ድርጊት እቆጥባለሁ 4. ሌላካለገለጽ/ _____	
304	ለጥያቄ 303 መልሱ ቁርስ/መቅሰስ /መቆያ አገዛበታለሁ ከሆነ፣ በአብዛኛውምን ትገዛበታለህ/ትገዥበታለሽ?	1. ብስኩት 2. በርገር 3. ኬክ 4. ፍራፍሬ 5. ቸፕስ 6. ለስላሳ መጠጦች 7. ሌላካለገለጽ/ _____	
305	አሁን ከምታገኛው የኪስ ገንዘብ ሁለት ወይም ሶስት እጥፍ በጥሬ ገንዘብ ቢሰጥህ ምን	1. ቁርስ/መቅሰስ/መቆያ አገዛበታለሁ 2. ሲኒማ ፊልም አይበታለሁ	

	ታደርግበታለህ?	3. ለተለየ ጫዋታ/ጉዳይ/ድርጊት እቆጥባለሁ 4. ሌላ ካለገለጽ/_____	
306	ለጥያቄ 301 መልስ አላገኝም ከሆነ፤ በቀንክ 10-20 ብር ቢሰጥህ ምን ታደርግበታለህ?	1. ቁርስ/መቅሰስ/መቆያ አገዛበታለሁ 2. ሲኒማ ፊልም አይበታለሁ 3. ለተለየ ጫዋታ/ጉዳይ/ድርጊት እቆጥባለሁ 4. ሌላ ካለ ገለጽ/_____	

ክፍል 4: የትምህርት ቤት አካባቢ ምግብ ሁኔታ ምዘና፣ የፍራፍሬ እቅርቦትን በተመለከተ

ተ.ቁ.	ጥያቄዎች	ምርጫ	ምርመራ
401	በት/ቤቱ ውስጥ ሻይ ቤት (ካፍቴሪያ) አለ?	1. አዎ 2. የለም	
402	የት/ቤቱ ካፍቴሪያ ፍራፍሬ ያቀርባል (ሁሉም ትኩስ/አዲስ የተቀጠፉ፣ የቀዘቀዘ፣ በቆረቆሮ የታሸጉ እና የደረቁና የፍራፍሬ ጭማቂ (ብርቱካንና የብርቱካን ጭማቂ፣ ፖም/አፕልና የአፕል ጭማቂ፣ ሙዝ፣ ወይን፣ ሀብሀብ፣ እንጆሪ፣ ዘቢብ)?	1. አዎ 2. የለም	
403	በት/ቤቱ አካባቢ የፍራፍሬ መሸጫ/ሻጭ አለ?	1. አዎ 2. የለም	
404	መልሱ አዎ ከሆነ፤ ከት/ቤቱ አካባቢ የፍራፍሬ መሸጫ/ሻጭ በምን ያህል እርቀት ላይ ይገኛል (በኪ/ሜ ወይም በእግር ጉዞ/በእርምጃ)?	_____	

405	በት/ቤት አቅራቢያ ከሚገኝው የፍራፍሬ መሸጫ ፍራፍሬ ትገዛለህ/ሽ?	<ol style="list-style-type: none"> 1. አዎ 2. የለም/አልገዛም 	
406	መልሱ አልገዛም ከሆነ ምክንትህ/ሽ ምንድን ነው?	<ol style="list-style-type: none"> 1. ውድ ስለሆነ 2. ፍራፍሬ ስለማልዎድ 3. ከት/ቤቱ ሩቅ ስለሆነ 4. ሌላ ካለገለጽ/_____ 	

ክፍል 5. የአመገብ መረጃ (ምግብ (ፍራፍሬ) ድግግሞሽ መጠይቅ)

የሚቀጥለው ጥያቄ ስለምትመገቡት ፍራፍሬ ይሆናል. ይህን ጥያቄ እየመለሱ እባኩት ትላንት ከዚህ (በተመሳሳይ) ሰዓት ጀምሮ የተመገቡትን ፍራፍሬ ያስቡ (የ24 ሰዓት ትውስታ መጠይቅ)

No.	የፍራፍሬ አይነት	የአመገብ ድግግሞሽ					ይዘላሉ
		አዎ (1)	አይደለም (0)	አዎ ካሉ ምን ያህል (እባክ በቁጥር ይግለጹ)	መልሱ አዎ ከሆነ የት እንደተመገቡ ይጠቀስ ቤት (1), ት/ ቤት (2), የጓደኛ ቤት (3), ካፌ/ ሬስቶራንት (4)	የተመገቡበት ቦታት/ቤት ከሆነ ፍራፍሬውን ከየት እንዳመጡት ይጠቀስ ቤት (1), ፍራፍሬ አደረ (2), የት/ቤት ካፌ (3),	
501	ሙዝ						
502	ብርቱካን						
503	ፖም						
504	ሃብሃብ						
505	ማንጎ						
506	እንጆሪ						
507	አናናስ						
508	ሌላ ካለ ይጠቀስ(fruit						

