

## Fruits and vegetables consumption and associated factors among in-school adolescents in seven African countries

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### Abstract

**Objectives** To present data on fruits and vegetables consumption and associated factors among African in-school adolescents.

**Methods** Data were collected by self-report questionnaire from nationally representative samples (total 17,656) of school children aged 13–15 years in seven African countries.

**Results** Thirty-six percent (36%) and 23% of 13–15-year-old boys and 32.6 and 22.3% of the 13–15-year-old girls had inadequate fruits and vegetables consumption (less than once per day). In multivariate analysis, inadequate fruits consumption was associated with distal factors such as going without food (OR = 1.50,  $P = .001$ ), being male (OR = 1.23,  $P = .012$ ) and higher education (OR = 1.56,  $P = .001$ ), proximal factors including lack of care giver connectedness (OR = 1.41,  $P = .000$ ), and smoking (OR = 1.52,  $P = .004$ ), and inadequate vegetables consumption was associated with lack of care giver supervision (OR = 1.57,  $P = .000$ ), no close friends (OR = 1.55,  $P = .000$ ) and having less education (OR = 0.73,  $P = .002$ ).

**Conclusion** The results stress the need for intervention programmes aimed at increased consumption of fruits and vegetables, targeting proximal factors such as the family environment, distal factors by aiming at reaching adolescents from lower socio-economic groups and integrating

other risk factors such as substance use and mental distress into health promotion among adolescents.

**Keywords** Fruits · Vegetables · Adolescents · Psychosocial correlates · Health-compromising behaviors · African countries

### Introduction

High fruit and vegetable intake can promote health and prevent chronic disease such as heart diseases and certain types of cancer (Key et al. 2002; Hu 2003). The health benefits of fruits and vegetables seen in epidemiology studies are the main reasons for the recommended intake of at least 400 g of fruit and vegetables per day (WHO 2003). During adolescents several factors impact on chronic diseases: the development of risk factors, the tracking of risk factors throughout life, and the development of healthy or unhealthy habits that tend to stay throughout life (WHO 2003). Because of this increasing fruit and vegetable consumption among children and adolescents is an important public health issue (Rasmussen et al. 2006).

In spite of the importance of an adequate intake of fruits and vegetables during adolescence, large population groups, including children and adolescents, eat far less than the recommended amount of fruits and vegetables, in most Western countries (Vereecken et al. 2004; Yngve et al. 2005), Asian countries (Musaiger and Gregory 1992; Ahmed et al. 1998; Lee et al. 2001; Omidvar et al. 2003; Shi et al. 2005), Costa Rica (Rojas 2001) and South Africa (Reddy et al. 2003). The Health Behavior in School-aged Children (HBSC) study 2001/2002 (Vereecken et al. 2004), which was conducted in 33 European and North American countries among 13- and 15-year-old students, showed that <50% of all young people

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reported eating vegetables and fruits on a daily basis. Reddy et al. (2003) found based on the South African National Youth Risk Behavior Survey in 2002 that nationally 58% of learners had eaten fresh fruit and fresh vegetables at 4 or more days during the week preceding the survey. Shi et al. (2005) found among school children in China that only about 42% of the boys and 55% of the girls from low socioeconomic status (SES) families ate fruit daily, compared with 66% and 72%, respectively in the high SES families.

To develop effective interventions to increase fruit/vegetable intake, an understanding of etiological processes and the identification of potentially modifiable correlates is needed. Few studies have examined fruit/vegetable intake and its correlates among adolescents in African countries. Factors that have been found to be correlated with fruit and vegetable intake in previous studies of adolescents include age, gender, socio-economic position, preferences, parental intake, parental modeling, family rules and parental encouragement and home availability/accessibility (Rasmussen et al. 2006; Pearson et al. 2009a). These correlates operate at a distal level (e.g., SES), whereas others (e.g., parental practices, family rules, availability of fruits and vegetables) may operate at a more proximal level. Based on previous research it is hypothesized that distal level factors (e.g., SES, culture or country) (United States Department of Health and Human Services 2000; Giskes et al. 2002; Rasmussen et al. 2006; Molcho et al. 2007; Richter et al. 2009) and proximal level factors [family (Neumark-Sztainer et al. 1996; Rasmussen et al. 2006; Pearson et al. 2009a) and friends (Lien et al. 2002) related factors] will be correlated with fruits and vegetables consumption. This framework proposes that the more distal determinants of fruit and vegetable intake can be found in the cultural, physical and social environment and that they in turn influence the more proximal personal factors such as attitude, social influences and self-efficacy (Klepp et al. 2005). In addition, it is hypothesized that insufficient fruits and vegetable intake can be considered as a behavior with underlying influences that are shared with other problem behaviors such as substance use (Neumark-Sztainer et al. 1996), mental distress (Neumark-Sztainer et al. 1996; Cartwright et al. 2003), and physical inactivity (Rasmussen et al. 2006; Pearson et al. 2009b), which is consistent with problem behavior theory (Jessor and Jessor 1977).

The aim of this study was to study fruits and vegetables consumption and associated factors among 13- to 15-year-old in-school adolescents in seven African countries.

## Methods

### Description of survey and study population

This study involved secondary analysis of existing data from the Global School-Based Health Survey (GSHS) from seven

African countries (Botswana, Kenya, Senegal, Swaziland, Tanzania, Uganda, and Zambia; the GSHS in Namibia and Zimbabwe did not collect data on fruits and vegetables consumption). All African countries from which GSHS datasets were publicly available were included in the analysis. Details and data of the GSHS can be accessed at <http://www.who.int/chp/gshs/methodology/en/index.html>. From all but one country, national samples were included while from Tanzania only the Dar es Salaam region was included. The aim of the GSHS is to collect data primarily from students of age 13–15 years. A two-stage cluster sample design was used to collect data to represent all students in grades 6, 7, 8, 9, and 10 in the country. At the first stage of sampling, schools were selected with probability proportional to their reported enrollment size. In the second stage, classes in the selected schools were randomly selected and all students in selected classes were eligible to participate irrespective of their actual ages. School-aged youth completed a self-administered questionnaire within the selected school. Data collection was conducted by trained survey administrators during one regular class period. Student privacy was protected through anonymous and voluntary participation, and informed consent was obtained as appropriate from the students, parents and/or school officials.

### Measures

The GSHS 10 core questionnaire modules address the leading causes of morbidity and mortality among children and adults worldwide: tobacco, alcohol and other drug use; dietary behaviors; hygiene; mental health; physical activity; sexual behaviors that contribute to HIV infection, other sexually transmitted infections, and unintended pregnancy; unintentional injuries and violence; hygiene; protective factors and respondent demographics (Centers for Disease Control 2009).

### Fruits and vegetables consumption and hunger

*Fruits* “During the past 30 days, how many times per day did you usually eat fruit, such as ‘country specific examples’?” Response options were 1 = I did not eat fruit during the past 30 days, 2 = less than one time per day, 3 = 1 time per day to 7 = 5 or more times per day.

*Vegetables* “During the past 30 days, how many times per day did you usually eat vegetables, such as ‘country specific examples’?” Response options were 1 = I did not eat vegetables during the past 30 days, 2 = less than one time per day, 3 = 1 time per day to 7 = 5 or more times per day.

Adolescents indicated that they were consuming fruits (or vegetables) less than once a day were coded as having

inadequate consumption patterns; this cutoff point was chosen to identify those at greater risk for inadequate intake (Neumark-Sztainer et al. 1996) and to compare with other studies (Vereecken et al. 2004). The United States Department of Health and Human Services (2000) recommends at least two daily servings of fruits and three daily servings of vegetables.

**Hunger** A measure of hunger was derived from a question reporting the frequency that a young person went hungry because there was not enough food at home in the past 30 days (response options were from 1 = never to 5 = always) (coded 1 = most of the time or always and 0 = never, rarely or sometimes).

#### Substance use variables

**Smoking cigarettes and the use of any other form of tobacco such as snuff, or chewed tobacco** during the past 30 days, on how many days did you smoke cigarettes or use other forms of tobacco? (Response options were from 1 = 0 days to 7 = all 30 days) (Coded 1 = 1 or 2 to all 30 days, and 0 = 0 days).

**Alcohol use was measured with two variables** (a) during the past 30 days, on how many days did you have at least one drink containing alcohol. Response options were from 1 = 0 days to 7 = all 30 days; coded 1 = 1 or 2 to all 30 days, and 0 = 0 days. (b) Excessive drinking: During your life, how many times did you drink so much alcohol that you were really drunk? Response options were from 1 = 0 times to 4 = 10 or more times; coded 1 = 1 or 2 to 10 or more times, and 0 = 0 times.

**Drugs** During your life, how many times have you used drugs, such as glue, benzene, marijuana, cocaine, or mandrax? Response options were from 1 = 0 times to 4 = 10 or more times; Coded 1 = 1 or 2 to 10 or more times, and 0 = 0 times.

#### Physical activity

Leisure time physical activity was assessed by asking participants: "Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, playing with friends, or walking to school. Some examples of physical activity are running, fast walking, biking, dancing, football. Do not include your physical education or gym class." "During the past 7 days, on how many days were you physically active for a total of at least 60 min per day?" and "During a typical or usual week, on how many days are you physically active for a total of at least 60 min per day?"

Leisure time sedentary behavior was assessed by asking participants about the time they spend mostly sitting when

not in school or doing homework: "How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking with friends, or doing other sitting activities."

#### Mental distress variables

**Loneliness** "During the past 12 months, how often have you felt lonely?" (Response options were from 1 = never to 5 = always) (Coded 1 = most of the time or always and 0 = never, rarely or sometimes).

**Suicide ideation** "During the past 12 months, did you ever seriously consider attempting suicide?" (Response option was 1 = yes and 2 = no, coded 1 = 1, 2 = 0).

**No close friends** "How many close friends do you have?" (Response options 1 = 0 to 4 = 3 or more, coded 1 = 1, 2-4 = 0).

**Anxiety or worried** During the past 12 months, how often have you been so worried about something that you could not sleep at night? (Response options were from 1 = never to 5 = always) (Coded 1 = most of the time or always and 0 = never, rarely or sometimes).

**Sadness** During the past 12 months, did you ever feel so sad or hopeless almost every day for 2 weeks or more in a row that you stopped doing your usual activities? (Response option 1 = yes and 2 = no) (Coded 1 = 1, 2 = 0).

Protective factors (peer support at school, parental or guardian supervision, connectedness, and bonding).

Peer support at school was assessed with the question "During the past 30 days, how often were most of the students in your school kind and helpful?" Parental or guardian supervision "During the past 30 days, how often did your parents or guardians check to see if your homework was done?" Parental or guardian connectedness "During the past 30 days, how often did your parents or guardians understand your problems or worries?" and Parental or guardian bonding "During the past 30 days, how often did your parents or guardians *really* know what you were doing with your free time?" Response options to these questions were from 1 = never to 5 = always, coded 1 = never or rarely and 0 = sometimes to always.

#### Data analysis

In order to compare study samples across countries each country sample was restricted to the age group 13–15 years, younger and older participants were excluded from the analyses. For each country, the schools' response rate ranged from 90 to 100%, students' response rate was 75–99% and the overall response rates were 69–96% (Table 1).

Data analysis was performed using STATA software version 10.0 (Stata Corporation, College Station, TX,

**Table 1** Sample response rate and age distribution of students surveyed; GSHS 2003–2006

Country	Schools approached (response rate) <i>N</i> (%)	Students approached (response rate) <i>N</i> (%)	Age groups in years (%)				
			≤12	13	14	15	≥16
Botswana	50 (100)	2,313 (95)	25 (1.1)	186 (8.3)	595 (22.4)	694 (32.7)	778 (35.5)
Kenya	46 (96)	4,246 (87)	0	689 (25.9)	1,068 (38.5)	1,001 (35.6)	0
Senegal	50 (100)	5,257 (60)	418 (11.6)	779 (24.0)	755 (24.4)	869 (28.0)	320 (11.9)
Swaziland	100 (97)	7,419 (99)	0	1,367 (20.2)	2,586 (38.7)	2,831 (41.2)	0
Tanzania	25 (100)	2,492 (87)	833 (46.8)	611 (26.6)	380 (14.5)	226 (8.5)	104 (3.5)
Uganda	50 (90)	4,218 (76)	0	261 (15.9)	679 (36.4)	938 (47.6)	0
Zambia	50 (94)	3,021 (75)	0	271 (26.9)	418 (33.2)	552 (39.9)	0

USA). This software has the advantage of directly including robust standard errors that account for the sampling design, i.e. cluster sampling owing to the sampling of school classes. In further analysis, the inadequate fruits and vegetables consumption variables were recoded separately into two categories: inadequate fruits and vegetables consumption (less than once = 1) and adequate fruits and vegetables consumption (once or more a day = 0). Associations between distal factors (sociodemographic variables, hunger), proximal factors (protective factors) and other risk behavior (mental distress, physical inactivity and substance use) among school children were evaluated calculating odds ratios (OR). Logistic regression was used for evaluation of the impact of explanatory variables for inadequate fruits and vegetables separately (binary dependent variables). In the analysis, weighted percentages are reported. The reported sample size refers to the sample that was asked the target question. The two-sided 95% confidence intervals are reported. The *P* value less or equal to 5% is used to indicate statistical significance. Both the reported 95% confidence intervals and the *P* value are adjusted for the multi-stage stratified cluster sample design of the study.

## Results

### Sample characteristics and fruits and vegetables consumption

The total sample included 17,656 school children aged 13–15 years from seven African countries. There were slightly more male (50.5%) than female (49.5%) school children. In all most children 77.5% consumed less than the recommended five servings of fruits and/or vegetable, this was significantly higher among boys than in girls. More than one-third of boys (36.0%) and 32.6% of girls reported inadequate fruits consumption (less than once or more per day), and 23.0% of boys and 22.3% of girls indicated

inadequate vegetable consumption (less than once or more per day). The mean number of fruits consumed per day was for girls (1.48) significantly higher than for boys (1.33), not far away from the recommended two fruits a day target. The mean number of vegetables consumption was for boys and girls 1.56, about half of the recommended three vegetables a day target. The mean daily servings of fruits and/or vegetables per day was 2.96, far below the recommended five servings a day target. Swazi, Ugandan and Senegalese school children had the most insufficient “less than five servings fruits and/or vegetables”, 81.6, 80.2 and 79.7%, respectively, and Tanzanian, Zambian and Botswana children the least (56.8, 68.6 and 71.5%, respectively). In terms of mean daily servings of fruits and/or vegetables, Tanzanian school children had the highest consumption (4.26), followed by Zambian (3.36) and Botswana (3.29) school children, and the lowest consumption was among Senegalese (2.61) and Ugandan (2.65) school children (Table 2).

### Inadequate fruits and vegetables consumption and its relationship with distal and proximal and other risk factors

In univariate regression analyses distal factors (male gender, higher education, going without food), proximal factors (lack of caregiver bonding, connectedness and supervision) and other risk behavior (smoking, parental tobacco use, no close friends, anxiety, physical inactivity, less sedentary behavior) were associated with inadequate fruits consumption. Distal factors (being older, higher education, going without food), proximal factors (lack of peer support, lack of caregiver bonding, connectedness and supervision) and other risk behavior (having ever used drugs, smoking and other tobacco use, suicide ideation, no close friends) were associated inadequate vegetables consumption. In multivariate analysis, inadequate fruits consumption was associated with distal factors such as going without food (OR = 1.50, *P* = .001), being male

**Table 2** Details of participating country samples included in the analyses (age 13–15 years only) and fruits and vegetables consumption; GSHS 2003–2006

Country (year of study)	Total (N)	Male (%)	Female (%)	Mean (95% CI) daily servings of fruits		Mean (95% CI) daily serving of vegetables		Mean (95% CI) daily serving of fruits and vegetables		
				M (M)	F (M)	M (M)	F (M)	M (M)	F (M)	All (M)
Botswana (2005)	1,305	51.4 (48.3–54.5)	48.6 (45.5–51.7)	1.62 (1.61–1.65)	1.59 (1.58–1.61)	1.66 (1.65–1.68)	1.69 (1.68–1.71)	3.30 (3.27–3.32)	3.28 (3.25–3.30)	3.29 (3.27–3.31)
Kenya (2003)	2,758	46.4 (43.8–49.1)	53.6 (50.9–56.2)	1.29 (1.29–1.30)	1.49 (1.49–1.49)	1.60 (1.60–1.60)	1.61 (1.60–1.61)	2.89 (2.89–2.90)	3.08 (3.08–3.09)	3.00 (3.00–3.00)
Senegal (2005)	2,403	47.6 (45.2–50.0)	52.4 (50.0–54.8)	1.09 (1.08–1.09)	1.14 (1.13–1.14)	1.52 (1.52–1.53)	1.50 (1.50–1.51)	2.60 (2.59–2.61)	2.63 (2.62–2.64)	2.61 (2.61–2.62)
Swaziland (2004)	6,784	47.7 (45.6–49.7)	52.3 (50.3–54.4)	1.42 (1.39–1.46)	1.46 (1.44–1.48)	1.33 (1.30–1.36)	1.40 (1.38–1.42)	2.76 (2.70–2.81)	2.86 (2.82–2.89)	2.82 (2.79–2.85)
Tanzania (2006)	1,217	51.4 (48.3–54.5)	48.6 (45.5–51.7)	2.01 (1.99–2.03)	2.06 (2.04–2.08)	2.17 (2.15–2.19)	2.29 (2.27–2.31)	4.19 (4.16–4.22)	4.33 (4.30–4.37)	4.26 (4.24–4.29)
Uganda (2003)	1,878	60.4 (58.3–62.5)	39.6 (37.5–41.7)	1.39 (1.39–1.40)	1.55 (1.54–1.56)	1.10 (1.10–1.11)	1.23 (1.22–1.24)	2.50 (2.49–2.52)	2.79 (2.77–2.80)	2.65 (2.64–2.67)
Zambia (2004)	1,241	35.6 (34.4–36.8)	64.4 (63.2–65.6)	1.68 (1.67–1.69)	1.63 (1.62–1.64)	1.76 (1.75–1.77)	1.65 (1.64–1.66)	3.46 (3.44–3.47)	3.25 (3.24–3.27)	3.36 (3.35–3.37)
Total	17,656	50.5 (49.3–51.7)	49.5 (48.3–50.7)	1.33 (1.33–1.33)	1.48 (1.47–1.48)	1.56 (1.55–1.56)	1.56 (1.56–1.57)	2.88 (2.88–2.88)	3.03 (3.03–3.03)	2.96 (2.96–2.97)
Country (year of study)	Fruits <1 or more		Vegs <1 or more		Fruits and Vegs <5					
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	All (%)	
Botswana (2005)	24.7 (20.9–28.5)	21.7 (18.0–25.5)	20.9 (17.2–24.5)	17.3 (13.9–20.7)	70.8 (67.1–74.6)	72.1 (68.9–75.2)	71.5 (69.1–74.0)			
Kenya (2003)	30.6 (26.8–34.4)	27.4 (24.2–30.5)	21.1 (17.8–24.5)	20.8 (17.9–23.7)	81.9 (79.5–84.3)	77.2 (74.9–79.6)	79.4 (77.7–81.1)			
Senegal (2005)	34.1 (30.8–37.4)	31.5 (28.4–34.6)	38.9 (35.5–42.3)	35.6 (32.4–38.8)	80.2 (77.8–82.5)	78.9 (76.2–81.6)	79.7 (77.9–81.5)			
Swaziland (2004)	34.5 (31.7–37.4)	29.8 (27.2–32.4)	16.8 (14.5–19.1)	17.3 (15.2–19.4)	81.4 (79.6–83.1)	81.6 (80.3–82.9)	81.6 (80.6–82.6)			
Tanzania (2006)	32.2 (27.8–36.7)	34.3 (30.4–38.3)	23.3 (19.4–27.3)	26.4 (22.7–30.0)	57.1 (52.2–61.0)	56.6 (52.2–61.0)	56.8 (53.7–59.9)			
Uganda (2003)	43.8 (40.9–56.7)	46.0 (42.7–49.3)	27.3 (24.7–29.9)	26.5 (23.5–29.5)	82.7 (80.0–85.3)	77.8 (75.0–80.6)	80.2 (78.3–82.1)			
Zambia (2004)	30.2 (28.2–32.2)	24.4 (23.0–25.7)	26.0 (24.5–27.9)	19.9 (18.6–21.2)	67.8 (63.2–72.4)	69.8 (65.9–73.7)	68.6 (65.5–71.6)			
Total	36.0 (34.3–37.6)	32.6 (31.0–34.2)	23.0 (21.6–24.4)	22.3 (20.9–23.6)	79.0 (77.6–80.4)	76.1 (74.7–77.5)	77.5 (76.5–78.5)			

(OR = 1.23,  $P = .012$ ) and higher education (OR = 1.56,  $P = .001$ ), proximal factors including lack of care giver connectedness (OR = 1.41,  $P = .000$ ), and other risk behavior such as smoking (OR = 1.52,  $P = .004$ ). Inadequate vegetables consumption was associated with and having less education (OR = 0.73,  $P = .002$ ), lack of care giver supervision (OR = 1.57,  $P = .000$ ), and no close friends (OR = 1.55,  $P = .000$ ) (Table 3).

## Discussion

The current investigation explores fruits and vegetables consumption and its correlates among in-school adolescents from seven African countries. Overall, low fruits and vegetables consumption was reported, 77.5% consumed less than the recommended five servings of fruits and/or vegetable, this was significantly higher among boys than in girls. More than one-third of boys (36.0%) and 32.6% of girls reported inadequate fruits consumption (less than once or more per day), and 23.0% of boys and 22.3% of girls indicated inadequate vegetable consumption (less than once or more per day). Studies from other African and developing and Western countries seem to confirm low fruits and vegetable consumption levels among adolescents, e.g., in South Africa 42.2% of learners had eaten fresh fruit and 41.8% had eaten fresh vegetables infrequently (less than 4 or more days) during the week preceding the survey (Reddy et al. 2003), in China less than 50% of school children ate fruits daily (Shi et al. 2005), in Gaza only 11.6% of boys and 16.2% of girls consumed fruits daily (Abudayya et al. 2009) and in Palestine 31% fruits and 45% vegetables daily (Al Sabbah et al. 2007). Vereecken et al. (2004) found among 13- and 15-year-old students in 33 European and North American school children that on average, 70% of boys and 63% of girls report not eating fruits daily and that less than 50% of all young people report eating vegetables daily. Eaton et al. (2008) found based on Youth Risk Behavior Surveillance in the United States, 2007 that during the 7 days before the survey, 78.6% of high school students had not eaten fruits and vegetables five or more times per day and Neumark-Sztainer et al. (1996) found from the Minnesota Adolescent Health Survey that less than daily consumption of fruits and vegetables was reported by approximately 40% of adolescents.

This study found cross-national variations in the prevalence of fruits and vegetable consumption. In terms of mean daily servings of fruits and/or vegetables Tanzanian school children had the highest (4.3) followed by Zambian (3.4), Botswana (3.3), Kenyan (3.0), Swaziland (2.8), Ugandan (2.7) and Senegalese (2.6) school children. Possible reasons for such country differences could be fruits

and vegetables availability, income and urbanization rate. In our study Senegalese school children had the lowest consumption of fruits and vegetables, probably due to Senegal being a Sahelian country with less availability of fruits and vegetables. In this study, Tanzanian school children from the Dar es Salaam region had the highest mean consumption of fruits and vegetables among participating countries, it also had the highest rate of going hungry (29%), low per capita income and medium low availability of fruits and vegetables. Possible reasons could be because of the mainly urban study population, most students (86.9%) reported that they had been taught at school about healthy eating (Nyandindi 2008) compared to only 48.6% in Zambia (Ministry of Health 2004) and perhaps employing a food-based approach using traditional methods of food preparation and locally available, cheap and affordable staples (fruits, pulses, vegetables and legumes) in the formulation of nutrient-enriched multi-mixes. WHO (2005) notes that fruits and vegetable consumption in sub-Saharan Africa rises with income and with urbanization. Yet data from the World Health Survey (WHS) show that for men and women combined (18–99 years), the poorest quintile had the highest prevalence of low fruit and vegetable consumption and urban residents had a higher risk of low fruit and vegetable consumption in a.o. Kenya and Zambia (Hall et al. 2009). Yet, other studies found that fruit and/or vegetable consumption is higher or more frequent among rural than urban adolescents (Rasmussen et al. 2006), also in developing countries, Costa Rica (Rojas 2001). On the whole the African region falls with 105.5 kg far below the 146 kg fruits and vegetables availability per person per year recommended by WHO/FAO and that of Asia 183.4 kg and Europe 196 kg (WHO 2005). However, discrepancies between ecological and individual data on fruit and vegetable have been pointed out (Pomerleau et al. 2003). The comparison of results across countries is further complicated by seasonal variability of fruits and vegetables consumption patterns (Pomerleau et al. 2004) (Table 4).

This study found in concurrence with other studies that distal factors such as gender (boys) (Vereecken et al. 2004; Rasmussen et al. 2006), age (older age) (Vereecken et al. 2004; Rasmussen et al. 2006), grade (higher grades) (Rasmussen et al. 2006), socioeconomic position (went without food) (United States Department of Health and Human Services 2000; Giskes et al. 2002; Rasmussen et al. 2006; Molcho et al. 2007; Richter et al. 2009) and proximal factors such as family related factors (parental style; lack of caregiver bonding, connectedness and supervision) (Neumark-Sztainer et al. 1996; Rasmussen et al. 2006; Pearson et al. 2009a), and friends-related factors (lack of peer support at school) (Lien et al. 2002), were associated with inadequate fruits and/or vegetables consumption.

**Table 3** Univariate and multivariate logistic regression of inadequate fruits and vegetables consumption, GSHS 2003–2006

	Male %	Female %	Fruits Crude OR (CI 95%) <sup>1</sup>	P	Pseudo R <sup>2</sup> = .31 Adjusted OR (CI 95%)	P	Vegetables Crude OR (CI 95%) <sup>1</sup>	P	Pseudo R <sup>2</sup> = .19 Adjusted OR (CI 95%)	P
Female			Ref		Ref		Ref		Ref	
Male			1.16 (1.05–1.29)	.004	1.23 (1.04–1.44)	.012	1.04 (0.93–1.16)	.484	–	
Age (years)										
13	25.5	26.9	Ref		–		Ref		Ref	.059
14	34.8	37.3	1.04 (0.91–1.18)	.590	–		1.17 (1.01–1.36)	.033	1.26 (0.99–1.61)	
15	39.9	36.0	1.04 (0.92–1.18)	.517	–		1.08 (0.94–1.25)	.279	–	
Grade										
6	45.6	43.6	Ref		Ref		Ref		Ref	.002
7	33.8	35.8	1.22 (1.09–1.37)	.001	1.23 (1.04–1.46)	.018	0.85 (0.75–0.96)	.012	0.73 (0.59–0.89)	
8	14.7	14.9	1.42 (1.22–1.64)	.000	1.56 (1.21–2.02)	.001	1.01 (0.86–1.18)	.935	–	
9	5.8	5.6	1.55 (1.25–1.92)	.000	1.56 (1.00–2.44)	.049	0.97 (0.76–1.24)	.812	–	
Alcohol and other drug use										
Current alcohol use	14.5	12.8	0.86 (0.73–1.02)	.079	–		1.13 (0.95–1.35)	.153	–	
Ever drunk	20.0	15.4	0.96 (0.84–1.10)	.587	–		1.15 (0.99–1.33)	.065	–	
Ever used drugs	12.2	11.8	0.98 (0.83–1.15)	.792	–		1.23 (1.04–1.46)	.015	0.90 (0.66–1.24)	.523
Tobacco use										
Current smoking	12.9	7.4	1.23 (1.01–1.43)	.049	1.52 (1.15–2.01)	.004	1.32 (1.07–1.65)	.011	1.28 (0.89–1.85)	.179
Current other tobacco use	12.0	8.6	1.14 (0.94–1.39)	.180	–		1.32 (1.07–1.63)	.011	1.13 (0.76–1.69)	.548
Tobacco use of any parent	22.9	18.6	1.29 (1.12–1.48)	.000	1.19 (0.98–1.45)	.084	1.03 (0.88–1.20)	.731	–	
Went hungry	13.0	14.2	1.26 (1.09–1.46)	.002	1.50 (1.18–1.92)	.001	1.21 (1.03–1.42)	.017	1.03 (0.79–1.35)	.821
Mental distress										
Loneliness	15.1	16.6	1.09 (0.92–1.29)	.345	–		1.04 (0.87–1.25)	.668	–	
Suicide ideation	24.7	27.0	1.05 (0.90–1.22)	.532	–		1.23 (1.05–1.44)	.010	1.05 (0.85–1.29)	.678
No close friends	11.3	13.0	1.20 (1.00–1.43)	.049	1.04 (0.81–1.32)	.778	1.48 (1.23–1.78)	.000	1.55 (1.22–1.98)	.000
Anxiety	15.1	14.4	1.32 (1.11–1.57)	.002	1.38 (1.08–1.76)	.010	1.16 (0.96–1.40)	.125	–	
Sadness	46.1	45.4	1.08 (0.96–1.23)	.208	–		1.04 (0.91–1.19)	.575	–	
Physical activity										
At least 60 min daily	14.8	10.4	0.83 (0.71–0.97)	.020	0.84 (0.67–1.05)	.132	0.88 (0.74–1.04)	.129	–	
Sedentary behavior	34.2	31.6	0.81 (0.72–0.91)	.000	0.84 (0.71–0.99)	.045	0.93 (0.82–1.06)	.288	–	
Protective factors										
Lack of peer support at school	31.0	27.7	1.07 (0.96–1.20)	.228	–		1.23 (1.09–1.39)	.001	1.12 (0.92–1.37)	.240
Lack of caregiver bonding	35.2	29.3	1.40 (1.25–1.56)	.000	1.23 (1.02–1.47)	.023	1.29 (1.15–1.45)	.000	1.08 (0.89–1.30)	.433
Lack of caregiver connectedness	34.6	31.3	1.51 (1.36–1.68)	.000	1.41 (1.18–1.69)	.000	1.29 (1.15–1.46)	.000	1.02 (0.84–1.24)	.822
Lack of caregiver supervision	32.0	27.8	1.46 (1.31–1.63)	.000	1.25 (1.04–1.49)	.016	1.53 (1.36–1.72)	.000	1.57 (1.30–1.89)	.000

**Table 4** Country comparison of fruits and vegetable consumption and associated indicators, GSHS 2003–2006

Country	Mean daily servings of fruits and/or vegetables (13–15 years) (2003–2006) <sup>a</sup>	Prevalence of low fruit and vegetable consumption (13–15 years) (2003–2006) <sup>a</sup>	Prevalence of low fruit and vegetable consumption (18–99 years) (2002–2003) <sup>b,bb</sup>	Mostly or always went hungry (13–15 years) (2003–6) <sup>a</sup>	Fruits and vegetables availability (kg/capita/year) (2003) <sup>a,c</sup>	% of under-fives underweight (1995–2003) <sup>a,d</sup>	Gross national income per capita (US\$) (2003) <sup>a,d</sup>	Urbanization (%) (2003) <sup>a</sup>
Tanzania	4.3	56.8		29.5	57.5	29	290	35
Zambia	3.4	68.6	78.1	9.4	33.7	28	380	36
Botswana	3.3	71.5		3.9	64.4	13	3,430	52
Kenya	3.0	79.4	86.8	14.2	85.1	20	390	39
Swaziland	2.8	81.6	63.5	13.8	75.1 (South Africa)	10	1,350	24
Uganda	2.7	80.2		10.6	226.3	23	240	12
Senegal	2.6	79.7	82.2	8.5	55.6	23	550	50

<sup>a</sup> Year of data collection

<sup>b</sup> Hall et al. 2009

<sup>c</sup> WHO 2005

<sup>d</sup> United Nations Population Fund 2007

Further, consistent with problem behavior theory the study found that substance use (smoking, tobacco use, use of drugs) (Neumark-Sztainer et al. 1996), mental distress (anxiety, no close friends, suicide ideation) (Neumark-Sztainer et al. 1996; Cartwright et al. 2003), and physical inactivity (Pearson et al. 2009b) were associated with inadequate fruits and/or vegetables consumption. Sedentary leisure time behavior (fewer hours sitting in a day) was in this study associated with inadequate fruits and/or vegetables consumption, while other studies found a positive association between hours watching TV and inadequate fruits and/or vegetables consumption (Rasmussen et al. 2006).

## Conclusion

The cross-national data on inadequate fruits and vegetable consumption from seven African countries point to the conclusion that programmes are needed to improve fruits and vegetables consumption of the adolescent population. Interventions to improve health-related behaviors should be tailored to the most important determinants or mediators of these behaviors. Our findings highlight the importance of targeting proximal factor such as the family environment for the promotion of healthy eating behaviors among adolescents. Since fruit and vegetable intake appears to decline with age among adolescents, intervention efforts are indeed needed to promote fruit and vegetable intake across childhood and adolescence. Furthermore, considering more distal factors interventions to promote fruit and vegetable intake should especially be aiming at reaching adolescents from lower socio-economic groups, and specific efforts should be made to also reach boys. Risk factors identified were consistent with problem behavior theory in which inadequate fruits and/or vegetables consumption is shared with other problem behaviors such as substance use, mental distress and physical inactivity. The connection between inadequate fruit and/or vegetables consumption and various risk factors including problem behavior such as substance use, mental distress and physical inactivity indicates that health promotion programmes should be broadened to include these factors collectively in health interventions for adolescents.

## Limitations of the study

This study had several limitations. First, the GSHS only enrolls adolescents who are in school. School-going adolescents may not be representative of all adolescents in a country as the occurrence of fruits and vegetable consumption may differ between the two groups. As the questionnaire was self-completed, it is possible that some



study participants may have miss reported either intentionally or inadvertently on any of the questions asked. Intentional miss reporting was probably minimized by the fact that study participants completed the questionnaires anonymously. Further, the assessment of correlates of fruits and vegetable consumption was limited and other factors such as preferences, parental intake, parental modeling, family rules and parental encouragement, home availability/accessibility, school level factors such as nutrition education, availability and policy of healthy and unhealthy foods, community and or neighborhood level factors, and national level factors such as price levels, policy, guidelines, supply, and exposure to mass media and commercials should be included in other studies among adolescents (Rasmussen et al. 2006; Pearson et al. 2009a). The questionnaire used in this study measured mental distress variables with single items, which are quite limited in their use as quantitative indices. Furthermore, this study was based on data collected in a cross-sectional survey. We cannot, therefore, ascribe causality to any of the associated factors in the study. Prospective studies are required to follow up fruits and vegetable consumption and a more comprehensive list of influencing factors.

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## References

- Abudayya AH, Stigum H, Shi Z, Abed Y, Holmboe-Ottesen G (2009) Sociodemographic correlates of food habits among school adolescents (12–15 year) in North Gaza Strip. *BMC Public Health* 9:185
- Ahmed F, Zareen M, Khan MR, Banu CP, Haq MN, Jackson AA (1998) Dietary pattern, nutrient intake and growth of adolescent school girls in urban Bangladesh. *Public Health Nutr* 1(2):83–92
- Al Sabbah H, Vereecken C, Kolsteren P, Abdeen Z, Maes L (2007) Food habits and physical activity patterns among Palestinian adolescents: findings from the national study of Palestinian school children. *Public Health Nutr* 10(7):739–746
- Cartwright M, Wardle J, Steggle N, Simon AE, Croker H, Jarvis MJ (2003) Stress and dietary practices in adolescents. *Health Psychol* 22(4):362–369
- Centers for Disease Control (CDC) (2009) The Global School and Health Survey background. <http://www.cdc.gov/gshs/background/index.htm>. Accessed 15 Apr 2009
- Eaton DK, Kann L, Kinchen S, Shanklin S, Ross J, Hawkins J et al (2008) Youth risk behavior surveillance—United States, 2007. *MMWR Surveill Summ* 57(4):1–131
- Giskes K, Turrell G, Patterson C, Newman B (2002) Socioeconomic differences in fruit and vegetable consumption among Australian adolescents and adults. *Public Health Nutr* 5:663–669
- Hall JN, Moore S, Harper SB, Lynch JW (2009) Global variability in fruit and vegetable consumption. *Am J Prev Med* 36(5):402–409
- Hu FB (2003) Plant-based foods and prevention of cardiovascular disease: an overview. *Am J Clin Nutr* 78:S544–S551
- Jessor SL, Jessor R (1977) Problem behavior and psychosocial development: a longitudinal study of youth. Academic Press, New York
- Key TJ, Allen NE, Spencer EA, Travis RC (2002) The effect of diet on risk of cancer. *Lancet* 360:861–868
- Klepp KI, Perez-Rodrigo C, De Bourdeaudhuij I, Due P, Elmadfa I, Haraldsdottir J et al (2005) Promoting fruit and vegetable consumption among European schoolchildren: rationale, conceptualization and design of the Pro Children project. *Ann Nutr Metab* 49(4):212–220
- Lee A, Tsang CK, Lee SH, To CT (2001) A YRBS survey of youth risk behaviors at alternative high schools and mainstream high schools in Hong Kong. *J Sch Health* 71(9):443–447
- Lien N, Jacobs DR Jr, Klepp KI (2002) Exploring predictors of eating behaviour among adolescents by gender and socio-economic status. *Public Health Nutr* 5(5):671–681
- Ministry of Health (2004) Zambia global school health survey-2004. Ministry of Health, Lusaka
- Molcho M, Gabhainn SN, Kelly C, Friel S, Kelleher C (2007) Food poverty and health among schoolchildren in Ireland: findings from the Health Behaviour in School-aged Children (HBSC) study. *Public Health Nutr* 10(4):364–370
- Musaiger AO, Gregory WB (1992) Dietary habits of school-children in Bahrain. *J R Soc Health* 112(4):159–162
- Neumark-Sztainer D, Story M, Resnick MD, Blum RW (1996) Correlates of inadequate fruit and vegetable consumption among adolescents. *Prev Med* 25:497–505
- Nyandindi US (2008) Tanzania global schoolbased student health survey report. The United Republic of Tanzania Ministry of Health and Social Welfare, Dar Es Salaam, CDC, WHO
- Omidvar N, Ghazi-Tabatbaie M, Eghtesadi S, Harrison G, Miinaie S (2003) Psychosocial correlates of low fruit and vegetable intake among adolescent boys and girls in Tehran, Iran. *Ecol Food Nutr* 42:385–397
- Pearson N, Biddle SJ, Gorely T (2009a) Family correlates of fruit and vegetable consumption in children and adolescents: a systematic review. *Public Health Nutr* 12(2):267–283
- Pearson N, Atkin AJ, Biddle SJ, Gorely T, Edwardson C (2009b) Patterns of adolescent physical activity and dietary behaviours. *Int J Behav Nutr Phys Act* 6:45
- Pomerleau J, Lock K, McKee M (2003) Discrepancies between ecological and individual data on fruit and vegetable consumption in fifteen countries. *Br J Nutr* 89(6):827–834
- Pomerleau J, Lock K, McKee M, Altmann DR (2004) The challenge of measuring global fruit and vegetable intake. *J Nutr* 134(5):1175–1180
- Rasmussen M, Krolner R, Klepp KI, Lytle L, Brug J, Bere E et al (2006) Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I: quantitative studies. *Int J Behav Nutr Phys Activity* 3:22
- Reddy SP, Panday S, Swart D, Jinabhai CC, Amosun SL, James S et al (2003) Umthenthe Uhlaba Usamila—The South African

- youth risk behaviour survey 2002. South African Medical Research Council, Cape Town
- Richter M, Vereecken CA, Boyce W, Maes L, Gabhainn SN, Currie CE (2009) Parental occupation, family affluence and adolescent health behaviour in 28 countries. *Int J Public Health* 54(4):203–212
- Rojas RM (2001) Fruits and vegetables consumption among Costa Rican adolescents. *Arch Latinoam Nutr* 51(1):81–85
- Shi Z, Lien N, Kumar BN, Holmboe-Ottesen G (2005) Socio-demographic differences in food habits and preferences of school adolescents in Jiangsu Province, China. *Eur J Clin Nutr* 59(12):1439–1448
- United Nations Population Fund (UNFPA) (2007) State of world population 2007. UNFP, New York
- United States Department of Health and Human Services (2000) Healthy People 2010. United States Department of Health and Human Services, Washington
- Vereecken C, Ojala K, Jordan MD (2004) Eating habits. In: WHO Regional Office for Europe. Young people's health in context. Health behaviour in school-aged children (HBSC) study: international report from the 2001/2002 survey. WHO Regional Office for Europe, Copenhagen, pp 110–119
- World Health Organisation (WHO) (2003) Diet, nutrition and the prevention of chronic diseases: report of a Joint WHO/FAO Expert Consultation. WHO, Geneva
- World Health Organisation (WHO) (2005) Patterns and determinants of fruit and vegetable consumption in sub-Saharan Africa: a multicountry comparison. WHO, Kobe
- Yngve A, Wold A, Poortvliet E, Elmadfa I, Brug J, Ehrenblad B et al (2005) Fruit and vegetable intake in a sample of 11-year-old children in 9 European countries: the pro children cross-sectional survey. *Ann Nutr Metab* 49:236–245