

Impact of food hazards in school meals on students' health, academic work and finance- Senior High School students' report from Ashanti Region of Ghana

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Highlights: Food Safety hazards and effect in schools- Ghanaian Senior High Schools students' report

- 1.** Seventy seven percent (77 %) of the sampled students ate school provided meals all or most of the time and 52 % had experienced foodborne infections between 3 to 12 times per academic year.
- 2.** Foodborne illness affected students both academically and financially as 12% of students spent more than 5 days off school when sick and 10% spent between GHC 30.00->50.00 on medication.
- 3.** A higher percentage of students who only sometimes ate school meals and supplemented with home meals, own stored food or bought from vendors on campus significantly ($p<0.05$) paid more on medication for FBD.
- 4.** Food allergy and physical contaminants in food were predominant among hazards reported by students though poorly managed.
- 5.** Effectively cleaned utensils, hand washing facilities with detergents in dining halls and kitchens and hot food were highly recommended GHPs by students.

1 **Impact of food hazards in school meals on students' health, academic work and**
2 **finance- Senior High School students' report from Ashanti Region of Ghana**
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5 **Abstract**

6 The study investigated the types of food hazards, the incidences and effect of foodborne
7 diseases (FBD) in Senior Secondary Schools in Ghana. A questionnaire was used to collect
8 data from 180 boarding school level 1 and 2 students from 45 sampled public schools in the
9 Ashanti Region of Ghana and analysed with SPSS Version 21. Stones and insects in food
10 received the highest complaints alongside food allergy and intolerance. Out of 180 students,
11 51.7% had experienced FBD with 21.1% of these reporting to health centers within their 1-2
12 years in school. FBD incidence rate was 3-12 times per academic year and 12 % of the
13 students had been absent from active academic work for as long as 5 days due to FBD with
14 10% spending between GHC 30.00 - >50.00 on medication per each episode. Students
15 recommended improved GHP including standard cleaning procedures, food temperature
16 control, available hand washing facilities with detergents at the dining halls and kitchens.
17 Mandatory requirement of routine hygiene and food safety training for food handlers was
18 required in schools with heightened monitoring, surveillance and law enforcement on
19 acceptable practices. Supplier control across the food chain to reduce physical and chemical
20 contaminants in agro products and food vendor's access control was required. Improving the
21 quality and variety of school meals could also reduce dependence on other sources for food
22 and help in controlling food safety risks. There was a need to increase awareness on the
23 appropriate channels to report FBD incidence in schools for effective control measures and
24 infection treatment.

25
26 Key words: Food hazards, Foodborne diseases, School meals, Senior High Schools, Students
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29 **1. Introduction**

30

31 The provision of safe food for children and adolescents of school going age is of great
32 concern to governments and other stake holders as it improves health, growth and
33 development of beneficiaries and encourages continued education in developing countries
34 (Santana *et al* 2009, Oranusi *et al*, 2007, Afoakwa, 2005 and WHO, 2002). In Brazil
35 approximately 37 million children from state elementary and middle schools are covered by
36 the National School Feeding programme (Santana *et al*, 2009). In Italy, the estimated
37 number of children benefiting from state school catering services is 2,700,000 (Marzano and
38 Balzaretto, 2013), in Wales 77,627 pupils out of 495,000 are entitled to free school meals and
39 the aim is to provide best health care possible through the provision of safe drinking water
40 and adequate and nutritious meals in a safe environment (Meldrum *et al* 2009). The National
41 school feeding scheme in South Africa equally aims at alleviating poverty and to improve
42 learning capacity of children (Nhlapo *et al*, 2014). Whilst an estimated 1,000,000 pupils in
43 basic education from poorest areas in Ghana are given one hot meal (lunch) per day in school
44 through the Ghana School Feeding Programme (GSFP) to supplement breakfast and dinner
45 from home, boarding students from Senior High Schools (SHS) in the country are given three
46 (3) square meals per day in school. SHS students thus highly depend on school communal
47 feeding programmes for their growth, wellbeing and general healthy lifestyle (Afoakwa,
48 2005). These good intentions by the government and stakeholders are challenged with
49 increasing foodborne infection report from schools.

50 Foodborne diseases (FBD), an outcome of poor hygiene practices (Dablood *et al* 2014,
51 Sumner *et al*, 2011, Panisello *et al*, 2000) are reported internationally in schools which tends
52 to defeat the aims of quality food provision. The confined nature of the school environment
53 favours direct transmission of diseases among individuals and may last for up to 3 to 5 days

54 (Nhlapo *et al* 2014). This interrupts education and affects growth and development with
55 persistent occurrence in children (Rodriguez-Caturla *et al* 2012). In Korea, 47% of the cases
56 of FBD were from schools (Ryu *et al*, 2011). In Japan within seven months in the year 1996,
57 11,826 cases with 12 deaths from *E. coli* O157: H7 infection were reported in schools, whilst
58 in Brazil 11.6% of documented FBD in 2005 were from school catering services (Santana *et*
59 *al* 2009). School children (157) in South Wales experienced *Escherichia coli* O157 outbreak
60 in 2005 due to cooked sliced meats supplied to schools (Meldrum *et al* 2009). In the year
61 2010, 544 adolescents had *Salmonella* food poisoning in France whilst 11,200 students in
62 Germany from several hundreds of schools were affected with norovirus in the year 2012
63 (Marzona and Balzeratti 2013). Although the Ministry of Health (MoH) in Ghana reported
64 that 1,348 children suffered from food poisoning in schools in Accra the Regional capital
65 alone in the year 2007 (MoH, 2007), there is low reporting culture (WHO, 2009 and 2012)
66 and lack of information from the other regions. Malm *et al* (2015) however reported that
67 food storage facilities in the affected schools were poor and there was lack of protocols to
68 avoid FBD from reoccurring in the schools in Ghana. Food poisoning reports are mainly from
69 the media in Ghana and these have predominantly occurred in secondary schools (Ababio and
70 Lovat, 2015). Foodborne diseases in Ghana were generally reported to have killed 90,692
71 people with 297,104 reported cases at Outpatient departments in hospitals costing the
72 government GHC 594,208.00 and approximately 594,279 productive days in 2006 (Odame-
73 Darkwa, 2008). The Ministry of Food and Agriculture and World Bank (2007) also indicated
74 that 1 in every 40 Ghanaians suffer serious FBD annually. The Food and Agriculture
75 Organisation/World Health Organisation (2005) reported in 2005 that microbiological
76 contaminants were the predominant hazard in street foods in Ghana and food vendors in the
77 Ashanti Region are reported to be carriers of the enteric pathogen, *Salmonella* (Feglo and
78 Sakyi, 2012) with most consumers not associating poor food hygiene with diseases

79 (Tomlins *et al* 2002). The types of food hazards and their effect in schools in Ghana are not
80 known, physical contaminants and chemical hazards are not reported in the country whilst
81 peanuts and pineapples alone have been reported to be sources of allergy in children between
82 the ages of 5 and 16 years in the country (Obeng *et al* 2011 and Boye, 2012).

83 School feeding services in SHS are managed by the schools established catering system
84 comprising of a domestic bursar (senior matron), a group of assistant matrons, cooks and
85 pantry men and a procurement unit. The state agencies in charge of surveillance and
86 monitoring include the Food and Drugs Authority and the Environmental Health Protection
87 units of the Metropolitan, Municipal and District Assemblies in Ghana. The primary hygiene
88 standard being Codex Alimentarius hygiene requirements (WHO/FAO, 2009). The School
89 Health Education Programme (SHEP) Unit of the Ghana Education Service also foresee
90 health and sanitation activities in schools (Ghana Education Service, 2012). However
91 sanitation facilities are reported to be low in secondary school kitchens in the country and
92 matrons are reported not to consider their practices to be of risk to students (Afoakwa, 2005).
93 This lack of motivation to improve hygiene systems and practice indicates a probable weak
94 surveillance and law enforcement systems in the country as indicated by WHO (2012) and
95 Dwonfour- Asare (2015). FBD in schools have been reported to be due to poor hygiene
96 standards internationally (Nhlapo *et al* 2014, Sourou-Bankole *et al* 2012, Adolf and Azis,
97 2012, Marzona and Balzaretto 2012) and affect the health, academic performance, growth and
98 future wellbeing of children and the research sought to investigate the types of hazards,
99 incidences of foodborne diseases and impact of these on students in Ghana. This study will
100 provide added information from institutional caterings in the country to available data from
101 the commercial sector.

102 **2. Methodology**

103 Permission to visit the Senior High Schools (SHSs) in the Ashanti Region of Ghana was
104 sought from the Regional Education Director. This region is the highest populated region out
105 of the 10 in the country (Ghana Statistical Service, 2012) with the highest number of public
106 SHSs (Ministry of Education, 2009, Siaw and Nortey, 2011). SHS students enrolment as at
107 2008/2009 in the country was 490,334 with Ashanti Region alone taking 44.1% of this
108 population. Ashanti Region is a central trading zone in the country with high number of food
109 handlers with low formal education and hygiene practices (Osei, 2010 and Feglo and Sakyi,
110 2012, Ababio and Adi, 2012). An approval letter was then taken to the institutional heads in
111 a randomly sampled 58 (67%) of the 86 public SHSs listed in the Ghana Education Service
112 Directory of the region. Out of the 58 schools visited, 45 (52%) were available for the
113 research between July and September 2013. One hundred and eighty (180) first and second
114 year students, four (4) from each school were selected through the permission of their
115 academic headmasters or domestic bursars for the survey. Third year (final years) students
116 had completed school and left and were not part of the study. Students were briefed on the
117 objective of the exercise and asked to complete a given questionnaire. Questionnaire included
118 questions on students' awareness of causes and symptoms of FBD, their sources of education
119 on FBD, their experience in school, source of confirmation of FBD and related impact if any,
120 types of food hazards and contaminants found during school meals, other sources of meals in
121 school, their recommendations on improvement of hygiene in school kitchens and student's
122 demographics. Data was analysed with descriptive statistic tools on SPSS version 21.

123 **3. Results and discussion**

124 *3.1 Students' demographics, food sources and food poisoning awareness*

125 Out of the 180 Senior High School students sampled from 45 schools, 46.1 were first years
126 and 53.9% were in their second year. Almost all the students had food poisoning awareness

127 (some knowledge of causes and symptoms) with the exception of 8 (4.5%) who had no
128 awareness or were not sure of what food poisoning was about.

129 **Table 1. SHS students from Ashanti Region, sources of meals, dining hall attendance**
130 **and food poisoning awareness**

131
132 Approximately half (50.5%) of the sampled students attended the dining hall for meals all the
133 time whilst the rest attended most of the time or some of the time. Almost all students had
134 other sources of meals that supplemented their regular dining hall meals. Only 3.9 %
135 depended wholly on school meals (Table 1). Other sources of meals in the schools included
136 students own stored food (42.2%), food vendors (37.8%), ready to eat food from relatives on
137 school visiting days (10.6%) and shops (5.5%). This could make the control of food safety in
138 SHS difficult as according to Afoakwa (2005) some of these vendors were not registered and
139 hence not screened or monitored. Students also lacked storage and heating facilities in their
140 dormitories. More than half of the students sampled (52%) reported to have experienced
141 some form of foodborne infection within their 1 to 2 years in secondary school. In Indonesia,
142 98.3% of students sample reported of high incidence of FBD after eating meals in schools
143 that charged no tuition fees and were rated as poor in hygiene whilst only 8.8% of students in
144 a high tuition fee paying school with good hygiene rate by students reported likewise (Adolf
145 and Azis 2012). Hygiene and sanitation practices of food handlers directly affect the food
146 safety and health of consumers. There was therefore the need to increase measures that would
147 help motivate kitchen matrons and staff and food vendors to improve food safety and hygiene
148 standards in schools (Panisello *et al* 2000) to prevent eminent FBD outbreak.

149 *3.1.1 Foodborne illness medium of education, rate of occurrence and management among*
150 *students in SHS in Ashanti Region*

151
152 From Table 2, students in both academic levels were aware of foodborne diseases and there
153 was no significant difference between the two academic levels on awareness. Knowledge on
154 FBD was gained from the media (81.2%), books (65%), parents (38.3%), personal experience

155 (25.4%), a friend's experience in school (20.7%), seminars (16.8%), and a relation's
156 experience (15.9%). Thus the media (radio and television) in Ghana was the major source of
157 FBD awareness education for students in SHS followed by reading materials and parents.
158 Seventy five percent (75%) of the students mentioned a combination of diarrhoea, stomach
159 crumps, vomiting and fever as symptoms related to FBD. This was similar to the report from
160 Indonesian schools in Adolf and Azis (2012) report although students in Indonesia added
161 cough and headache. Those who had ever experienced foodborne illness in school in Ghana
162 were more than half of the population sampled (51.7%) although a higher percentage did self-
163 confirmation of the possible cause of their illness. This was contrary to Tomlins *et al* (2002)
164 who reported that most consumers among 530 people sampled in Accra did not associate
165 diseases with poor hygiene and unsafe food. The SHS students in Ashanti Region were well
166 informed although only 40.8% (21.1% of total) of those who reported to have suffered from
167 FBD in school sought medical attention from doctors and nurses (Table 2).

168 **Table 2 Foodborne disease rate of occurrence among academic levels and source of**
169 **confirmation of related experience**

170
171 Although the rate of foodborne illness was high (1 - 4 times per school term) in the schools,
172 only 21.1 % out of the 51.7% reported to have their foodborne illness confirmed by a
173 recognised health official whilst 30.6 % only blamed food they had eaten to be the cause of
174 their illness. Report of FBD was low among the students in SHS in the Ashanti Region of
175 Ghana as reported by WHO (2009) in Nigeria. This culture makes tracing of causes and
176 effect of FBD and the making of decisions on the necessary precautions difficult. It also
177 creates a false sense of safety thus leading to lack of motivation to improve on poor hygiene
178 practices among food handlers and their managers (Panisello *et al* 2000). If the FBD
179 incidence rate among secondary school students (adolescents) was this high (1-4 times in 3
180 months) then the situation among the vulnerable groups in the Ghanaian society; babies,
181 pregnant women, the aged and immunocompromised could be worse considering the

182 increasing reliance on places outside the home for meals (Tomlins *et al*, 2002 and Dwonfour-
183 Asare 2015) and the reported substandard hygiene conditions prevailing (Feglo and Sakyi,
184 2012, Ababio and Adi, 2012). Those who had fallen sick during school term due to
185 foodborne illness were significantly higher than those who had not and the rate of FBD
186 occurrence was higher than the 1 in every 40 Ghanaians suffering from FBD annually in the
187 country reported by Ministry of Food and Agriculture/World Bank (2007) and supports
188 Afoakwa (2005) in Ghana and Sourou-Bankole *et al* (2012) from Benin who reported that
189 students in boarding schools were subjected to unhygienic food due to poor sanitary
190 conditions. Sumner *et al* (2011) reported of food handlers in the United States reporting to
191 work with diarrhoea and vomiting symptoms due to the absence of policies for staff to absent
192 themselves from work when sick. Without proper hygiene training and control, students
193 could be subjected to unsafe food due to lack of similar food safety policies and awareness in
194 the work place in Ghana. The abuse of food holding time and temperature after cooking and
195 inadequate cleaning and disinfection of food contact surfaces in schools could also subject
196 students to food safety risks as reported by Dablood *et al* (2014) and Marzano and Balzeratti
197 (2013) from Italian schools respectively.

198 *3.1.2. Sources of meals for students in SHS in Ashanti Region and food safety risks*

199 Most meals served in dining halls were cooked ready-to-eat meals that required hot holding
200 temperature and time control for safety. Rice was the most popular meal among 58.2% of the
201 180 students sampled. Based on school menu, level of preference of school meals were in
202 the sequence of jollof rice, waakye (rice with beans) and pepper source with fish, rice balls
203 with groundnut soup, rice and tomato stew, rice with kontomire stew and rice with beans
204 stew, followed by Gari and beans (25.6%), kenkey with sardine and pepper sauce (11.1%),
205 Banku with okro stew or soup (2.3%) and 0.6% for yam with vegetable stew. The rest were
206 tom brown and rice pudding for breakfast. Thus rice related meals were the most popular

207 meal among the students which required effective temperature control against *Bacillus cereus*
208 food poisoning and multiplication of *Staphylococcus aureus* and other pathogens in food
209 from poor handling and temperature abuse (Dablood *et al*, 2014, Malm *et al* 2015)). There
210 were no fruits on the menu plans in all the schools visited with the exception of one,
211 supporting Afoakwa (2005) report on absence of fruits in SHS feeding plan. Although a
212 higher percentage of students ate their 3 square meals from the school dining hall, they
213 supplemented these with other sources of food (Table 1). This could be due to small portion
214 sizes, dislike for a particular meal or lack of variety, absence of fruits and other allergy or
215 intolerance issues (Fig. 2). In Korean schools Ryu *et al* (2011) reported of the provision of a
216 variety of side dishes and desserts with the main meal in schools. This was not present in the
217 schools in Ashanti Region. Thus these may be additional factors that encouraged the use of
218 other sources for food including food vendors in the schools.

219 Students who bought food from vendors in their school had the highest report (21.1%) on
220 FBD experience in school. The highest source of alternative meal among students was their
221 own stored food (42.2%) kept in 'chop boxes' under ambient conditions. Comparatively a
222 higher percentage of those who bought meals from vendors (55.8%), those who ate meals
223 brought in by visiting relatives (68.6%) and those who totally depended on only school meals
224 (75.9%) had experienced FBD during their 1-2 years in Senior High School. School meals,
225 food from vendors and home meals brought to students and those kept in their boxes could all
226 be causing FBD in the schools and required control.

227 3.2. Available food hazards in school meals and food allergy management

228 **Fig 1. Types of physical contaminants identified in school meals**

229 A high level of students (66.4%) complained of physical contaminants in school meals,
230 followed by chemical contaminants and mould. Approximately 2% of students reported of
231 mould on school meals. Although students reported of chemical contaminants in food or

232 funny smell, names of chemicals were not given however kitchen matrons in a previous
233 interview had complained of the agro chemicals in food with special reference to grains with
234 pesticides and fresh vegetables from local suppliers.

235 Among the physical contaminants present in school meals in SHS in Ashanti Region, stones
236 were the highest food hazard followed by insects, human hair and metallic substances (Fig. 1)
237 mostly from sponges used in cleaning pots. This happens when there is lack of standard
238 operating procedures and Good Hygiene Practices (GHPs) including supplier control, raw
239 material specification, process control, integrated pest management and personal hygiene.
240 These are demanded by Codex Alimentarius (WHO/FAO, 2009) for catering services and
241 other food establishments and must be enforced in Ghana as a member country. This
242 supports Ababio and Adi (2012) and Afoakwa's (2005) report on the absence of GHP's
243 among food handlers in Kumasi Metropolis and lack of standard sanitary conditions in
244 schools in Ghana respectively.

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Fig. 2. Food that students have allergy /intolerance problems with

248 Food allergy and intolerance, another emerging food hazard was present in the schools
249 (Fig.2). Ghanaian students surveyed had some form of allergy or intolerance with foods
250 including peanuts, eggs and milk, seafood, gluten, monosodium glutamate, and okro. The
251 'other' response included beans or cowpea. The rising cause of food allergy and its effect in
252 Ghana is not known but there is the need for control as some reactions could be fatal and the
253 report from students implied the existence among consumers was not restricted to pineapple
254 and peanuts as indicated by Obeng *et al* (2011) and Boye, (2012).

255 Over half of the students sampled (56%) who had a form of allergy or intolerance were more
256 likely not to report when in school but would avoid such meals when prepared or served in
257 the dining hall. Of the 56% who had food allergy or intolerance, only 37% of these (20.5%

258 of total) had reported food allergy and only 24% were given a special diet that is 13% were
259 not given any consideration from school kitchens. There was a significant difference between
260 food allergy or intolerance level and forms of management in schools ($p < 0.05$) although this
261 did not significantly affect the level of attendance to dining hall among students. Food
262 allergy and intolerance however could be contributing factors to infrequent dining hall
263 attendance which constituted 25.4 % of students sampled. The group of students who did not
264 know if they had allergy problem or not but refused to take school meals or attend to the
265 dining hall all the time could also be educated to make informed decisions. Improving on
266 food quality and variety and provision of suitable meals for students with intolerance and
267 allergy issues could help reduce the dependence on other sources of food including food
268 vendors. This could help with effective control of food safety improvement strategies in
269 schools by school matrons and managers.

270 *3.3 Economic and Academic impact of foodborne illnesses in Senior High Schools in Ashanti* 271 *Region*

272 The benefits of providing meals to school going age children by administrators are to ensure
273 that students have good health and development and also to encourage continued education
274 (Santana *et al*, 2009, WHO, 2002, Oranusi *et al*, 2007, Nhlapo *et al* 2014). Foodborne
275 illness causes economic loss to countries world over and Ghana is not an exception.

276 **Table 3. Dining hall attendance and days and amount spent by students who suffered** 277 **FBD's during school term**

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279
280 From Table 3, 49.4% of students sampled who experienced some form of foodborne illness
281 spent at least a day to more than 5 days from school or active academic work. This supports
282 the cost on productive days lost in Ghana due to FBD reported by Odame- Darkwa, (2008).
283 Considering the fact that 26% of the 180 students reported of 2 – 4 episodes of FBD within a
284 term, that is to say 13 in every 50 SHS students in Ashanti Region experience between 3- 6

285 cases per school academic year. This rate from SHS is high as compared to the 1 in every 40
286 Ghanaian suffering from FBD annually case reported by MoFA/WorldBank (2007) and
287 similar to the Indonesian report by Adolf and Azis (2012) who reported 118 out of 120
288 students from poor hygiene categorised school reported of experiencing FBD after meals.
289 This is a report from public schools with boarding facilities only and figures could be high if
290 private schools in the region were considered and could be even higher with the other regions
291 in the country considered. The seriousness of the disease if considered to determine how
292 long a student recovered from illness did not however have any significant effect on the level
293 of attendance to the dining hall for meals ($p>0.05$) as most students mostly depended on the
294 school dining hall for their meals. Sickness goes with spending as the sufferer would need
295 medication, other health related investigation if available and attendance depending on the
296 level of discomfort. Out of the 180 students sampled, 60.5% were sure to have spent some
297 amount of money ranging from GHC 1.0 to more than GHC 50.0 on medication due to
298 foodborne illness during school term. Thus between GHC 108.9 - > GHC 5,445.00 is spend
299 on medication alone per term by 60.5% of students in SHS in Ashanti Region. Thus
300 approximately, a sum of between GHC 324.00 - > GHC 16, 335.00 (87.5- > 4410.00 USD)
301 is spent by 60.5% of students, their parents, schools and National Health Insurance on
302 medication alone annually due to FBD. This supports Odame-Darkwa (2008) and
303 MoFA/WorldBank (2007) report on cost of FBD in the country. As most meals served in the
304 schools visited were cooked ready to eat meals, the quality of raw materials, processing
305 procedures, food holding temperatures and time, kitchens utensils cleanliness and kitchen
306 staff hygiene could all affect the safety of the meals post processing and required monitoring
307 and improvement in hygiene. Those who reported to have taken medication for the treatment
308 of foodborne infections were more than the 21.1% who reported to have visited health
309 facilities (nurse and doctors) during their ailment. This could be one of the possible causes of

310 low reporting culture of foodborne infections as consumers are able to access over the
311 counter drugs (OCD) for the treatment of infections (WHO, 2012). This could also lead to
312 abuse and antibiotic resistance in the Ghanaian population. A situation that is not helpful for
313 the need for proper surveillance and control to improve on food safety as a nation. There
314 was a significant difference ($p= 0.01$) between the level of attendance to dining hall for meals
315 and the amount of money spent by students. Those who attended the dining hall all the time
316 were more likely to spend less money on medication for FBD than those who went less
317 regularly. Other sources of meals could be subjecting students to more food safety risks.
318 This was equally reported by Adolf and Azis (2012) who recommended yearly education on
319 food safety practices for sellers of foods around school campuses and staff in school canteens
320 in Indonesia. Cost on medication for students was borne either by parents (30.6%), National
321 Health Insurance (15.6%), schools (8.3%), the student (7.2%) and other combinations of the
322 above (2.3%).

323 *3.4 Recommended hygiene improvement suggested by students*

324
325 All the students responded on the affirmative on the need to improve food hygiene and
326 kitchen hygiene practices in their schools. The listed GHP were potable water, hand washing
327 facilities, an enclosed kitchen, pest control, hot food, clean utensils and protective clothing
328 for kitchen staff. From Figure 3, clean utensils was the single most mentioned
329 recommendation by 52.5% of the students. This was followed by the need for hand washing
330 facilities in both the kitchens and dining halls (44.5%). Hot food was the next recommended
331 food hygiene practice by 33.3% of the students followed by portable drinking water (28.3%).
332 Pest control was next with 27.2% recommendations then enclosed kitchen (13.9%) before
333 protective uniforms for staff (10.9) and a combination of all the listed the listed GHP's
334 (10.6%). As a Codex member country the General Principles of Food Hygiene by Codex
335 Alimentarius (WHO/FAO, 2009) is applicable to the food industry in Ghana. The basic GHP

336 listed include facility design, process control, maintenance and sanitation, personal hygiene
337 and training, transport control and information and consumer awareness. Hazard Analysis
338 and Critical control Point is also recommended by the body for good practice. These if
339 adhered to and regularly monitored by the relevant state agencies including Food and Drugs
340 Authority and Environmental and Health Protection Unites of individual Metropolis and
341 District Assemblies could help with effective food safety control in schools. The Schools
342 Health Protection Programme units of the Ghana Education Service could also include
343 kitchen matrons and staff in hygiene training and auditing to improve on food safety practices
344 as currently their mandate and focus has been on students and pupils below tertiary education
345 level only (Ghana Education Service, 2012).

346 **Fig. 3. SHS boarding students recommended improvements in GHP in school kitchens**

347
348 In Brazilian schools, Santana *et al* (2009) reported of poor temperature control in poor and
349 medium hygiene category schools before GHP intervention which negatively affected the
350 microbiological quality of food. They reported that even in the presence of regulations set by
351 the Health and Surveillance Committee, food safety measures were inadequate in schools as
352 schools did not take into consideration the specific sanitation requirements needed. Thus in
353 the presence of low FBD reporting culture, weak surveillance and law enforcement there is
354 low motivation on the part of food handlers and managers to operate according to appropriate
355 standards (WHO, 2012, Dwonfour- Asare 2015). Meldrum *et al* (2009) reported of a
356 relatively safer ready- to- eat meals in schools in Wales as there were no microbiologically
357 unacceptable food. The schools in Wales had HACCP in place whilst in Korea, the
358 microbiological quality of school meals sampled were reported not to be adequate to ensure
359 food safety (Ryu *et al*, 2011) hence the high rate of FBD from schools in the country. Ryu *et*
360 *al* (2011) recommended the introduction of HACCP to improve food safety in Korean
361 schools. Food stored out of recommended storage temperature and time could encourage

362 spoilage and growth of pathogenic microorganisms to cause disease. Nhlapo *et al* (2014)
363 equally reported on the absence of readily available hand washing facilities for kitchen staff
364 in South African schools which they reported hindered good hand hygiene practice. Poor
365 personal hygiene among staff could affect food safety and Sourou- Bankole *et al*, (2012)
366 from Benin reported of high level of microbiological contaminants on staff hands in schools
367 presenting risk to students. Marzano and Balzeratti (2013) recommended HACCP in schools
368 as it improved cleaning practices and staff hygiene in Italian schools which was absent in all
369 schools visited in Ghana. Standard cleaning procedures with training, supervision and
370 appropriate time schedules for entire kitchens and ancillary rooms was required to improve
371 cleanliness in Ghana. Lack of properly designed kitchens causes the loss of access control to
372 both unauthorised persons and animals with their related hazards to food. Thus most of the
373 schools needed improvement even as suggested by the students. This goes to support the
374 need for improved food safety management systems in our Senior High Schools as
375 recommended by Afoakwa, (2005) in Ghana and Sourou Bankole *et al*, (2012) from Benin in
376 order to provide safe food for students. The lack of motivation on the part of matrons and
377 kitchen staff to improve hygiene practices with the illusion that current practices were not a
378 risk to food safety as reported by Afoakwa (2005) could also be due to low foodborne disease
379 reporting culture among students, lack of regular rigorous surveillance with weak law
380 enforcement in institutional kitchens and lack of knowledge of food hygiene requirements in
381 the country and required improvement. A system to monitor and control the overall food
382 chain in the country from farm to form, including suppliers of raw materials to SHS was
383 required.

384 **4. Conclusion**

385 Food safety report from the Senior High Schools in the Ashanti Region of Ghana as reported
386 by students required improvement. Students in the secondary schools who were adolescents

387 (14-18 years) could be exposed to food hazards that had both immediate and protracted health
388 consequences in their growing lives. There was the need for regular monitoring and
389 surveillance of school food services by the appropriate state agencies with heightened law
390 enforcement, increased reporting culture of FBDs among students to appropriate health
391 facilities for control, media coverage with further investigation on causes and effect,
392 mandatory and regular hygiene and food safety training for matrons, kitchen staff and food
393 vendors that commensurate with their activities, developed and documented standard
394 operating procedures availability with improved hygiene practices (adequate cleaning and
395 disinfection of food contact surfaces, food handlers infectious disease control and hand
396 washing), supplier and raw material specification and control as part of GHP and financial
397 investments in infrastructure and resources (hand washing basins and detergents with dryers
398 in kitchens and toilets) to improve on the current conditions in the schools. Other sources of
399 meals to students equally required control with special reference to food vendors who gain
400 access to sell food in SHS in Ashanti Region of Ghana.

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Table 1 SHS students from Ashanti Region, sources of meals and food poisoning awareness

<i>Gender</i>	Frequency	Percentages
Male	88	48.9
Female	92	51.1
<i>Academic level</i>		
First year	83.0	46.1
Second year	97.0	53.9
<i>Food poisoning Awareness</i>		
Yes	172	95.5
No	7	3.9
Not sure	1	0.6
<i>Attendance to dining hall for meals</i>		
All the time	91	50.5
Mostly	48	26.7
Sometimes	41	22.8
<i>Other sources of meals for students</i>		
My own stored food	76	42.2
Food vendors in school	68	37.8
Home meals	19	10.6
Shops	10	5.5
None	7	3.9

Table 2. Foodborne illness rate of occurrence among academic levels and source of confirmation of related experience

<i>Academic levels</i>	FDB awareness					Chi square
	Yes	No	Not sure	No response	Total	
First year	44.4	1.1	0.6	0.0	46.1	2.118(0.714)
Second year	51.1	2.8	0.0	0.0	53.9	
<i>Academic levels</i>	Rate of FBD occurrence per school term					Chi square
	Once	Twice	Three to Four times	Can't remember + NA	Total	
First year	9.4	7.2	5.0	24.5	46.1	9.177(0.515)
Second year	12.2	9.4	3.9	28.4	53.9	
<i>Foodborne illness experienced in School</i>	Source of confirmation of related foodborne illness experienced during school term					Chi square
	School Nurse	A Doctor	Personal decision	Not Applicable	Total	
Yes	4.4	16.7	30.6	0	51.7	101.560(0.001)
No	2.8	6.1	7.8	31.7	48.4	

NA= Not applicable

Table 3. Dining hall attendance and days and amount spent by students who suffered FBDs during school term

<i>Attendance to dining hall</i>	<i>Length of days spent off sick</i>							Total	Chi square
	1 day	2 days	3 days	4 days	5 days	> 5 days	Not Applicable		
All the Time	3.8	2.8	10.0	1.1	5.6	2.8	24.4	50.5	20.859(0.105)
Most of the time	0.6	4.4	2.8	1.1	0.6	0.0	17.2	26.7	
Sometime	1.7	3.3	5.0	0.5	1.1	2.2	9.0	22.8	

<i>Attendance to dining hall</i>	<i>Amount Spent on Medication</i>						Total	Chi square	
	1.0-10.0 GhC	11.0-20.0 GhC	21.0-30.0 GhC	31.0-40.0 GhC	> 50.0 GhC	Can't Remember			Not Applicable
All the Time	13.8	8.3	4.4	0.6	3.9	2.8	16.7	50.5	26.107(0.010)
Most of the time	7.2	2.8	2.8	0.0	0.0	1.1	12.8	26.7	
Sometime	2.2	5.5	4.0	1.7	3.3	1.1	5.0	22.8	

Possible use of over the counter drugs among students as percentage reporting at health centers, 21.1% (Table 2) was lower than those buying medication for infection treatment (60.5% Table 3)

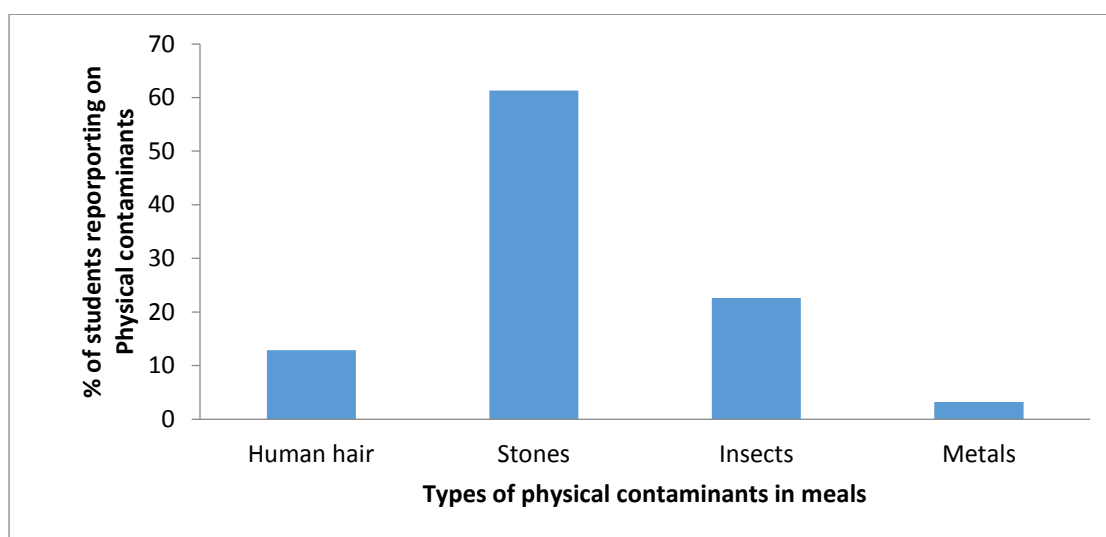


Figure 1. Percentage of students reporting types of physical contaminants in meals

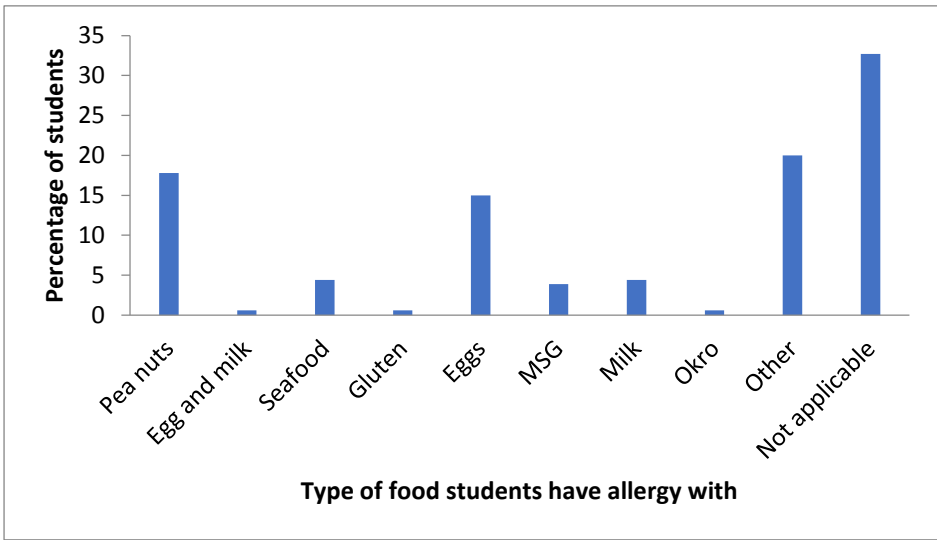


Fig. 2. Food that students have allergy /intolerance problems with

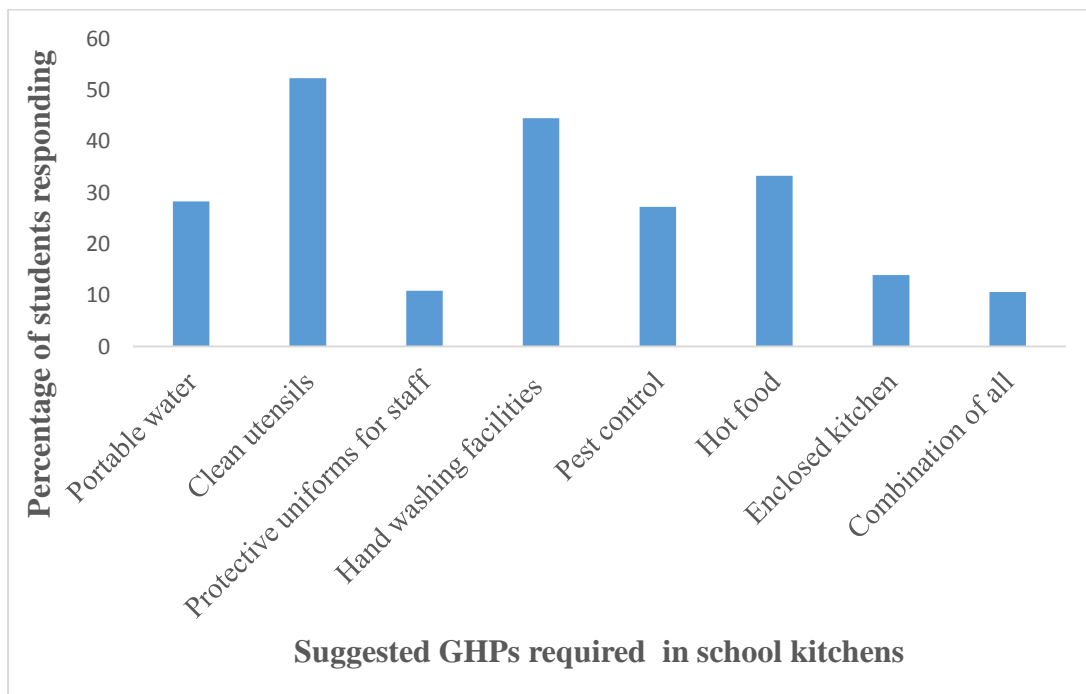


Fig. 3. SHS boarding students recommended improvements in GHP in school kitchens