

# Are the attitudes and practices of foodservice managers, catering personnel and students contributing to excessive food wastage at Stellenbosch University?

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**Objective:** The aim was to investigate factors contributing to food wastage by Stellenbosch University (SU) students in selected residences, and to determine the attitudes and practices of students and catering personnel impacting on food waste and a sustainable environment.

**Design:** Cross-sectional, descriptive study.

**Setting:** Stellenbosch University, Western Cape.

**Subjects:** Six foodservice managers, 63 catering personnel and 517 students participated in the study.

**Outcome measures:** A weighed-food wastage study was conducted at seven selected residences during lunch and supper on three non-consecutive weekdays. Food service managers (FSMs) and catering personnel completed interviewer-administered questionnaires, while SU students completed an electronic survey.

**Results:** Ninety percent of students preferred the standard menu options, despite a relatively high average plate waste of 16.9%. More production waste was generated during lunch than supper. The male residence generated more plate waste. Even though students requested larger servings of vegetables, the wastage of these items was high. Factors contributing to wastage were the booking system, menus and serving style, meal plan stipulating the serving of dessert and serving of a large starch portion. All FSMs and 88.5% catering personnel considered it important to reduce food wastage to a minimum.

**Conclusion:** Education of catering personnel and students regarding food waste reduction measures is crucial. A representative forum including students, catering companies and faculty management should be involved when seeking solutions to reduce food wastage and improve communication. By implementing these strategies, a university-wide culture of sustainability with a focus on food waste reduction can be developed and nurtured.

**Keywords:** food, plate waste, students, sustainable

## Introduction

“Food wastage represents a missed opportunity to improve global food security, but also to mitigate environmental impacts and resource use from food chains”.<sup>1</sup>

Attention towards the global issue of food wastage increases apprehension around environmental, social and economic costs<sup>2–4</sup> and food insecurity globally.<sup>5</sup> The uncontrolled and persistent avoidable wastage of food has a significant impact on the environment through atmospheric emissions, leachate (a liquid that contains concentrated substances, which can include minerals and nutrients) odours and pests.<sup>1,6,7</sup> Levels of food wastage can be considered tolerable when any attempt to reduce food wastage would compromise quality, client choice and nutritional intake or when the cost of monitoring and addressing food wastage exceeds the financial value of wastage itself.<sup>8</sup>

According to the Council for Scientific and Industrial Research (CSIR), over 9 million tons of food (177 kg/capita), representing 30% of South African agricultural production, is wasted in either food production and/or consumption systems.<sup>9</sup> It is important to recognise that some food wastage is inevitable in all catering environments, due to unavoidable wastage (food not intended for human consumption, such as seeds, pips, peels, teabags, eggshells and bones).<sup>10</sup>

Food waste occurring at the end of the food supply chain, is influenced by consumer behaviour.<sup>11</sup> In the context of foodservice

units (FSU), food wastage can be defined as any food materials (raw or cooked) unnecessarily, inefficiently or inappropriately lost or discarded before, during or after meal preparation, cooking and the distribution thereof.<sup>12</sup> Wastage can be categorised as avoidable wastage (food which prior to disposal was edible) and possibly avoidable wastage (foods which can be eaten but consumption thereof depends on personal preference and other factors such as health concerns).<sup>10</sup>

It is important for the foodservice manager (FSM) to minimise food wastage by carefully considering limitations or constraints such as budget; infrastructure and facilities; employee competence; food availability; type of menu and service; policies and regulations; as well as consumer needs.<sup>13,14</sup>

Vast quantities of food waste are generated in dining rooms and cafeterias due to large student populations at universities. According to the admissions office, Stellenbosch University (SU) had approximately 16 000 undergraduate students in 2015. The facility manager reported a steadily increasing amount of waste generated in residence dining rooms and cafeterias. At the main campus, 3500 kg per week of food waste collected from 22 residences for 42 weeks per annum needed to be processed.<sup>15</sup> The safe storage of large volumes of wet, organic food waste until disposal occurs, poses a challenge. This problem is further compounded by the fact that organic waste is no longer accepted in landfills by many municipalities.<sup>15</sup>

The following alternative approaches for processing food waste on site were thus initiated at SU in 2012: using bokashi to preserve food waste;<sup>16</sup> direct digesting by soldier flies;<sup>17</sup> incorporation of waste (20%) in static wind row composting;<sup>18</sup> experimental co-digesting food waste with cow manure in an anaerobic biodigester;<sup>19</sup> and, on-site waste management systems using vermicomposting.<sup>15</sup> Despite these initiatives, initial food waste volumes did not show a decline. Subsequently, the Division of Human Nutrition was approached by the Waste Management Committee of SU (2015) in order to investigate the possible causes of food wastage among students making use of dining facilities at residences.

Determining the carbon footprint of a foodservice unit is problematic due to the complexity of the menu choices, time constraints and the lack of standards.<sup>20</sup> There is a paucity of data in current literature regarding food wastage in FSUs globally;<sup>21</sup> and, more specifically, at university residences. This serves as

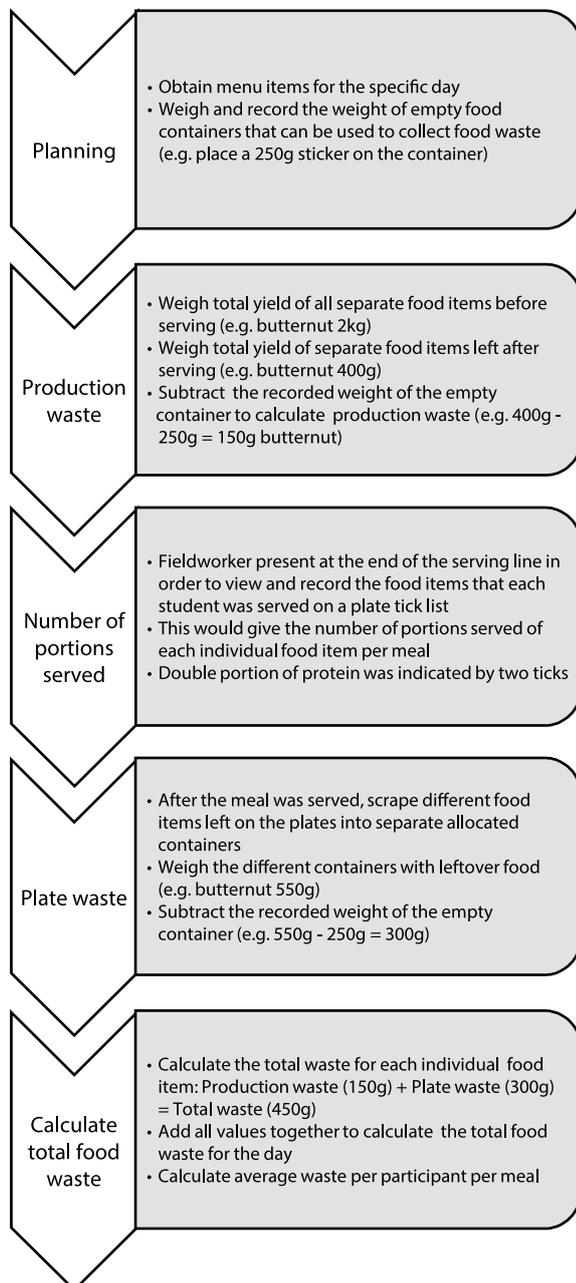


Figure 1: Procedure to determine total food wastage

further motivation to determine the reasons behind this predicament. The aim of this study was to investigate factors contributing to food wastage by SU students in selected residences, and to determine the attitudes and practices of students and catering personnel affecting food waste and a sustainable environment.

### Ethical considerations

Approval for the study was granted by the Health Research Ethics Committee of Stellenbosch University [N14/08/113], the Stellenbosch University Division for Institutional Planning, as well as the catering company concerned. Consent was obtained from all participants prior to data collection and a pilot study was conducted to optimise the process and enhance face and content validity of the questionnaires.

### Methodology

A cross-sectional, descriptive study with an analytical component was conducted using two methods of data collection: determination of food wastage and questionnaires. Fifteen final year SU dietetic students were trained and standardised to administer questionnaires and to determine food wastage. Data was collected at seven SU residences in Stellenbosch (South Africa) contracted to the same catering company.

### Determining food wastage

The food wastage study was conducted at two purposively selected residences: a female residence (Res FM), providing meals to its female residents as well as private students (thus both genders were catered for); and a male only residence (Res M). Students could choose between different menu options: standard, vegetarian, healthy or grill. Res FM offered the choice of menu options for lunch and supper, whilst Res M only offered the standard option for lunch and the choice of menu options for supper. The meal plan was similar for all options, consisting of a protein dish, starch, two vegetables and/or salads and dessert. In this particular male residence, it is customary for all residents to attend lunch. The choice of menu options had to be ordered 48 h in advance using an electronic booking system.

Food waste was measured at lunch and supper on three non-consecutive weekdays. Breakfast and weekend days were omitted due to the limited number of students who book these meals and the low wastage of breakfast meals as reported by the regional manager of the catering company.<sup>22</sup>

Total food wastage was determined by measuring production waste (food left in the bain-marie) and plate waste. Measurement of pre-production wastage was beyond the scope of this study. A SECA electronic scale was calibrated before food wastage was measured, using a set of standard weights (1 kg and 5 kg). Figure 1 depicts the process followed to collect data and calculate the total food wastage.

### Questionnaires

Based on current literature and the objectives of the study, three questionnaires were developed as research tools to determine participants' perspectives on food wastage: questionnaires for FSMs (interviewer-administered questionnaire), catering personnel (self-administered questionnaire) and students (self-administered electronic questionnaire).

All questionnaires (questionnaires are available on request from the corresponding author) included a section to determine the

demographic profile of the participants. A four-point Likert scale was used to avoid excessive selection of the middle value,<sup>23</sup> closed and open-ended questions were used to investigate the attitudes and practices of participants regarding the causes of food wastage, participant's role in the reduction of food wastage and the perceptions about client satisfaction.

BSc Dietetic students were standardised as fieldworkers and facilitated the completion of the questionnaires for FSMs and catering personnel. Questionnaires were completed one day prior to conducting food wastage studies to eliminate participant bias. After consent was obtained, questionnaires were completed in the participants preferred language in a minimally distracting area. The questionnaires took 15-20 min to complete.

The student questionnaire hosted on the university intranet was available through a link delivered in an electronic invitation to SU students, (main campus N = 14 502) excluding those from the Faculty of Military Science and the University of Stellenbosch Business School. The questionnaire contained an introductory page explaining the content thereof. Consenting students could continue with the questionnaire which took 20-30 min to complete. The first part of the questionnaire investigated the attitudes and practices of all students regarding food wastage in general. The second section was completed only by students who consumed meals at the selected residences. The questionnaire was available for a two week period in March 2015. To increase participation, weekly reminders were sent electronically, informative posters were displayed centrally on campus, and a monetary incentive was awarded to two randomly selected students at the end of the data collection period.

**Analysis of data**

Questionnaire data was captured in MS Excel and analysed with STATISTICA version 12. Summary statistics were used to describe the characteristics of the study population. A *p*-value < 0.05 represented statistical significance and 95% confidence intervals were used to describe the estimation of unknown parameters. The information provided in open-ended questions was organised thematically and analysed using qualitative techniques.

**Results**

**Demographics**

The demographic profile of the study sample is depicted in Table 1. Six FSMs, 63 catering personnel and 517 students participated in the study (28% student response rate). Forty-one percent (*n* = 213) of these students also completed the section specifically for those who consume meals at the seven residences. The majority of students were female (*n* = 340, 65.7%), younger than 22 years (*n* = 488, 94.4%) and in their first year of study (*n* = 218, 42.4%).

**Menu specifications**

The meal plans and menus offered in SU residences were in accordance with the specifications stipulated in the contract with the catering company. For instance, the meal plan specified that dessert must be offered twice per day.<sup>22</sup> Although students could choose from several menu options, the majority (90%) of students preferred the standard option and 5% chose the burger special or the lifestyle option.

**Table 1:** Demographic information of participants

		<i>n</i>	%
<b>Catering personnel (N = 63)</b>			
Job title	Cook	9	14.3
	Assistant Catering Manager, Supervisor	10	16.8
	General Assistant, Stores clerk	33	52.4
	Cashier, administrative	11	17.5
Gender	Female	39	62.9
	Male	24	38.1
Highest qualification	≤ Grade 7	6	9.5
	Grade 8 – 12	57	90.5
<b>Foodservice managers (N = 6)</b>			
Gender	Female	5	83.3
	Male	1	16.7
Highest qualification	Grade 12	2	33.3
	Tertiary	4	66.7
<b>Students (N = 517)</b>			
Faculty	AgriSciences	30	5.8
	Arts	66	12.7
	Economic and Management Science	119	23.0
	Education	14	2.7
	Engineering	95	18.3
	Law	28	5.4
	Medicine and Health Sciences	91	17.6
	Science	70	13.5
	Theology	4	0.8
Year of study	First	218	42.4
	Second	163	31.5
	Third	91	17.6
	Fourth	33	6.4
	Fifth	9	1.7
	Sixth	3	0.6
Age	18 – 21 years	488	94.4
	22 years and older	29	5.6
Gender	Female	340	65.7
	Male	177	34.3

**Table 2:** Average food waste for the male residence (Res M) and female residence (Res FM)

	Production waste		Plate waste		Total waste	
	Res M	Res FM	Res M	Res FM	Res M	Res FM
Lunch	Standard menu	Choice of menus	Standard menu	Choice of menus	Standard menu	Choice of menus
	13.65kg; 12.6%	1.94 kg; 17.4%	16.37 kg; 17%	0.87kg; 9%	30.03 kg; 27.8%	2.81kg; 25.1%
Supper	Choice of menus	Choice of menus	Choice of menus	Choice of menus	Choice of menus	Choice of menus
	2.11kg; 6.3%	1.18 kg; 16.1%	5.95 kg; 19%	0.67kg; 1.11%	8.05 kg; 24.1%	1.85 kg; 25.4%
<b>Average waste per day</b>	11.8%		16.9%		26.7%	

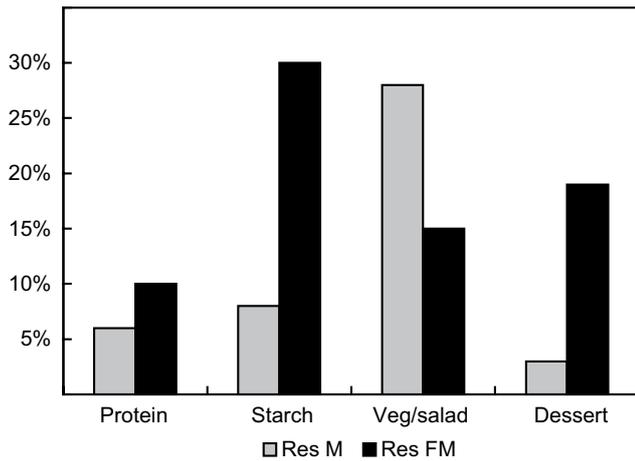


Figure 2: Production waste per food category for lunch and supper combined

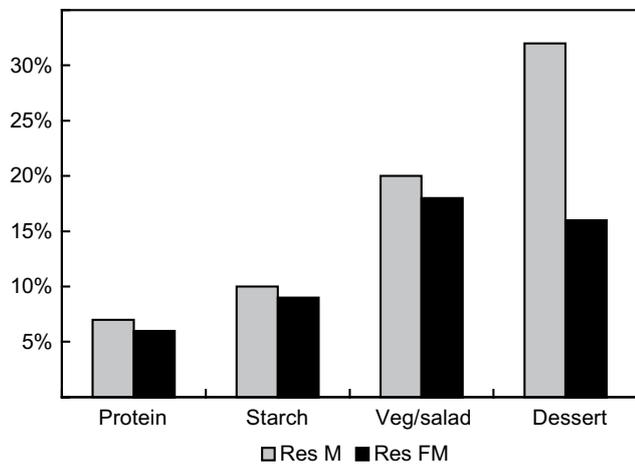


Figure 3: Plate waste per food category for lunch and supper combined

**Production and plate wastage in the foodservice units of two Stellenbosch University residences**

The total average food waste for both residences (Res M and Res FM) was 26.7%, calculated from the production waste plus plate waste. The average percentage plate waste, calculated from the total of amount of food served, was 16.9% (Table 2).

Trends indicate that more production waste was produced during lunch than supper, irrespective of the residence (Res M: 12.6% and 6.3%; Res FM: 17.4% and 16.1%; respectively). Plate waste generated at lunch and supper was dependent on the type of residence. Res M produced more plate waste using the choice of menu options at supper whereas Res FM produced more plate waste at lunch (Table 2).

**Food category production and plate waste**

Figure 2 shows the difference in production wastage at Res M and Res FM for both lunch and supper combined, namely that the production waste of starch (30%) and dessert (19%) was more in Res FM than in Res M (8% and 3%, respectively). Res M, generated more production waste for vegetables and salad (28%). Comparing the difference in plate wastage for both lunch and supper combined, it clearly shows that Res M generated more plate waste for all categories (Figure 3).

**Attitudes of foodservice managers, catering personnel and SU students regarding food consumption and food waste**

*Foodservice managers and catering personnel*

Table 3 contains the questions that were posed regarding food consumption and food waste. In response to the question "I think I can do more to reduce food wastage", it was interesting to find that only 33% (n = 2) FSMs agreed with the statement compared to 80% (n = 48) of catering personnel whom agreed and strongly agreed with this statement.

Table 3: Attitude and practices of participants towards food wastage

Statement	Participants	N	Strongly disagree		Disagree		Agree		Strongly agree	
			n	%	n	%	n	%	n	%
I think I can do more to reduce food wastage	FSMs*	6	2	33.3	2	33.3	2	33.3	0	0
	Catering personnel	60	4	6.6	8	13.3	37	61.6	11	18.3
	Students	517	32	6.2	138	26.7	300	58.0	47	9.1
It is important to me that food wastage is reduced to the minimum	FSMs	6	0	0	0	0	1	17	5	83
	Catering personnel	61	0	0	7	11.4	31	50.8	23	37.7
	Students	517	26	5.0	19	3.7	221	42.7	249	48.1
Menus are planned according to the students' needs and preferences	FSMs	6	0	0	0	0	3	50	3	50
	Catering personnel	62	6	9.6	8	12.9	41	66.1	7	11.2
	Students	213	26	12.2	99	46.5	83	38.9	5	2.3
There is usually a large amount of food leftover after serving	FSMs	6	0	0	5	83	1	17	0	0
	Catering personnel	62	4	6.5	35	56.5	20	32.2	3	4.8
Personnel receive regular training on correct portioning and pre-preparation methods to minimise wastage	FSMs	6	0	0	0	0	3	50	3	50
	Catering personnel	62	3	4.8	15	24.2	38	61.2	6	9.6

\*FSMs = Foodservice managers.

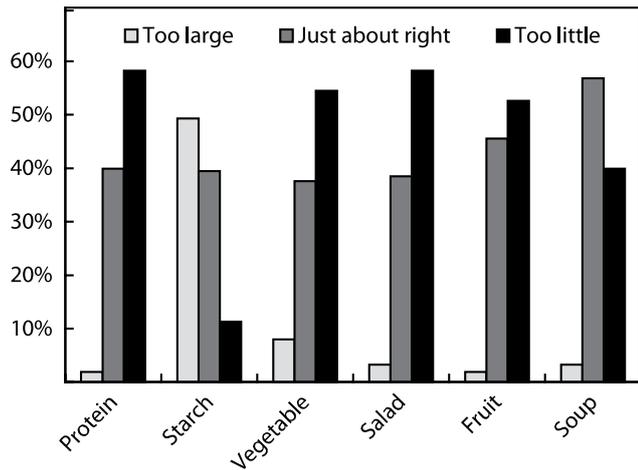


Figure 4: Stellenbosch University students' opinions about the serving size of menu items (n = 213)

**Students**

The majority of students (67.1%; n = 347) agreed that they could do more to reduce food wastage and 91% acknowledged the importance of reducing food wastage to a minimum. Responding to open-ended questions, students regarded food wastage as inhumane, unacceptable, unjust and unnecessary as "a lot of people in Stellenbosch, let alone the rest of the country, would appreciate [to receive] the food being wasted". Students felt guilty wasting food and expressed the opinion that continued food wasting will have a negative impact on the environment and economy, while causing the hungry to become even poorer.

**Practices of foodservice managers, catering personnel and SU students regarding food consumption and food waste**

**Booking system**

Nearly 65% (n = 140) of the students consuming meals at residences (N = 213) agreed that the pre-booking system enforced by the catering company was not a useful means of

decreasing food wastage. A quarter of these students (25.3%; n = 54) indicated that they do not always collect their pre-booked meals. Catering personnel (58%, n = 37) suggested that students should book their meals correctly and according to their schedules. The most common reasons preventing students from collecting pre-ordered meals were as follows: made other plans for the meal (34.7%); were invited to lunch/supper on short notice (35.2%); forgot about it (23.0%); lecture halls too far from residence (23.9%); lectures ended late (25.8%); and studying (17.8%). Responding to open-ended questions, the pre-booking system was described as ineffective and unnecessary, warranting the need for changes to allow flexibility.

"Change the date to book meals to 1 day before"

"Allow us to at least cancel a meal on the day ... within a window period of a few hours so as not to waste meals that you had to miss because of changed plans"

Currently, the menus are available on a website accessible to registered students. However, students felt the system needed improvement in order to allow for more detail and easy access, requesting "to put the menus online or on the res [residence's] website so students have easy access to it".

**Menus**

Contrary to the FSMs and catering personnel who felt confident that menus were planned according to the students' needs and preferences (100% and 77.3%, respectively), 58.7% of students consuming meals at residences disagreed/strongly disagreed (Table 3). All FSMs reported that there is a meal complaint system implemented in the form of a feedback book in each dining room and that they adapt menu options according to the feedback received from the students. Either the students were not aware of the feedback book or they did not utilise it optimally, as students felt strongly that food providers should communicate with them to "find out what the students actually enjoy and base a menu on that, therefore people will be less likely to waste" or "ask students what they prefer to eat and serve meals that students are bound to finish".

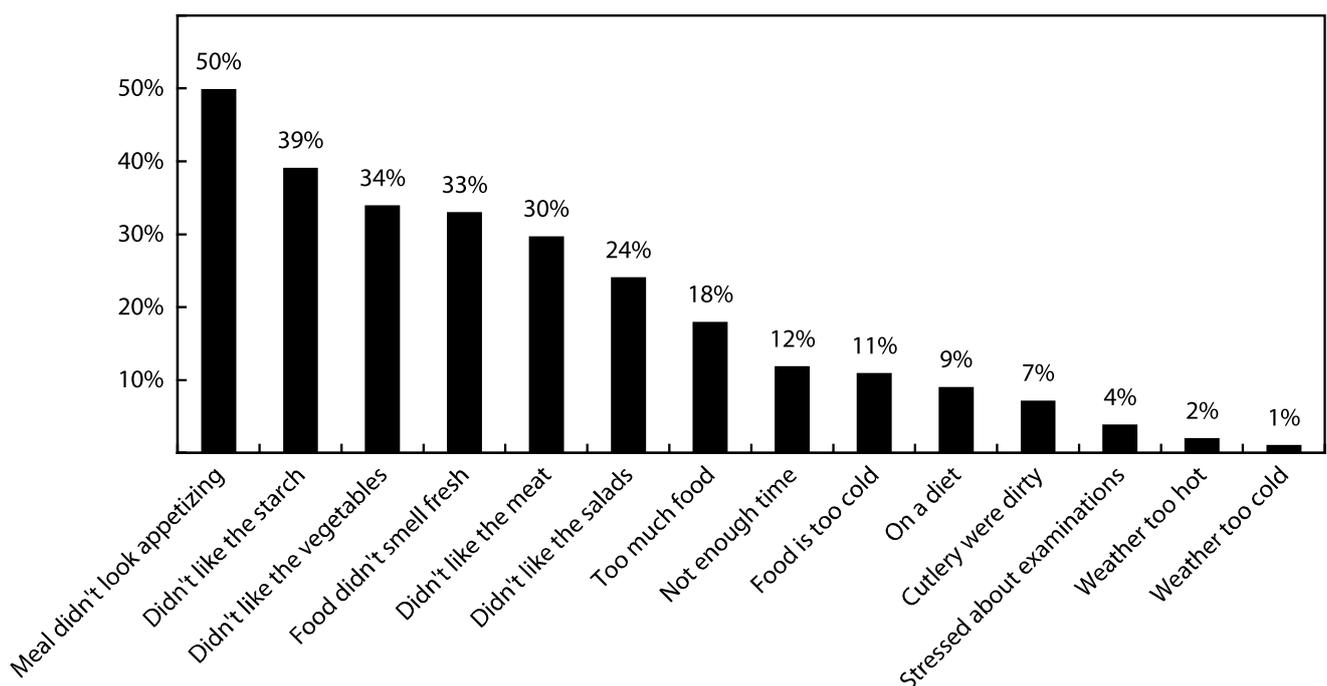


Figure 5: Reasons why students don't eat all their food (n = 213)

### Portioning

Most of the portion sizes served complied with the menu specifications. While the FSMs (67%,  $n = 4$ ) had measures in place to standardise portion sizes through the use of a sample plate, standardised portioning utensils, training in portioning techniques and ordering the correct portion; catering personnel agreed that better portion control should be implemented (22.5%,  $n = 36$ ) in the FSU. Sixty-two percent ( $n = 38$ ) of catering personnel reported that a sample plate is used to guide portioning, and 48% ( $n = 30$ ) reported that they make use of portioning spoons. The majority of students were, however, of the opinion that serving sizes were too small, except for the starch portion, where 49.3% ( $n = 105$ ) of students indicated that portions were too large (Figure 4).

The average percentage wastage was as follows: protein (6.6%), starch (9.5%), salad (11%), vegetables (32%) and dessert (59%). Significantly more female students ( $p = 0.0015$ ) indicated that the starch portions were too large compared to the male students. Significantly more male students ( $p = 0.044$ ) found the protein portion too small.

### Reasons for plate waste

It is important to determine reasons why students don't eat all their food in order to reduce food wastage. Half of the catering personnel ( $n = 31$ ) were of the opinion that students didn't finish their meals because they disliked some menu items, while 33.8% ( $n = 21$ ) said that students eat something else directly before having their booked meal, thus potentially decreasing their appetite. Students provided different reasons for not eating all their food (Figure 5), e.g. meals appeared unappetising (50%) and a dislike for the starch option (39%).

The main factors affecting students' appetite were linked to the perceived cleanliness of the dining area (62.9%;  $n = 134$ ) and the attitude of personnel serving the food (16.9%;  $n = 36$ ). In the open-ended questions, students also mentioned issues such as the quality, preparation and taste of food, especially vegetables, salads and stews. Students' suggestions included: "serve better quality food (more freshly prepared food and less oily food)"; and "they can cook better food that is both tasty and healthy". Additional reasons for not finishing meals were allergies (mostly seafood), preferences, dislikes, emotions and stress. Some students felt that the tray serving system should be changed to a buffet style system, as this will manage portion control and accommodate preferences potentially reducing plate wastage.

### Training

Half of the FSMs confirmed catering personnel received regular training on correct portioning and pre-preparation methods in order to minimise waste, whereas some catering personnel (29%;  $n = 18$ ) disagreed. Even though FSMs (83%,  $n = 5$ ) and catering personnel (68%;  $n = 39$ ) agreed that there was usually little food left after serving, the majority of the catering personnel (80%;  $n = 48$ ) felt there could be some improvement on their part. Half of the FSM's strongly agreed that the catering company has created awareness amongst the personnel on food wastage reduction and prevention.

### Discussion

The process of reducing food waste is complex but can be controlled at multiple stages in the food chain. This study focused on aspects relating to food wastage in the FSU context.

### Total waste

The average total plate waste in this study was 16.9%, which is higher than benchmarks set to curb avoidable food wastage. These range from 0%<sup>24</sup> to less than 10%.<sup>8</sup> Uncontrolled food waste is a serious sustainability issue<sup>24</sup> and SU has, therefore, put several measures in place to manage this. However, these ventures could only be successful if waste management was integrated into sustainable practices and food preparation procedures.<sup>24</sup> Various themes emerging from this study could be considered as contributing factors to the generation of uncontrollable amounts of food waste by SU students. Some of these factors are systemic and need to be addressed through consultation between all role players (university management, the catering company, student bodies) in order to find sustainable solutions.<sup>24</sup> Other factors seem to be embedded in human nature. Addressing these will require innovative ways of creating awareness of the consequences of food wastage through training of catering personnel, as well as educating students and FSMs.<sup>25</sup>

### Booking system

In a survey to reduce food waste conducted at the University of Cape Town during 2012, the implementation of an ordering system to book meals 48h in advance came highly recommended.<sup>20</sup> The experience at SU residences, however, contradicts these suggestions to a large extent. Nearly two-thirds of students described the pre-booking system as not conducive to decreasing food waste, and provided possible reasons for a large number of SU students not collecting their pre-booked meals.

### Meal plan and menus

The catering company is contractually bound to the agreed meal plan and any deviations are regarded as a breach of contract. In this study it was clear that dessert, which was offered daily as part of the standard menu, contributed to a large percentage of total waste. The specifications of the meal plan therefore need to be renegotiated before the catering company could replace the dessert and reduce wastage.

The standard option was most popular with the SU students and few students chose the other options that were intended to offer a wider variety and freedom of choice. Changing the menu type might offer some solutions as research indicated that the amount of wastage amongst different menu types do not differ markedly.<sup>24,25</sup> Careful observation of consumption trends should provide FSMs with valuable information to pre-empt menu changes accordingly, with the potential of reducing overproduction and food waste by at least 10%.<sup>25</sup>

### Production and preparation

FSMs might consider critical evaluation of their current purchasing and production practices to find new ways to satisfy the changing student profile.<sup>25,26</sup> Although FSMs considered the daily production planning as effective, overproduction was still reported, especially during lunch. Accuracy of meal production could be improved by utilising computer generated recipes where the measurements were adjusted to the actual number of consumers.<sup>25</sup> However, the current system of booking meals two days in advance poses a challenge to ensure accuracy in using such forecasting techniques. One way to overcome this obstacle is to prepare food, especially vegetables, as needed during the serving time (batch-cooking), which allows for greater accuracy than preparing all the food before the meal based on meal bookings.<sup>25</sup> Furthermore, a total plate wastage of 16.9% could be

concerning as some students might not meet their Dietary Reference Intakes of certain nutrients in the long term.

### **Serving style and portioning**

Some SU students felt that the tray serving system should be changed to buffet serving allowing students to communicate their preferences for food items and portion sizes, thus ultimately reducing food wastage.<sup>24</sup>

The concept of a "portion size" remains elusive, varying according to the circumstances of the clients, their nutritional requirements and personal preferences. Catering establishments use set specifications and portioning techniques in an attempt to standardise serving procedures and optimise control.<sup>26</sup> Clients, and in this case students, are not necessarily familiar with these specifications, which may lead to misunderstanding and possible client dissatisfaction.

SU students' perceptions of the portion sizes were contradicted by their actual consumption. Students stated that the starch portions were too big (female) and that they were unable to eat the entire portion served to them. The protein, fruit and vegetable portions were described as too little (male), yet double the percentage of vegetables were wasted compared to starch. Merrow *et al.* suggests the use of smaller plates/bowls to control portion sizes, different portion size options and having students taste the dish before choosing it.<sup>24</sup> Literature also suggests the use of a trayless dining system to curb the amount of plate waste by encouraging students to take control of their meal choice and only request the amount of food they would be able to finish.<sup>24,25</sup>

### **Reasons for food waste**

By conducting surveys of student preferences, and performing visual food wastage studies daily,<sup>27</sup> FSMs should be able to identify changing trends timeously. These trends could be discussed amongst students, menu-planners and cooks in monthly meetings to elicit creative adaptations to the menu, recipes or cooking methods.<sup>24</sup>

In this study the vegetable wastage was high and reasons for this should be investigated. Vegetarian options were unpopular in this study, contradicting results from a UCT study where three quarters of students requested vegetarian options.<sup>20</sup> The preparation methods of vegetables should also be investigated as poor quality resulting from sub-optimal preparation methods can result in visually unappetising dishes and increased wastage. The latter could explain the finding that students complained about the small portion of vegetables yet the wastage was high.

A survey conducted at UCT (2012) concluded that students' ( $n = 400$ ) first priority was food of high quality, thus they were generally dissatisfied with the food available and lack of variety.<sup>20</sup> SU students were very critical about the preparation, taste and visual appearance of food, especially vegetables, salads and stews, but refrained from offering any constructive criticism. SU students acknowledged that acceptability of menu items was affected by their stress and emotions. Client satisfaction and food consumption could have been influenced in this study by the cleanliness of the dining area and the attitude of the personnel serving the food. These aspects can be addressed through stringent quality control measures and personnel training.<sup>26</sup>

### **Training**

Overall, SU students, FSMs and catering personnel were positive about reducing food waste and were aware of the environmental impact. However, catering personnel blamed students for causing

most of the wastage. As universities are regarded as leaders in the community,<sup>20,25</sup> an alliance between catering personnel, students and management is needed to implement environmentally and economically sustainable practices. Awareness programmes and education should remain a priority amongst students and foodservice personnel, firstly by establishing an awareness of facts about food waste and then obtaining their cooperation in developing strategies to combat it.<sup>24,25</sup>

Merrow *et al.* regarded well-developed informative programmes as a sustainable way of teaching consumers [students] about the negative impact of food waste. If the statistics of wastage are made known, it could influence students' choices, portion sizes and consumption.<sup>24</sup> Providing nutritional information on menu items<sup>20</sup> might also serve as an incentive for higher consumption.<sup>20,24</sup>

Values thus instilled in future professionals and leaders will nurture them as 'environmental stewards of the future'.<sup>25</sup> It is important to note that continuity needs to be facilitated by the university as commitment of students to environmental issues varies with each student group and is often limited to a small group of active students.<sup>25</sup> If FSMs were well-trained to comprehend the detrimental impact of food wastage on the environment and food security, they would be better equipped to support and educate catering personnel. It is thus imperative to source suitable training programmes for the FSMs.<sup>24</sup> In this regard, the university could make an important contribution to provide additional training resources. Ideally, residences should aim for zero-waste in dining rooms, which could be phased in over a period of time in conjunction with other sustainable projects.<sup>24</sup>

### **Recommendations to curb food wastage**

- Well-planned interventions to encourage students to consume the recommended daily intake of 5–8 portions of fruit and vegetables should be done in consultation with all role players, to provide micronutrients essential for health and prevention of non-communicable diseases.
- The donation of food leftovers to organisations or hunger projects is also an option.<sup>25</sup> This will, however, require close collaboration between representatives of the catering company and the relevant beneficiaries.
- Improved access to menus by making them available online or on the residence websites.
- Re-evaluating the 48 h-in-advance booking system and allowing students to cancel meals 24 h in advance should be considered.
- Reducing the number of menu options will result in simplified production planning and lower food waste.
- Creating a representative forum to discuss food-related matters.
- Active participation in food audits could result in students learning about their own wasteful habits and could generate constructive feedback.
- Meal plans and portion sizes should not be generic, but should be adapted to fit the different preferences of male and female students, making them gender specific.
- Catering personnel could be included in the waste management committee to develop and implement waste management endeavours.

### **Conclusion**

A comprehensive and thorough approach to integrating sustainable practices into waste management and food service procedures is crucial. Raising awareness and identifying issues

contributing to food wastage should remain a priority. This information can be obtained by conducting continued baseline food wastage audits at regular intervals, thus allowing the FSMs to monitor progress and give feedback to relevant role players. Awareness can also be raised by training catering personnel and students, and sharing information, communication and publicity regarding waste reduction and recycling.

It is important that a holistic approach to reducing food wastage be followed and includes students, catering companies and faculty management. Student preference should be considered when meal plans and menus are developed. Regular feedback and communication between students and caterers can ensure that students' needs and preferences are met. This can create a space where insight, opinions and knowledge can be openly shared. Feedback should include how student complaints or suggestions are going to be addressed or incorporated in the menu. It was deduced that the current booking and serving system can be improved. This necessitates an in-depth investigation into the most suitable booking system conducive to reducing food wastage at SU residences. By implementing the above strategies, a university-wide culture of sustainability with a focus on waste reduction can be developed and nurtured.

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## References

1. FAO. Food Wastage Footprint: Impacts on natural resources; Summary report. 2013. [cited 2016 Mar 22]; Available from: <http://www.fao.org/docrep/018/i3347e/i3347e.pdf>
2. Kantor LS, Lipton K, Manchester A, et al. Estimating and addressing America's food loss. *Food Review*. 1997;20(1):2–12.
3. Gustavsson J, Cederberg C, Sonesson U, et al. Global food losses and food waste: extent, causes and prevention [Online]. Rome: Food and Agriculture Organization of the United Nations; 2011. [cited 2012 Mar 15]; Available from: <http://www.fao.org/docrep/014/mb060e/mb060e.pdf>
4. Slaper TF, Hall TJ. The triple bottom line: what is it and how does it work? *Bus Horiz*. 2011;86(1):4–8.
5. International Food Policy Research Institute (IFPRI). 2105 Global hunger index: armed conflict and challenge hunger [Online]. 2015. [cited 2016 Mar 22]; Available from: <http://www.ifpri.org/publication/2015-global-hunger-index-armed-conflict-and-challenge-hunger>
6. Osteen C, Gottlieb J, Vasavada U. Agricultural resources and environmental indicators, 2012 edition [Online]. U.S. Department of Agriculture; 2012. [cited 2014 Apr 10]; Available from: <http://www.ers.usda.gov/publications/eib-economic-information-bulletin/eib98.aspx#.U231SPmSyaA>
7. Dobbs R, Oppenheim J, Thompson F, et al. Resource revolution: meeting the world's energy, materials, food, and water needs [Online]. McKinsey Global Institute; 2011. [cited 2014 April 10]; Available from: [http://www.mckinsey.com/insights/energy\\_resources\\_materials/resource\\_revolution](http://www.mckinsey.com/insights/energy_resources_materials/resource_revolution)
8. NHSE Hospitality. Managing food waste in the NHS [Online]. 2005. [cited 2016 Aug 3]; Available from: <http://www.hospitalcaterers.org/documents/foodwst.pdf>
9. Oelofse S, Nahman A, de Lange W. The magnitude and cost of food waste in South Africa. CSIR Briefing note 2013/01 [Online] 2013. [cited 2016 Aug 3]; Available from: [http://www.csir.co.za/nre/pollution\\_and\\_waste/docs/Briefing%20Note%20No%202013\\_1\\_food%20waste%20version%205%20Final.pdf](http://www.csir.co.za/nre/pollution_and_waste/docs/Briefing%20Note%20No%202013_1_food%20waste%20version%205%20Final.pdf)
10. Bond M, Meacham T, Bhunnoo R, et al. Food waste within global food systems. a global food security report [Online]. 2013. [cited 2014 Apr 10]; Available from: [www.foodsecurity.ac.uk](http://www.foodsecurity.ac.uk)
11. Gustavson J, Cederberg C, Sonesson U. Global food losses and food waste - extent, causes and prevention [Online]. 2011. Rome: Food and Agriculture Organisation of the United States. [cited 2016 Aug 3]; Available from: <http://www.fao.org/docrep/014/mb060e/mb060e.pdf>
12. Peregrin T. Sustainability in foodservice operations: an update. *J Am Diet Assoc*. 2011;111(9):1286–94. <https://doi.org/10.1016/j.jada.2011.07.017>
13. John SAE, Edwards A, Julie AS. Food service management in hospitals. *Int J Contemp Hosp Manag*. 2000;12(14):263–4.
14. Byers BA, Shanklin CW, Hoover LC. Food service manual for health care institutions. AHA Publishing, San Francisco, USA; 1994. p. 357–88.
15. De Wet JA. Facility management, Stellenbosch University. Personal communication; 2015 Jan 18.
16. Beraud S. Kitchen waste management at Stellenbosch University. Report to the Waste Management Committee. Stellenbosch University. 2012 Oct 18.
17. Pieterse E. Dept of Animal Science, Stellenbosch University. Personal communication.
18. Wilding M. Faculty of Agri Science, Stellenbosch University. Personal communication.
19. Kafula S. Anaerobic digestion of dairy manure waste water, food and fruit waste, a sustainable source of bio-energy and waste management. Stellenbosch: MSc Agric in Sustainable Agriculture, Faculty of Agri Sciences, Stellenbosch University; 2016.
20. Gravernor M. Food sustainability at UCT. MSc climate change and sustainable development [Online]. University of Cape Town; 2012. [cited 2016 Jun 13]; Available from: [http://acdi.uct.ac.za/sites/default/files/GRVJOS001\\_2012\\_ACDI\\_Dissertation.pdf](http://acdi.uct.ac.za/sites/default/files/GRVJOS001_2012_ACDI_Dissertation.pdf)
21. Schneider F. Review of food waste on an international level. *Waste Resour Manag*. 2013;166(WR4):188–203.
22. Ward L. Fedics contract specification. Fedics regional trainer: Cape. Personal communication.
23. Katzenellenbogen J, Joubert G. Data collection and measurement. In: Joubert G, Ehrlich R, editors. *Epidemiology: a research manual for South Africa*. 2nd ed.. Cape Town: Oxford University Press; 2008. p. 106–10.
24. Morrow K, Penzien P, Dubats T. Exploring food waste reduction in campus dining halls [Online]. Kalamazoo, MI: Western Michigan University; 2012. [cited 2016 Jun 13]; Available from: <https://wmich.edu/sites/default/files/attachments/ENVS%204100%20Final%20Project%20Report%20-%20Morrow%2C%20Penzien%2C%20Dubats.pdf>
25. Sapphire D. Getting an a in lunch: smart strategies to reduce waste in campus dining. New York: Inform; 1998. [cited 2016 Mar 22]; Available from: <http://www.informinc.org/reportpdfs/wp/GettinganA.pdf>
26. Puckett RP. Food service manual for health care institutions. 4th ed. San Francisco, CA: Jossey-Bass; 2013.
27. Connors PL, Rozell SB. Using a visual plate waste study to monitor menu performance. *J Am Diet Assoc*. 2004;104(1):94–96. <https://doi.org/10.1016/j.jada.2003.10.012>

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