Running head: EATING BEHAVIOUR OF BRITISH STUDENTS

Eating Behaviours of British University Students: A Cluster Analysis on a Neglected Issue.

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Abstract

Unhealthy diet is a primary risk factor for noncommunicable diseases. University student populations are known to engage in health risking lifestyle behaviours including risky eating behaviours. The purpose of this study was to examine eating behaviour patterns in a population of British university students using a two-step cluster analysis. Consumption prevalence of snack, convenience and fast foods in addition to fruit and vegetables was measured using a self-report 'Student Eating Behaviours' questionnaire on 345 undergraduate university students. Four clusters were identified 'risky eating behaviours', 'mixed eating behaviours', 'moderate eating behaviours' and 'favourable eating behaviours'. Nineteen percent of students were categorised as having 'favourable eating behaviours' whilst just under a third of students were categorised within the two most risky clusters. Riskier eating behaviour patterns were associated with living on campus and Christian faith. The findings of this study highlight the importance of university micro-environments on eating behaviours in university student populations. Religion as a mediator of eating behaviours is a novel finding.

Keywords: Noncommunicable disease, university students, eating behaviours, cluster analysis, living arrangement, religion.

Introduction

Noncommunicable diseases (NCDs) continue to be the leading cause of chronic illness, disability and mortality globally [1] . An unhealthy diet is one of the four preventable primary risk factors for NCDs [2]. Low fibre intake and excessive fat intake are reported as distal risk factors for overweight and obesity, which in turn are intermediate risk factors for NCDs [3]. Fast foods and convenience foods are often low in nutritional value although energy dense [4]. Furthermore, higher consumption of convenience and fast foods has been associated with a lower intake of fruit and vegetables [5, 6] and lower diet quality [7]. Sufficient consumption of fruit and vegetables is important as the nutritional content of fruit and vegetables, such as dietary fibre, vitamins and minerals, is associated with a reduced risk of cardiovascular disease and type II diabetes [8]. University student populations are widely reported to engage in unhealthy lifestyle behaviours including unhealthy eating behaviours such as; high consumption of snack foods [9-13], consumption of convenience foods [7], high consumption of fast foods [5, 7, 11, 13-16] and insufficient consumption of fruit and vegetables [9, 11, 12, 14-26]. Thus, students indulging in these behaviours may be at increased risk of weight gain and future development of NCDs.

Comparison of studies examining the prevalence of eating behaviours in student populations is difficult due to the different ways in which eating behaviours have been measured and reported, and differences in the demographic characteristics of the students sampled. That said, trends are beginning to emerge that suggest cause for concern. Published figures suggest more than a third of students consume snack foods ‘at least several times a week’ [11, 12] or 3-4 times a week or more [13].

The reported prevalence of fast food consumption; three or more times per week [5, 14], ‘at least several times per week’ [11], and 3-4 times a week or more [13] is varied, ranging from

20.2% in Polish university students [13] to 46% in USA university students [5]. Of interest, using the criteria of two of more takeaway meals as a main meal per week, Thorpe [7] reported only 12.5% of Australian university students to meet the criteria. The lower prevalence despite a more acute criteria may be explained by the specification that takeaway meals must have been consumed as a main meal to be included in the data [7] or may reflect cultural differences between Australian university students and students of other countries, such as has been demonstrated by El Ansari [11].

World Health Organisation (WHO) and United Kingdom (UK) guidelines recommend a minimum consumption of five portions of fruit and vegetables each day. Average daily consumption by university students has been found to range from 2.2 to 3.8 portions per day [14, 17, 19, 20, 25, 26]. The prevalence of students meeting current fruit and vegetable consumption guidelines is low ranging from 3.27% to 34.7% [12, 18, 21-24].

Only one study [7] to the authors' knowledge has reported on the consumption of convenience food in a student population . Examining the behaviours of an Australian university student population, Thorpe [7] reported 30% of students to consume a convenience meal as a main meal at least once per week [7].

Eating behaviours have been reported to differ by sex [9, 12] and living arrangement [11, 27] in university student populations. Moreno-Gómez et al., [9] reported diet quality to be higher in females, whilst El-Ansari et al., [12] found recommended consumption of fruit and vegetables and consumption of sweet items such as chocolate and candy to be higher amongst female students. El-Ansari, Stock, Mikolajczyk, [11] and Papadaki et al., [27] found students living away from the parental home to have poorer eating habits for most indicators.

Despite evidence demonstrating that health and lifestyle behaviours co-exist [28-35], few studies have examined the clustering of health and lifestyle behaviours in university student populations [16, 19, 36]. Only one study to the authors' knowledge included more than one indicator of eating behaviour [16]. Consequently, no study to date has examined solely the clustering of eating behaviours in a university student population. Cluster analysis technique enables sub-groups with shared characteristics to be identified within a population [19]. Examining how such behaviours cluster together, and the impact of demographic and university micro-environment factors on eating behaviours is important, particular as the presence of multiple unhealthy lifestyle behaviours contributes to multiplicative rather than additive health risk [12].

Presently, resources to address the growing prevalence of NCDs are stretched [3]. Thus, in order to reduce future prevalence of NCDs, preventative action is required [37]. University students are of interest as they present a large, captive population of emerging adults [38, 39] who are expected to fulfil influential roles in society as teachers, policy makers and professionals [19]. The years spent in university education have been promoted as a time for supporting emerging adults to develop health promoting lifestyle behaviours [16]. The transition into university education is significant as during this period emerging adults experience greater freedom to make choices regarding their health and lifestyle behaviours [17, 40, 41]. Furthermore, many students find themselves in a new environment [18, 41] and experience changes to support networks and social norms [18, 42, 43]. Consequently, transition in living environment is likely to alter eating behaviours [11, 44]. As decision makers and role models, the attitudes and behaviours adopted by graduates during their university education have the

potential to have further reaching impact on wider society [45] and therefore the health and lifestyle behaviours of university students are of public health interest [19, 45].

The limited research on students' unhealthy eating behaviours is not conclusive. Clarity of eating behaviour patterns is essential in this population, to ensure appropriate interventions are introduced that will encourage health promoting eating behaviour practices [46]. Research on this area needs to go beyond just reporting the unhealthy and healthy eating behaviours students undertake, but move towards demonstrating how eating behaviours relate to each other and how student characteristics and environment can impact upon such practices [46]. Despite prevalence of risky eating behaviours in student populations, there is a lack of research examining the clustering of health risking and health promoting eating behaviours using cluster analysis technique in both UK and international university student populations. Minimal research has examined the dietary behaviours of European university students [46]. Therefore the aims of this study were twofold; to examine the eating behaviour patterns of a university student population using cluster analysis and to identify demographic and university micro-environment correlates of student eating behaviour patterns.

Method

Sample and Procedure

Data collection took place in a single English university with an undergraduate population of 1,707 undergraduate students. Three hundred and forty five undergraduate students (20.2% of the population) volunteered to complete a 'Student Eating Behaviour Questionnaire'. Questionnaires were administered during lecture time. Data was collected across the academic year of 2014-2015. Ethical approval was received from the institutional research ethics committee prior to data collection. Students were provided with an information sheet and consent

form to complete before completing the self-report questionnaire. Sample characteristics are presented in Table 1.

Measures

A self-administered survey titled 'Student Eating Behaviours' was developed based on previously validated questions that had been used within the literature. The questionnaire included questions on:

Demographic characteristics: Demographic information was collected on age, sex, ethnicity, self-reported height and weight (from which BMI was calculated), religion, living arrangement and year of study.

Eating behaviours: Students were asked 'During the **last seven** days how many times **per day** have you eaten the following foods?' [11]. Students were required to indicate the number of portions of fruit, vegetables and snack foods (e.g. chocolate, sweets, crisps, cakes etc.) they had consumed. Students were also asked 'During the last **seven days** how many times **per week** have you eaten the following foods?'. Students were asked to indicate the number of convenience meals (e.g. microwave meals and oven ready foods such a pizza, chicken nuggets etc.) and fast food or takeaway meals (e.g. Chinese, Indian and Thai takeaway food, fish and chips, fried chicken, McDonald's etc.) they had consumed. Reported number of fruit and vegetables were combined to allow comparison against current UK guidelines.

Statistical Analysis: A two-step cluster analysis was used to identify clusters based on four eating behaviours. Two-step cluster analysis was chosen as it is appropriate for both continuous and categorical data and data sets larger than 200 [47]. Analyses including chi-square, to identify differences between the clusters with regards to demographic characteristics, and MANOVA, to identify differences between each of the eating behaviours within the clusters,

were employed. A Bonferroni adjusted *p* value was used for the MANOVA to correct for multiple comparisons. All analyses were conducted using the Statistical Package for Social Sciences (Version 22, SPSS Inc. Chicago, IL, USA).

Results

Descriptive statistics:

Three hundred and forty five British undergraduate students (66% female; 71% white; 49% Christian; 82% living off campus; 44% first year of study) volunteered to complete a questionnaire. BMI was defined by American College of Sports Medicine (2010) criteria. Mean BMI was 23.5±4.0. Sixty nine percent of students were classified as normal weight by BMI, 25.9% were classified as overweight or obese. Demographic characteristics are shown in table 1.

Cluster Analysis:

The cluster analysis technique revealed four distinct clusters (Table 2). Cluster 1 (risky eating behaviours) was characterised by high snacking, high consumption of convenience and fast foods and low consumption of fruit and vegetables. Cluster 2 (mixed eating behaviours) was characterised by high snacking, high consumption of convenience and fast foods and moderate consumption of fruit and vegetables. Cluster 3 (moderate eating behaviours) was characterised by low snacking, moderate consumption of convenience and fast foods and low consumption of fruit and vegetables. Cluster 4 (favourable eating behaviours) was characterised by moderate snacking, low consumption of convenience and fast foods and high consumption of fruit and vegetables. Cluster 4 was the only group to meet current UK recommendations [48, 49] for fruit and vegetable intake.

Significant differences were found between the clusters, across religion ($X^2_{(2)}$=32.824, p<0.01, Cramer's phi = .313) and living arrangement ($X^2_{(2)}$=13.140, p<0.01, Cramer's phi

= .196) but no significant differences were observed for age, sex, BMI, ethnicity or year of study (p>0.05) (see table 2). These findings should be considered in accordance with the sample size. Significant associations between cluster 1 (risky eating behaviours) and 2 (mixed eating behaviours), cluster 1 and 3 (moderate eating behaviours), cluster 1 and 4 (favourable eating behaviours), cluster 2 and 3 and religion were observed with a higher percentage of Christian students found in cluster 1 and cluster 3. However, no significant associations were found between cluster 2 and 4 or cluster 3 and 4 and religion. Data are presented in table 3.

Significant differences between cluster 1 and 2, and cluster 1 and 4 and living arrangement were observed with a higher percentage of students living on campus found in cluster 1. Significant associations between cluster 2 and 3 and living arrangement were observed with a cluster 3 characterised by both a higher percentage of students living on campus, and a higher percentage of students living off campus. Significant associations between cluster 3 and 4 and living arrangement were observed with a higher percentage of students living on campus found in cluster 3. No significant associations were found between cluster 1 and 3 or cluster 2 and 4 and living arrangement. Data are presented in table 3.

MANOVA revealed significant differences between the clusters and eating behaviours ($F_{(8, 810)}$=103.910, p<0.0125, Pillai's Trace=1.650, partial eta squared=.550-large effect). Follow-up post hoc tests revealed significant differences (p<0.0125) between the clusters (see table 2).

Discussion

Unhealthy diet is one of the four primary preventable risk factors for NCDs [50]. Furthermore, unhealthy diet is a known risk factor for overweight and obesity [3]. Findings of this study demonstrate distinct cluster patterns of eating behaviours in a British university student population. Based on the eating behaviours measured, four distinct clusters were

identified; cluster 1 – risky eating behaviours, cluster 2 – mixed eating behaviours, cluster 3 – moderate eating behaviours, and cluster 4 – favourable eating behaviours. Only 18.6% of the sample was grouped within the favourable eating cluster. Just under a third of the sample (31.6%) fell within cluster 1 (risky eating behaviour) or cluster 2 (mixed eating behaviour), the two clusters characterised by the most risky eating behaviours. The high prevalence of unhealthy eating behaviour patterns demonstrates the need for interventions promoting healthy eating behaviour patterns amongst British university students [46].

Snack, convenience and fast food consumption were clearly shown to cluster together with a high prevalence of these behaviours characterising cluster 1, and a low prevalence of these behaviours characterising cluster 4, with significant differences observed for fruit and vegetable, convenience and fast food consumption. Furthermore, clear distinctions between cluster 2 (mixed eating behaviours) and cluster 3 (moderate eating behaviours) can be observed with significant differences for snack and convenience food consumption.

In contrast to previous research on diet and eating behaviours, clusters were found not to differ by sex although differences were observed by living arrangement and religion. A higher proportion of students living on campus were found in cluster 1 (risky eating behaviours) and cluster 3 (moderate eating behaviours). Research has reported students living outside of the family home to consume fewer fruit and vegetables [11, 27]. In agreement with this, both cluster 1 and 3 were characterised by low fruit and vegetable consumption. Eighty two percent of students reporting to live off campus also reported living with a parent or guardian. In terms of snack and fast food consumption El Ansari, Stock and Mikolajczyk, [11] reported living arrangement not to influence consumption, however the findings of this study are less clear. Whilst cluster 1 (risky eating behaviours) is characterised by a higher consumption of snack and

fast foods and a higher percentage of students living on campus, cluster 3 (moderate eating behaviours) is characterised by a lower consumption of snack and fast foods and is characterised by both a high percentage of students living on and a high percentage of students living off campus. Thus, the relationship between snack and fast food consumption is not clear and further investigation is required.

Religion has been reported to have a protective affect against health and lifestyle risk behaviours including risky alcohol consumption [51-53] and drug use [54, 55], however religion has not previously been shown to be associated with healthy and unhealthy eating behaviours. The current study found cluster 1 (risky eating behaviours) and cluster 3 (moderate eating behaviours) to be categorized by a higher percentage of Christian students. Of interest, findings of Berry et al., [56] found students of Christian faith to report levels of binge drinking and sexual activity exceeding those of the wider student population sampled, including students of Muslim and Jewish faiths, leading to the suggestion that Christianity may offer less protection against riskful health and lifestyle behaviours than other religious faiths. A possible explanation for this may be the cultural expectations of specific religious groups [57]. Religion may support healthy lifestyle choices through mechanism such as culture [58], social support and prescription of expected behaviours [59].

The findings of this study reaffirm the role of the university micro environment, particularly on campus living, on eating behaviours in university student populations. Suggested explanations for this include financial restrictions [11], availability of healthy meals [11] and food availability on campus [46, 60]. Whilst further research is needed to understand students' eating behaviour choices, current understanding would support a review of university food

environments in sight of the recognised importance of supporting and developing health promoting eating behaviours in emerging adult populations.

The findings of this study should be considered with acknowledgement of the limitations. In comparison to other studies examining health behaviours in university student populations, the findings of this study are based on a relatively small sample size. Sample size was influenced by the total number of undergraduates at the chosen university and is sufficient for the analysis chosen. Thus the relatively small sample should be taken into consideration when reviewing the findings, especially within the analyses that assessed differences between the clusters and the separate factors e.g., gender and BMI should not be ignored. Data was collected by means of a self-report questionnaire and therefore recall error is possible. Furthermore, behaviours during the last seven days may not be representative of typical behaviour. Data reported is cross-sectional and therefore causation cannot be inferred. Finally clustered identified are population specific and thus the findings cannot be generalised [19].

Unhealthy and healthy eating behaviours have been shown to cluster together in an English university student population. Moreover riskier patterns of eating behaviour were observed in students living on campus and of Christian faith. Universities have a duty of care to their students and therefore the finding that students who spend greater amounts of time on campus are engaging in riskier eating behaviours should be cause for concern for university leaders. Further understanding of the factors shaping the eating behaviours of students living on English university campuses including analysis of university micro environments is needed. Research to affirm the relationship and to clarify the mechanisms (e.g. social support, cultural expectation etc.) underpinning the relationship between religion and lifestyle behaviours may enable lessons to be learnt that can foster health promoting behaviours.

Table 1. Sample characteristics

Age (years)	(mean (SD))	21.4 (4.7)
Sex	(*n* (%))	
Male		117 (33.9)
Female		228 (66.1)
BMI ($kg \cdot m^{-2}$)	(mean ± SD)	23.5 (4.0)
BMI Classification	(%)	
Underweight		5.0
Normal weight		69.1
Overweight		19.6
Obese		6.3
Ethnicity	(%)	
White		70.9
Mixed		5.2
Asian or Asian British		17.2
Black British		4.1
Chinese		0.3
Other		2.3
Religion	(%)	
Christian		48.8
Hindu		1.5
Muslim		15.2
Sikh		2.1
Atheist		26.2
Other		6.3
Living arrangement	(%)	
On campus		18.1
Off campus		81.9
Year of study	(%)	
1		43.8
2		28.1
3		26.4
4		1.4
5		0.3

Table 2. Mean scores and percentages for the four clusters of British students at a UK university in 2014-2015.

	Cluster 1(*n*=64/18.6%) risky eating behaviours	Cluster 2 (*n*=45/13.0%) mixed eating behaviours	Cluster 3 (*n*=172/49.9%) moderate eating behaviours	Cluster 4 (*n*=64/18.6%) favourable eating behaviours
Eating behaviours	Mean (%)			
Snacking (per day)	2.03***b***	4.69 ***a,d,e***	1.29	1.59
Convenience food consumption (per week)	7.07***a,b,c***	2.53***d,e***	1.47	0.96
Fast food consumption (per week)	4.2 ***a,b,c***	1.89 ***d,e***	1.19	0.85
Fruit and vegetable consumption (per day)	2.88	3.44	2.69	7.10 ***c,e,f***
Demographic factors				
Religion				$X^2_{(2)}$=32.824, phi=.313**
Christian	26.2	12.2	45.7	15.9
Hindu	0.0	0.0	80.0	20.0
Muslim	19.6	23.5	39.2	17.6
Sikh	0	42.9	28.6	28.6
Atheist	8.0	10.2	61.4	20.5
Other	19.0	0.0	57.1	23.8
Living arrangement				$X^2_{(2)}$=13.140, phi=.196**
On campus	27.1	4.8	59.7	8.1
Off campus	16.4	15.0	47.9	20.7
Age				$X^2_{(2)}$=11.455, phi=.182
Sex				$X^2_{(2)}$=6.905, phi=.141
BMI				$X^2_{(2)}$=12.992, phi=.208
Ethnicity				$X^2_{(2)}$=17.235 phi=.224

*p<0.05, **p<0.01, MANOVA: ***a*** denotes significantly higher consumption when comparing cluster 1 and 2, ***b*** denotes significantly higher consumption when comparing cluster 1and 3, ***c*** denotes significantly higher consumption when comparing cluster 1 and 4, ***d*** denotes significantly higher consumption when comparing cluster 2 and 3, ***e*** denotes significantly higher consumption when comparing cluster 2 and 4, ***f*** denotes significantly higher consumption when comparing cluster 3and 4.

Table 3 – Between Cluster Differences

	Cluster 1 vs. 2		Cluster 1 vs. 3		Cluster 1 vs. 4	
	1	2	1	3	1	4
Religion	($X^2_{(2)}$=12.556, p<0.05, Cramer's phi = .341)		($X^2_{(2)}$=15.350, p<0.01, Cramer's phi = .258)		($X^2_{(2)}$=12.127, p<0.05, Cramer's phi = .311)	
Christian	68.3	31.7	36.4	63.6	62.3	37.7
Hindu	0.0	0.0	0.0	100.0	0.0	100.0
Muslim	45.5	54.5	33.3	66.7	52.6	47.4
Sikh	0.0	100.0	0.0	100.0	0.0	100.0
Atheist	43.8	56.3	11.5	88.5	28.0	72.0
Other	100.0	0.0	25.0	75.0	44.4	55.6
Living arrangement	($X^2_{(2)}$=7.181, p<0.01, Cramer's phi = .258)		($X^2_{(2)}$=.741, p>0.05, Cramer's phi = .056)		($X^2_{(2)}$=7.930, p<0.01, Cramer's phi = .251)	
On campus	85.0	15.0	31.5	68.5	77.3	22.7
Off campus	52.3	47.7	25.6	74.4	44.2	55.8

Table 3 continued – Between Cluster Differences

	Cluster 2 vs. 3		Cluster 2 vs. 4		Cluster 3 vs. 4	
	2	3	2	4	3	4
Religion	($X^2_{(2)}$=15.880, p<0.01, Cramer's phi = .274)		($X^2_{(2)}$=7.865, p>0.05, Cramer's phi = .274)		($X^2_{(2)}$=1.718, p>0.05, Cramer's phi = .087).	
Christian	21.1	78.9	43.5	56.5	74.3	25.7
Hindu	0.0	100.0	0.0	100.0	80.0	20.0
Muslim	37.5	62.5	57.1	42.9	69.0	31.0
Sikh	60.0	40.0	60.0	40.0	50.0	50.0
Atheist	14.3	85.7	33.3	66.7	75.0	25.0
Other	0.0	100.0	0.0	100.0	70.6	29.4
Living arrangement	($X^2_{(2)}$=5.291, p<0.05, Cramer's phi = -.157)		($X^2_{(2)}$=0.62, p>0.05, Cramer's phi = -.024).		($X^2_{(2)}$=5.868, p<0.05, Cramer's phi = .158)	
On campus	7.5	92.5	37.5	62.5	88.1	11.9
Off campus	23.9	76.1	42.0	58.0	69.8	30.2

References