Title

Healthy snacks in hospitals: testing the potential effects of changes in availability

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ABSTRACT

Background: Hospitals offer snacks for sale to patients, staff and visitors. Aims: As food choice is heavily influenced by the options available, the present study: (1) audited snack availability and purchase in NHS hospital sites across a large UK city, and (2) tested the potential effects of changes to this availability in an online choice experiment. Methods: In Study 1 (audit), single-serve snacks (n=376) available in 76 hospital food retail units were audited. Purchasing data were obtained from 6 food retail units over 4 weeks (27,989 sales). In Study 2 (online experiment), participants (n=159) chose snacks from pictured ranges containing 25% (minority), 50% (equivalent) or 75% (majority) healthy options. Results: Available single-serve snacks varied markedly in calorie (18-641kcal), fat (0-39g), sugar (0.1g-76g) and salt (0g-2.9g). Only 30% of available snacks were healthy options and only 25% of the most commonly purchased snacks were healthy options. In Study 2, snack choice was significantly associated with the availability of healthy options in the choice array ($X^2$ (2) = 59.71, p<.01). More participants made healthy choices when product ranges contained 75% healthy options compared to 50% (p<.01) and 50% healthy options compared with 25% (p<.01). Conclusion: Healthy snacks are readily available in NHS sites but there is a greater relative variety of unhealthy snack products. Many consumers continue to purchase unhealthy items. Further increasing the availability and variety of healthy options may support consumers to make healthier choices.

Keywords: snacking; hospital; food choice; availability; healthy choice
INTRODUCTION

The UK’s National Health Service (NHS) is one of the largest organisations in the world, employing 1.7 million staff (Nuffield Trust, 2017) and dealing with more than a million people every 36 hours (Department of Health, 2005). Consequently, NHS sites carry significant potential as venues in which to promote healthy behaviours to a large and diverse cross section of the general population. In addition, despite a clear NHS commitment to improving the health of staff (NHS Strategy and Innovation 2018), many UK healthcare workers live with overweight or obesity (Kyle et al, 2016; Kyle et al, 2017), and it has been argued that more could be done to support staff to make healthy food choices on NHS premises (Malhotra, 2013).

While there are a multitude of factors that influence food choice, two key drivers of choice are innate preference and availability. People have strong taste preferences for high fat/high sugar foods (Drewnowski and Almiron-Roig, 2010) and may select unhealthy options with little or no conscious awareness if such options are readily available in the surrounding environment (Marteau et al, 2012). In contrast to innate preference, the relative availability of healthy and unhealthy products within a choice array is a modifiable feature of the food environment and deliberate changes to the availability of different foods within a particular setting can be used to influence the choice and purchasing behaviour of consumers (Hollands et al, 2017). Where empirical studies have increased the availability of healthy options in a given food environment, healthy options are typically selected more frequently. For example, recent systematic reviews conclude that interventions which increase the availability of healthy products relative to unhealthy products tend to be effective in increasing the selection of healthy options (Hollands et al, 2019; Grech and Allman-Farinelli,
and may successfully prompt healthier choices in healthcare settings (Al-Khudairy et al., 2019).

In recent years, great progress has been made in the UK towards implementing positive changes in the availability of healthy and unhealthy foods on hospital premises. For example, in England, NHS organisations are incentivised to restrict the availability of unhealthy foods within the healthcare environment (e.g. NHS England, 2017) and in Scotland, mandatory nationwide standards ensure that at least 50% of available foods meet enhanced nutritional standards (Healthcare Retail Standards; Scottish Government, 2016).

Of particular interest are the latter Scottish Healthcare Retail Standards, as they are not optional (as in the rest of the UK) and guarantee that hospital patients, staff and visitors will be able to make food choices from product selections where healthy and unhealthy options are equivalently available. While this is clearly a positive health intervention, it may not represent true equivalency of choice for two reasons.

Firstly, retailers may offer an equivalent number of healthy and unhealthy items for sale overall, but there may be less variety / availability of healthy options within particular product categories. For example, a retail unit selling 10 types of crisps and 10 types of chocolate (20 product lines) could hypothetically meet the Healthcare Retail Standard by selling 10 healthier types of crisps (50% of product lines) alongside the original selection of chocolate. For a customer wishing to buy only chocolate, the relative availability and variety of products that will be considered remains the same. Secondly, as people display strong innate preferences for unhealthy foods (Drewnowski and Almiron-Roig, 2010) and require cognitive resources and skills to resist them (Allan et al., 2016), it is possible that in situations where healthy and unhealthy options are equally available (i.e. 50:50), or where only a minority of options are healthy (i.e. 25:75), the relative pull of unhealthy items will be stronger in the moment than if a clear majority of available options were healthy (e.g. 75:25).
At present, while the vast majority of hospital-based food retailers in Scotland (96%) comply with the 50% healthy food standard, very few exceed this proportion (Shipton, 2019).

The present paper reports the results of two empirical studies which aim to extend the evidence base in this area. Firstly, in a descriptive audit, the relative availability of healthy options within one health-relevant food category – single serve snack foods - is comprehensively assessed across all food retail units (shops, cafes and vending) in healthcare sites across a large Scottish city. Secondly, in an online experiment, the potential benefits of further increasing the relative availability of healthy options within this category are investigated.

**STUDY 1 - METHODS (SNACK FOOD AUDIT)**

**Design**

Descriptive audit which aimed to determine the relative availability and purchasing of healthy and unhealthy single-serve snacks in all food retail units within NHS settings across one large city in Scotland.

**Setting**

All food retail sites (n=76) comprising shops (n=2), cafes/canteens (n=11), cafes with integrated shops (n=4) and vending machines (n=59) located in the 7 main, urban NHS hospitals (comprising 1 acute/general; 1 maternity; 1 paediatric; 1 dental, 1 psychiatric and 2 community hospitals) and 1 NHS management building (regional headquarters) across one city in Scotland were visited between January and May 2017 and had their snack range
recorded. The city under study provides acute care services for around 500,000 patients from across the socioeconomic spectrum and employs approximately 7,000 healthcare staff.

Materials and Procedure

The audit aimed to collect data on the availability and purchasing of single serve snacks. Such foods were the focus of the current study because they are typically supplementary to the ‘core’ diet, are available across all hospital food retail sites (cafes, shops and vending), vary markedly in nutritional quality (from e.g. fruit to chocolate bars) and are typically consumed in their entirety, making it easier and more appropriate to infer likely consumption following purchase. The products which fell into the single serve snack category included confectionary, fruit, dried fruit, crisps, savoury snacks, cereal bars, and pre-portioned cakes and traybakes. Data on two types of single serve products were not collected; chewing gum (as it is not consumed) and products designed for customers with special dietary needs such as diabetic sweet ranges (as customers purchasing these items often do not have a realistic alternative).

To determine availability, data were collected on the type and nutritional content of each unique variety of single-serve snack food available in the 76 retail sites. Where possible, information was collected directly from the pack information. Where this was not possible (e.g. for unpackaged baked goods and fruit), information was requested from suppliers or taken from published nutritional information. To estimate purchasing, data on the numbers of each product sold per week were sought from retailers. Detailed purchasing data on individual products were not available from vending machines (where only spend was recorded) or from many of the cafes/canteens included (where only broad category of purchase was recorded). Consequently, the purchasing data reported reflects electronic records of purchases (n=27,989) made in 6 of the largest sampled retail sites only (located in
the main acute/general hospital (n=2); the maternity hospital (n=1); the dental hospital (n=1);
the psychiatric hospital (n=1) and in one of the two community hospitals (n=1) covered by
the study). Purchasing was recorded over 4 weeks and the top selling items identified. As an
indicator of relative ‘healthiness’, each product (available or purchased) was coded according
to whether it met set criteria for a healthy option or not according to the Healthcare Retail
Standards (Scottish Government, 2016). This meant that to be coded as a ‘healthy option’,
products weighing ≤100g had to contain <17.5g fat per 100g; < 5g saturated fat per 100g;
<22.5g sugar per 100g; and <1.5g salt per 100g). Data were descriptively summarised. No
pre-specified hypotheses were tested.

**STUDY 1 RESULTS (SNACK FOOD AUDIT)**

More than 500 different varieties of snack foods (n=533) were available for sale to hospital
staff, patients and visitors in NHS hospital sites across the target city, of which the majority
(n=407) were single-serve items, that is, not multi-packs or sharing packs. Nutritional
information was not available for 31 products (typically goods from local bakers). Data are
presented for all remaining single-serve snacks (n=376) on a per product basis.

**Nutritional characteristics of single-serve snacks**

Information about the average calorie, fat, sugar and salt content of different types of single
serve snacks is shown in Figure 1.
Figure 1: Average nutritional content of single-serve snack items by category

Across the whole available range, single-serve snacks (n=376) varied in; (a) calorie content from 18kcals per product (fresh passionfruit) to 641 kcals per product (slice of raspberry cake); (b) fat content from 0g (e.g. apple and grape bag) to 39g (chunky pork pie); (c) sugar content from 0.1g (e.g. ready salted crisps) to 76g (slice of raspberry cake); and (d) salt content from 0g (e.g. apple and grape bag) to 2.9 (cheese, pickle and crackers snack pack).

Availability / variety of single serve snack foods

While retailers ensured that 50% of all food products offered for sale in each site met the criteria for a healthy option (equal availability, in line with the Healthcare Retail Standards), within the category of single serve snacks foods, only 30% (112/376) of unique product lines in the present data set were healthier options.
Purchasing of single-serve snack foods

Purchasing data revealed that 27,989 snacks were purchased over 4 weeks in the 6 retail units able to provide itemised purchasing data. The top 20 selling items accounted for 45% of total snack sales (12,492 snacks). Of the 20 top selling single serve snacks, 7 were crisps/savoury snacks (5,565 sales), 7 were confectionary (3,194 sales), 4 were baked goods (2,356 sales) and 2 were fruit (1,377 sales). Only 5 of the 20 top selling snacks complied with healthy option criteria (3 baked crisps within the savoury snack category and the 2 fruit options).

STUDY 2 - METHODS (ONLINE CHOICE EXPERIMENT)

In order to investigate the potential benefits of increasing the relative availability of healthy options within single-serve snack ranges, an online experiment was conducted. It was hypothesised that the proportion of healthy choices made would be higher when the relative availability of healthy options within a pictured range was higher.

Design

Online, within participant experiment comparing choices made from selections of snacks available in Study 1 manipulated to contain either (a) 25% (minority) healthy items; (b) 50% (equivalent) healthy items; or (c) 75% (majority) healthy items.

Participants

Members of the public (n=173) were recruited via online adverts and a recruitment service (Surveycircle).
Materials and procedure

Images of commonly available snack foods were selected from the Study 1 audit data and used to create photo arrays of different snack ranges. In total, images depicting 15 different ranges of 24 snack foods were created including a variety of fresh fruit, savoury snacks, confectionary and baked goods. Of these 15 ranges; 5 were created to contain 25% (6/24) products that met healthy option criteria (minority condition; broadly comparable to actual availability in Study 1); 5 to contain 50% (12/24) products that met healthy option criteria (true equivalence condition); and 5 to contain 75% (18/24) products that met healthy option criteria (majority condition). As snack foods in hospitals are sold in shops, cafes and vending machines, the ranges were pictured on both traditional shelves and in vending machines. The spatial location of healthy and unhealthy snacks within each range was randomly varied in each pictured range.

Participants made snack choices from 15 different pictured ranges, 5 from each condition (25%; 50%; or 75% healthy). Within each condition, choices were coded as a binary outcome variable indicating whether they were predominantly healthy options (≥ 3/5 choices met the criteria for a healthy option) or predominantly unhealthy options (≥3/5 choices did not meet the criteria for a healthy option).

Participants who responded to study adverts were directed to the online experiment hosted on the PsyToolkit platform. After reading the study information and indicating consent, participants were asked to complete some basic demographic information (age, gender) before beginning the main food choice task. In the food choice task, participants were presented with all 15 food ranges (in counterbalanced order) and were asked to pick the snack from each that they would be most likely to purchase if confronted with this range in real life. There was no limit on how long the participants could take to make their choice.
Both the study hypothesis and analysis plan were pre-specified. As the outcome variable is binary (predominantly healthy vs unhealthy product choices), a Cochran’s Q test was used to test whether the proportion of people who made predominantly healthy choices differed according to the relative availability of healthy options within each condition. All analyses were carried out using IBM SPSS Statistics version 25.

STUDY 2 RESULTS (ONLINE CHOICE EXPERIMENT)

A sample size of n=172 was planned a priori to be able to detect a medium effect size in a chi squared based analysis with 0.90 power at $\alpha=.05$. Of the participants who began the online experiment (n=173), 14 failed to complete all trials, leaving complete data from 159 participants. The final sample size remained sufficient to meet the minimum assumption required by the Cochran’s Q test used in the analysis (Ramsey & Ramsey, 1981). Participants in the final sample were predominantly female (F=105) and had an average age of 29.7 years (SD=11.1 years; range =18-65 years).

Product choices were coded as predominantly healthy or unhealthy and the proportion of each was calculated across the whole experiment and within the 3 different availability conditions. On average, across the whole experiment, fewer participants made predominantly healthy choices (n=194; 41%) than unhealthy choices (n=283; 59%). However, this proportion varied significantly (Cochran’s Q test; $X^2(2)= 59.71$, p<.01) from condition to condition (37/159 in the 25% healthy condition; 65/159 in the 50% healthy condition; and 92/159 in the 75% health condition) as illustrated in Figure 2. Post hoc McNemar tests (with manually applied Bonferroni corrections to allow for multiple comparisons) determined that
participants were more likely to make predominantly healthy choices when the ranges they were choosing from contained 75% healthy options compared to 50% (p<.01) or 25% (p<.01) and when ranges contained 50% healthy options compared with 25% (p<.01).

Figure 2: Proportion of healthy and unhealthy product choices from ranges with 25%, 50% or 75% healthy options

DISCUSSION

While healthy foods in general are now readily available in Scottish hospitals, audit data collected in the present study show that only a minority (30%) of unique product lines within one identified health-relevant food category (single serve snacks) met healthy option criteria. Furthermore, in a sample of purchased snack items, the majority (15/20) of best-selling products were not healthy options. When pictures of single-serve snack ranges were experimentally manipulated to increase the relative availability of healthy options within the
The results of Study 1 indicated that while healthy options are now readily available for purchase in hospital based shops, cafes and vending machines, around three quarters of the most commonly purchased snack items do not meet Healthcare Retail Standard criteria and cannot be considered healthy options. Across the product range assessed, there was substantial variability in the nutritional characteristics of available products, with consumers able to purchase single snacks which varied markedly in calorie, fat and sugar content. Despite equivalence in the number of healthy and unhealthy (individual) products available across each retail unit as a whole, within the single-serve snack category, only 30% of unique product lines were healthy options. This indicates that consumers intending to purchase just a snack are not presented with equivalent numbers of healthy and unhealthy options, rather they must select from a range where there is a greater variety of unhealthy options. This echoes the finding of Boelsen-Robinson et al (2017) who reported that even after the number of healthy products in Australian hospital vending machines was increased to at least 50% of the total number of available items, there was still less variety within the healthy than unhealthy product range.

Variety is an important aspect of choice; consumers value variety as it increases the likelihood that they will find an option that matches their own wants and needs (Johnson et al, 2012). Experimental studies have demonstrated that increases in perceived variety lead to increases in food selection and consumption (Kongsbak et al, 2016; Meings et al, 2012; Brondel et al, 2009), suggesting that the higher purchasing of unhealthy items observed in the present study may partly reflect the larger relative variety of unhealthy products within the available selection. While increasing the available variety of healthier products may go some way towards addressing this, the impact of such a strategy needs to be investigated.
Increasing the variety of options available when products are unfamiliar (e.g. when
introducing new healthy products lines) may actually increase the cognitive demands of
choice (Johnson et al, 2012), making it more likely that consumers will default to more
familiar unhealthy choices.

Great strides have been made in recent years to restrict sales of unhealthy food in UK
hospitals (NHS England, 2017; Scottish Government, 2016). However, the present data
suggest that when looking for snack foods, many consumers continue to purchase unhealthy
items, even when healthy alternatives are also available. Consequently, further interventions
may be required to successfully tip the balance of consumer purchasing towards healthier
snacks as the norm. One viable strategy may be to introduce mandatory caps on the
maximum permissible calorie/fat/sugar/salt content per item on all items for sale (rather than
for just a set proportion). This would serve to remove the least healthy products from the
available range while retaining some choice for consumers. For example, a selection of baked
goods, confectionary and savoury snacks could be retained for sale but without the extreme
outliers within each range (e.g. removing the slices of cake with >600kcals). Alternatively,
hospital retailers could further modify the relative availability of healthy vs unhealthy options
within product categories until healthy options make up the majority of products for sale.

This latter possibility was tested in the present Study 2 using pictures of snack foods
commonly available for sale in the retail units included in Study 1. The results of this online
experiment demonstrated that participants were significantly more likely to choose a healthy
snack when the proportion of healthy options relative to unhealthy options was increased.
Specifically, the data indicated that when healthy and unhealthy options were equally
available, or where healthy options were in the minority within a range (as was the case in the
real retail data collected in Study 1), most people selected an unhealthy option. In contrast,
when the availability of healthy options was increased so that three quarters of items within
the array were healthy, the majority of people (58%) opted for a healthier item. These
findings echo those of studies showing that larger increases in the relative availability of
healthy options have a stronger impact on healthy food choice (Van Kleef et al, 2012).
Similarly, in a recent evaluation of the effects of a change in policy around hospital vending
machines in Victoria (Australia), Boelson-Robinson (2017) found that an increase in the
availability of healthy items to at least 50% of available items and a simultaneous reduction
in the availability of the most unhealthy items to below 20% of available items, led to
consumers purchasing around 55% fewer unhealthy items than would have been expected
from pre-policy sales patterns.

Other studies of availability in the healthcare context have investigated the effects of
manipulating perceived (rather than actual) availability. For example, Ryan et al (2020) and
Huse et al (2016) report the results of an intervention in a large hospital café where all of the
least healthy beverages were removed from view (although were still available on request).
While this intervention primarily targeted the visibility of unhealthy items, it also
functionally reduced the immediate (self-service) availability of unhealthy items resulting in
unhealthy drink purchases reducing from 33% of total sales prior to the change to 10%
immediately after and 7% 18 months later.

There are several possible reasons why increased availability may have led to a higher
proportion of healthy choices in the present study. Firstly, it may be that simply increasing
availability was sufficient to prompt healthier choices. Availability is one of six core features
of the environment empirically shown to change the behaviour of people within that
environment (Hollands et al, 2017). Simply put – people choose the products because they
are there. Secondly, as the increase in availability in Study 2 also increased the variety of
healthy options, this increased variety may have increased uptake. Participants in
experimental studies eat more when perceived variety is increased (Kongsbak et al, 2016;
Meengs et al, 2012; Brondel et al, 2009) and increasing the healthy range to contain a larger selection of unique items may have made it more likely that the participants found a healthy snack that was to their liking. Thirdly, choice may have been affected not by the increases in the availability or variety of the healthy product range, but instead by decreases in the availability and variety of the unhealthy product range. In situations where few unhealthy products are available, it is possible that participants were less able to find an option that was to their liking, or that the relative ‘pull’ of the unhealthy items was reduced, making it easier to resist the temptation of an unhealthy snack. The latter possibility is supported by experimental work demonstrating that changes in the availability of unhealthy options seem to have a stronger effect on choice than comparable changes in the availability of healthy options (Pechey and Marteau, 2018). Future studies should further investigate these possibilities.

The present study is not without limitations. Data for the Study 1 audit were collected between January and May 2017 during the period around the final deadline for compliance with the Healthcare Retail Standards (31st March 2017). All sites included in the present food audit had already fully implemented the HRS guidelines or were in the very final stages of doing so but minor changes to the products on offer during the first 8 weeks of the study may have occurred. In addition, purchasing data could only be collected from larger retail units who recorded sales at the individual product level and so the reported pattern of purchasing does not reflect purchasing across the full spectrum of retail outlets operating in hospitals. However, the larger units sampled were located in a range of different acute, community, general and specialised hospital settings and so were broadly presentative of all hospital settings in the city under study. The choice experiment conducted in Study 2 used a convenience sample that was not stratified and so is unlikely to be representative of the broader general population. Furthermore, this study was an online forced choice task and
asked participants only for their preference amongst a selected range of products. No information was given on factors such as price that are highly likely to influence choice in real life, and participants did not actually purchase and consume the chosen snacks, limiting the ecological validity of the results.

In conclusion, while great progress has been made in supporting healthy choices in hospitals in recent years, there is still scope to further increase the availability and variety of healthy single-serve snack options in this setting. The present study revealed that when making choices from ranges containing 75% healthy snacks, people selected significantly more healthy options than when the ranges included 50% healthy snacks or 25% healthy options. Further research on the relationships between availability, variety and choice is required.

ETHICAL STATEMENTS

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Availability of data: Data is available from the authors on request, with the exception of the retail sales data which we do not have permission to share.
Authors’ contributions: JA conceived of study 1 and study 2 and drafted/revised the manuscript. MH collected and descriptively summarised the data for study 1. SD collected and analysed the data for study 2. FM, SW and MJ contributed to the design and execution of study 1 and commented on drafts of the manuscript. All authors approved the final version of the manuscript.

Conflicts of interest: The authors have no competing interests to declare.

Consent for publication: All authors consent to publication.

Ethical approval: Study 1 received ethical approval from the University of Aberdeen’s College of Life Sciences and Medicine Ethics Research Board (approval reference: CERB/2017/1/1414). Study 2 received ethical approval from the University of Aberdeen’s College of Life Sciences and Medicine Ethics Research Board (CERB/2019/2/1713). All participants gave informed consent before taking part.
REFERENCES


