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Improving the nutritional quality of charitable meals for homeless and vulnerable adults: A mixed method study of two meals services in a large English city.

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ABSTRACT

Inadequate nutrition may contribute to poor health in homeless and vulnerable adults. Charitable meals are critical to this group's nutrition.

The nutrient content of charitable meals at two organisations was assessed. Ethnography investigated organisational practice; semi-structured interviews explored influences on meal provision.

Meals were adequate for energy and the majority of nutrients, but exceeded thresholds of saturated fat, salt and sugars and lacked vitamin D and selenium in both organisations.

Organisations were constrained by budget, equipment, food donations, volunteer capabilities and time. Organisational values influenced meal provision; strategies to reduce fat, salt and sugar content may be resisted because of an ethos of hospitality and overprovision.

Introduction

Poor nutrition due to food insecurity is endemic in homeless populations around the world [1–3] and is thought to be germane to health inequalities [4]. A UK study recently reported that homeless adults had inadequate intakes of energy, non-starch polysaccharides (NSP), vitamin A and several minerals [5]. However energy and micronutrient intakes were greater on days where charitable meals were consumed, and participants described '*depend[ing] on these services fully, completely*' [5]. The importance of charitable meals has been demonstrated in other homeless populations [3,6]. While most research has examined charitable meals in relation to people who are homeless, a spectrum of vulnerable adults (drug and alcohol addicts, probation clients, asylum seekers and refugees) also makes use of, and depends on such services [7]. Homeless and other vulnerable people have a poor health profile [4,8].

The nutritional quality of charitable meals has been criticized. Tse and Tarusuk [9] concluded that charitable meals in Toronto were insufficient to meet nutritional needs of vulnerable people, while others argue that such meals may actively contribute to poor health in homeless people [10]. The literature on nutritional quality of charitable meals is sparse. One study in Toronto noted that charitable meal providers had little capacity for meal improvement, particularly in organizations constrained by funding and staff [11]. Indeed a cost-to-nutrient analysis of nutrient provision amongst homeless people in Paris found that intake could not be improved using local foodstuffs, therefore researchers chose to develop a fortified street food product [12].

This study sought to examine charitable meal provision in two small organizations that offered a weekly free meal to their local community in a large English inner city. Specific objectives were to analyze the nutritional composition of meals served, to

investigate influences and constraints on meal provision, and if possible to develop recommendations to improve meals' nutritional quality.

Method

This research was conducted from a 'critical realist' perspective [13]. Mixed methods, namely immersive ethnography augmented by interviews with volunteers and quantitative nutritional analysis of meals served, were employed to capture the complexity of the phenomena [14,15]. The University of Sheffield Ethics Committee granted ethical approval.

Ethnography

Each week between April-August 2013 the research team (CJF and SPB) worked as volunteers helping with meal provision. Initially they helped with food preparation and service, and in July and August they took the role of catering managers in Organization 1 having responsibility for menu planning from existing recipes and food acquisition. Meal information was collected during their initial role. Both researchers completed a reflective report. Information from food purchase receipts, committee meeting minutes, personal communications and organizational websites augmented understanding.

Interviews

Semi-structured interviews were conducted with a purposive sample of volunteers (n=6) who represented various food preparation and service roles within each organization, including the catering manager and session leader. The questions pertained to the following topics: operational practice within the organization, the participants' history and current role within the organization, their experience of cooking, understanding of a healthy diet, and their perceptions of guests' food preferences. The 40-minute interviews were held in convenient locations. Informed consent was obtained verbally and recorded as part of the interview. The audio-

recording was transcribed *verbatim.* Thematic analysis [16] identified key influences on meal provision.

Nutritional assessment

Quantitative information on food served was collected over a 9-week period at Organisation 1 and over an 8-week period at Organization 2. Descriptive detail of all food items served including brand and cooking method was recorded. Portion size was determined by weighing each meal component to the nearest gram using digital scales (Salter, model: 1100UJDR). Portions for weighing were served by the kitchen staff at the organization. Weighing of food took place after guests had been served; at least two portions of each item were weighed. Food items that were routinely served were not weighed on more than four occasions.

Where direct weighing was not possible, if all available food was served to guests, portion size was estimated using packet weights or imputed weights for similar items. During the study period the catering manager at Organization 1 developed new meals; nutrient content data of these meals were obtained through recipe analysis. For self-service items (sugar, salt, cereals), which were available to guests *ad libitum,* weights were obtained for these items at the start and end of each session. The net weight used over the session was calculated and intake per guest per meal calculated. The self-service items were not used for other purposes. Nutrient content of meals was generated using NetWisp 3.0 (Tinuviel Software, Warrington). Meal and recipe items were entered into the software as the most similar food available; in two instances a new food was created to match manufacturers' nutrition information. Average energy and nutrient content of meals was compared to a goal of one-third of the UK Estimated Average Requirement (EAR) and Reference Nutrient Intake (RNI), respectively.

Population Average Values were used for NSP, fat energy and Non-Milk Extrinsic Sugars (NMES) energy [17,18]. Extrinsic sugars are the sugars that are not contained within the cellular structure of food. NMES exclude sugars in milk and milk products. NMES include sugars added to food e.g. sucrose, glucose and fructose, and sugars naturally present in fruit juice e.g. glucose and fructose. Non-starch polysaccharides are the major fraction of dietary fibre, comprising cellulose and non-cellulose polysaccharides (e.g. arabinogalactans, arabinoxylans, gums, mucilages) [17].

Results and Discussion

Both organizations utilized church halls for delivery of their services and operated an 'open-door' policy; as such no information was collected on the housing status of those in attendance. Organization 1 considered its clients to be exclusively homeless or vulnerable. Organization 2 was open to anyone, but recognized a high proportion of homelessness among attendees. The number of guests in attendance fluctuated over the observation period, but was typically between 60 and 80 at Organization 1 and 40 to 50 at Organization 2.

Organization 1 provided a Sunday lunch and Organization 2 a weekday breakfast with additional items for guests to take away. Both organizations also provided self-service items. Table 1 details the constituent food items of the meals. [TABLE 1 HERE]

Nutrient composition of meals served

Table 2 shows the nutrient composition of meals served at both organizations. The meals served met nutritional targets (33% of DRV) with the exception of vitamin D and selenium at both organizations and NSP at Organization 1. Several nutrients exceeded the DRV. Adversely, the sodium and NMES content of meals at both organizations was greater than the DRV; at Organization 2 the breakfast exceeded the recommended maximum daily intake for sodium. The fat and saturated fat content of the meals in both organizations was high; these bordered daily DRV limits, whilst saturated fat exceeded the limit at Organization 2.

[TABLE 2 HERE]

Self-service food items made a substantial nutrient contribution at both organizations. At Organization 1 these items provided 20-40% of DRV targets for energy, protein, vitamin E, folate, calcium and iron, with lesser contribution for other nutrients. However, self-service items also provided 17.7 g fat, 33.5g NMES and 1374.9mg sodium. Similarly, at Organization 2 self-service items provided at least 70% of the DRV for all B vitamins and iron and greater than the DRV for vitamin C and thiamin. Again these items raised the sugar and sodium content to over the DRV target providing 49.5g NMES and 1041.7mg sodium.

At Organization 2 take-away items (defined in Table 1) also made important contributions to nutrient content. The cooked meal without take-away items plus self-service items did not meet goals set for energy, vitamins C, magnesium, or potassium (data not shown).

There are limitations to the data presented here. Firstly the nutrient content of self-service items is based on average portions served and may be skewed by exceptional

135 portions. Additionally nutrient content of meals cannot be used as a proxy for nutrient
136 intake as food waste was not measured. Further error may have been introduced by
137 inaccuracies in the nutrient analysis software, especially for food items frequently
138 consumed such as bread. However, our data indicate that charitable organizations can
139 provide meals containing least one third of the dietary reference value for nearly all
140 nutrients assessed.

141 Soup kitchen meals in Michigan, USA also met nutritional standards [19]. However a
142 target of 33% of daily intake may be conservative; other studies have set higher goals
143 [9,10]. Indeed Tse and Tarasuk [9] argue that a single charitable meal should meet the entire
144 DRV since this meal may be the only one consumed [5,6]. This argument is especially
145 pertinent in evaluation of meal provision at Organization 1 because, as far as we know,
146 this is the only service providing meals over the weekend in this city.

147 The sodium and NMES content of meals at both organizations was excessive, in large
148 part due to the salt and sugar content of the self-service items. The entire breakfast at
149 Organization 2 provided 63g NMES of which 22g was table sugar; excess dietary sugar
150 intake was previously reported in homeless adults [5]. The provision of food *ad libitum*
151 to a food insecure population may encourage overconsumption. On the other hand self-
152 service items made an important contribution to energy, vitamin and mineral intake.
153 These benefits arose from provision of fortified flour products (breakfast cereals and
154 bread), as well as milk and fruit juice.

155 Across both organizations meals did not meet the target set for vitamin D. Similarly
156 selenium content was low at Organization 1. Intakes of selenium in the UK are
157 typically lower than the Reference Nutrient Intake (RNI), with no adverse outcomes [20].
158 Nevertheless selenium is an immunostimulant and adequate intake of this nutrient may

protect against CVD [21]. Thus increasing the selenium content of the meals may benefit guests' health. Vitamin D intakes were also low relative to the RNI. However, it should be noted that this value (10µg/d) has been suggested for elderly people (>65y) and may not be wholly applicable to adults (18-64y) [17]. The current study did not evaluate nutritional status of the guests in attendance, but dietary intakes as estimated have potentially adverse ramifications for bone and cardiovascular health [22]. Strategies to increase these micronutrients and reduce fat, saturated fat, salt and sugar content of meals should be considered.

Organisational Operations

Both organizations were staffed and run by volunteers who were responsible for purchasing, cooking and serving of food. In Organization 1 a volunteer had been nominated to act as a part-time catering manager who had additional duties, including monitoring food safety and development of menus. There was a similar mix of volunteers at both organizations, including professionals, students and several retirees, many of who were church members. Interviewees at Organization 1 saw this heterogeneity in cooking experience and physical robustness as a potential limitation to catering performance.

> *'…but y'trouble is you've not got the consistency, they'll be chefs and cooks who come in all sorts and sizes, you've gotta have kind of a fairly standard procedure involved.'* (Volunteer 1, Organisation 1)

> *"They're all brilliant cooks… but [it's] difficult to know whether they would want to go down[stairs]… stirring giant pots and things, and lifting great big heavy pots, I mean, some of the volunteers are very elderly,'* (Volunteer 2, Organization 1)

Facilities were comparable between to two organizations; both utilized an eight-ring stove with a double oven and had cold, dry and frozen storage facilities, although these were somewhat *'limited'* (Volunteer 3, Organization 1). Equipment was stored separately away from the food preparation area as dictated by the building layout in Organization 1 and transfer of equipment was time-consuming. Whilst Organization 1 had cooking equipment sufficient *'to get the job done'* the volunteers felt that they were *'restrained'* particularly by the capacity of the stove and ovens *(*Volunteer 1, Organization 1). Such difficulties were compounded by the limited time available for preparation; *'You know, you're at the limit because those potatoes are only just ready'* (Volunteer 1, Organization 1). The physical space and equipment at Organization 2 were appropriate for its current menu operation, but there was limited potential to expand the menu to provide more complex meals.

Both organizations received food donations. The poor nutritional quality of donated food has previously been highlighted [23]. Whilst donations were valued, volunteer 2 at Organization 1 described having to reject donations of '*high risk*' food items, such as cakes with fresh cream, which the organization did not have capacity to store in line with food safety regulations. Donations of bread at Organization 1 and cereals at Organization 2 adversely contributed to salt and sugar intakes, respectively.

Both organizations had a budget sufficient for the purchase of the majority of food items, and as such they had a degree of autonomy in food acquisition. The approximate ingredient cost per meal was £1.20 ($2.03) at Organization 1 and £2.05 ($3.47) at Organization 2; these budgets were substantially greater than cited elsewhere [24]. Indeed a volunteer at Organization 2 felt their funding was ample. At Organization 1 Volunteer 2 described financial uncertainty. Difficulties were associated with providing

sufficient food within budget, although the revised meals were seen as more economical; '*instead of a hundred pounds [the revised meals] have come in at just over 70 pounds,'* (Volunteer 2, Organization 1). The research team experienced the limitations of budget, equipment and facilities through personal experience. This lack of material resources is in keeping with studies of charitable organizations in Canada, which were seen to labor under similar constraints [11,24].

Supplies are typically purchased from supermarkets, which was *'convenient'* as part of volunteers' domestic *'weekly shopping' (*Volunteer 4, Organization 2*)*. At Organization 1 a supermarket delivery service was used to ensure sufficient food arrived fresh, but 'bulk' items could not always be ordered and the quality of certain items delivered was seen as poor. Alternatively a wholesale retailer was utilized; however this involved making special advance arrangements to access the hall.

The Meaning of Food Provision

The primary function of both organizations was food provision; this presents a contrast to 'faith-based' organizations observed in other studies [9,24] where food distribution was secondary to religious or educational objectives. There were some differences between Organization 1 and 2 in ethos.

Organization 1 valued social interaction and time was allotted for this prior to the meal, in order to make the social aspect distinct. In this setting the purpose of the meal itself was clearly to fulfil physiological requirements (for energy) and alleviate hunger. This stance of aiming to "fill bellies" was also noted in an analysis of charitable meal services in Canada [24]. It is notable that promoting health beyond providing energy was not a

consideration in meal provision at either organization (with the notable exception of a volunteer at Organization 1).

> *'…if some of them are out in all weathers they need some… calories in, they need some sort of stodge stuff, don't they'* (Volunteer 3, Organization 1)

> *It is about the meal and I don't think we're setting ourselves up to change people's behavior. I think we're setting ourselves up to offer a breakfast*.' (Volunteer 5, Organization 2)

Organization 2 developed as a means to '*get people together*' (Volunteer 4 Organization 2), and the emphasis on social interaction persisted. Two longstanding volunteers described how physical space had been manipulated through introduction of trestle tables to facilitate this objective. Furthermore the social element of volunteering was cited as a prominent reason for involvement. Value was also placed on the inclusive nature of the organization; *'…I like the fact that we don't ask questions at the door, erm, except what you'd like for your breakfast*' (Volunteer 5, Organization 2). Indeed the service was patronized not only by homeless and vulnerable adults, but also by a small number of local professionals. Social interaction was presumed to motivate guest attendance at Organization 2; *'… some would continue to come, because they'd like the atmosphere and the friendliness*' (Volunteer 5 Organization 2). Yet whilst many guests clearly enjoyed the social element, remaining to chat to friends and other guests long after they had finished eating, others displayed a more perfunctory attitude. For a minority it was clear that maximizing food consumption was paramount - taking extra milk out of sight of volunteers or claiming untruthfully they lacked certain items exemplified this attitude. These observations concur with previous study of homeless adults for whom food represented survival rather than enjoyment [5].

The second aspect of organizational ethos pertinent to meal provision at Organization 2 is the demonstration of hospitality; providing a meal is an expression of the Christian ideal, and therefore had an intrinsic moral component that was valued. To demonstrate hospitality the meal must do more than meet basic requirements.

> "*There's that element of hospitality which I think the church is all about but also what meal times potentially are all about*.' (Volunteer 5, Organization 2)

> '*It's an important message the churches want to give. Hospitality is important… and we're not just giving people a little, we're giving them more than they need really, and I actually think that's… a good thing to do*.' (Volunteer 5, Organization 2)

At Organization 2 it was clear that hospitality was central and non-negotiable and thus organizational ethos may act as a barrier to provision of healthy meals. Volunteer 5 perceived that improving the meal's nutritive value would entail 'remov[ing] the meat' and animal foods; as such improving health was associated with giving less and thus directly opposed the organization's objectives. This attitude was unexpected; the researchers had not previously considered the purpose of food beyond gastronomic enjoyment, satiation or its nutritional value. Indeed the social aspects of sharing food may just be important for the physical health of guests as balances of food and nutrients; it has been documented that social inclusion is associated with lower disease risk [25,26].

An adjunct to the notion of hospitality is the concept of '*homeliness*'. Homeliness extends to the physical environment at Organization 2, where having breakfast is like '*meeting around someone's kitchen table*' (Volunteer 5, Organization 2) and is reflected

in the rhetoric of both organizations where instead of 'service users' those attending the meal are known as '*guests*' or '*breakfasters*' (Volunteers, Organization 1 and 2). There was an indication that the meal (or certain items) also connotes homeliness.

> *'There's something… already very homely about a full English breakfast that's been cooked as well as if by their mother'* (Volunteer 5, Organization 2)

Such connotations are known to prevail across cultures [27,28]. The familial and homely aspects of food are likely to be absent in the lives of many guests and from this she infers the value of the meal for them; '*they don't get treated like a client group. They're having breakfast as if they're at someone's home really'* (Volunteer 5, Organization 2). A sense of pride was apparent in this volunteer; this homeliness was part of what made the breakfast '*special*' (Volunteer 5, Organization 2). Again homeliness was associated with plenty; *'…if we took off the plate some of the things that we currently serve them … it would become slightly less… homely'* (Volunteer 5, Organization 2). Again it appears that adaptation of the breakfast towards a reduction in any component is problematic within Organization 2.

Interestingly this association between the meal and the home extends only to the cooked items; the take-away items hold a different meaning. There is a discourse in the literature surrounding what constitutes a meal; Volunteer 5 seems to support the idea that a "proper meal… must be cooked (not raw), hot (not cold), hand-made (not brought in) and eaten together" [29]. In stark contrast to the homeliness of the cooked breakfast these cold, portable items represent a '*currency*', and Volunteer 5 described practices such as '*bartering*' and '*stock piling*'.

297 *'You can't take away your breakfast but you can take away your [cereal] bar and*
298 *your banana and they're a form of currency. For some, yeah'* (Volunteer 5,
299 Organization 2)

300 *'...I suspect they're also high energy bars for the middle of the day'* (Volunteer 5,
301 Organization 2)

302 The distinction between cooked and take-away items stemmed from an understanding
303 of guests' attitudes – take-away items represented either a tradable or purely functional
304 commodity. However, these properties increase their '*desirability*' (Volunteer 5,
305 Organization 2). This insight supports other anecdotal evidence suggesting that
306 supplements distributed to a homeless population were traded rather than consumed
307 [30]. This raises questions about how best to provide nutritional support to this
308 population; we need to *'[be] aware of how people use the food that isn't cooked on the*
309 *plate'* (Volunteer 5, Organization 2). Although a wrapped fortified product has been
310 used to alleviate food insecurity in a homeless population [12], if these items are traded
311 then their nutritive value is negated.

312 **Attitudes to change**

313 Organization 1 was observed during a period of substantial change as external factors
314 forced them to relocate within the building. The '*logistics*' of the '*move upstairs*' dictated
315 a change in meal format; in response to this the catering manager developed '*one-pot*
316 *meals'* that were also vehicles for *'better nutrition'* (Volunteer 2, Organization 1). The
317 locational change could not be opposed and caused systemic anxiety amongst
318 volunteers as to whether they would still be able to provide the same service. When the
319 research team discussed the notion of healthy meals it was met with some resistance.

This opposition seemingly stemmed from concerns as to whether such meals would be acceptable to guests; there was a preconception amongst volunteers that guests would not tolerate '*exotic*' (unfamiliar) flavors and might '*give the vegetables a miss if they could*' (Volunteer 2, Organization 1). Volunteers were also concerned that provision of healthier foods would not be feasible within the budget; *'[I] would like to apply that here… but that's a constraint of money, mostly money and time"* (Volunteer 1, Organization 1). This resistance we describe seemed to stem from concern for the organization and its guests, as opposed to a general inertia to change, as described by Piderit [31]. Once the revised, one-pot meals were implemented modestly positive attitudes were expressed.

> *'There's obviously less stuff for the kitchen staff to do which means the kitchen staff possibly could have a little bit more flexibility to experiment, a little bit, possibly*.' (Volunteer 1, Organization 1)

> *"…but no I don't think… there was any complaints about it…I think [the guests have] taken to the changes very well*" (Volunteer 3, Organization 1)

At Organization 2 introducing additional food items, as opposed to taking away food items might be acceptable to volunteers (and guests). Volunteer 5 indeed felt this would be possible within the current budget, however provision of appropriate breakfast foods may be limiting; *'breakfast's breakfast, isn't it'* (Volunteer 4, Organization 2). A further impediment to change is the central role of hospitality within the organizational ethos; reducing meal items is likely to be resisted and later abandoned, as reported by others [32]. Congruence between organizational values and proposed developments is required to implement enduring changes to products or services. Furthermore

resistance from 'non-elite' members can impede their execution [32]; careful leadership is required to overcome such obstacles.

To summarize, there was well-meaning resistance to change, which was overcome by the influence and determination of a key organizational member (the catering manager) and improved menus were introduced. Further menu adaptations may be possible at Organization 1. Substitution of breakfast items for low-salt or fortified products might be acceptable at Organization 2, but they have limited potential to embrace change due to restrictions imposed by the nature of the meal itself, as well as the organizational ethos of hospitality.

Conclusion

This was a small study, and its findings are not generalizable; however it is encouraging to report that charitable meals can provide at least 50% of the DRV for most nutrients. There are key nutritional challenges to be addressed; at both organizations selenium and vitamin D contents of meals were lacking, whilst fat, salt and sugar content should be reduced without compromising the energy and micronutrient content of the meal**.** Although we interviewed a small sample of volunteers, this study provides an in-depth insight into the factors that influence meal provision. We conclude that organizational ethos, volunteer attitudes and practical constraints, such as equipment, finance and food donations, may limit menu alterations**.**

Guests' food preferences were not evaluated here; whilst menu alterations were readily accepted at organization 1 this might not always be the case. The issue of lowering fat and sugar content of meals may be particularly difficult. We recommend that charitable organizations test menu changes for acceptability and uptake. It would also be useful to

366 address how food served at other charitable services across the city dovetails to meet
367 DRV targets. Ideally coordination in meal provision could address possible gaps to
368 provide a better balance of macronutrients. Future research should investigate not
369 only the feasibility of such coordination, but also its dietary impact for homeless and
370 vulnerable adults.

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448 **Table 1** Food items comprising menus at both organisations

Organisation 1	Organisation 2
Standard Meal	**Standard Meal**
Cooked items comprised two variations on a chicken and vegetable stew and two variations on a minced beef dish containing pulses and frozen vegetables. Mashed potatoes accompanied meals.	Cooked items available were a pork sausage, a slice of bacon, a fried egg[a], a serving of baked mushrooms, canned chopped tomatoes and canned baked beans in tomato sauce Meals were accompanied by toast[b], spread with margarine.
Desserts comprised a variety of cake or tart, served with instant custard[c],	[No dessert provided]
[No take-away foods provided]	Take-away items available were a banana[d] (donated) and a cereal bar.
Self-service items included salt and pepper, sugar and reduced-fat (semi-skimmed) UHT milk (for hot beverages), cookies[e], flavoured fruit drink, instant soup and (donated), bread[f] with margarine.	Self-service items included several varieties of (donated) breakfast cereals, semi-skimmed milk, a glass of orange juice[f] and condiments; salt, pepper, sugar, marmalade, tomato ketchup and brown sauce.

449 [a] One cook poached eggs however this occurred less than once per month so was not included in
450 the analysis; [b] White and brown bread were available, brown bread infrequently chosen and
451 was not included in the analysis; [c]Custard as served was made with custard powder (dried eggs
452 and corn flour) with added water; One cook made the custard with milk, however this was not

453 the standard procedure and was not included in the analysis; [d]Small bananas were served more
454 frequently than large bananas and were therefore included in the analysis over larger bananas
455 sometimes available; [e]Cookies were served in pairs with each cup of tea or coffee taken; [f]These
456 items were not available *ad libitum* and so a standard weighed portion was analysed.

457

458 **Table 2** Nutrient composition of total meal and self service food items in relation to Dietary Reference Values

Nutrient	*Organisation 1*		*Organisation 2*		UK DRV[(a)]
	Total Meal (% DRV)	***Self Service items (% DRV)***	**Total Meal (% DRV)**	***Self Service items (% DRV)***	
Energy (KJ)	6094.5(57.5)	*2340.3 (22.1)*	5694.9 (*53.7)*	*1924.9 (18.2)*	10600
Protein (g)	67(120.8)	*12.4 (22.3)*	43.6 (*78.5)*	*12.0 (21.6)*	55.5
Total fat (g)	55.5 (98.0)	*17.9 (31.6)*	50 (*94.3)*	*4.9 (9.2)*	≤ 35%
Saturated fat (g)	19.4 (109.1)	*7.7 (43.4)*	15.6 (*93.6)*	*2.2 (13.2)*	≤ 11%
Carbohydrate (g)	182.8 (100.4)	*93.0 (51.1)*	196.6 (*115.6)*	*98.3 (57.8)*	~ 50%
NMES (g)	72 (179.7)	*33.5 (83.6)*	62.9 (*168.2)*	*49.5 (132.4)*	≤ 11%
NSP[b] (g)	7.7 (42.5)	*2.6 (14.4)*	10.9 (*60.4)*	*3.3 (18.3)*	18
Vitamin A[c] (µg)	470.9 (67.3)	*105.0 (15.0)*	369.3 (*52.8)*	*48.0 (6.9)*	700
Vitamin C (mg)	28.9 (72.3)	*3.4 (8.5)*	62 (*155.1)*	*44.6 (111.5)*	40
Vitamin D (µg)	2.4 (23.8)	*0.6 (5.6)*	3.3 (*32.7)*	*0.4 (4.0)*	10
Vitamin E (mg)	4.6 (114.2)	*1.5 (37.5)*	2.2 (*54.0)*	*0.7 (17.2)*	4
Thiamin (mg)	0.8 (75.0)	*0.2 (23.0)*	1.7 (*171.0)*	*1.1 (110.6)*	1
Riboflavin (mg)	0.7 (57.2)	*0.2 (19.3)*	1.7 (*126.9)*	*1.1 (82.1)*	1.3
Niacin (mg)	9.9 (58.4)	*2.2 (12.9)*	18.8 (*110.5)*	*12.6 (74.0)*	17
Vitamin B_6 (mg)	1.2 (87.5)	*0.2 (12.8)*	1.8 (*130.7)*	*1.0 (72.7)*	1.4
Vitamin B_{12} (µg)	2 (132.3)	*0.2 (12.0)*	2.5 (*166.7)*	*1.1 (73.3)*	1.5
Folate (µg)	146.1 (73.1)	*56.4 (28.2)*	260.5 (*130.3)*	*170.9 (85.5)*	200
Calcium (mg)	562.7 (80.4)	*275.7 (39.4)*	573.9 (*82.0)*	*259.4 (37.1)*	700
Iron (mg)	8.9 (102.7)	*2.7 (31.3)*	13.2 (*151.8)*	*7.6 (87.4)*	8.7
Zinc (mg)	8.2 (86.4)	*1.4 (14.9)*	5.2 (*54.6)*	*1.8 (18.9)*	9.5

Magnesium (mg)	158.2 (52.7)	*48.9 (16.3)*	187.9 (*62.6)*	*70.7 (23.5)*	300
Selenium (µg)	20.3 (27.1)	*4.4 (5.9)*	25.6 (*34.2)*	*5.7 (7.6)*	75
Potassium (mg)	1956.2 (55.9)	*459.7 (13.1)*	1890 (*54.0)*	*669.1 (19.1)*	3500
Sodium (mg)	2001 (125.1)	*1374.7 (85.9)*	2825.6 (*176.6)*	*1042.6 (65.2)*	1600

[a]For DRV figures see [1]Department of Health . The DRVs for males of age 19-50 years have been used for comparison. Where reference nutrient intakes () are available these values were employed. For fats, carbohydrates, NMES, and NSP population average values (PAV) (excluding alcohol derived energy) were used. For vitamin E the safe intake was used. For the purpose of this analysis Population Average Values for percentage energy derived from fats, carbohydrates and NMES have been assumed as an absolute target

1. Department of Health. *Report on Health and Social Subjects 41 Dietary Reference Values for Food Energy and Nutrients for the United Kingdom*. London; 1991.