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ScienceDirect
Appetite 48 (2007) 129–134
Appetite
www.elsevier.com/locate/appet

Research review

Avoidance of unhealthy fattening: A longstanding proposal

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Received 1 May 2006; received in revised form 11 July 2006; accepted 17 July 2006

Abstract

Diverse customary patterns of eating, drinking or movement are hypothesised to be effective in weight control based on laboratory experiments or theoretical calculations, in some cases supported by ecologically valid evidence. This method is applicable to healthy members of the public and to patients at high risk of and from obesity such as those having type-2 diabetes or chronic arthritis. Weight-reducing behaviour not adequately identified in current best practice educational messages includes: integration of exercise into desk-based employment; uses of stairs; uncompensated vigorous activity or reduction in amount eaten at a meal; protein level and carbohydrate timing in meals; having a "snack". This paper presents the scientific parts of a request for funds to integrate a suite of research methods based on theoretical models that can be applied to identify further, culturally and locally specific eating customs that avoid overweight and reduce obesity and can be iterated in a continuous (re)development of evidence-based expert advice and self-care practices in health and chronic disease.

Keywords: Weight control; Healthy eating; Active lifestyle; Primary prevention; Diabetes; Rheumatic disease; Evidence-based therapy

Contents

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doi:10.1016/j.appet.2006.07.083

Importance of the proposed research for science and health

This brief review contains the scientific part of the latest of a 30-year series of unfunded proposals to test hypotheses from both physiology and social research on sustainable changes in weight in individuals.

The need for sound science on behaviour to reduce obesity and to prevent overweight was clear as early as the 1970s to some physiologists and psychologists in the UK, Germany and USA (Booth, 1978; Garrow, 1974; Mahoney, 1975; Pudel, 1976). However, that inclusive approach was rejected by the obesity research community of the time (Booth & Toates, 1978). Research methods needed to gather such evidence are still neglected (Booth, 1996; Booth, Blair, Lewis, & Baek, 2004), despite the rapid rise in the prevalence of obesity and associated metabolic pathologies (WHO, 2000). The present proposal offers the opportunity to exploit the coherent theoretical approach and realistic research methodology offered by an integrated psychobiosocial understanding of human life (Booth, 1980, 1988a, 1998; Booth, Blair, Conner, & Lewis, 1991).

The proposal is to make culturally realistic tests of particular physiological hypotheses that implicate readily feasible and widely understood patterns of eating, drinking or movement in the sustained avoidance of gain or regain of body weight into the unhealthy range. Each custom to be tested is inferred to relate to long-term weight control from results of laboratory experiments or theoretical calculations, some of which are supported by evidence from observational and interventional studies in real-life settings. More such evidence that specific patterns of behaviour affect unhealthy body fat content is needed, both in the general (currently healthy) population and among patients with chronic diseases such as type-2 diabetes and chronic arthritis of the hip or knee, who gain weight and so risk heart disease in addition.

Such research should gather systematic hard data on the relative contributions to body fat reduction from well-specified patterns of behaviour within the local environment (encompassing issues such as cultural context and physical resources, especially transport, leisure facilities and food outlets). The proposed design tests particular hypotheses about the mechanisms by which a maintained change in frequency of a customary pattern of exercise or eating should cause a shift in energy exchange, resulting in an asymptotic change in body weight. If a particular habit, which lowers body fat and weight, can often be sustained indefinitely, then an evidence-based educational package could be designed for a subsequent pilot trial.

Identification of components of self-care that are effective in particular circumstances will also generate evidence on which to specify and prioritise strategies for change in the environment that support avoidance of unhealthy fattening. The rise in obesity is not likely to be slowed by continued campaigns against supply of foods containing sugar (BNF, 1987) and fat (Booth & Platts, 2000). The issue for the food industry (Booth, 1988b, 1989) and its regulators is to work out how to reduce the health risks to which consumers are exposed by their patterns of eating with available foods. Other parts of this research link attractions of foods to healthier end-uses: for example, Conner, Booth, Clifton, and Griffiths (1988) showed that steady reduction of salt in bread would have no effect on sales, saving industry costs from yeast as well as salt; UK bakers took up this opportunity only recently, albeit before the governmental campaign to lower salt intake. The proposed design will allow us to estimate effects on blood pressure (broken by age-ranges) of blood-volume challenges from high-sodium eating occasions over 1–2 years.

The two published studies closest to the present approach did not use information that is crucial to understanding correlations between changes in weight and changes in particular patterns of behaviour (French, Jeffery, & Murray, 1999; Westenhoefer, von Falck, Stellfeldt, & Fintelmann, 2003). Their measures of dietary habits combined diverse food choices and, by using multiple regression, they left to chance which of two correlated measures was predictive of weight change. Instead, measures of discrete eating or movement patterns should first be factor analysed to extract latent structure (Booth et al., 2004). When the two patterns on the same factor are categorised as different in the culture studied, while each correlates well with weight change, an unmeasured cause in common needs testing (such as a broader concept of healthy living).

Existing evidence on sustainable behaviour avoiding unhealthy weight (re-)gain

No widely applicable clinical treatment results in reliable reduction of obesity, i.e. loss of weight that is sustained for the years needed to put health at risk. Trials on reduction of obesity in diabetes have provided evidence of group-mean weight reduction after 2 years but the "lifestyle" interventions used are far too expensive for universal implementation (Tuomilehto, Lindstrom, Eriksson, et al., 2001; Diabetes Prevention Program Research Group, 2002). However, the behaviourally specific design proposed here was not used and so there is no information on which components (if any) were both effective and indefinitely sustainable.

The manual for a UK trial of cognitive behavioural therapy (piloted by Blair, Lewis, & Booth, 1990, 1992; Lewis, Blair, & Booth, 1992) addresses problems of weight loss maintenance but acknowledges both lack of evidence for the treatment package preventing an eventual return to original weight (Cooper, Fairburn, & Hawker, 2003, pp. 4–5 and 12) and also that this regain of weight arises from patients' realisation that the change in behaviour is unsustainable and/or ineffective (Cooper et al., 2003, pp. 6–7). Rapid loss of weight requires drastic changes in behaviour and so the notion of boosting self-confidence by the immediate effects is self-stultifying because such

changes generally cannot be maintained. As pointed out in the early years of behaviour therapy (Booth, 1980; Mahoney, 1974), the more readily maintained components of such packages have not been shown to reduce weight and even had contrary evidence (Booth & Mather, 1978).

There remains very little direct evidence on which specific patterns of behaviour to target in behaviour modification and cognitive re-structuring in the clinic (Cooper et al., 2003), to support by the actions of medication on metabolism, on assimilation of energy nutrients or on appetite for food or desire to be active (Avenell, Broom, & Brown, 2004), to communicate to the public though therapy groups or broadcast messages, or to facilitate environmentally through public health strategies (Saris, Blair, van Baak, et al., 2003).

Hard data on avoiding unhealthy weight gain or re-gain

Culturally recognised self-descriptions

One of the most important additions to knowledge by the proposed research is hard data on descriptions of behaviour that may predict changes in weight. In this approach, the informant is asked to characterise briefly a recent particular occasion involving eating, drinking or movement. Sets of usual practices are collected by either systematic non-evaluative recall using cognitive interview techniques (Armstrong, MacDonald, Booth, Platts, & Knibb, 2000) or consultation on expertise gained by a disease-management support group from personal experiments (“flexible dieting”: Westenhoefer, Stunkard, & Pudel, 1999). Sub-samples then categorise their and others’ descriptions (Guss, Kissileff, Booth, & Nolan, 2000).

The firmest available datum on what a person is doing is a description in the individual’s own words in accord with consensus in the culture, i.e. as a recognised custom (Blair, Booth, Lewis, & Wainwright, 1989; Booth, 1998; Booth et al., 2004). When a person records a current activity in such terms or recalls the last time it was executed, the human ability to formulate executable intentions is fully exploited. Even if intensive video recording and its analysis were logistically and ethically feasible, coding of such observations would need validating on what members of that culture describe as visibly done. Behavioural data are degraded by use of investigators’ wordings rather than those of the participants.

Occasion-specific record or recall

An illusory impression of physical reality is created by the numbers of grams in an individual’s record of weights of foods, as shown by evidence from doubly labelled water of under-reporting in proportion to BMI. In contrast, the recording or recalling of a particular occasion relies on the richness of episodic memory (cf. Armstrong et al., 2000), of which the timing of the actions is a highly accurate part.

Estimates of frequency

The reciprocal of the time interval between two occasions of the same action is a precise estimate of its frequency, and over an exactly defined period as well (Booth & Platts, 2000). Food frequency questionnaires yield much softer data because they take each food out of its differing contexts and also ask how many times a week it was consumed over a stated period. Answers to such direct questions about frequency are generated by arbitrary options among biased heuristics over periods of time that recall cannot control (cf. Sedlmeier & Betsch, 2002).

Physical translations of customs

To design foods, eateries, transport, buildings, etc. that support fattening-avoidant habits, the agreed description of a proven weight-lowering custom needs ‘translating’ into both weights of foods or activity-induced rate of energy expenditure and into the usual physical and social contexts. The acknowledged biases and noise in both dietary assessment procedures and inventories of physical activity open the possibility that the above approach will provide more valid and no less precise estimates of habitual intakes of nutrients (Booth & Platts, 2000) and of the work done by each customary pattern of (in)activity (Westerterp, 2001).

Evidence-based messages

Wordings of messages to the public on healthy eating and active lifestyle need the firmest database of all. A custom for which a change in frequency is associated with change in weight constitutes “what works in your ‘circs.’” [circumstances] (Booth et al., 2004). A custom that is high in point-prevalence and frequent in some individuals is likely to be feasible to change (French et al., 1999). Hence the wordings yielded by this methodology are directly usable in messages to the public, without either the subjective minutiae of much qualitative research or arrays of numbers that fail to measure the processes by which a message might change individuals’ behaviour.

Measurement of effects of specific patterns of behaviour on body weight

The aim of the proposed research is to discover which readily described customs are most effective in permanent weight control, at least within a particular geographical region’s physical and social culture. In a prospective cohort design, individuals’ changes in frequency of each culturally recognised habit will be tested for association with subsequent changes of weight in weekly reports, also measuring the number of weeks to asymptote of change in weight and the behaviour-change decay function over 3–24 months. Any widely used medication can be evaluated in the same way. Where such a concurrent correlation is

found, the direction of causation is tested by cross-lagged analyses.

Theoretical mechanisms to be tested

An extensive set of readily feasible and widely understood patterns of exercise or eating are hypothesised to affect weight.

(a) *Walking or cycling to and from work*. One of the few widely feasible forms of prolonged physical activity is walking on the way between home and work (not excluding use also of seated transport if the distance is long); if the individual makes a habit of cycling to/from work, clearly this is likely to be at least as good at spending energy. The expected effect of this pattern's combination of thermodynamics and maintainability was early supported by the correlational method (Blair et al., 1989; Booth et al., 2004). Effects of changes in the distance walked or cycled will also be tested.

(b) *Using stairs rather than lifts/escalators*. Changes in relative use of stairs and lifts/escalators in multi-storey buildings (workplace, department stores, apartment block, etc.), allowing for differentiation between riding up and riding down, are hypothesised to correlate (while the change persists) with changes in weight in accord with the shift in energy exchange.

(c) *Opting to visit or meet elsewhere rather than to be visited*. One contribution to 'middle-age[d] spread' may be time at the desk increasing with seniority at work, e.g. being visited by other staff, refreshments brought to the office, etc. If strategies to 'get out of the office' are a culturally recognised category with sufficient prevalence, increased frequencies will be tested for independent association with loss in body weight.

(d) *Vigorous activity*. A generic category will be sought that includes house-cleaning, outdoor games, gardening, dance, aerobics, etc. Accelerometry and duration will be used in translations to energy expenditure and to facilitating contexts.

(e) *A walk before* vs. *after a meal*. A walk (or a cycle-ride) timed specifically in relation to a meal will be analysed separately. This approach might detect greater association with weight-loss of an increase in habitual exercise after a meal than before a meal, be it from increased intake at the meal, the exercise countering postprandial sedation, or metabolic synergy (Ballor & Poehlman, 1995).

(f) *Not doing anything else while eating (or the inverse concept)*. A common target of behaviour modification is a habit like reading while eating or eating while watching TV. A great variety of mechanisms could be involved in any effect on energy exchange and so direct evidence on the effect of this category of behaviour on weight will be sought for the first time.

(g) *Avoiding energy intake between usual meals or snacks*. The mechanism by which between-meals energy could be more fattening than within-meals energy is mixing of a small amount of energy in or with a drink sufficiently long before a meal with gastric contents from the previous meal, thus not suppressing appetite during the next meal (Booth, 1988c). The simplest test optimises timing on correlation. The most precise analysis mixes the extra intake with the previous meal emptying from the stomach, using the only physiologically and behaviourally realistic computer simulation of appetite and energy balance (Booth & Mather, 1978), allowing also for liver glycogen loading.

(h) *Including sufficient protein in each meal to prevent hunger before the next meal*. Ingested protein, unlike carbohydrate, slows the rise of hunger some hours after a meal (hypothetically by fuelling the alanine cycle), an effect (Booth et al., 1970; French, Wainwright, Booth, & Hamilton, 1992) replicated several times as "stronger satiety" by methods that fail to attend to timing of physiological influences on eating. Low-carbohydrate (Atkins) diets are no more effective than any low-calorie diet at reducing weight (Bravata, Sanders, Huang, Krumholz, & Olkin et al., 2003), but are sustainable for longer because higher in protein content (e.g. Due, Toubro, Skov, & Astrup, 2004). Sustainable eating patterns will be tested for such an effect (especially on (g.).).

(i) *Eating at regular times and tuning amounts to intervals (anticipatory hunger)*. The mammalian brain can detect which foods are followed by onset of hunger before food is available again and increase the volume eaten just enough to prevent hunger (Thibault & Booth, 2006). This provides an automatic mechanism for eating a bigger meal to 'bridge the gap' to the next usual eating time and so 'hunger management' need not require deliberate effort. On the hypothesis such learning prevents caloric intake at fattening times between meals (g.), those who eat at conventional mealtimes will be tested for less weight gain after an increase in volume eaten of their usual foods—conversely to the idea that large portion sizes are fattening (hypothesis (k.)).

(j) *Eating a small amount of bread at the start of a meal*. The only known mechanism by which the energy content of a meal from a particular menu can influence the habitual amount eaten from that menu is 'conditioned satiety' (Booth, Lee, & McAleavey, 1976; Booth, Mather, & Fuller, 1982; Gibson & Booth, 2000). A little rapidly digested carbohydrate eaten in high concentration on an empty stomach induces hypertonicity from glucose in the wall of the duodenum (Booth, 1981). This aversively conditions the jointly sensory and gastric cues to eating at the end of the meal just consumed, hence lowering intake of dessert at subsequent such meals and of any 'nibbles' afterwards. Those experiments used starch-derived oligosaccharides to get the aversive after-effect but the proposed research will test for the first time if starting with bread (over 40% of starch as a gel) can condition down meal size in a way that is associated with weight loss. If prevalent enough at the start of meals, potato (though more dilute), biscuits (probably too sweet) and a disruptive effect of fat (by reducing dumping) should also be tested.

(k) *Avoiding larger sizes of serving in a range to be identified*. "Large portions" is not a scientific specification. The first experiment to show an effect of difference in sizes of portions on the amount eaten in a meal (Booth, Fuller, & Lewis, 1981) showed greater intake from the larger of the two sizes of 'small' pieces of food. Therefore, recent claims that offers of large burgers make customers fat will be assessed by relativising the sizes (and numbers) of items of each food within each type of meal or snack.

(l) *Substituting fruit for confectionery between meals and snacks*. This self-described habit had one of the highest correlations with weight loss over a year in the English Midlands study (Booth et al., 2004), loading with "avoiding calories between meals" (hypothesis (g.)) as expected. The size of this effect will be re-investigated.

(m) *Selecting specified lower-fat versions of meat and cheese products*. Weight loss over a year was relatively well correlated with cutting these two large contributors to UK fat intake (Booth et al., 2004). This effect will be re-measured using more specific categories of food choice.

(n) *Substituting oven-baked potato chips for deep-fried*. This way of lowering the fat content of a popular food also will be tested for effect on weight.

(o) *Selecting lower-salt versions of savoury and sweet foods*. This healthy practice was successfully used as a 'control' (Blair et al., 1989) and will be again. Nevertheless, also the frequency of occasions that translate as high Na content may be correlated over 12–24 months with increases in blood pressure.

(p), (q) *etc*. Sufficiently prevalent patterns of eating or activity described during elicitation will be tested too, as in addition will be common ways of using medication prescribed for obesity.

Exploitation of the findings

Successive adoption of readily maintained eating, drinking and exercise patterns thus shown to be effective will lead to a steady reduction in unhealthy fatness and prevent its re-gain or the onset of overweight.

Thus, the results of the proposed research programme can be used to provide individual enquirers and their professional advisors with personally and culturally tailored messages on readily feasible changes in well recognised practices that enable desired control of body weight and waistline. Public health and clinical services require identical evidence on how to avoid unhealthy increases in body fat. Both healthy members of the public and healthcare outpatients need valid and trustworthy information on specific and sustainable changes in lifestyle that help each person to approach or to stay in the healthy weight range (e.g. Lean, Han, & Seidell, 1999), as well as environments proven to be supportive of the effective habits against the counter-productive practices.

Acknowledgements

This paper reproduces the scientific parts of the latest response to calls from health research funders for effective ways of reducing and preventing obesity. This grant application was rejected in November 2005 by the Health Services and Public Health Research Board of the UK Medical Research Council.

The independent reviewers of this paper are thanked for their helpful suggestions.

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