Systematic Review

Key Characteristics of Public Health Interventions Aimed at Increasing Whole Grain Intake: A Systematic Review

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ABSTRACT

Objective: To identify characteristics of successful public health interventions aimed at increasing whole grain consumption.

Methods: The Preferred Reporting Items for Systematic Reviews and Meta-analyses framework, guided by higher-quality interventions with greatest effect size, was adopted to conduct a systematic literature review.

Results: Of 8,500 initial records, only 8 interventions with demonstrated reach (up to national populations) and effectiveness (increasing consumption 8−27 g/d) were eligible for synthesis. Their characteristics included multiple stakeholder involvement, specified target intakes in dietary guidelines, manufacturer codes of practice, product reformulation, evidence-based educational resources, social media, and community events with tasting and preparation opportunities. Empowerment of food service providers was also linked to success.

Conclusions and Implications: Successful interventions require multifaceted strategies across multiple aspects of the food system, underpinned by multiple stakeholder partnerships. Uniform capture of interventions using an online, searchable, public domain resource may provide a strategy to enable health professionals globally to plan local interventions across cultural settings, drawing on best practice guidelines developed from interventions with demonstrated reach and effectiveness.

Key Words: consumption, increase, intervention, public health, whole grain (*J Nutr Educ Behav.* 2018; 000:1−11.)

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INTRODUCTION

A risk assessment of the Global Burden of Disease[1] attributed 71% of deaths in 2015 to behavioral risks, with 53% of these risks attributable to dietary risks.[1] The authors suggested that a policy focus to promote increased intake of vegetables, fruit, whole grain (WG), nuts and seeds, and ω-3 from seafood may have a comparatively larger effect than focusing on the sugar and fat components of diets.[1] In support of such a focus, large observational studies[2] suggested that WG consumption may mitigate cardiovascular disease (CVD), weight gain, type 2 diabetes, and cancer and enhance the gut microbiome. In 2016 alone, at least 6 meta-analyses[3−8] were published reviewing WG consumption and reduced risk of noncommunicable diseases and all-cause mortality. In quantifying a dose-response of WG intake to mortality, Zong et al[8] showed that for every 16-g/d increase in WG, the relative risks of CVD, cancer, and total mortality decreased.[8]

Despite strong evidence of the health benefits of WG for many years, consumption in most countries remains below recommendations. For example, intake in Australia and the US ranges from 20 to 27 g/d,[9,10] with recommended intakes at 48 g/d.[11,12] These recommendations are not new; initiatives to improve WG intake exist[13−19] yet it remains low. Evidence-based health promotion initiatives are needed.

This systematic literature review aimed to determine key characteristics of public health interventions that increased WG consumption at a national level, to inform government agencies and other groups that promote WG intake.

METHODS

This review used the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines[20] and was registered with PROSPERO (Registration No. CRD42017056563). Researchers included a student researcher (RS), an expert working with a nonprofit

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organization promoting grains (MB), and an academic researcher with significant experience in grains research and systematic reviews (EB). Cochrane Library, the Cumulative Index to Nursing and Allied Health Literature, MEDLINE, Science Direct, Scopus, PubMed, and Web of Science databases were searched using the terms (grain OR "whole grain" OR wholegrain OR whole-grain) AND ("public health" OR epidem* OR population OR community OR cohort OR "health promotion") AND (increas* OR rais* OR escalat* OR improv* OR promot* OR chang*) AND (eat* OR diet* OR consum* OR intake OR input) in February, 2017. In addition, gray or unpublished literature meeting the search criteria was sourced as referenced. Although original PROSPERO registration included a review of purchase intent, the lack of quantifiable measures of intent meant that this aspect was not included.

Eligibility Criteria

The characteristics of population (humans) intervention (public health initiatives aimed at increasing WG intake), comparator (no intervention), outcome (change in WG consumption), and study design (not specified) formed the basis for the research question *What are the key characteristics of public health initiatives aimed at increasing WG intake?* Inclusion criteria were (1) reported in English, (2) humans, (3) grain related, and (4) published in peer-reviewed journals or independent gray literature. Studies were excluded if (1) participants were provided with food (such as randomized control trials) with no subsequent assessment for elective WG intake; (2) the intervention was aimed at reducing another macronutrient (eg, fat), inadvertently resulting in increased WG consumption; (3) WG as 1 of many foods or nutrients included in the intervention was not quantified in the outcome; (4) the study tested the acceptability of WG reformulated foods (5) or only assessed an increase in knowledge of WG after the intervention; (6) they were not scalable to a public health level; and (7) WG consumption was not recorded at both baseline and after the intervention.

Study Selection, Data Collection, and Synthesis

The identified studies were screened (based on the title for the first screening and the abstract for the second screening) by the primary author (RS) and checked for eligibility (full article) by 2 independent reviewers (RS and EB) as per the Preferred Reporting Items for Systematic Reviews and Meta-analyses process.[20] Eligible studies were reviewed in full and characteristics were extracted into a predesigned table. All authors reviewed the summary and synthesis of results. The quality of the studies was assessed using the Critical Appraisal Skills Program: Cohort Studies checklist.[21] Data were qualitatively synthesized on a narrative basis at a group level. Higher-quality studies guided the discussion and were used to develop recommendations for future interventions. When possible, effect size was reported.

RESULTS

Study Selection

Initial electronic database searches retrieved 8,496 records (Figure). Gray literature searches retrieved a further 20 interventions. After screening, 8 interventions were included in the final synthesis (Table 1). All interventions were published in peer-reviewed journals,[22–28] except for a Danish intervention.[29,30]

Study Characteristics

Interventions dated from 1991[25] to 2016[22] and were conducted in Australia,[25] the US,[22,24,26,27] the UK,[23] The Netherlands,[28] and Denmark.[29,30] The number of participants varied between 80[26] and national populations (the US[27] and Denmark[29,30]). When settings were specified, they included primary schools,[24,28] colleges[22,26] and a retirement community.[25] One intervention was conducted with overweight adults who consumed <1 serving/d of WG (20 g in that study).[23]

Some interventions focused on education, using point of selection signage and text messaging,[22] extension of the knowledge base on WG (through lessons and hands-on activities); influenced the surrounding environment, and created supporting networks.[24,26] Other interventions prescribed WG foods for a time to familiarize consumers with WG-containing foods,[23] made consuming WG foods fun,[28] or promoted other beneficial effects.[25] Interventions influencing increased WG consumption on a national scale were multifactorial, incorporating multiple stakeholders and multiple strategies.[29,30] Policy reformulation and increased product availability that influenced WG availability[27,29–31] were part of the solution, but many other factors such as regulated specific target intakes in national dietary guidelines, codes of practice for manufacturers, and clear and consistent public relations and communication activities were employed in the Danish Wholegrain Public Private Partnership (Danish PPP).[29,30]

Whole Grain Intake Outcomes

Two study outcomes were presented as increased sales in bread and WG products[25,27] and another as increased consumption of bread rolls.[28] Five interventions demonstrated an increase in WG intake (grams per day). The college awareness intervention resulted in an 8-g/d (0.5-serving) increase from baseline to 31 g/d at 6 months' follow-up (after a 6-week intervention).[22] The 16-week prescribed WG[23] and *Power of 3* school intervention[24] both resulted in an increased intake of approximately 16–36 g/d (1 serving) at 12 months' follow-up. Meanwhile, the college nutrition course[26] increased consumption by 23–33 g/d (about 1.5 servings) and the Danish PPP[29,30] resulted in a national average increase in consumption from 36 g/10 MJ/d in 2000–2004 to 63 g/10 MJ/d in 2014.

Quality Assessment

Based on an assessment using the Critical Appraisal Skills Program quality rating tool[21] (Table 2), the