Food Environmental Interventions Protocol Using Social Marketing or Incentive-Based Strategies for Improving Dietary Behaviours and Health Outcomes - Systematic Review and Meta-Analysis

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Protocol

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Abstract

Background: In recent years, behavioural science theories such as social marketing or incentive-based food price strategies have been proposed to promote healthy and desirable eating habits potentially staving off a global increase in certain non-communicable disease (NCDs) such as obesity.

This paper describes a systematic review protocol that validates the effectiveness of social marketing including financial incentive interventions in preventing unhealthy eating behaviour and diet-related NCDs.

Methods: We will search online databases for interventions using randomized controlled trials (RCTs) and cluster RCTs. We will assess social marketing included financial incentive interventions in setting such as supermarkets, places of work, or school cafeterias and vending machines for all people. Two authors will read the papers independently, discuss the content, and come to a consensus on the judgment. If two authors cannot reach an agreement, they will consult with the other authors to reach a resolution. For the qualitative assessment, methodology relying on the Cochrane Collaboration Risk of Bias Tool 2 will be used to confirm the risk of bias for the included trials.

Discussion: This is a protocol for a systematic review, and the main purpose of the review is to identify the effectiveness of social marketing and incentive-based approaches to increase desirable eating and consumption behaviours to prevent NCDs in communities, workplaces, and schools.

Trial registration: This review protocol is registered with PROSPERO

(CRDxx) on [PROSPERO](#), 2020.

Background

According to WHO, NCDs have common causes like unhealthy eating, lack of exercise, smoking, and excessive drinking and can often be prevented by lifestyle improvements.[1, 2] NCDs are an international issue, and prevention and improvement research is being conducted in various fields such as public health and the clinical field.[2, 3] The correlation between chronic diseases and nutrition intake in public nutrition is due to lack of vegetables, fruits and dietary fibre and inappropriate intake of salt and lipids. [4–8] WHO reported that lifestyle-related diseases, such as obesity, were linked to diet (WHO; 2003)[9] and that limiting fats and sugars and increasing the intake of vegetables, fruits and whole grains such as rye bread and millet rice was recommended.[9] Despite this knowledge, the number of obese people has doubled since 1980 [10] and methods to prevent such chronic diseases are common issues in many countries.

Therefore, in recent years, nations like Mexico, the United States and the United Kingdom have implemented national policies taxing foods high in sugar (i.e. sugar tax) [11] to suppress the intake of so-called junk food and increase the intake of healthy food.[12] Privately owned companies in the restaurant

industry have introduced price discounts and point systems for healthy food, a clear demonstration of efforts to make it easier for citizens with economic disparities to obtain healthy food through behavioural science theories such as social marketing.

Social marketing is a theory introduced by Kotler and his colleagues in the 1980s to promote healthy behaviour in society which has been widely applied to international health programs.[13] The difference between regular marketing and social marketing is that social marketing is not just about selling products or services but about improving desirable habits and social environment such as separate smoking areas. One social marketing strategy is price and compensation incentives. In this review, social marketing is defined as a health promotion program that uses pricing strategies. Incentives have been attracting attention in recent years, and the effects of behavioural changes have been raised, such as implementing taxing cigarette [14] penalties for not wearing helmets.[15] Therefore, a well-balanced setting is required (price difference; value variance). Current findings suggest that lower prices imply lower quality and do not lead to behavioural change, while high prices deter purchases or weaken the sustainability of behavioural change.

In this study, we plan to conduct a systematic review with meta-analysis that collects comprehensive evidence on consumer eating behaviour, including supermarkets and convenience stores used by local residents and cafeterias and shops used by students and school children. This study is a systematic review protocol that aims to determine the effectiveness of social marketing and incentive-based approaches versus without these approaches to improve dietary behaviours and health outcomes.

Methods

Study Type

The study design will include various types of randomized controlled trials (RCTs) such as clustered and crossover RCTs. This protocol is based on International Prospective Registered in the Register of Systematic Reviews (PROSPERO) (No. † xxxx).

Participants

We will include adults and children of all ages from any worksite, community, household, school and university.

Intervention

We plan to include food-based interventions that focus on social marketing interventions including incentive strategies (e.g., discount coupon, point systems) implemented in worksite, school or university cafeterias, supermarkets, small shops, vending machines, or greengrocer etc.

Comparator(s)/control

Any other intervention of not incentive and social marketing, or no intervention

Outcome measures

Measuring method:

- Food and nutrient consumption (or intake) will be measured by questionnaires and purchasing data
- Obesity and blood pressure values are the actual measurement values of body measurements and self-reported values
- Cholesterol, triglycerides, haemoglobin A1c are measured values of blood tests

Primary outcomes (Continuous variables)

- Changes in fruits and vegetables/fruit/vegetables consumption (or intake) [g or Serving; SV]
- Changes in healthy food/healthy lunch/ healthy drinks consumption (or intake) [g or score]
- Changes in snacks or sweets or sugary beverages consumption (or intake) [g or score]
- Weight changes (including body mass index (BMI) [kg/m^2], body fat %)

Secondary outcomes

- Changes in blood pressure [mmHg]
- Changes in cholesterol (LDL cholesterol, HDL cholesterol, total cholesterol) [g]
- Changes in triglycerides [mg/dl]
- Changes in haemoglobin A1c [%]
- Changes in nutritional intake
- changes in fat and oil intake [g]
- changes in energy intake [kcal]
- Adverse effects that are defined by the authors

Electronic searches

We will search the following the electronic databases from inception to the present date.

- CENTRAL; monthly searches of the Cochrane Central Register of Controlled Trials

▯MEDLINE; weekly searches of MEDLINE

▯EMBASE; weekly searches of EMBASE

▯CINAHL; weekly searches of CINAHL

▯PsycINFO ; weekly searches of PsycINFO

Appendix 1 shows the keywords in searches. An experienced librarian at the National Center for Child Health and Development will implement these strategies according to the Cochrane methods and guidance.

Searching other resources

We will also utilize Google Scholar for related studies, and we will hand-search systematic reviews and reference lists included in these studies. Additionally, we will review the titles and summaries of these studies.

Data collection and analysis

Inclusion criteria

▯Study design: RCTs (including cluster and cross-over RCTs).

▯Participants: children and adults of any age.

▯Intervention site: worksites, community sites (e.g. supermarket, small shop), and schools.

▯Intervention: organization-based, incentive pricing strategies, or social marketing. We will include co-intervention.

Exclusion criteria

▯Excluded designs: quasi-experimental design and pre-post and observational studies.

▯Excluded participants: mental illness

▯Excluded intervention programs:

▯Fitness- and exercise-focused interventions

▯Programs that do not use behavioural science theoretical approaches incorporating incentive pricing strategies for food and social marketing

▯Taxation or subsidy studies

▯Alcoholic beverage and drug studies

☐Excluded publications:

☒Non-academic journals and reports

☒The abstracts of conferences

☒Other than English

Data extraction

Review authors (KS and Y Y) will separately read titles, abstracts and extract studies. They will then independently decide whether to include or exclude the studies and reach a consensus on each other's extracted data. In case of a discrepancy, KS and YY will consult with other authors to come to a resolution. If there is unclear information at the time of data extraction, the preferred course of action will be to seek more information by contacting the author of the original paper.

Assessment of risk of bias in included studies

Assessment of risk of bias will be conducted through random sequence generation, concealment of allocation sequences, reporting of results and other bias criteria. [16]

In addition, KS and YY will independently assess each domain as high risk, low risk, or uncertain risk of bias and utilize the Cochrane Systematic Review Methodology Tool2 to determine whether to include the study in the meta-analysis.

If more than one study report has the same outcome and is sufficiently homogeneous conceptually, methodologically, and statistically, we will perform meta-analysis of these studies. If there are any disagreements between the two authors, the differences will be discussed and resolved, and if no agreement is reached, the opinion of the third or fourth author (KL, NW) will be sought. In case of any further conflict, a decision will be made in consultation with all authors.

Measures of treatment effect

Continuous data

Method of measuring intervention effect

For continuous data, we will use the Mean Difference (MD) and 95% Confidence Interval (CI) if the same method is used to measure results between trials. If the trials do not involve measurement of results based on the same method, we will use standardized mean difference (SMD) for the analysis. For dichotomous data, we will report a summary of results using risk rate (RR) and 95% CI.

Methods of unit of analysis

When we use similar intra-cluster correlation coefficient (ICC) estimates, we will check the sample size of each test, and when we utilize other sources' ICCs, we will perform a sensitivity analysis to determine the ICC variability and analyse the effect. If both cluster RCTs and individual cluster RCTs are found, the required information will be included. We use both individual and cluster results when minimal heterogeneity exists between study designs and the effect of the intervention and the interaction between the randomization units are considered distant.

Dealing with missing data

In the case of missing data, we will contact the authors involved in the research of the main article and request the missing data or information. All subjects will be analysed in the already assigned group rather than based on whether they actually received the planned intervention program.

We will check for missing participant values in included trials and consider whether the results include trials with a substantial amount of missing data. Intention-to-treat (ITT) analysis is used whenever possible for all outcomes

Assessment of heterogeneity

We will determine heterogeneity in the meta-analysis based on if we statistically confirm $I^2 (\geq 30\%)$, $T^2 (> 0)$, or $\chi^2 (> 0.1)$.

Assessment of reporting bias

If we are able to confirm more than 10 trials, we will use the funnel plot tool to evaluate publication bias. Plot effect size values and study accuracy will be utilized to assess bias.

Data synthesis

If two or more outcomes are the same and no heterogeneity is observed, we will use a fixed effects model. If there is more than one instance of the same outcome and heterogeneity is observed, we will use a random effects model if it is considered to be meaningful for the mean program effect. Further, if we use random- and meta-mixing effects, this will be displayed as the mean conditioning effect that is provided as the evaluation of I^2 and T^2 with a 95% CI.

We will use Review Manager V.5.3 (Cochrane Collaboration software) for statistical analysis when integrating data.

If quantitative synthesis is not appropriate, we will describe the summary using the evidence of table.

Subgroup analysis and investigation of heterogeneity

We will perform a subgroup analysis on the following items and investigate heterogeneity using sensitivity analysis:

□Type of intervention: social marketing or incentive strategies intervention only versus social marketing or incentive strategies intervention including other intervention program versus control

□Type of incentive: pricing versus not pricing (coupons or points) / all pricing (discount, coupons and points) versus free offer

□Location of intervention: worksite versus community (including home) versus school (including university)

□Intervention impact (discount rate): $\leq 20\%$ / $\geq 20\%$ – 30% / $\geq 30\%$

□Participants including obese participants or participants with other physical illness versus normal participants

□Participants: low-income versus others

Sensitivity analysis

We will perform a sensitivity analysis of the primary outcomes, excluding studies with a high risk of bias as the risk of bias can affect the meta-analysis. Therefore, randomization concealment and allocation and data with incomplete results will be judged to be high risk.

Recommendations

We will use the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) [17] to determine the quality of evidence and recommendations for this systematic review. The GRADE does not assess individual evidence but rather the quality of body of evidence that integrates multiple studies according to outcome. The GRADE approach includes five factors: risk of bias, inconsistency of results, indirectness of evidence, imprecision, and publication bias. We will GRADE the main outcomes based on the quality grade of the evidence (High, Moderate, Low, Very Low) and create a summary of findings using tables.

Discussion

In the intervention program, we will analyse the effect of research on the price strategy program alone. However, if the number of included studies is limited, we will consider conducting a subgroup analysis that also includes studies of co-interventions such as educational programs.

This systematic review will provide evidence of the effectiveness of dietary interventions through price strategies and guide future interventions and research in nutrition and health promotion.

Abbreviations

NCDs: Non-communicable disease

RCTs: Randomized controlled trials

PROSPERO: International prospective register of systematic reviews

WHO: World Health Organization

SV: Serving

BMI: Body mass index

TC: Total cholesterol

LDL: Low-density lipoprotein

HDL: High-density lipoprotein

TC: Total cholesterol

TG: Triglycerides

MD: Mean difference

CI: Confidence interval

SMD: Standardized mean difference

RR: Risk ratio

ICC: Intra-cluster correlation coefficient

ITT: Intention-to-treat

GRADE: The Grades of Recommendation, Assessment, Development and Evaluation

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

Not applicable. This manuscript does not contain any data.

Competing interests

The author(s) declare(s) that they have no competing interests.

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Authors' contributions

KS and NW conceived of the review protocol and drafted the manuscript. KL and YY participated in the design of the review methods and commented on the draft. All authors read and approved the final manuscript.

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