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Using Transtheoretical Model to Facilitate Cardiovascular Dietary Knowledge and Behaviour in an Urban Community Setting

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Abstract

Background

The aim of this study is to explore the impacts of using an innovative stage-based behaviour change communication strategy to facilitate dietary knowledge and behaviour change associated with reduced cardiovascular disease within an urban context.

Methods

The community-based dietary intervention was designed and carried out in partnership with the members of a community in an urban population context. The general knowledge of the participants on the relationship between healthy eating and cardiovascular health using five-point Likert scale questionnaire were investigated. This was followed by early interviews. This informed the need for an educational intervention on 'healthy eating' and 'interpretation of food labels' as it affects healthy eating.

Results

The change in dietary knowledge and behaviour associated with reduced cardiovascular disease increased from week 4 all through to week 14 which marks the end of the intervention. The participants reported trying a new behaviour relating to consumption of fruit and vegetable at week 4 and adopting it at week 10. The participants maintained cardiovascular dietary behaviour at week 12, and told others about their new behaviour at week 14.

Conclusion

A dietary change intervention designed and implemented collaboratively with community members within an urban population context in a participatory action research is useful in facilitating change in knowledge and dietary behaviour within a month. As participants moved along the change continuum, cardiovascular health friendly dietary Knowledge and intake increased, barriers associated with dietary change steadily decreased, whilst dietary-self efficacy increased.

Keywords: Cardiovascular Health, Behaviour Change Communication, Health Promotion, Transtheoretical Model, Cardiovascular Diet

Introduction

Cardiovascular disease remains the leading cause of deaths in all continents of the globe in spite of the progress made in medical management and evidence-based dietary interventions to improve cardiovascular health [1, 2]. Cardiovascular disease is an umbrella term that describes a group of disorders of the heart and blood vessels caused by atherosclerosis and thrombosis. Cardiovascular disease comprises of coronary heart disease, stroke, peripheral arterial disease, and aortic disease [3]. There is wealth of evidence that indicates that cardiovascular disease is caused by risk factors that can be controlled, treated or modified, including hypertension, high cholesterol, unhealthy diets, obesity, tobacco use, physical inactivity and diabetes [4, 1].

The association between some dietary consumption and cardiovascular health is well established. Diets rich in fruit, vegetables, legumes, whole grains, lean protein sources but devoid of sugar sweetened beverages, processed foods, trans-fats are important for primary prevention and secondary management of cardiovascular disease [2]. The study by Keys and colleagues from 1958 to 1964 was one of the earliest epidemiological researches that investigated the association between diets and cardiovascular disease within seven countries. The study found that myocardial infarction rate was less prevalent in countries where there are higher consumption of fruit, vegetables, beans, grains, and fish [5].

This study involved an innovative eight-stage stages of change to facilitate consumption of healthy diets within an urban population context with the focus to improve cardiovascular health. The eight-stage stages of change include pre-awareness, awareness, contemplation, and intention stages. Other stages of change are trial, adoption, maintenance, and telling others. A

previous intervention research [6] has selected this approach to facilitate physical activity, in a similar context, as a means to promote cardiovascular health. This approach was chosen in this study due to its extra layers of cycle compared with traditional transtheoretical model and it provides systematic and detailed communication strategy to persuade, encourage, and support behaviour change.

[6] At Pre-awareness stage, people are not aware of the health behaviour changes that they need to make. At awareness stage, the individuals have heard about the need to change their health-risk behaviour but need additional help and persuasion to start actually to bring about the health behaviour change. At contemplation stage, the individuals are thinking about changing their health-risk behaviour but needs more information and continued support and persuasion about the merits and demerits of changing their health-risk behaviour. At intention stage, individuals have understood the merits and demerits of changing their health-risk behaviours but needs encouragement to overcome the challenges of undertaking the new health behaviour. At trial stage, the individuals have tried the behaviour or action required, but has faced challenges. At adoption stage, the individuals are demonstrating the new behaviour. At maintenance stage, the participants' health behaviour has changed, and they understand the benefits of the change. At telling others stage, the individuals have done the behaviour for a considerable length of time. It has become routine behaviour and now leads to the person convincing others about the benefits of their health-related behaviours.

Raising awareness about various diets and their impacts on cardiovascular health is essential in facilitating primary and secondary prevention of cardiovascular disease [2]. However, there are many barriers and limitations to adopting diets that improve cardiovascular health. The aim of this study is to explore the impacts of using an innovative stage-based behaviour change communication strategy to facilitate dietary knowledge and behaviour change associated with reduced cardiovascular disease within an urban context. The objectives of this research are to: i. explore barriers and strategies for facilitating intake of diets that are beneficial to cardiovascular health, ii. explore the impacts of community-based health education on cardiovascular health Knowledge, iii. explore the impacts of community-based health education on cardiovascular health behaviour.

Materials and Methods

Ethical approval was sought and obtained from the School of Health and Life Sciences Ethics Committee, University of the West of Scotland and the Lagos State Ministry of Health, Lagos State, Nigeria. Informed consent was obtained from all participants that participated in the study. Fifty participants were recruited through convenience sampling in an urban population in Nigeria. The community-based intervention was carried out in partnership with the members of the community, including healthcare workers, and faith communities. The inclusion criteria for participants that took part in the study reflected certain characteristics. The participants were Nigerians, understand and speak English, between the ages of 20-80 and were residing in the community. Exclusion criteria include non-Nigerians, Nigerians outside the age bracket (20-80), and Nigerians residing outside the Agege local community. The healthy eating programme was developed and implemented collaboratively with the community, in a participatory approach at least twice a week, and monitored at two-weeks intervals throughout the programme which lasted for fourteen weeks.

The researcher investigated the general knowledge of the participants on the relationship between healthy eating and cardiovascular health using five-point Likert scale questionnaire. This was followed by early interviews. This informed the need for an educational intervention on 'healthy eating' and 'interpretation of food labels' as it affects sugars, fats, saturates and salt content of packaged foods. The Agege Community Health Project (ACHP) engaged the participants on how to promote intake of monounsaturated and polyunsaturated fats which are beneficial to cardiovascular health and minimise saturated and trans-unsaturated fats which are harmful to cardiovascular health. Also, the participants were engaged in brainstorming on how to promote the intake of fish and other types of food which are rich in omega-3-fatty acids which has a protective effect on cardiovascular health.

The community was supported via learning activities on the needs of getting five (400g) portions of fruit and vegetables every day. To improve availability and affordability of fruit and vegetables by the community members, the participants set up community grocery shops in conjunction with local churches where fruit and vegetables were sold at subsidised rates. The ACHP promoted a reduction in salt intake to 5grams as recommended by WHO. Finally, the ACHP discussed nutrition as it affects overweight/obesity, blood pressure, and cholesterol in relation to cardiovascular disease. At the end of the community-based intervention, each of the 50 participants was encouraged to share their learning and experiences with ten members of the communities to pass the information across to the wider population.

An approach of the staged-based BCC (Behaviour Change Communication) strategy adapted from the report by the Ethiopian Ministry of Health, the Regional Health Bureaux, and Health Education and Learning Team[7] was used to facilitate and monitor intake of fruit and vegetables in this study. The questions relating to eight stages of change with respect to promotion of intake of fruit and vegetable are shown in Table 1. There was a 5-point Likert scale for the each of the questions which ranged from strongly agree (SA) to strongly disagree (SD). The responses to each of the statements are shown in Fig 1 and Table 3. Figure 1a shows the responses in a separate graph to each of the statements at two-week intervals while Figure 1b shows the responses in a separate graph for each question.

The questions relating to Pre-awareness for nutrition activities are negative statements, while the rest are positive, and are therefore shown as the reverse score in the figures and tables and used as the reverse score in statistical analyses. Thus, a shift from 3 (uncertain), 4 (disagree), 5 (strongly disagree) to a score of 1 (strongly agree) or 2 (agree) on the Likert scale can be regarded as a shift to self-reported knowledge/behaviour in this study and relevant from a knowledge/behaviour perspective. The week at which this shift occurred for each individual was used in the correlation matrix shown in Table 3. Correlation of knowledge score with the stages of change of nutrition is shown in Table 4. The differences between weeks for each question was compared by one-way ANOVA, taking into account repeated measures (Friedman's test). Qualitative

data was analysed using a thematic approach to data analyses [8].

Table 1: Questions adapted from stage-based BCC strategy used to facilitate and monitor change in intake of fruit and vegetables.

Stage	Fruit and vegetable intake
Pre-awareness	I do not know the importance of eating five (400g) portion of fruit and vegetables per day to cardiovascular health
Awareness	I have heard about the importance of eating five (400g) portion of fruit and vegetables per day to cardiovascular health, but need extra help and persuasion to start implementing it
Contemplation	I'm thinking and considering the need of eating five (400g) portion of fruit and vegetables per day
Intention	I have understood the advantages of eating five (400g) portions of fruit and vegetables per day and disadvantages of eating less or no fruit and vegetables per day, but need encouragement to get started
Trial	I have tried to eat five (400g) portions of fruit and vegetables per day, but fail to meet up with five portions at times
Adoption	I now eat five (400g) portion of fruit and vegetables per day, but I still need support and encouragement to continue with the behaviour
Maintenance	I now eat five (400g) portions of fruit and vegetables per day; it has become part of my behaviour, and I think I can continue with the behaviour
Telling others	I now tell other people about the benefits of eating fruit and vegetables to cardiovascular health and encourage them to eat five (400g) portion of fruit and vegetables per day

Results

Approaches used to promote higher intake of fruit and vegetables among the participants, facilitators, and motivators of increasing intake of fruits and vegetables, barriers to increasing intake of fruit and vegetables, and communication strategies used to overcome identified potential barriers are shown in Table 2a and 2b below.

Table 2a: Strategies for promoting intake of fruit and vegetables

Ways used to promote higher intake of fruit and vegetables among the participants	Facilitators and motivators of increasing intake of fruits and vegetables	Barriers to increasing intake of fruit and vegetables	Communication strategies
•Eating varieties of fruit and vegetables	•Having better life style •Don't want to suffer from heart diseases and stroke •Don't want to die young •Want to live long	•Lack of knowledge •Lack of money •Not sure if inorganic fruit and vegetables are safe for consumption	•Reinforced the opportunity the health education session provided for them to gain the right knowledge to improve their health. •Signposted to the stall where they can buy fruit and vegetables at reduced prices. •Reinforced the need to eat plenty of fruit and vegetables to promote a healthy heart. •Encouraged the participants to look out for organic fruit and vegetables if they buy from supermarket. However, they can still do with inorganic one's as there is no confirmed significant hazards in consuming them
•Smoothie recipes	•A healthier option to soft drinks •Rich in minerals and vitamins	•High cost of fruit and vegetables blenders	•Re-emphasized how blending fruit and vegetables could easily help to meet five a day and reduced the temptation to dwell on fizzy drinks and soft drinks •Encouraged the participants to save certain amount of money per month to buy fruit and vegetables blenders if they cannot afford to pay for it once.

Table 2b: Strategies for promoting intake of fruit and vegetables (continuation)

Ways used to promote higher intake of fruit and vegetables among the participants	Facilitators and motivators of increasing intake of fruits and vegetables	Barriers to increasing intake of fruit and vegetables	Communication strategies
•Eat mix of nuts in between diets to enhance varieties	•Minimize the potential of being tired of fruit and vegetables	•Nuts are not cheaply available	•Reinforced the importance of eating nuts such as cashew nuts, peanuts, and almond nuts to CV health. •Encouraged them to see it as a way of adding varieties to their diets
•Increasing the amount of fruit and vegetables in the house	•Promote fruit and veg consumption •Reduce consumption of fats and high carbohydrate foods	•Fruit and vegetables are expensive	•Re-emphasized the fact that the more fruit and vegetables available in the house the more likely they would be consumed.
•Snacking on fruit and vegetables	•A healthy alternative to biscuits and cakes	•Lack of money	•Encouraged the participants to see the money spent on buying fruit and vegetables as better alternative to buying medicine and paying hospitalization bills as a result of long-term health conditions from eating unhealthy foods.

Changes in community knowledge of how diets affect cardiovascular health

The level of knowledge of the importance of healthy eating on cardiovascular health increased at the end of intervention among the participants compared to baseline. Over half of the participants either strongly disagreed or disagreed with the false statement that "Fructose in fruits is not an example of natural sugar" at baseline and no participant either strongly disagreed or disagreed with the statement at the end of the programme ($P < 0.0001$). There was a 46% increment in the number of the participants that answered the question correctly at the end of the health education intervention. The pattern of response to the question 'Lactose in milk is an example of natural sugar' is similar to the pattern of response to the question "Fructose in fruits is not an example of natural sugar" both at baseline and at the end of the health education intervention.

With nearly third-quarter of the participants either strongly disagreeing or disagreeing with the false statement that "No amount of sugars in soft drink is bad to health" at baseline and no participant either strongly disagreeing or disagreeing with the statement at the end of the programme ($P < 0.0005$). This represents 28% of the participants that expressed the correct views at the end of the health education intervention. Almost half of the participants either agreed or strongly agreed with the true statement that ''Olive oil is a healthier choice for cooking'' at baseline and no participant either strongly disagreed or disagreed with the statement at the end of the programme ($P < 0.0001$). This shift in views translate to 52% number of the participants that changed their perspectives at the end of the health education.

Slightly above two-fifth of the participants either agreed or strongly agreed to the true statement that ''Some fish meals reduce the amount of cholesterol (bad fat) in the blood'' at baseline and all participant either strongly agreed or agreed with the statement at the end of the programme ($P < 0.0001$). This change in views translate to 56% increment in the number of the participants that changed their views at the end of the health education. Slightly over one-fifth of the participants either agreed or strongly agreed to the true

statement that ''Palm oil is less healthy choice for cooking'' at baseline and all participant either strongly agreed or agreed with the statement at the end of the programme ($P < 0.0001$). 78% of the participants changed their views at the end of the health education session. Overall, the question 'Palm oil is less healthy choice for cooking'' generated the largest change in views among the participants regarding the understanding of the relationship between nutrition and CV health while the question "No amount of sugars in soft drink is bad to health" generated the least.

Change in consumption of fruit and vegetables

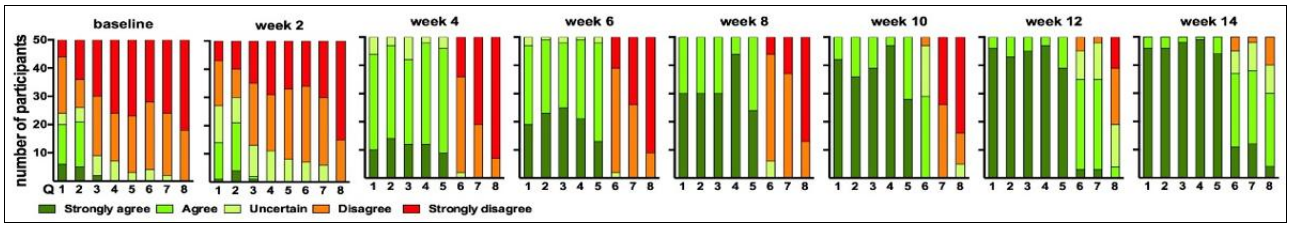
Change in response to each question in Table 1 across the study period is illustrated in Fig 1. The baseline period (designated week 0 in Fig 1) represents the period participants were recruited for this study and completed the first questionnaires (during a two-week period). Most participants reported that they were not aware of the importance of eating five (400g) portion of fruit and vegetables per day to CV health at baseline and week 2.

The Awareness stage has a similar pattern of change in responses as the Pre-awareness stage. The potential for the participants to express stronger view 'agree' increased from week 4 through to the final week. The significant shift to self-reported Pre-awareness, Awareness, Contemplation, and Intention at week 4 aligned with planning the complex cardiovascular health dietary intervention with community members and discussion about various ways to improve consumption of cardiovascular health friendly diets.

Awareness of various diets and their impacts on cardiovascular health may have motivated the participants to start thinking about improving their cardiovascular health and making plans towards it. Nevertheless, the participants did not adopt the health behaviour of consuming five (400g) portion of fruit and vegetables per day as well as minimising intake of foods that are harmful to cardiovascular health until week 10.

There was an apparent plateau in the Trial stage until another rapid shift at week 10 to the Adoption and, at week 12, to Maintenance and week 14 to Telling others. Overall, participants were less likely to strongly disagree with the statements on nutrition.

(a)



(b)

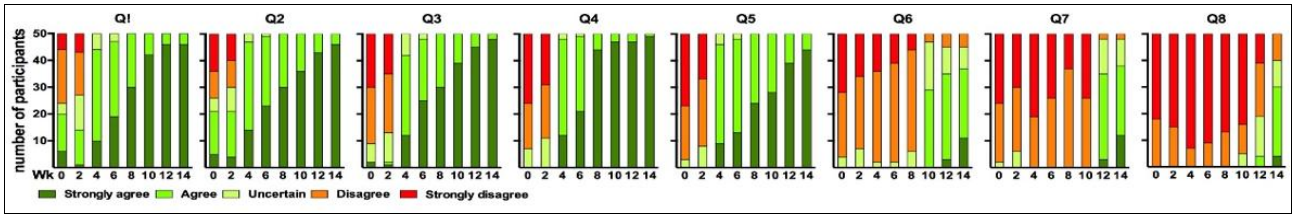


Fig 1: *Impacts of promotion of intake of fruit and vegetables on knowledge and health behaviour at two-week intervals.* The questions were repeated every two-week up until the end of health education intervention, and the number of participants in each Likert category are shown. The responses are shown week-by-week (a) and to each other (Q). Q1 is a negative statement, while the rest are positive, and is therefore shown as reverse score.

Table 3: *Nutrition and cardiovascular health:* Responses to each question are the median and mean (95%CI) values, treating the Likert scale data as a continuous variable. The differences between weeks for each question was compared by one-way ANOVA, taking into account repeated measures (Friedman's test) and significant difference between groups are shown in italics (**0** compared to week 0, **2** compared to week 2, etc. for the same question; significance set at $P < 0.001$; Dunn's multiple comparison test)

Question Stage	Week 0	Week 2	Week 4	Week 6	Week 8	Week 10	Week 12	Week 14
1	4	3	2	2	1	1	1	1
Pre-awareness	3.1 (2.8-3.5)	3.3 (3.0-3.6)	1.9 (1.8-2.1)	1.7 (1.5-1.8)	1.4 (1.3-1.5)	1.2 (1.0-1.3)	1.1 (1.0-1.2)	1.1 (1.0-1.2)
(reversed score)				***2***	***0,2***	***0,2,4***	***0,2,4***	***0,2,4***
2	3	3	2	2	1	1	1	1
Awareness	3.2 (2.8-3.6)	3.1 (2.7-3.7)	1.8 (1.6-1.9)	1.6 (1.4-1.7)	1.4 (1.3-1.5)	1.3 (1.2-1.4)	1.1 (1.0-1.2)	1.1 (1.0-1.2)
				0,2	***0,2***	***0,2***	***0,2,4***	***0,2,4***
3	4	4	2	1.5	1	1	1	1
Contemplation	4.1 (3.9-4.4)	4.0 (3.7-4.2)	1.9 (1.7-2.1)	1.5 (1.4-1.7)	1.4 (1.3-1.5)	1.2 (1.0-1.2)	1.1 (1.2-1.5)	1.0 (1.0-1.1)
			0,2	***0,2***	***0,2***	***0,2***	***0,2,4***	***0,2,4***
4	5	4	2	2	1	1	1	1
Intention	4.4 (4.2-4.6)	4.2 (3.9-4.4)	1.8 (1.7-2.0)	1.6 (1.4-1.8)	1.1 (1.0-1.2)	1.1 (1.0-1.1)	1.1 (1.0-1.1)	1.0 (1.0-1.1)
			0,2	***0,2***	***0,2***	***0,2,4***	***0,2,4***	***0,2,4***
5	5	4	2	2	2	1	1	1
Trial	4.5 (4.3-4.7)	4.2 (4.0-4.4)	1.9 (1.8-2.0)	1.8 (1.6-1.9)	1.5 (1.4-1.7)	1.4 (1.3-1.6)	1.2 (1.1-1.3)	1.1 (1.0-1.2)
			0,2	***0,2***	***0,2***	***0,2***	***0,2***	***0,2,4***

6	4	4	4	4	4	2	2	2
Adoption	4.4 (4.3-4.7)	4.2 (4.0-4.4)	4.2 (4.1-4.4)	4.2 (4.0-4.3)	4.0 (3.9-4.1)	2.5 (2.3-2.7)	2.3 (2.1-2.6)	2.1 (1.9-2.4)
						0,2,4,6,8	***0,2,4,6,8***	***0,2,4,6,8***
7	5	4	5	4	4	4	2	2
Maintenance	4.5 (4.3-4.6)	4.3 (4.1-4.5)	4.6 (4.5-4.8)	4.5 (4.3-4.6)	4.3 (4.1-4.4)	4.5 (4.3-4.6)	2.3 (2.1-2.5)	2.0 (1.8-2.3)
							0,2,4,6,8,10	***0,2,4,6,8,10***
8	5	5	5	5	5	5	4	2
Telling others	4.6 (4.5-4.8)	4.7 (4.6-4.8)	4.9 (4.8-5.0)	4.8 (4.7-4.9)	4.7 (4.6-4.9)	4.6 (4.4-4.8)	3.8 (3.5-4.0)	2.5 (2.3-2.8)
							2,4	***0,2,4,6,8,10***

Table 4: *Correlation of knowledge score with the stages of change of nutrition.* The week at which there was a shift to self-reported knowledge or behaviour is compared to the score in a 6-item questionnaire using spearman's rank correlation. The r and p values are shown

	Knowledge test	Pre-awareness	Awareness	Contemplation	Intention	Trial	Adoption	Maintenance
Pre-awareness r *p*	-.342 *.015*							
Awareness r *p*	-.293 *.039*	.654 *<.001*						
Contemplation r *p*	.103 *.478*	-.165 *.253*	-.082 *.571*					
Intention r *p*	.144 *.320*	-.212 *.139*	-.231 *.106*	.177 *.219*				
Trial r *p*	-.146 *.312*	.098 *.500*	.067 *.646*	-.060 *.677*	-.060 *.679*			
Adoption r *p*	-.239 *.094*	.369 *.008*	.178 *.217*	-.116 *.424*	-.168 *.245*	-.082 *.574*		
Maintenance r *p*	-.266 *.061*	.271 *.056*	.225 *.116*	-.184 *.201*	-.132 *.360*	-.029 *.841*	.883 *<.001*	
Telling others r *p*	-.077 *.595*	-.106 *.464*	-.048 *.743*	-.224 *.117*	-.243 *.088*	-.002 *.987*	.123 *.396*	.065 *.654*

Table 4 shows the correlation of the knowledge score (6-item knowledge questionnaire) with the stages of the change of nutrition. There is a strong correlation between Awareness and Pre-awareness stages. There is strong correlation between Adoption and Maintenance stages, implying that the participants that reported eating fruit and vegetables for two weeks are more likely to continue with the behaviour. The Awareness stage has a similar pattern of change in responses as the Pre-awareness stage. The potential for the participants to express stronger view 'agree' increased from week 4 through to the final week. The participants reported trying a new behaviour relating to consumption of fruit and vegetable at week 4 and adopting it at week 10. There was an apparent plateau in the Trial stage until another rapid shift at week 10 to the Adoption and, at week 12, to Maintenance and week 14 to Telling others.

During the health education session, the views of the participants were explored on why they wanted to improve their intake of fruit and vegetables. Reasons given by the participants were numerous, including the need to have a better lifestyle, the desire to live long, and the desire not to suffer from chronic diseases. An example of a quote expressing the views of the participants on their desire to live a healthy lifestyle as to reduce the chances of suffering from a chronic disease is shown below.

> 'I have seen the first-hand experience of what it means to suffer from a stroke. My uncle is a stroke patient and has paralysis on the left part of his body. He has a speech impairment and even needs help with doing many things including feeding. If eating fruit and vegetables could prevent me from getting such disease, why not?' – [P_{27}, female, graduate, 40 – 49yrs]

The ideas on how to improve intake of fruit and vegetables were discussed, and the participants were encouraged and supported with information to make the right health decisions.

In Contemplation stage, there were significant changes in responses at week 4. The Intention stage is somewhat similar to Contemplation stage. The activities that were carried out during the intervention may have catalysed transition through the Contemplation and Intention stages to practical action in trying a new behaviour. For example, the views of the participants were explored through group interviews and one-to-one interviews on how they would like to improve their intake of fruit and vegetables. The views that emerged were numerous, including the need to eat varieties of fruit and vegetables, the need to use smoothie which is rich in minerals and vitamins as a healthier choice to soft drinks, the need to increase the amount of fruit and vegetables in the house to promote fruit and vegetable consumption, and the need to snack on fruit and vegetables as a healthier alternative to biscuits and cakes.

> 'I can increase intake by eating varieties of fruit and vegetables. Personally, I don't like banana, but I like pawpaw, oranges, watermelon, carrots and mangoes' I think eating different types would increase the possibility to eat more – [P_{15}, female, graduate, 30 – 39yrs].

In the Trial stage, there was a significant change in response at week 4, followed by a plateau until week 14. In the Adoption stage, there was a significant change in response at week 10, followed by a plateau. The participants were not only supported and motivated to eat plenty of fruit and vegetables per day but were signposted to fruit and vegetable stall set up through community efforts where they bought them at lower prices. The views of the participants on the barriers they encounter in trying to increase their intake of fruit and vegetables were explored. A number of views emerged, including lack of money, not sure if inorganic fruit and vegetables are safe for consumption, and the fact that some fruit and vegetables are seasonal.

> 'I don't think money should be a major issue for me. I'm more worried about the chemical (fertilisers) that is used to grow them - not sure if those grown with chemicals are safe for consumption' – [P_{11}, male, graduate, 40 – 49yrs].

While money is not a problem for healthy eating for some participants, a few participants expressed concerns about increasing cost of healthier food options, including fruits and vegetables.

> 'Fruit and vegetables smoothies are very rich drink, but the main challenge remains how to afford high cost of fruit and vegetable blenders to make them' – [$P_{27,}$ female, high school, 50 -58yrs].

The participants were encouraged to see the money that will be spent on buying blenders for making smoothies as well as money that will be spent on buying fruit and vegetables as a better alternative to buying medicines and paying for hospitalisation bills as a result of potential long-term health conditions from eating unhealthy foods.

In the Maintenance stage, there were significant differences in responses at week 12. In Telling others stage, there was a significant difference in response at week 12, followed by a rapid change at week 14. Participants explored ways that enabled them to continue with consumption of fruit and vegetable among themselves. Some of the views that emerged were the need to devise means to make intake of fruit and vegetables fun by playing games with them as well as increasing availability at home.

> 'I would play games with my meals and find a way to add extra fruit and vegetables. If I'm eating rice, for example, I may choose to eat handful of vegetable for every four tablespoons of rice taken' – [P_{25}, female, undergraduate, 20 – 30yrs].

The participants that reported that they had maintained their health behaviour were praised and congratulated. Those that were struggling were encouraged and supported to put in more efforts. For example, they were encouraged to solicit support from their families to help remind them to take their fruit and vegetables on a daily basis.

Discussion

In a previous research, the researchers, in a participatory action research used transtheoretical model to facilitate physical activity and promote cardiovascular health knowledge in an urban community setting [6]. In the study, participants reported trying a new behaviour associated with improved physical activity at week 8 and adopted the new behaviour at week 12. The new physical activity tried by the participants include cycling, swimming, jogging, running, and participating in a local leisure football matches. While the researcher in the previous study facilitated physical activity to improve cardiovascular health, the current study promoted cardiovascular health friendly dietary knowledge and behaviour change to achieve the same purpose. the participants reported improved consumption of fruit and vegetable at week 4 and adopting the new behaviour at week 10. This implies that participants are more likely to try and embrace a dietary intervention as means to improve cardiovascular health outcome at earlier time compared with physical activity.

While the participants in the health intervention study to promote physical activity reported that they maintained and told other people about their new physical activity behaviour at week 12 the participants in this current study reported that they maintained and told other people about their dietary health behaviour at week 14. This finding suggest that it is much easier to maintain and tell other people about one's current physical activity level compared with dietary changes.

The views expressed by the participants in the current study on their desire to live a healthy lifestyle as to reduce the chances of suffering from a chronic disease accords with the principle of 'perceived severity', one of the six constructs of the Health Belief Model (HBM), which explains that one's opinion of how serious a health condition and its consequences are, may influence people to change their health behaviour [9]. In the same vein, encouraging participants in this study during the ACHP to spend more money on healthy eating instead of spending money paying for hospital bills due to illness that may occur if they don't adopt healthy eating aligns with one of the principles of HBM known as 'cue to action', which is a stimulus needed to trigger the decision-making process to accept a recommended health behaviour change. These cues may be internal, e.g., noticing symptoms of an illness or external, e.g. advice from others, illness of family members [10].

A study that examined the influence of psychological factors, difficulties associated with making dietary changes and food security on stages of change for dietary fat reduction and increased fruit and vegetable intake found that as participants moved along the change continuum, dietary fat intake and barriers associated with dietary change steadily reduced whilst dietary-self efficacy increased [11]. The study involved convenience sampling of 111 women of Maori descent in New Zealand. In investigating difficulties associated with increasing fruit and vegetable intake, 35% of the participants reported that the high cost of fruit and vegetables is the most significant barrier to improving consumption. This finding is consistent with the views expressed by participant in this current study. The least reported barrier was that fruit and vegetables are often of poor quality (15%). The most commonly reported difficulties associated with reducing fat intake was that they taste good (52%).

The similarities between study by Tassel and colleagues and the current research are that both examined barriers to making dietary changes. However, there are differences in methodological approaches. While Tassel and colleagues used questionnaires, this current study used one-to-one

interviews to facilitate discussions on the barriers and ways of overcoming identified barriers to dietary changes, in contrast to the study by Tassel and colleagues. In both studies, participants moved along the stages of change continuum. The study by Tassel and colleagues involved a higher number of participants, and they were of the same sex, unlike the current study.

Conclusion

Cardiovascular disease remains the leading cause of deaths in all continents of the globe in spite of the progress made in medical management and evidence-based interventions to improve cardiovascular health. Raising awareness about various diets and their impacts on cardiovascular health is essential in facilitating primary and secondary prevention of cardiovascular disease. In this study, as participants moved along the change continuum, cardiovascular health friendly dietary Knowledge and intake increased, barriers associated with dietary change steadily decreased, whilst dietary-self efficacy increased. This research provides helpful insights into planning, designing, facilitating, and monitoring interventions to improve consumption of cardiovascular health friendly diets within an urban population context as a prerequisite to improve cardiovascular health. The intervention was designed in collaboration with a community and programmes such as this can have significant impacts on trying a new behaviour relating to improved consumption of fruit and vegetable at week 4 and adopting it at week 10.

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