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The Complete Health Improvement Program (CHIP) and Reduction of Chronic Disease Risk Factors in the Philippines

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ABSTRACT

Lifestyle modification has been demonstrated to effectively reduce the risk factors associated with chronic disease. The Complete Health Improvement Project, a 30-day diet and lifestyle modification program, has been shown to be efficacious in the US, Australasia and Canada. The present study examined the changes in selected biometric measures of 61 participants from six programs delivered in Manila, in the Philippines (May 2013 to November 2014). Overall, significant reductions were recorded in body mass (2.2%, $p<0.001$), systolic and diastolic blood pressure (6.0%, $p<0.001$ and 3.3%, $p=0.040$; respectively), total cholesterol (9.1%, $p<0.001$), low-density lipoprotein cholesterol (6.8%, $p=0.021$), and fasting blood sugar (12.4%, $p=0.001$). Overall, triglyceride levels did not change significantly over the course of the intervention ($p=0.299$). Stratification of the data revealed more dramatic responses in those presenting with the greatest risk factor levels. Those presenting with cholesterol levels >5.17mmol/l recorded an average reduction of 14.4%. A mean decrease of 17.0% in low-density lipoprotein levels was observed among those who entered the program with a low-density lipoprotein level >3.35 mmol/l. Individuals who presented with triglycerides >2.26 mmol/l recorded a mean reduction of 21.8%. Individuals with systolic blood pressure above 139 mmHg and diastolic blood pressure above 89 mmHg decreased levels by 10.3% and 7.1%, respectively. Finally, fasting plasma glucose decreased on average 24.8% among individuals entering the program with levels above 6.9 mmol/l. In conclusion, significant reductions in chronic disease risk factors can be achieved in a 30-day life style intervention delivered in the Philippines.

Keywords: Chronic disease, risk factors, Philippines, lifestyle intervention, nutrition.

Introduction

The burden of chronic diseases, including cardiovascular disease, diabetes and cancer, represents a major health challenge worldwide [1,2]. Deaths from chronic diseases are projected to increase by 15% by 2020 worldwide [1]. In the Philippines, the probability of dying from one the four main chronic diseases in 2014—cardiovascular disease (CVD), cancer, respiratory disease and diabetes—is one of the highest in the world, at 27.9%[1].

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Unhealthy lifestyle is recognized as one of the major risk factors of chronic diseases[1] and lifestyle interventions have been shown to be efficacious for their primary, secondary and early tertiary prevention [3-7].Consequently, lifestyle interventions are attracting increasing attention for managing the burgeoning rise of chronic disease. The Complete Health Improvement Program (CHIP) is an intensive, community-based lifestyle intervention that focuses on the promotion of a whole-food, plant-based eating pattern, and also encourages daily moderate-intensity physical activity. The program is managed and coordinated by the not-for-profit Lifestyle Medicine Institute; it has been used in clinical settings[8], workplace environments[9], and community settings, and has been facilitated by Seventh-day Adventist churches[6,7]. Over the past 15 years, an estimated

50,000 people have completed the CHIP program worldwide, which has demonstrated significant benefits for the management of cardiovascular disease (CVD)[6-8,10], type 2 diabetes mellitus[6,11], and depression[12].While the program was developed for a United States audience, recent studies from Australasia and Canada[7,13] have shown similar levels of effectiveness, despite the inherent cultural differences. The purpose of this study was to examine the short-term effectiveness of CHIP in reducing selected chronic disease risk factors in the Western Pacific context.

Materials and Methods

The study examined the changes in selected chronic disease risk factors of 62 individuals (age = 51.4±13.5yrs, 41% male/59% female) who chose to participate in one of 6 CHIP interventions in the Adventist Medical Center Manila.The programs ranged in size from 6 to 13 participants (mean group size = 10.3). Participants were encouraged to engage in the program in consultation with their personal health care provider.Consent for the study was obtained from Avondale College of Higher Education Human Research Ethics Committee(Approval No. 20:10:07). The CHIP interventions were advertised on social networking sites (Facebook), internet podcasts, newspaper articles by local journalists, information sessions to local businesses and churches, posters and billboards around the Adventist Medical Center Manila premises and distribution of brochures to hospital visitors, patients and residents of the local community. In some instances local medical practitioners recommended the program to their patients to the program. Of the 62 participants who enrolled in the program, 61 (98%) completed the 30-day intervention after which they were followed up via phone calls, text messages, social network messages and announcement posts and encouraged to visit the Adventist Medical Center Manila, Health and Wellness Department for monitoring of their health status through individual and group consultations, attendance of health forums, attendance of cooking classes and annual CHIP alumni and anniversary events. Participants were deemed to have completed the program if they attended all of the 18 sessions and underwent both pre and post-intervention blood testing. As shown in Table 1, at program entry the participants were representative of an at-risk population with a mean BMI in the 'overweight' category (26.5 kg/m^2), 'diabetic' fasting blood sugar (FBS) levels (7.2mmol/L), 'prehypertensive' systolic and diastolic blood pressures (129 mmHg and 84.6 mmHg, respectively) and above 'optimal' low-density lipoprotein (LDL-C) cholesterol levels (2.6 mmol/L).The programs were facilitated by a subsidised Filipino Lifestyle Medicine physician who had an interest in positively influencing the health of members of their local community. The facilitator was a health professional, although not all the staff involved in the program mechanics were. The facilitator underwent three days of training to develop group facilitation skills after which they were provided with a comprehensive CHIP resource package that included a curriculum guide for program delivery, 18 pre-recorded educational lectures presented by qualified experts, a cookbook and participant textbook and journal. The role of the facilitator was to organize and facilitate the proceedings of the group sessions, not to educate. Even though the facilitator had medical training, the supplied resources were used and the program delivery was consistent. The CHIP intervention involved 18 three-hour group sessions over 30 days. Each session typically involved viewing a thirty to forty-five minute pre-recorded lecture which covered the following themes: the causes of chronic disease; the benefits of positive lifestyle choices, with particular attention to diet and physical activity as therapy for conditions including obesity, type 2 diabetes, and CVD;and positive psychology and how it influences long-term health habits, including stress management, forgiveness, and self-worth. The objective of the CHIP intervention was to educate and empower individuals to provide intelligent self-care. The program involved a conglomerate of behaviour change strategies but was principally founded on the theory of planned behaviour, which asserts that behaviour is determined by intentions; these, in turn, are formed by attitudes, social norms, and perceived behavioural control[14]. The program endeavoured to change participants' attitudes toward positive lifestyle choices through education, create new social norms through a group setting, and increase perceived behavioural control by providing an intensive experience in which positive changes were experienced in a short time. The primary focus of the intervention, however, was a whole-food, plant-based eating pattern ad libitum. The consumption of whole grains, legumes, and fresh fruits and vegetables was recommended for the achievement of a daily target of fewer than 20% of calories from fat, fewer than 10 tsp of added sugar, less than 5000 mg of salt (2000 mg of sodium), and less than 50 mg of cholesterol. Participants were also encouraged to consume 2 to 3 L of water daily[10].Furthermore, daily exercise (30 minutes at moderate intensity or 10,000 pedometer recorded steps) was advocated.In addition to the pre-recorded lecture, each session also included a cooking demonstration, buffet meal, group discussion and a behaviour change challenge. The cooking demonstration usually involved food assemblage principles were presented. Shopping tours, nutrition workshops and guided exercise sessions were also incorporated into the program when local health experts could be sourced. Participants paid a fee of approximately 27,500Philippine pesos to cover the cost of venue hire, buffet meals atevery session, resources including reading materials and pedometer, and biomedical assessments.

Biometric measurement

At program entry and after 30 days, participants' height, weight, blood pressure (BP), and 12-hour lipids and FBS were measured. Height, weight, and resting BP were measured at the Adventist Medical Center Manila, where the CHIP intervention was conducted. Height and weight were measured at the same time of day; participants removed their shoes and light clothing was worn on each occasion. For the sake of consistency, resting BP was measured by the same health professional at each site. The blood samples were collected by trained phlebotomists not involved in the program and were analysed at the Adventist Medical Center Manila's laboratory department for total cholesterol (TC), LDL-C, high-density lipoprotein cholesterol(HDL-C), triglycerides (TG), and FBS.

Statistical analysis

The data were analysed with SPSS Statistics (version 19, IBMCorp, Armonk, NY, 2010). Data are expressed as means ± standard deviations.Paired t-tests were used to assess changes in the biometric measures from baseline to post-intervention, both forthe overall and stratified data. McNemar's chi-square testing was used to determine changes from program entry to 30 days in the distribution of participants across the various risk factor categories. Participants' weight was characterized using standard cut points but the highest categories were combined due to small numbers: BMI as normal, overweight, and obese[15]; BP was classified using the Fifth Joint National Committee for Hypertension guidelines[16]; and FBS was characterized according to conventional normal, impaired, and diabetic levels[17]. The National Cholesterol Education Program Adult Treatment Panel demonstrations in which recipes from the CHIP cookbook and local recipes based on CHIP dietary III classification system[17]was used to categorize the participants for all risk factors except total cholesterol, for which the Framingham risk classification[18], which had a greater number of categories than the National Cholesterol Education Program Adult Treatment Panel III classification system. $P < .05$ was considered significant. To reduce the Type 1 error that can occur when simultaneous tests are performed in a data set, Bonferroni correction was applied to each biometric separately. Because there was a different number of risk category comparisons for each biometric, the correction applied was 0.05/n, where n was the number of categories within each biometric.

Results

Participants' mean changes from baseline to post-intervention are presented in Table 1"INSERT TABLE 1 HERE". Significant reductions were recorded in all biometric measures, except triglycerides, with the most notable being in TC,LDL-C and FBS. Table 2"INSERT TABLE 2 HERE" displays the stratified data, using conventional risk factor categories. Participants who entered with the highest risk factor classifications tended to have the greatest improvements and the effect sizes were moderate to large. As Table 2"INSERT TABLE 2 HERE" indicates, many participants who entered the program with the highest risk factor classifications had moved to lower risk factor classifications by the end of the intervention. Among the 15 individuals with elevated TC levels (>5.2mmol/L) at program entry, this biometric was normalised in10 (67%). Similarly, of the 11 individuals with elevated LDL-C levels at baseline, 6 (55%) experienced a reduction in scores to below 3.35mmol/L in the 30 days. Further, of the 23 individuals with elevated SBP at baseline, 11 (48%) reduced this to below 139 mmHg. A comparison of the risk factor reductions in this study with those recently reported in the United States [6], Australasia [7] and Canada[13]appears in Table 3"INSERT TABLE 3 HERE". Similar outcomes were observed in the four cohorts, except for LDL-C, FBS and TG, where changes were significantly lower, higher and did not change, respectively, compared to the other three cohorts.

Table 1: Mean changes in selected chronic diseases risk factors from baseline to post-intervention

	N	Baseline Mean	SD	Post-Mean	SD	Mean change	Lower CI	Upper CI	% change	t	*p*-value	Cohen's d
Total Cholesterol, mmol/l	61	4.69	0.88	4.27	0.82	-0.43	0.26	0.59	-9.1	5.29	<0.001	0.68
High-density Lipoprotein, mmol/l	61	1.28	0.38	1.05	0.29	-0.23	0.15	0.30	-17.8	5.99	<0.001	0.77
Low-density Lipoprotein, mmol/l	61	2.70	0.80	2.51	0.70	-0.18	0.03	0.34	-6.8	2.38	0.021	0.30
Triglyceride, mmol/l	61	1.50	0.71	1.57	0.65	0.07	-0.22	0.07	5.0	-1.05	0.299	-0.17
Fasting Blood Sugar, mmol/l	61	7.16	4.37	6.28	2.75	-0.89	0.35	1.42	-12.4	3.33	0.001	0.43
Body Mass Index, kg/m^2	61	26.5	7.82	25.9	7.49	-0.59	0.37	0.82	-2.2	5.31	<0.001	0.68
Systolic Blood Pressure, mmHg	61	129	18.4	121.3	13.8	-7.70	5.13	10.3	-6.0	5.98	<0.001	0.77
Diastolic Blood Pressure, mmHg	61	84.6	12.9	81.8	11.2	-2.79	0.14	5.44	-3.3	2.10	0.040	0.27

Table 2: Changes in chronic disease risk factor levels within 30 days according to initial risk factor classification

	Bas	Post - N	Base-Mean	SD	SE	Post-Mean	SD	SE	Mean change	SD	SE	Lower CI	Upper CI	% change	t
Total cholesterol, mmol/l	X^2=16.0*														
<4.14	17	31	3.61	0.40	0.10	3.49	0.53	0.13	-0.11	0.46	0.11	-0.13	3.50	-3.10	0.99
4.14-5.16	29	20	4.74	0.27	0.05	4.35	0.64	0.12	-0.40	0.69	0.13	0.13	0.66	-8.34*	3.11
>5.17	15	10	5.83	0.44	0.11	4.99	0.66	0.17	-0.84	0.45	0.12	0.59	1.09	-14.4**	7.21
High-density lipoprotein, mmol/l	X^2=20.3**														
>1.54	16	4	1.78	0.24	0.06	1.29	0.36	0.09	-0.49	0.37	0.09	0.29	0.69	-27.7**	5.28
1.03-1.54 men, 1.30-1.54 women	18	14	1.32	0.15	0.04	1.07	0.23	0.05	-0.25	0.22	0.05	0.14	0.36	-18.8**	4.75
<1.03 men, 1.30 women	27	43	0.97	0.19	0.04	0.91	0.19	0.04	-0.06	0.14	0.03	0	0.11	-6.06	2.20
Low-density lipoprotein, mmol/l	X^2=5.88														
<2.59	26	34	1.97	0.43	0.08	2.15	0.50	0.10	0.19	0.46	0.09	-0.37	0	9.40	-2

															.07
2.59-3.35	24	21	2.94	0.19	0.04	2.58	0.58	0.12	-0.36	0.56	0.11	0.12	0.60	-12.3*	3.16
>3.35	11	6	3.90	0.47	0.14	3.23	0.80	0.24	-0.66	0.50	0.15	0.33	1.00	-17.0*	4.41
Triglycerides, mmol/l	X^2=0.643														
<1.69	39	37	1.06	0.32	0.05	1.27	0.46	0.07	0.20	0.45	0.07	-0.35	-0.06	19.5*	-2.90
1.69-2.25	14	17	1.96	0.15	0.04	2.05	0.68	0.18	0.10	0.70	0.19	-0.50	0.31	4.86	-0.51
>2.26	8	7	2.79	0.55	0.20	2.18	0.51	0.18	-0.61	0.17	0.06	0.47	0.75	-21.8**	10.4
Fasting Blood Sugar, mmol/l	X^2=5.57														
<5.50	34	39	4.83	0.37	0.06	4.87	0.37	0.06	0.04	0.31	0.05	-0.15	0.07	0.85	-0.78
5.50-6.90	11	8	5.87	0.39	0.12	5.45	0.42	0.13	-0.43	0.53	0.16	0.07	0.79	-7.28	2.68
>6.9	15	13	13.4	4.90	1.27	10.1	3.27	0.84	-3.33	2.98	0.77	1.68	4.98	-24.9*	4.34
Body mass index, kg/m²	X^2=3.00														
<18.50	4	3	17.5	1.01	0.51	18.0	0.73	0.36	0.55	1.67	0.83	-3.20	2.10	3.15	-0.66
18.50-24.99	26	29	22.1	1.93	0.38	21.6	1.74	0.34	-0.46	0.75	0.15	0.16	0.76	-2.08*	3.11
25.00-29.99	20	18	26.8	1.07	0.24	26.0	0.98	0.22	-0.75	0.47	0.10	0.53	0.97	-2.80**	7.18
>29.99	11	11	39.5	9.20	2.77	38.5	8.94	2.69	-1.05	1.03	0.31	0.35	1.74	-2.65*	3.36
Systolic blood pressure, mmHg	X^2=13.6*														
<120	13	18	105.4	6.60	1.83	107	10.32	2.86	1.54	5.55	1.54	-4.89	1.81	1.46	-1.0

															0
120-139	25	32	124	5.00	1.00	118	7.46	1.49	-5.60	7.12	1.42	2.66	8.54	-4.52*	3.93
>139	23	11	148	12.0	2.51	133	11.8	2.45	-15.2	9.47	1.98	11.1	19.3	-10.3**	7.71
Diastolic blood pressure, mmHg	X^2=2.08														
<80	11	15	65.5	5.22	1.58	68.2	8.74	2.64	2.73	6.47	1.95	-7.07	1.62	4.17	-1.40
80-89	22	20	80.0	0	0	79.6	8.44	1.80	-0.45	8.44	1.80	-3.29	4.20	-0.57	0.25
>89	28	26	95.7	7.90	1.49	88.9	7.86	1.49	-6.79	11.6	2.19	2.30	11.3	-7.09*	3.11

X^2 McNemar Chi-squared Test; ***p*<0.001, *Bonferroni correction applied: difference in change at *p*< .017 with 3 risk categories, *p*<0.012 with 4 risk categories

Table3: Comparison of the mean changes in selected chronic disease risk factors from baseline to post-intervention in the present study and CHIP participants from Australasia and the United States

Biometric	Australasia	United States	Canada	Philippines
	(N=787)	(N=5070)	(N=1008)	(N=61)
BMI	-3.8%	-3.2%	-3.1%	-2.2%
SBP	-5.6%	-4.9%	-5.4%	-6.0%
DBP	-4.6%	-5.3%	-5.3%	-3.3%
TC	-14.7%	-11.0%	-11.3%	-9.1%
LDL	-17.9%	-13.0%	-12.9%	-6.8%
HDL	-8.3%	-8.6%	-8.8%	-17.8%
TG	-12.5%	-7.7%	-8.2%	5.0%
FPS	-5.6%	-6.1%	-7.0%	-12.4%

Discussion

The current study findings suggest that the CHIP intervention, which centers on a whole food, plant-based eating pattern, can lead to rapid and meaningful reductions in chronic disease risk factors in the Western Pacific context. Further, individuals at greatest risk experience the greatest benefits. That these outcomes can be achieved with a subsidized, hospital/community-based intervention is noteworthy, given the burgeoning rise in chronic disease in the Western Pacific. Of note is the fact that in only 30 days, improvements of approximately 15-20% were observed in participants with the highest classifications of TC (14%), LDL-C (17%), TG (22%), and FBS (25%). The changes in TC and LDL-C compare favorably with those achieved by pharmaceutical interventions involving statins [19], and exceed the typical expectations of dietary interventions for lowering blood lipids[20].The program's emphasis on a whole-food, plant-based eating pattern, which is largely free from exogenous cholesterol, low in saturated fat, and high in fibre may explain the large changes. The substantial reduction in serum TC and LDL-C, leading to a decreased need for reverse cholesterol transport, may also explain the acute reduction in HDL-C seen in this study and others that advocated a plant-based eating pattern [7,21,22].Interestingly, the change in LDL-C was about half that reported in the US[6], Australasian[7] and Canadian studies[13].The mean baseline levels of LDL-C in the current study, which is much lower than in the other three cohorts, may explain the smaller changes following this intervention. As noted above, individuals at greatest risk experience the greatest benefits and this may also explain why the changes in FBS were about twice as great as those in the US, Australasia and Canadian studies. In the present study mean baseline FBS was indicative of diabetes, while in the other three cohorts, this ranged from 5.5-5.8 mmol/l[6,7,13].This trend is supported by national prevalence data for impaired glucose tolerance and diabetes in the Philippines[23]and in the US[24], Australia and Canada[23].It is not clear why triglyceride levels increased following the intervention when in the other international sites, triglycerides decreased substantially, although it is noteworthy that many of the Filipino participants did attest to drinking some fruit juice to replace soda and on the occasion of no available unpolished rice, would take polished/white rice or white rice noodles instead.

Lifestyle interventions and prevention

Many chronic diseases have lifestyle underpinnings [1] and this observation has led to the growing awareness that lifestyle interventions have merit at all levels of prevention. In terms of primary prevention, results of the 52-country INTERHEART study[25] indicated that positive lifestyle practices, such as the consumption of fruits and vegetables, physical activity, and avoidance of tobacco use, can prevent up to 90% of myocardial infarctions. In terms of secondary prevention, the Diabetes Prevention Program Research Group[26] showed a 16-session lifestyle education program to be twice as effective as pharmaceuticals (metformin) for preventing the progression of prediabetes to diabetes in at-risk patients. At the tertiary level, several studies have included an exploration of lifestyle medicine interventions for potential chronic disease regression [4, 27, 28] and most have been centered on a whole-food, plant-based diet high in fibre (>30 g) and lowing fat (<20%), cholesterol, and refined sugar. The Lifestyle Heart Trial[4] demonstrated CVD reversal through plant-based nutrition combined with exercise, social support, and stress management techniques, while Esselstyn[27]showed regression of heart disease when a low-fat (<10%)plant-based diet alone was used. Barnard et al.[28] reported that approximately40% of people with type 2 diabetics mellitus treated with insulin could discontinue its use through participation in a 26-day residential program involving a near-vegetarian, low-fat diet in conjunction with exercise. In the current study, about 13% of participants who entered the program with FBS levels indicative of diabetes experienced reductions to levels below this classification in 30 days. This observation is lower than our findings in CHIP participants from the US and Australasia, however the mean FBS at this classification was about 30% higher in the Philippines than it was in either the US or Australasia [6,7].

Confounders and limitations

Several confounders may explain the magnitude of the changes observed in the biometric risk factors measured in this study. Firstly, as the participants were self-selected, they likely entered the program with an elevated readiness for change and hence willingness to engage in the intervention [29]. Evidence for this can been seen in the very high program completion rate (98%), which was likely influenced by the participant shaving to pay to be involved. The generalizability of the findings to less motivated populations needs to be determined. Second, the extent to which regression to the mean explains the observed improvements is undetermined, as the study had no control group. Consistent with regression to the mean is that the individuals with the most extreme baseline measures tended to experience the greatest improvements and hence inclination towards the norm. However, given that the same trends were observed on other studies with large size [6, 7, 13] and that for some of the biometrics the high-risk categories moved up to 1.5 standard deviations, regression to the mean likely is only a small component of the changes. Further, a small, randomized controlled trial of the CHIP intervention in the United States showed changes in the treatment group of similar magnitude to those observed in the current study [8].A further limitation is that medication changes were not recorded. Several anecdotal reports from participants in this study indicated that personal physicians decreased doses or even discontinued participants' medications (e.g., for hypertension,hypercholesterolemia,or hyperglycemia) during the 30 days of the intervention. While this is a desirable outcome, reduced medication usage may have caused the results to be understated. Similarly, program compliance data were not collected, and, while the biometric changes suggest participants changed their health behaviors, the extent to which this occurred is unknown. Presumably, the participants entered the program with different health behaviours and made varying degrees of change throughout the intervention. Further studies are in process to explore the influence of these factors on the outcomes achieved in the program. Notwithstanding the limitations in the research design, the current study results are noteworthy, given the size of the sample and the effects observed.

Conclusions and Recommendations

The results indicate that, within the Western Pacific context, the CHIP intervention can meaningfully improve chronic disease risk factors within 30 days, especially among at-risk individuals. The nutrition-centered CHIP intervention, which can be delivered in a cost effective manner in the community setting, shows promise for assistance with the management of chronic diseases in the western Pacific.

A randomized controlled trial is warranted to investigate the effectiveness and longer-term sustainability of the improvements in chronic disease risk factors. Improvements in participant's chronic disease risk factors have been observed for up to 4 years after the CHIP intervention in Australasia [30], but a sustainability study is needed in the Western Pacific. A further investigation of the acceptability of the specific nutritional recommendations of the CHIP intervention in the Western Pacific setting is also required.

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