Original Article

Reduction of abdominal fat and chronic disease factors by lifestyle change in migrant Asian Indians older than 50 years

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The objective of this study was to assess the impact of a group diet and physical activity intervention on body composition, blood lipid profile and insulin resistance in migrant Asian Indian volunteers. Total body and abdominal fat, waist girth, serum glucose, insulin and lipids were measured one month before and immediately prior to an intervention designed to encourage increased physical activity and improved diet. Measurements were repeated after a 5-month period of altered exercise and dietary habits. Over this period monthly group education sessions were held on diet and physical activity and the importance of lifestyle changes to reduce risk factors for chronic disease. Forty one (21M, 20F) volunteers (aged >50 y) were recruited from Asian Indian community groups in urban Auckland, New Zealand. Body weight, total and percentage body fat, waist girth and abdominal fat decreased in men following the intervention ($p<0.006$) while these changes were not statistically significant in women. In both men and women high density lipoprotein (HDL) levels increased and LDL and total cholesterol/HDL ratio decreased ($p<0.002$) without changes in serum glucose, insulin and triglycerides. Reduction in systolic and diastolic blood pressure was associated with an increase in HDL cholesterol in women ($r=0.63$, $p=0.003$, $r=0.48$, $p=0.03$) but not in men ($r=0.09$, $p=0.69$, $r=0.04$, $p=0.86$). Over a five month period, an Asian Indian community group diet and physical activity intervention resulted in significant reductions in total and abdominal body fat and blood lipid risk factors but not in insulin sensitivity or resistance.

Key Words: Obesity, diabetes, lifestyle, physical activity, dual-energy X-ray absorptiometry

INTRODUCTION

Increased body fat particularly in the abdominal area is a major risk factor for Type 2 diabetes, cardiovascular disease, hypertension and death. Increased abdominal fat is also closely related to increased insulin resistance.[1] An epidemic of Type 2 diabetes and cardiovascular disease is occurring in New Zealand [2-4] and, as in other countries,[5] the epidemic is mainly driven by demographic trends such as an aging population, changes in dietary patterns and physical activity, and the increasing prevalence of overweight and obesity. In 2000 in New Zealand it was estimated that the number of people with Type 2 diabetes is 179,000 and this is projected to rise to 307,000 by 2030.[6] The epidemic most severely affects the Maori and Pacific ethnic groups[4] who represent more than 21% (15 and 6%, respectively) of the population.[7] A survey in South Auckland between 1992 and 1995 recorded the prevalence of known Type 2 diabetes as European 3.4%, Maori 7%, Pacific Islands 6% and in Asian Indian more than 8%.[4] The Asian population which includes Chinese and Indian is currently 7% of the total New Zealand population and is predicted to rise to 15% of the total population by 2010.[8] New Zealand Indians are the second largest ethnic group among the New Zealand Asian population. Twenty-six percent of the usually resident NZ Asian population in 2001 identified as Indian or Fijian Indian.[9]

It has been shown in many populations that morbidity and mortality is increased at high levels of BMI [5] but the lack of discriminatory power of this measure to differentiate between body fat and lean mass may limit its use as a risk factor.[10] The World Health Organisation (WHO) has classified and shown relationships between BMI and risk of co-morbidities.[11] Asian populations have a higher body fat percentage (BF%) than Europeans at equivalent BMI[12]. Correspondingly, for equivalent risk of obesity-related diseases, a lower BMI than adopted in European populations may be appropriate for Asians. Potential public health BMI action points were identified for Asian Indians that are lower than those recommended for European populations. Cut-offs for other ethnic groups are under active discussion by the WHO and current considerations are that ethnic-specific values be lower for Asian people and higher for Polynesians.

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We have shown that central/abdominal obesity is associated with insulin resistance syndrome and risk factors for the development of Type 2 diabetes and cardiovascular disease independent of ethnicity in young Maori, Pacific and European men [13] and that Asian Indian men have high levels of central fat.[14] Risk factors that are associated with increased body fatness and in particular central obesity [15] include increased total cholesterol, increased triglyceride, increased low density lipoprotein, decreased high density lipoprotein, increased fasting glucose, increased diastolic and/or systolic blood pressure and increased insulin resistance and decreased insulin sensitivity by homeostasis model assessment (HOMA).[16] The aim of the current study was to investigate the effect of lifestyle modification in a cohort of older Asian Indians resident in New Zealand on abdominal obesity, insulin resistance, blood lipid profile and blood pressure.

METHODS

Subjects

Asian Indians aged >50 years and resident in the urban Auckland area were recruited for this study by personal contact with community organisations. Exclusion criteria were total knee or hip joint replacement, lifting weights more than once per week, pregnancy, major medical conditions (such as diabetes or cancer), and medication which could affect body composition (such as oral steroids). The study was approved by the Auckland Regional Ethics Committee and all participants provided written informed consent.

Protocol

Study participants visited the Department of Surgery Body Composition Laboratory on three occasions. On each visit, after overnight fasting, body weight and height were measured, a dual-energy X-ray absorptiometry (DXA) scan was performed, blood pressure was measured twice after lying for at least 15 minutes using a mercury sphygmomanometer and a stethoscope and a blood sample was obtained. The second visit occurred approximately one month after the first and immediately prior to a group intervention session designed to encourage increased physical activity and improved diet. This visit was included in the study design so that the effect of recruitment to the study without intervention and internal validity could be assessed. The final visit occurred 5 months following the introduction of the intervention.

Anthropometry and body composition

Height and weight were measured with participants wearing light clothing or standard hospital gown and no shoes. An estimated clothing weight was subtracted. Body composition (fat, fat-free soft tissue and bone mineral content) was measured by DXA (model DPX+ with software version 3.6y, GE-Lunar, Madison, WI). Fat-free mass (FFM) was calculated as the sum of fat-free soft tissue and bone mineral content. Percent body fat was calculated as 100 x fat mass/(fat mass + FFM). The whole-body DXA scans were analysed for abdominal fat using a region of interest positioned with the lower horizontal border on top of the iliac crest and the upper border approximately parallel with the junction of the T12 and L1 vertebrae.[17] The sides of this region were adjusted to include the maximum amount of abdominal tissue. Percent abdominal fat was defined as the ratio of abdominal fat mass to total tissue mass in the region of interest expressed as a percentage.

Blood biochemistry

Blood serum and plasma samples were stored at -85ºC and analysed in batches. Serum samples were assayed by Diagnostic Medlab Laboratories (triglycerides, HDL, LDL, total cholesterol, and glucose). Lipids were measured by standard Roche-Hitachi methodology and HDL was by direct assay. Glucose was measured by the Roche Hitachi glucose oxidase method. All assays were within target limits specified by the RCPA Quality Assurance Program. Plasma samples were assayed by LabPlus of Auckland City Hospital for insulin levels using the Abbot IMx Insulin assay (list No2A10, Abbot Laboratories, Japan). Insulin resistance and sensitivity were calculated using the HOMA index algorithm [16] derived from the fasting glucose and insulin levels (using a DOS algorithm supplied by Jonathan Levy, Oxford University).

Intervention

An initial group education session to encourage increased physical activity and improved diet was delivered to two community groups at their regular meeting. The messages and handouts were given to everyone at the meetings irrespective of their participation in the study. Two booklets, *Good Health*, *is in your hands*! *A food guide for Indian Adults in New Zealand* published by the National Heart Foundation of New Zealand, which included a Hindi translation, and *Healthy Living*, *Putting the squeeze on lifestyle disease for NZ Indian people* written by Elaine Rush especially for this study, were also provided. Those who had undergone the two baseline measurements were provided with individually- marked waist threads (to assess changes in girth), pedometers and diaries to record number of steps taken daily. Following this initial session, monthly group sessions with handouts were held which included a cooking demonstration with encouragement to use canola oil in place of other oils, to remove fat from meat, and to increase fish consumption; a pedometer club; and "weigh-ins". Canola oil has recognised health benefits due to its α-linolenic acid content.[18]

Statistical analysis

Statistical analyses were performed by SPSS Version 14 (SPSS Inc, IL). Student's *t* and paired-t tests were used to assess differences between males and females, differences between baseline measurements and the effect of the intervention. Pearson correlation coefficients were used to assess associations between body composition changes and blood biochemistry. $p < 0.05$ was chosen to represent statistical significance. Results are presented as means ± SD.

RESULTS

Twenty women (age 59 ± 8 y) and 21 men (age 62 ± 8 y) completed the study. The two sets of baseline measurements made before the intervention are reported in Table 1 separately by sex. Women were shorter, weighed less and had higher total and percentage fat than men. They

Table 1. Pre-intervention baseline measurements one month apart in 20 female and 21 male Asian Indians.

	Female					Male				
	Baseline 1		Baseline 2		*p*	Baseline 1		Baseline 2		*p*
Body weight (kg)	63.5	(8.6)	63.1	(8.2)	0.22	72.2	(10.3)	71.5	(10.2)	0.07
Body fat (kg)	28.2	(6.2)	27.7	(6.1)	0.09	23.3	(6.1)	22.8	(6.2)	0.27
Body fat (%)	44.3	(4.8)	43.7	(4.8)	0.06	31.8	(4.9)	31.5	(5.1)	0.41
Waist (cm)	88.9	(9.0)	88.2	(8.8)	0.38	95.6	(8.9)	94.8	(9.0)	0.12
Abdominal fat (kg)	2.64	(0.70)	2.61	(0.74)	0.64	2.57	(0.80)	2.55	(0.72)	0.63
Abdominal fat (%)	47.9	(5.5)	47.3	(6.0)	0.21	41.7	(4.4)	41.4	(5.3)	0.50
Cholesterol (mmol/L)	5.4	(1.0)	5.5	(1.1)	0.76	5.1	(1.2)	4.9	(0.8)	0.12
HDL (mmol/L)	1.42	(0.43)	1.33	(0.38)*	0.024	1.10	(0.33)	1.02	(0.22)	0.08
LDL (mmol/L)	3.3	(1.1)	3.5	(1.0)	0.12	3.2	(0.9)	3.2	(0.7)	0.84
Total/HDL	4.17	(1.54)	4.49	(1.67)	0.05	4.99	(1.73)	5.00	(1.27)	0.92
Triglycerides (mmol/L)	1.4	(0.7)	1.5	(0.5)	0.37	1.7	(1.1)	1.5	(0.6)	0.25
Glucose (mmol/L)	5.7	(0.7)	5.7	(0.9)	0.98	5.1	(0.9)	5.1	(0.6)	0.98
Insulin (pmol/L)	80.3	(49.8)	86.3	(70.2)	0.73	75.1	(33.5)	84.7	(51.5)	0.28
HOMA B%	94	(41)	105	(71)	0.45	122	(5.8)	122	(48)	0.99
HOMA S%	97	(76)	88	(62)	0.58	90	(52)	91	(63)	0.85
Systolic (mmHg)	131	(20)	129	(21)	0.58	131	(18)	126	(16)	0.16
Diastolic (mmHg)	78	(11)	75	(11)	0.07	78	(8)	75	(9)	0.29

* Baseline 1 significantly different to baseline 2, $p<0.05$. Data are mean (SD)

Table 2. Measurements before and after lifestyle intervention in 20 female and 21 male Asian Indians.[a]

	Female				Male			
	Before	After	Change	*p*	Before	After	Change	*p*
Weight (kg)	63.3(8.4)	62.1(7.9)	-1.2(2.5)	0.06	71.8(10.2)	70.3(9.8)	-1.5(1.8)	0.001
Body fat (kg)	27.9(6.1)	26.9(5.4)	-1.0(2.3)	0.066	23.0(6.1)	21.9(6.2)	-1.1(1.4)	0.002
Body fat (%)	44.0(4.7)	43.1(4.0)	-0.9(2.2)	0.09	31.7(4.9)	30.6(5.5)	-1.1(1.6)	0.004
Waist girth (cm)	88.9(9.0)	88.0(8.8)	-0.8(3.5)	0.30	95.6(8.9)	93.6(7.6)	-2.0(2.9)	0.005
Abdominal fat (kg)	2.62(0.71)	2.52(0.63)	-0.10(0.22)	0.10	2.61(0.75)	2.47(0.77)	-0.14(0.22)	0.006
Abdominal fat (%)	47.5(5.6)	46.5 (4.9)	-1.0(2.2)	0.056	41.6(4.7)	40.3(6.0)	-1.3(2.6)	0.031
Total Cholesterol (mmol/L)	5.4(1.0)	5.4(1.0)	-0.1(0.7)	0.67	5.1(1.0)	4.8(0.9)	-0.2(0.9)	0.22
HDL (mmol/L)	1.37(0.40)	1.50(0.4)	+0.13(0.15)	0.001	1.09(0.30)	1.20(0.18)	+0.11(0.26)	0.06
LDL (mmol/L)	3.4(1.0)	3.2(1.0)	-0.2(0.6)	0.11	3.2(0.1)	2.9(0.7)	-0.3(0.7)	0.06
Total/HDL	4.33(1.57)	3.84(1.22)	-0.49(0.49)	<0.001	4.92(1.48)	4.07(0.95)	-0.86(1.07)	0.002
Triglycerides (mmol/L)	1.5(0.6)	1.6(0.8)	+0.1(0.3)	0.17	1.5(0.1)	1.4(0.1)	-0.2(0.6)	0.28
Glucose (mmol/L)	5.7(0.7)	5.8(1.2)	+0.1(0.8)	0.41	5.1(0.1)	5.1(0.1)	+0.1(0.9)	0.70
Insulin (pmol/L)	83.3(47.7)	76.1(29.9)	-7.3(42.3)	0.46	79.9(8.4)	75.5(8.0)	-4.4(38.1)	0.60
HOMA B(%)	99(50)	96(39)	-3(40)	0.71	121(11)	117(14)	-3(71)	0.83
HOMA S(%)	93(59)	78(28)	-15(39)	0.13	89(12)	83(7)	-6(38)	0.45
Systolic (mmHg)	131(19)	126(17)	-4(14)	0.19	128(3)	125(4)	-3(13)	0.25
Diastolic (mmHg)	78 (7)	75(9)	-3(6)	0.020	76(2)	75(2)	-2(7)	0.36

Data are mean (SD). [a] Measurements 'Before' are the average of two baseline measurements.

also had a higher HDL level (p=0.014) but not total cholesterol or total/HDL ratio than men. LDL was not different between sexes. Men had higher β cell function (HOMA B%) and lower insulin sensitivity (HOMA S%) than women.

The two baseline measurements were not significantly different and were therefore averaged and the average baseline values were compared with the post-intervention measurements separately by sex (Table 2). Following the 5-month intervention there was a strong tendency for weight, body fat, girth and abdominal fat to decrease. Decreases in total cholesterol were mainly related to an increase in HDL and therefore a decrease in the total/HDL ratio in the order of 20%. Changes were more pronounced in the male group but overall on average the 41 participants lost 1.3 kg of weight and 1.1 kg of this was body fat which meant that the percentage fat of the group was reduced by 1%. This corresponded with an average reduction of 1 cm in waist circumference. Triglycerides and blood pressure did not change and insulin sensitivity and resistance showed a tendency to decrease. Reduction in systolic and diastolic blood pressure was associated with an increase in HDL cholesterol in women (r=0.63, p=0.003, r=0.48, p=0.03) but not in men (r=0.09, p=0.69, r=0.04, p=0.86).

The most popular reported changes in lifestyle were related to diet. Changing the cooking oil to canola (all participants), eating more cereals, removing the skin from chicken before cooking and drinking water when thirsty were reported by more than 90% of participants. Twenty-four reported alcohol consumption at baseline, all of whom decreased their consumption following the intervention. Fish consumption increased in only three cases but this recommendation was not applicable to everyone as 9 (7F, 2M) of the 41 were lacto-ovo vegetarian.

DISCUSSION

In a group of older Indian people, lifestyle changes mediated by group education and individual follow-up to increase physical activity and modify diet resulted in a reduction in whole body and abdominal fat, improvements in the lipid profile and therefore reduced risk for cardiovascular disease. Beneficial changes occurred in both women and men but tended to be greater in men. A number of gender-specific differences in biology, behaviour and social activities may explain this difference but were not measured in this study. Of the 41 who completed the study 8 women and 4 men (29%) had a fasting blood glucose above 5.6 mmol/litre at both entry and post-intervention. This level according to the American Diabetes Association criteria [19] defines an individual as having impaired fasting glucose. The relatively high insulin resistance and central fatness [20] of this population could mean that the capacity for favourable adaptation of the secretion of insulin and therefore reduction of other metabolic risk factors with lifestyle change is limited.[21] The relatively high level of serum triglycerides (7 had triglyceride levels more than 2 mmol/L) may be related to the relative vegetarian lifestyle of this population - a high carbohydrate diet is known [22] to be associated with raised triglyceride levels.

Despite the high risk, average age of 60y, relatively high carbohydrate diet and "metabolic resistance" in this community, changes were made in the group statistics for a relatively small investment in time. Other studies have shown successful lifestyle interventions in older women [23] and group [24, 25] settings. The nature of the group involvement also adds to the potential for the changes to be sustained by the volunteers, the rest of the community and families without the involvement of the researchers.

The question of how much of the high risk for lifestyle disease amongst the Indian population is genetic, foetal in origin or related to diet and physical activity levels has been discussed by Yajnik [26] but cannot be answered by this study. Since the diet and activity modifications were introduced as part of a package we are not able to separately quantify the effects of these lifestyle changes. We have shown that lipid and blood pressure risk factors in an older, high risk group of Indian migrants can be modulated by a combination of individual choices of changes in diet and activity. The urgent need to move from contemplation to action for the Indian population has been identified by Reddy and colleagues in one [27] of a series of recent articles about chronic disease in *The Lancet*. Modifications to the environment including policy, health infrastructure, education and actions at the individual and group level are called for.

While group changes are reported it is the individual that changes behaviour within a supportive environment. To be practical, individuals require a choice of different modifications that they can make. Throughout the duration of the intervention in this study it was emphasised that small, but sustainable change was the way to make a lifetime difference – not just for themselves but also for their children and grandchildren. In this holistic approach many small changes have summed to make a significant change in apparent group risk. Anecdotally it was reported that changes were adopted by others in the community group and wider families. This community has undertaken to continue to work together to maintain these lifestyle changes which may lead, over the longer term, to reduced incidence of chronic disease such as type 2 diabetes and cardiovascular disease.

The challenge is to find ways of implementing change at the community level and this study has demonstrated that a tailored group approach has this potential.

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AUTHOR DISCLOSURES

Elaine C Rush, Vishnu Chandu and Lindsay D Plank, no conflicts of interest.

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Original Article

Reduction of abdominal fat and chronic disease factors by lifestyle change in migrant Asian Indians older than 50 years

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生活型態改變降低 50 歲以上亞洲印度人移民腹部脂肪與慢性疾病因子

本研究目的為評估一個團體飲食與體能活動的介入，對自願的亞洲印度移民之身體組成、血脂肪以及胰島素阻抗之影響。在介入活動（鼓勵增加體能活動及改善飲食開始）前一個月及即將開始前測量受試者的總脂肪以及腹部脂肪、腰圍、血糖、胰島素及脂質。在改變運動以及飲食習慣介入活動之後五個月，重複這些測量。在介入期間，每個月有一次團體教育課程，針對飲食與體能活動及降低慢性疾病危險因子之生活習慣改變的重要性的。從紐西蘭奧克蘭城市亞洲印度人社區招募 40 名（21 名男性，20 名女性）自願者（年齡>50 歲）。介入之後，男性的體重、總脂肪及體脂率、腰圍與腹部脂肪顯著降低(p<0.006)，女性則沒有統計顯著的改變。男女性的高密度脂蛋白(HDL)量均上升，LDL 及總膽固醇/HDL 比值則下降(p<0.002)，血糖、胰島素及三酸甘油酯則沒有改變。女性收縮壓及舒張壓降低與 HDL 上升具相關性(r=0.63，p=0.003，r=0.48，p=0.03)，但在男性則沒有(r=0.09，p=0.69，r=0.04， p=0.86)。五個月的亞州印度社區團體飲食與體能活動介入，能顯著降低總脂肪、腹部脂肪與血脂危險因子，但對胰島素敏感性或阻抗性則沒有作用。

關鍵字：肥胖、糖尿病、生活型態、體能活動、雙能量 X 光吸收光儀。