Clinical and Experimental Medical Sciences, Vol. 1, 2013, no. 3, 97 – 109
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Weight Loss and Ethnicity: A Cohort Study of the Effects Induced by a Very Low Calorie Diet

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Abstract

Background: We aimed to determine whether British Asians of Indian or Pakistani descent differed in their baseline characteristics and in response to a 12 week very low calorie diet (VLCD). We then assessed if changes in weight and waist circumference in response to a VLCD differs between Asians and Caucasians.
Methods: Weight loss was achieved using a nutritionally complete (energy deficient), very-low-calorie diet (VLCD) with an average daily intake of 550kcal (50g protein,50g carbohydrate, mean 17g fats and ≥100% recommended daily allowances (RDA) for key vitamins and minerals), alongside a unique behaviour change programme (LighterLife –LL). Data from Asians recruited onto LL total in 2009/2010 for whom 12 week weight change information were available were analysed. Waist circumference data were available for a subset of Asians. These were age, body mass index, and gender matched to a Caucasian population and compared by independent t-test.
Results: No differences were observed between the Indian and Pakistani group for baseline measurements or weight change at 12 weeks. Caucasians had a greater percent excess body weight loss (%EBWL) than Asians at 12 weeks (72.4 ± 22.1

vs 48.9 ± 18.0, p <0.0001). However, Asians had a greater waist circumference reduction per kilogram of weight loss when compared to Caucasians (1.16 ± 0.7 vs 0.95 ± 0.3, p = 0.037). Conclusions: It appears that despite a greater %EBWL for Caucasians, Asians had a greater waist circumference reduction per kilogram of weight loss using a VLCD approach for a 12 week period.

Keywords: Weight loss, ethnicity, obesity, waist circumferences

Background

Data from the 1992 Singapore National Health Survey clearly demonstrated that despite living under similar socio-economic conditions and having similar diets, Chinese, Malay and Asian Indians differed in the prevalence of obesity and type 2 diabetes (T2D) (Tan et al, 1999); where Asian Indians had the greatest prevalence of T2D of the three groups (Tai et al, 2000). Similarly, it has been reported that for the same body mass index (BMI), the body fat percent in Asian Indians is higher than Caucasians as well as other Asian populations (Rush et al, 2009).

Evidence also suggests that Asian Indians store a greater proportion of their body fat in the visceral compartment which has been associated with greater risk of T2D and cardiovascular disease risk (Anjana et al, 2004). Due to this, the World Health Organisation (WHO) recommends using lower BMI values to define a healthy BMI for Asians than for Caucasians. Hence, for Asian populations a BMI of 23-25 kg/m^2 is considered overweight and a BMI >25 kg/m^2 is considered obese (WHO, 2004).

To date, there is no evidence for the use of alternative dietary approaches to weight loss such as very low calorie diets (VLCD) and behavioural therapy in this population. We therefore investigated the effectiveness of VLCDs in Asians self-referred to the LighterLife Total VLCD programme. We aimed to determine if self-reported Indian and Pakistanis differ in their baseline characteristics and in response to a 12 week VLCD. We also investigated changes in weight and waist circumference in response to a VLCD between Asians and age, BMI and gender-matched Caucasians.

Methods

Study Participants

Participants were self-referred and were asked to have their GPs or healthcare provider assess their medical status using a standardised form provided by LighterLife.

Participants were eligible if they were Asians recruited onto LL Total VLCD in 2009/2010 for whom weight at baseline and 12 week weight change information were available. Baseline demographics and 12 week changes in weight were compared for Indians and Pakistanis.

Dietary Intervention

For those individuals who were eligible, weight loss was achieved using a nutritionally complete (energy deficient), VLCD. LighterLife Total is a commercial weight-management programme for individuals with BMI≥30. It offers the opportunity to lose weight and to identify personal psychological motivation for over-consumption, thereby enabling participants to develop robust strategies for more successful weight management in the future.

The VLCD provides an average daily intake of 550kcal (50g protein, 50g carbohydrate, mean 17g fats and ≥100% recommended daily allowances (RDA) for vitamins and minerals including Vitamins A, C, D, E, K, thiamine, riboflavin, niacin, B6, B12, folic acid, biotin, and pantothenic acid, calcium, phosphorous, iron, zinc, magnesium, iodine, potassium, sodium, copper, manganese, selenium, molybdenum, chromium, chloride, fluoride).

Participants undertook the VLCD alongside a unique behaviour-change programme developed specifically for weight management in the obese. This is informed by concepts from cognitive behavioural therapy and transactional analysis (transactional cognitive behavioural therapy – TCBT®) and addiction/change theory (Buckroyd and Rother, 2007; Cooper etal, 2003; DiClemente, 2003; Leach, 2006). It is delivered in small, single-sex, weekly groups by LighterLife weight-management counsellors who are specifically trained in the facilitation of behaviour change.

Abstinence from conventional food on the LighterLife Total VLCD provides patients with the clarity of explicit boundaries around food and drink. Coupled with the behaviour-change work done in group, this helps patients to create a reflective space in which to explore the reasons for their overeating and develop new strategies – both practical and psychological – for long-term weight management.

Statistical Analysis

All variables were assessed for normality. Those variables which were not normally distributed were log transformed. Baseline comparisons were carried out by independent t-test for continuous data and by Chi square for categorical data.

Waist circumference data were available for a subset of Asians. These were age, BMI and gender matched to a Caucasian population and compared by independent t-test. The Caucasian control group was matched with each individual in the Asian group within the tolerance of ±1 BMI unit and an exact match for age and gender (89 individuals). For those individuals in the Asian group who did not have a corresponding match, the BMI tolerance was increased up to ±3 BMI units and an exact match for age and gender were obtained. Finally the, twelve remaining individuals in the Asian group required tolerances of ±3 BMI units, and ±2 years for age for matching. Individuals were not matched for waist circumference.

Excess weight for Caucasians was calculated based on an ideal BMI of 25 kg/m^2 while excess weight for Asians was calculated based on an ideal BMI of 23 kg/m^2. Data were analysed using SPSS for Windows (version 15.0) (SPSS Inc., Chicago, IL, USA).

Results

Of the 1407 Asians recruited onto LL Total in 2009/10, 12 week weight change data were available for 510 individuals. Of these participants, 128 were Pakistani (113 females) and 382 were Indian (316 females). Baseline demographics for these two groups are presented in Table 1.

Changes in weight and %EBWL at 12 weeks are presented in Table 2.

Table1: Baseline demographics for Asians who underwent LL total (n=510).

	Indian	Pakistani	P
Age	37.0 ±10.6	36.9 ± 10.0	0.947
Weight (kg)	96.4 ± 17.8	98.6 ± 16.0	0.197
Height (m)	1.63 ± 0.09	1.64 ± 0.08	0.300
BMI (kg/m^2)	36.2 ± 4.7	37.0 ± 6.1	0.180
Excess weight (kg)	35.2 ± 14.6	36.8 ± 12.7	0.263
Gender males females	 66 316	 15 113	 0.136

BMI – Body mass index. Data presented as means ± standard deviation. Excess weight was calculated using a BMI of 23 kg/m^2.

Table 2. Comparison of 12 week changes for Indians compared to Pakistanis.

	Indian	Pakistani	P
Weight loss (kg)	-14.6 ± 5.7	-15.6 ± 6.9	0.148
% EBWL	45.0 ± 18.4	44.5 ± 18.4	0.800

% EBWL – percent excess body weight loss. %EBWL was calculated based on a BMI of 23 kg/m^2. Data presented as means ± standard deviation.

Of the 510 Asian individuals who had weight change data at 12 weeks, waist circumference data were available for 101 (83 females, 18 males) of these. As there were no differences at baseline, Indians and Pakistanis were joined to form an Asian group which was compared to 101 age, BMI and gender-matched Caucasians. Caucasians were significantly taller, and heavier at baseline, however, Asians had significantly greater excess weight. Significantly greater excess weight in Asians was only observed in women, although a similar trend was observed in men (Table 3).

Table 3: Comparison of baseline measurements for Asians versus Caucasians (n= 202)

	All (n = 202)			Men (n = 36)			Women (n = 166)		
	Asian	Caucasian	P	Asian	Caucasian	P	Asian	Caucasian	P
Age (y)	36.6 ± 11.4	36.6 ± 11.3	0.977	39.8 ± 10.9	39.9 ± 10.6	0.950	35.9 ± 11.4	35.9 ± 11.3	0.996
Height (m)	1.64 ± 0.1	1.67 ± 0.1	0.002	1.76 ± 0.1	1.81 ± 0.1	0.018	1.61 ± 0.1	1.64 ± 0.1	<0.0001
Weight (kg)	96.2 ± 17.4	100.9 ± 18.5	0.045	117.0 ± 21.5	126.5 ± 22.0	0.182	91.7 ± 12.6	95.4 ± 12.0	0.040
BMI (kg/m^2)	35.8 ± 4.4	35.9 ± 4.6	0.854	37.8 ± 5.8	38.5 ± 6.1	0.728	35.4 ± 4.0	35.4 ± 4.0	0.999
Waist circ (cm)	107.9 ± 14.3	109.5± 13.9	0.415	125.6 ± 14.9	125.4 ± 16.3	0.961	104.0 ± 10.9	106.1± 10.6	0.227
Excess weight (kg)	34.5 ± 13.6	30.8 ± 14.2	0.012	46.0 ± 19.0	44.3 ± 19.7	0.182	32.1 ± 10.8	27.9 ± 10.7	0.004

BMI – Body mass index; circ - circumference. Excess weight was calculated based on a BMI of 23 kg/m^2 for the Asian group and a BMI of 25 kg/m^2 for the Caucasian group. Data presented as means ± standard deviation.

At 12 weeks, an average weight loss of 15.7 ± 5.6 kg for the Asians and 20.2 ±5.4 kg in the Caucasians (p <0.0001) was observed. Significance in greater weight loss was found in Caucasian versus Asian women (p<0.0001) as was the amount of waist circumference reduction (p = 0.001). A similar trend was observed for the overall population (Table 4). The amount of waist circumference reduction per kilogram lost was greater in Asians than Caucasians (Table 4).

Table 4: Comparison of changes in measurements at 12 weeks for Asians versus Caucasians.

	All (n = 202)			Men (n = 36)			Women (n = 166)		
	Asian	Caucasian	P	Asian	Caucasian	P	Asian	Caucasian	P
Weight loss (kg)	15.7 ± 5.6	20.2 ± 5.4	<0.0001	21.4 ± 6.7	24.4 ± 8.2	0.229	14.5 ± 4.6	19.3 ± 4.2	<0.0001
Weight loss (%)	16.3 ± 4.9	26.5 ± 8.1	<0.0001	18.1 ± 4.0	18.6 ± 7.3	0.782	15.9 ± 5.0	28.1 ± 7.3	<0.0001
EBWL (%)	48.9 ± 18.0	72.4 ± 22.1	<0.0001	49.3 ± 13.2	58.7 ± 14.7	0.050	48.9 ± 19.0	75.4 ± 22.4	<0.0001
Waist circ change (cm)	16.7 ± 8.2	18.4 ± 5.6	0.089	20.6 ± 12.8	16.1 ± 6.7	0.192	15.9 ± 6.6	18.9 ± 5.3	0.001
Amount of waist circ reduction/ kg lost	1.16 ± 0.7	0.95 ± 0.3	0.037	1.05 ± 0.7	0.71 ± 0.4	0.241	1.19 ± 0.74	1.00 ± 0.3	0.066

% EBWL – percent excess body weight loss, circ - circumference. %EBWL was calculated based on a BMI of 23 kg/m^2 for the Asian group and a BMI of 25 kg/m^2 for the Caucasian group. Data presented as means ± standard deviation.

Discussion

Our results suggest that despite a smaller %EBWL after 12 weeks on a VLCD, Asians have a greater reduction in waist circumference per kilogram lost when compared to an age, BMI and gender matched Caucasian population. This is particularly relevant as it is well documented that Asians have greater prevalence of abdominal obesity and cardiovascular health risk(Khoo et al, 2011). Upon reviewing LighterLife database records, it appeared that Asians generally presented with a lower BMI. This suggests Asian patients may be motivated to attempt weight-loss interventions earlier than Caucasians or that they are aware of the different thresholds defining obesity.

Both the Asian and Caucasian groups achieved a body-weight reduction on this programme well in excess of that known to reduce weight-related co-morbidity risk, thus providing evidence to support the effectiveness of VLCDs in obese individuals from minority ethnic groups. Nevertheless, %EBWL was greater for Caucasians than Asians using a VLCD. Interestingly, weight loss has also been found to be greater in Caucasians than Asians in response to weight loss medications such as Orlistat and Sibutramine (Osei-Assibey et al, 2011). It remains unclear as to why there is such a discrepancy between the groups and whether this can be attributed to a biological or environmental factor. Data on insulin resistance in these participants would have been beneficial. It has been observed that Asians have increased prevalence of insulin resistance (Mente et al, 2010) which has been associated with hindering weight loss when compared to individuals with a normal insulin response (Rolland and Broom, 2009). Mente et al (2010) also suggest that lower levels of adiponectin may be involved in the greater insulin resistance observed in Asians. In addition, Khoo et al (2011) argue that differences in insulin sensitivity between different ethnic groups may be due to ethnic-specific sensitivity to the effects of increasing adiposity including body fat distribution, in particular in the visceral area. Evidence also suggests that individuals with an abdominal type of obesity benefited more from weight loss resulting in greater loss in waist circumference and greater improvements in blood glucose and serum lipids than in the gluteal-femoral type of obesity (Vansant et al, 1998; Wabitsch et al, 1992).

This study did have some limitations. The self-reporting nature of the ethnicity data collection, resulting in possible misclassification in mixed-race participants may have underestimated the associations observed. In addition, the inclusion of other factors in our analysis such as; education, income, time of migration (or generation of migration/nation of birth), lifestyle, medication, smoking, alcohol drinking, physical activity would have been beneficial. Also, some allowances for an increase in BMI and age tolerances had to be implemented to allow for the matching of a small subset of individuals. Finally, locating the anatomical waist can be problematic in the obese (Stewart et al, 2010). We accept waist circumference is an imperfect measure of adiposity, and more accurate methods of assessing adiposity and fat distribution may have shed more light on the results observed.

As Kumanyika (2008) suggests, special attention should be paid to weight interventions in ethnic minority populations as there is concern that typical programmes may not be as effective in these populations as compared to others.

In the review by Abate and Chandalia (2003), they explain that the prevalence of diabetes in rural areas of India is 2%, 8% in urban areas such as Chennai, but that Asian Indians who migrate to the UK or other westernised countries have about four times higher prevalence of diabetes compared to those living in India. In the NHS Centre for Reviews and Dissemination (CRD) report 5 (1996), it is made clear that South Asians in the UK experience significantly raised rates of cardiovascular disease. In fact, they report that South Asian populations in the UK overall have approximately 40% higher death rates from coronary heart disease (CHD) than the Caucasian population. Surveys attempting to identify causes of raised mortality in South Asians found a higher prevalence of insulin resistance in this group which is associated with increased rates of obesity and central obesity.

The benefits of lifestyle modification in native South Asians in subjects with impaired glucose tolerance (IGT) was unknown until a prospective randomised controlled trial demonstrated that lifestyle modification (diet and exercise) significantly reduced the incidence of diabetes in Asian Indians with IGT (Ramachandran et al, 2006). There remains scarce evidence of the benefits of lifestyle modification and dietary intervention in native or migrant South Asians in the literature. One exception is the Diabetes Prevention Programme where 4.4% of the study participants were Asians (this small group included people identifying their origins as being from anywhere in Asia, including India or Southeast Asia, in addition to Pacific Islanders) where lifestyle modification was as effective in this group as in other ethnic groups for preventing diabetes (Diabetes Prevention Program Research Group, 2002). Similarly, Balagopal et al (2008) also demonstrated improvements in hyperglycaemia and type 2 diabetes in adults and adolescents by improving dietary patterns (increasing fibre and protein uptake; substituting of white rice with millets, sprouted legumes and vegetables; reducing fat intake and portion sizes.)

The implications for ethnic predisposition to obesity and associated co morbidities needs to be taken into account when designing public health policies and considering best practice for weight management. Fortunately, there have been programmes initiated aiming at increasing awareness and prevention of childhood obesity (CHETNA – Children Health Education Through Nutrition and Health Awareness programme; MARG – Medical Education for Children/Adolescents for Realistic Prevention of Obesity and Diabetes and for Healthy Ageing) (Bhardwaj et al, 2008; World Diabetes Foundation, 2011) but the success of these programmes may be improved if better informed by dietary intervention studies in these specific populations. Hence, we are in agreement with the CRD report (1996) and Avenell et al (2004) who suggest that there is a need for longer term studies in ethnic groups.

Conclusions

To our knowledge, we are the first to report the greater reduction in waist circumference per kilogram lost in Asians as compared to Caucasians. It remains unclear as to whether this relationship is specifc to the use of a VLCD or if it would be observed using other dietary interventions (i.e. low fat, reduced calorie diets) or exercise, and if this relationship remains present in the longer term. Evidence from Chaston and Dixon (2008) suggest that the preferential weight loss of visceral fat using VLCDs may be transient and that this is reduced with greater weight loss and is not related to the method of weight loss. In addition, there are a number of mechanisms linking obesity with cardiovascular disease, several of them associated with insulin resistance (Van Gaal et al, 2006), future work investigating the effects of VLCDs in Asian populations should include both anthropometric and biochemical tests.

Competing interests

CR has received lecture honoraria and has attended national/international meetings as a guest of LighterLife Ltd, UK.

CR, IB and LVG have been involved with other companies with an interest in obesity.

IB, CH, SL, JW and LD are employed by LighterLife Ltd, UK.

LVG is a consultant to LighterLife Ltd, UK.

Acknowledgements

Funding for this study was provided by LighterLife Ltd, UK. We would also like to thank Dr. Ian Macdonald for reviewing this manuscript prior to submission.

References

[1] N. Abate, M. Chandalia, The impact of ethnicity on type 2 diabetes, Journal of Diabetes Complications, **17** (2003), 39-58.

[2] M. Anjana, S. Sandeep, R. Deepa, K.S. Vimaleswaran, S. Farooq, V. Mohan, Visceral and central abdominal fat and anthropometry in relation to diabetes in Asian Indians, Diabetes Care, **27** (2004), 2948-2953.

[3] A. Avenell, J. Broom, T.J. Brown, et al, Systematic Review of the long term effects and economic consequences of treatments for obesity and implications for health improvement, Health Technology Assessment, **8** (2004), 1-458.

[4] P. Balagopal, N. Kamalamma, T.G. Patel, R. Misra, A community-based diabetes prevention and management education program in a rural village in India, Diabetes Care, **31**(2008), 1097-1104.

[5] S. Bhardwaj, A. Misra, L. Khurana, S. Gulati, P. Shah, N.K. Vikram, Childhood obesity in Asian Indians: a burgeoning cause of insulin resistance, diabetes and sub-clinical inflammation. Asia Pacific Journal of Clinical Nutrition, **17 Supplement 1** (2008), 172-175.

[6] J. Buckroyd, S. Rother, Therapeutic groups for obese women: A group leader's handbook, Wiley & Sons Ltd, Chichester, 2007.

[7] T.B. Chaston,J.B. Dixon, Factors associated with percent change in visceral versus subcutaneous abdominal fat during weight loss: findings from a systematic review, International Journal of Obesity, **32** (2008), 619-628.

[8] Z. Cooper, C.G. Fairburn, D. Hawker, Cognitive Behavioral Treatment of Obesity: A clinician's guide, Guildford Press, New York, 2003.

[9] Diabetes Prevention Program Research Group, Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin, New England Journal of Medicine, **346** (2002), 393-403.

[10] C.C DiClemente, Addiction and change**:** how addictions develop and addicted people recover, Guilford Press, New York, 2003.

[11] C.M. Khoo, S. Sairazi, S. Taslim, et al, Ethnicity modifies the relationships of insulin resistance, inflammation, and adiponectin with obesity in a multiethnic Asian population, Diabetes Care, **34** (2011), 1120-1126.

[12] S. Kumanyika, Ethnic minorities and weight control research priorities: Where are we now and were do we need to be?, Preventive Medicine, **47** (2008), 583-586.

[13] K. Leach, The overweight patient: a psychological approach to understanding and working with obesity, Jessica Kingsley Publishers, London, 2006.

[14] A. Mente, F. Razak, S. Blankenberg, et al, Ethnic variation in adiponectin and leptin levels and their association with adiposity and insulin resistance, Diabetes Care, **33** (2010), 1629-1634.

[15] NHS Centre for Reviews and Dissemination, Ethnicity and health: reviews of literature and guidance for purchasers in the areas of cardiovascular disease, mental health and haemoglobinopathies, University of York, York, 1996.

[16] G. Osei-Assibey, Y. Adi, I Kyrou, S. Kumar, K. Matyka. Pharmacotherapy for overweight/obesity in ethnic minorities and white Caucasians: a systematic review and meta-analysis, Diabetes Obesity and Metabolism, **13** (2011), 385-393.

[17] A. Ramachandran, C. Snehalatha, S. Mary, et al, The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1), Diabetologia, **49** (2006), 289-297.

[18] C. Rolland, J. Broom, Diet and food-based therapies for obesity in diabetic patients. In: Barnett AH, Kumar S eds. Obesity & Diabetes, John Wiley and Sons Ltd, Chichester, 2009, 87-102.

[19] E.C. Rush, I. Freitas, L.D. Plank, Body size, body composition and fat distribution: comparative analysis of European, Maori, Pacific Island and Asian Indian adults, British Journal of Nutrition,**102** (2009), 632-641.

[20] A.D. Stewart, A.M. Nevill, R. Stephen, J. Young, Waist size and shape assessed by 3D photonic scanning, International Journal of Body Composition Research, **8** (2010), 123-130.

[21] C.E. Tan, S.C. Emmanuel, B.Y. Tan, E. Jacob, Prevalence of diabetes mellitus and ethnic differences in cardiovascular risk factors: The Singapore national health survey, Diabetes Care, **22** (1999), 241-247.

[22] E.S. Tai, S.C. Lim, S.K. Chew, B.Y. Tan, C.E. Tan, Homeostasis model assessment in a population with mixed ethnicity: the 1992 Singapore National Health Survey, Diabetes Research in Clinical Practice, **49** (2000), 159-168.

[23] L.F. Van Gaal, I.L. Mertens, C.E. De Block, Mechanisms linking obesity with cardiovascular disease, Nature, **444** (2006) 875-88.

[24] G. Vansant, C. Den Besten, J. Weststrate, P. Deurenberg, Body fat distribution and the prognosis for weight reduction: preliminary observations, International Journal of Obesity, **12** (1998), 133-140.

[25] M. Wabitsch, H. Hauner, A. Böckmann, W. Parthon, H. Mayer, W. Teller, The relationship between body fat distribution and weight loss in obese adolescent girls, International Journal of Obesity, **16** (1992), 905-911.

[26] World Diabetes Foundation, Primary prevention in Indian schools. http: www.worlddiabetesfoundation.org/composite-1279.htm. (Accessed August 2011).

[27] World Health Organisation, Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies, Lancet, **363** (2004), 157-163.

Received: May, 2012