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Original Articles

Managing Obesity in a Paediatric Clinic: Local Experience

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Abstract The rising prevalence of childhood obesity and the associated complications confer significant burden on health care system. The study aims to investigate the probable risk factors of obesity in Hong Kong children and the effectiveness of management in an ambulatory care setting. The dietary and activity pattern in the group of obese children and adolescents aged 7 to 18 years old were compared to a non-obese group. We found that the obese children consumed more calorie dense food items, had less moderate or vigorous exercise and spent more time in television viewing. Parental obesity was also a significant factor. Intervention in an ambulatory clinic did improve the degree of obesity, the eating and lifestyle behaviour in the group reviewed in the study. However most of the children referred to the clinic had already defaulted and some of the studied patients developed new complications of obesity. Thus implementation of primary and secondary preventive measures in the community targeting on the probable risk factors is likely an important alternative to combat the problem of obesity in children and adolescents.

Key words Adolescents; Children; Obesity

Introduction

Obesity is associated with increased frequency of metabolic complications including hyperlipidaemia, abnormal glucose tolerance, hypertension, left ventricular hypertrophy, sleep-disordered breathing, liver, menstrual and orthopaedic problems.[1,2] The morbidities of obesity are well studied in adult populations. As the prevalence of obesity in children and adolescents rises throughout the world,[1] these adult diseases are increasingly reported in the childhood population. Moreover, it has been observed that childhood obesity tends to track into adulthood.[3] Thus childhood obesity confers immense adverse effect on the health of the population and the economy of the society.[4]

In Hong Kong, a similar trend of rising prevalence of childhood obesity is observed.[5] Obesity has been one of the commonest problems referred to the outpatient clinic in the hospital. With the worsening problem of childhood obesity, the paediatricians are now confronted with greater load of patients with established complications like hypertension and type 2 diabetes mellitus.[2,6]

Genes account for about 40-70% variability in fat mass and the heritability of body mass index was estimated to be around 40%.[7,8] However, it is believed that environment is the causative factor of the epidemic of obesity. International studies demonstrated that energy content of diet and the sedentary lifestyle are the major contributing factors to the rising prevalence of obesity in children.[9] Excessive sweetened soft drinks, fast food consumption, television viewing and computer use are among the important factors.[10-12]

Various interventions such as exercise program and behaviour modification had been studied in Western population. Epidemiological study in Hong Kong was

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sparse. This study aims to investigate the probable risk factors of obesity in Hong Kong children and the effectiveness of a program of counselling sessions in an ambulatory care setting in management of the problem.

Methods

The population studied included an obese and a non-obese group of children and adolescents aged from 7 to 18 years. Children become more independent after they enter Primary school. Many have the opportunity to choose their food items in meals or snacks. They also are attracted to television and computer programs. Hence children of age 7 and above were selected to study the association of dietary pattern, activity levels and parental obesity with childhood obesity.

International experts support the use of body mass index (BMI) for assessment of childhood obesity. In United Kingdom, obesity is diagnosed as BMI at or greater than 95th percentile.[13] In this study, the BMI cutoff of 97th percentile is used to define obesity in both sexes as this is provided in our local charts.[14]

The obese group was recruited from those who attended the Obesity Clinic in Caritas Medical Centre. Most were referred from the Student Health Service and some were picked up by the colleagues in the Department. Those with syndromal diseases such as Prader Willi syndrome, chronic illness or those receiving regular medication were excluded to avoid the effects on growth parameters and capacity of physical activities. The non-obese group was selected from those who attended the paediatric clinic in Caritas Medical Centre and the Our Lady of Maryknoll Hospital or those admitted into hospital for simple medical problems like febrile illness. The study subjects were asked to fill-in a questionnaire on the dietary intake including the consumption of soft drinks and calorie dense food items such as chips and ice-cream, physical activity, television and computer use in recent one month.

The questionnaire also included information on parental heights and weights. These were self-reported and measurements were confirmed in the clinic if they turned up in the clinic. The definition of adult obesity as BMI at or greater than 25 in Asian population[15] was used to indicate parental obesity.

The obese children and adolescents were managed in the Obesity Clinic in Caritas Medical Centre. This is a combined clinic consisting of consultation and counselling by the paediatricians and physiotherapists. In-door physical exercises such as stepping exercise supervised by the physiotherapists were arranged in each clinic visit. Follow-up was scheduled every 3 to 4 months.

The main approach was to encourage the patients to modify their lifestyle to adopt a healthy diet and increase physical activities. They were advised to avoid extra calorie intake rather than reducing basic requirement. Each patient was encouraged to have vegetable and fruits everyday, to slowly cut down amount of soft drinks and replace with plain water and to cut down calorie dense food items. Portion size of rice and meat was also attended to. Advice from dietitian was offered to many of them, especially if they had problems like hyperlipidaemia. The children were encouraged to pick up exercises that were of interest to them and to incorporate them into their leisure time schedule especially in weekends and holidays. If they did not have access to outdoor activities or had not yet developed interest in exercise, home exercise as suggested by the physiotherapist was encouraged. They were advised to limit the total time spent on television viewing and computer use to less than 2 hours a day.

Each patient was given a log book to record weight, height, BMI, waist circumference and blood pressure measured in the clinic. Percentile charts on weight and BMI were also included. They were also encouraged to weigh at home and record in the log book every month. One to two goals on diet modification and increasing physical activity were set in each clinic visit. The date setting the goal was recorded and the patient then signed in the log book. When the goal was achieved as reviewed at follow-up, a sticker or a symbol was put down in the log book to indicate success. Reasons of failure to achieve the set goal would be explored and ways to overcome the obstacle were discussed.

Other complications of obesity including history of snoring during sleep and menstrual problem were looked into during the consultation. Fasting blood samples of lipid profile, glucose, liver and renal function tests and urine albumin were studied for those who were older than 10 years old. Oral glucose tolerance test was arranged when they had acanthosis nigricans or family history of diabetes. Further investigations such as cardiac echocardiogram were performed when indicated.

Variables including consumption of soft drinks and calorie dense food items, physical activity, television and computer use and parents' BMI were compared between the obese and non-obese groups to study the relationship of dietary pattern, activity levels and parental adiposity with childhood obesity. The intensity of activity was classified

into light, moderate or heavy, in accordance to the intensity code.[16] A simplified version was used in this study (Table 1).

To assess the effectiveness of a combined Paediatric and Physiotherapy clinic in managing the problem of obesity in children and adolescents, the BMI z-score[14,17] at the first consultation was compared to the BMI z-score after more than one year of consultation in the clinic. They were asked to fill-in the questionnaire again at the time of the study period. This allowed us to see whether the patients had made changes in their diet and activity pattern.

Statistics

The statistical analysis was performed by using the NCSS software program. The t-Test was used to assess the differences of the variables between the obese and non-obese groups. The Chi-square test would determine the difference in group proportions. Comparison of the change in BMI z-score, diet and activity parameters after intervention in the Obesity Clinic was performed using the Paired t-Test and the non-parametric Wilcoxon Signed-Rank Test.

The level of significance was set at p-value <0.05.

The parents of the participants gave written consent at the time of filling-in the questionnaire. The study was approved by the Clinical Research Ethics Committee, Kowloon West Cluster, Hospital Authority, Hong Kong.

Results

Altogether 188 subjects (105 boys and 83 girls) in the obese group (BMI z-score 1.90 to 3.38) and 194 subjects (93 boys and 101 girls) in the non-obese group (BMI z-score -1.66 to 1.87) were recruited in the Caritas Medical Centre and Our Lady of Maryknoll Hospital from January 2000 to March 2006. The demographic characteristics of the two groups were shown in Table 2.

Table 3 summarised the relationship of the variables in the obese and non-obese groups. Obese children and adolescents consumed more calorie dense food items (mean 2.25 items per week in the obese group, mean 1.7 items per week in non-obese group, p=0.03). Consumption of

Table 1 Intensity of exercises

Light	Moderate	Heavy
Walking	Basketball	Running
Cycling for pleasure	Badminton	Walk stairs
Table-tennis	Dancing	Swimming (freestyle)
Volleyball	Swimming leisure	Soccer
Fishing	Skateboard	Handball

Table 2 Demographic characteristics of the obese and non-obese groups

	Obese group n=188	Non-obese group n=194	p-value
Sex distribution			
Male	105	93	
Female	83	101	
Male: Female	1.26:1	0.92:1	0.14
Age in year: mean (SD)			
Male	11.1 (2.6)	11.2 (2.4)	0.80
Female	11.6 (2.6)	11.0 (2.7)	0.18
All	11.3 (2.6)	11.1 (2.6)	0.53
BMI z-score: mean (SD)			
Male	2.33 (0.27)	0.15 (1.04)	<0.05
Female	2.46 (0.31)	0.36 (0.81)	<0.05
All	2.39 (0.29)	0.26 (0.93)	<0.05

n = number, SD = standard deviation

Table 3 Results of relationship of variables in the obese and non-obese groups

Variable	Obese group	Non-obese group	p-value
Soft drinks per week			
Mean (SE)	5.13 (0.30)	5.24 (0.27)	0.79
≥7 drinks/week (% subjects)	31.3%	32.1%	0.95
Calorie dense food			
no. items per week			
Mean (SE)	2.25 (0.19)	1.70 (0.17)	0.03
≥4 items/week (% subjects)	25.1%	13.2%	0.003
Television viewing			
hrs per day on weekdays			
Mean (SE)	3.33 (0.14)	2.82 (0.13)	0.01
>2 hrs/day (% subjects)	65%	51%	0.008
hrs per day on holidays			
Mean (SE)	4.51 (0.21)	3.89 (0.16)	0.02
>2 hrs/day (% subjects)	78.1%	72.9%	0.29
>6 hrs/day (% subjects)	21.8%	11.9%	0.01
Computer time			
hrs per day on weekdays			
Mean (SE)	0.90 (9.36)	1.12 (8.85)	0.09
hrs per day on holidays			
Mean (SE)	1.45 (0.15)	1.86 (0.14)	0.05
School exercise class			
hrs per week			
Mean (SE)	1.32 (0.04)	1.27 (4.11)	0.50
After-school exercise			
hrs of moderate & heavy exercises per week			
Mean (SE)	1.60 (0.19)	2.28 (0.22)	0.02
No exercise (% subjects)	30%	19%	0.01
Father BMI (kg/m^2)			
Mean (SE)	25.52 (0.30)	23.44 (0.23)	<0.01
BMI >25 (% subjects)	51%	31%	<0.01
Mother BMI (kg/m^2)			
Mean (SE)	25.26 (0.36)	23.00 (0.29)	<0.01
BMI >25 (% subjects)	45%	26%	<0.01

SE = standard error, hrs = hours

soft drinks was not statistically different between the two groups (mean 5.13 cans in obese group and mean 5.24 cans in non-obese group, p= 0.79).

Time spent in television viewing was significantly greater in obese subjects (mean 3.3 hours on weekdays and 4.5 hours on holidays in the obese group, 2.8 hours on weekdays and 3.8 hours on holidays in non-obese group, p=0.01 and p=0.02 on weekdays and holidays respectively). Significantly more obese subjects spent more than 2 hours in television viewing on weekdays (65% in obese group and 51% in non-obese group, p=0.008) while up to 21% of obese children spent more than half-day (6 hours) on holidays as compared to 11% in non-obese group (p=0.01). We observed that there was no significant difference in the time spent in computer use between the obese and non-obese groups.

Most of the school children had exercise class of duration 1 to 2 hours a week at school. However, up to 30% of students in the obese group did not have any exercise after school, as compared to 19% in the non-obese group (p=0.01). Duration of moderate and heavy exercises was also significantly less in the obese group (mean 1.6 hours per week) than the non-obese group (mean 2.2 hours per week, p=0.02).

Parental obesity was significantly more frequently observed in obese children. Fifty-one percent of fathers and 45% of mothers had BMI at or greater than 25 in the obese group while the proportion in the non-obese group was 31% and 26% respectively (p<0.01).

Patients who had attended the Obesity Clinic in Caritas Medical Centre for more than one year were reviewed in the period July 2005 to March 2006 to study the effectiveness of intervention offered in the Clinic. At the time of censor, 45 patients managed for more than a year (duration of follow-up ranged from 1 to 6 years, mean duration 3.4 years) still followed-up in the clinic and most of the rest already defaulted. Mean BMI z-score decreased from 2.44 to 2.11, p<0.01. Figure 1 demonstrated the change of BMI z-score in this group of patients. We observed that 33 (33/45 or 73%) patients had a decrease in the BMI z-score after intervention (change of BMI z-score >0) and 10 (10/45 or 22%) achieved BMI less than 97th percentile. The group had a statistically significant improvement in dietary pattern, sedentary behaviour and exercise profile (Table 4). They consumed less soft drinks and calorie dense food, spent less time in television viewing and had picked up more moderate or vigorous exercises. However, the children reported longer time in using computer as assessed at the follow-up review.

Among the 45 patients, 12 had complications of obesity of hyperlipidaemia, fatty liver, hypertension or obstructive sleep apnoea detected in initial attendances (Table 5). At time of review, five (5/12 or 40%) of them achieved normal biochemical data. However another five (5/12 or 40%) had

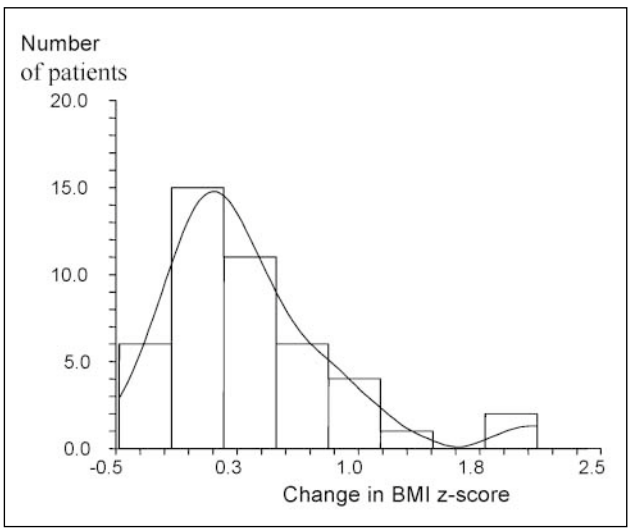

Figure 1 Histogram of change in BMI z-score after intervention.

Table 4 Change in degree of obesity and lifestyle characteristics after intervention (n=45).

Variable	Baseline	Follow-up	p-value
BMI z-score:			
Mean (SE)	2.45 (0.05)	2.10 (0.07)	<0.01 (*<0.01)
Soft drinks: no. per week			
Mean (SE)	4.80 (0.65)	2.16 (0.34)	<0.01 (*<0.01)
Calorie dense food: no. items per week			
Mean (SE)	2.73 (0.52)	0.61 (0.98)	<0.01 (*<0.01)
Television viewing			
hrs per day on weekday			
Mean (SE)	2.85 (0.20)	2.21 (0.26)	0.01 (*<0.01)
hrs per day on holidays			
Mean (SE)	3.55 (0.29)	2.67 (0.30)	0.01 (*<0.01)
After-school exercise			
hrs of moderate & heavy exercises per week			
Mean (SE)	1.34 (0.26)	2.46 (0.48)	0.03 (*0.03)

* p-value analysed by Wilcoxon Signed-Rank Test

Table 5 Complications of obesity before and after intervention

Patient no.	1st Visit		Follow-up	
	BMI z-score	Problems	BMI z-score	Problems
1	2.18	Liver - ↑ALT	1.95	normal
2	2.67	Lipid - ↑LDL	2.10	normal
		OSAS		normal
3	2.42	Lipid - ↑LDL	2.06	normal
4	2.20	Lipid - ↑LDL, TG	2.1	normal
5	2.13	Liver - ↑ALT	1.54	normal
6	2.67	Lipid - ↑LDL	2.35	normal
		OSAS		same
7	2.36	Liver - ↑ALT	2.12	normal
		Lipid - ↑LDL		same
8	2.86	Lipid - ↑LDL	2.52	same
		Liver - ↑ALT		same
9	2.03	Lipid - ↑LDL	1.17	same
10	2.39	Liver - ↑ALT	2.61	same
11	2.51	Hypertension	2.99	Type 2 DM, LVH
12	2.24	Hypertension	2.66	LVH
13	2.42	no complication	2.58	PCOS
14	2.55	no complication	2.45	Lipid- ↑LDL

ALT = aminotransaminase, LDL = low density lipoprotein, TG = triglyceride, PCOS = polycystic ovary syndrome, DM = diabetes mellitus, LVH = left ventricular hypertrophy; OSAS = obstructive sleep apnoea syndrome

persistent problem of hyperlipidaemia, fatty liver or obstructive sleep apnoea. The remaining two patients developed complications of type 2 diabetes mellitus and left ventricular hypertrophy respectively. One adolescent girl who had no complication initially developed polycystic ovary syndrome later as there was no improvement in degree of obesity. A boy was found to have hyperlipidaemia at review as he changed the dietary intake in lunch. On the other hand, one adolescent developed type 2 diabetes mellitus and one developed polycystic ovary syndrome during the course of follow-up but both recovered at the time of the review study.

Discussion

The study showed that obese children and adolescents consumed more calorie dense food than the non-obese ones. They also spent more time in sedentary life activity of television viewing and had less moderate or vigorous exercises. Almost one third of them did not have any physical activity besides the school exercise lessons. Parental adiposity is significantly associated with childhood obesity. In Hong Kong, about 23.4% of men and 12.7% women of age 20-64 years old had BMI at or greater than 25 as studied in year 2004.[17] In our data analysis, up to 51% of fathers and 45% of mothers in the obese group were obese. Thus the study demonstrated that genetic background may be an important factor in obesity while dietary intake, sedentary lifestyle and physical activities also contribute to obesity in children and adolescents. Besides the genetic element, parents' eating habits and activity pattern may also influence their children's behaviour and thus the risk of obesity.

The role of the contributing factors was further illustrated by the result of intervention in the ambulatory clinic. The approach of management was to introduce behavioural changes to have healthier eating pattern and increased physical activity. We believe that children and adolescents attending the clinic for a year or more were more consistent in their change of behaviour. This group did have a significant improvement of the degree of obesity. This was shown by the overall decrease of the BMI z-score at the time of the review, as compared with that in the first visit. The improvement in the diet intake and activity level also highlighted the importance of these factors in causing obesity. More than one third had resolution of the complications of obesity. The approach of the interventions

in an ambulatory clinic, with the support of the physiotherapists and advice from dietitians, is probably an effective way to manage the group of children and adolescents who are complaint to clinic attendances.

The significance of our data was limited by the use of questionnaire in assessment of the parameters. More objective methods including calculation of calories from the food diary using standard food composition tables or measurement of physical activity using heart rate monitoring or motion counter are probably more reliable. Moreover, food intake tends to be under-reported in older children and adolescents.[18] Controlled outcome studies are needed to investigate the relative importance of the causative factors and programs of intervention in the management of obesity.

Our data, similar to survey performed in developed countries like United States,[19] showed that a lot of our local children and adolescents are very physically inactive. Though the non-obese subjects had on average more exercises, up to 20% of them did not have any physical activity after school. In fact only 32% of them had the recommended average duration of 30 minutes moderate exercise a day (total three and half hours a week), assuming that they had about one hour exercise at school each week. This might increase the risk of obesity as they enter adulthood and their physical fitness may be adversely affected.

The followed-up group did show a significant improvement in BMI z-score. However we can see that about 78% of the children remained obese at the time of review. Some had worsening of the degree of obesity and a few developed new complications of obesity. Moreover, most of the referred patients had already defaulted and the effectiveness of our effort in this group was uncertain.

From our report, we find that there is no relationship of computer use with obesity, as different from results in other study.[20] Larger scale study might be needed to confirm the finding. Anyway, computer use might explain the less optimal exercise profile in the non-obese children and the persistence of problems in the follow-up group.

The high default rate and cases with failed results call for alternative intervention to achieve satisfactory outcome. Lack of patient motivation and parent involvement are the known important obstacles to long-term effectiveness.[21] Family-based, school-based interventions and population strategies to modify environment were suggested to improve adherence and effectiveness was demonstrated in some studies.[22-25] We believe that these approaches should be incorporated into our community as primary and secondary preventive measures to combat the problem of obesity in children and adolescents.

In conclusion, the study demonstrated that parental obesity, increased high calorie food intake, sedentary lifestyle and little exercise are likely the risk factors causing obesity in children and adolescents. Intervention in an ambulatory setting probably helps those who are motivated to attend the clinic but is inadequate to tackle the problem.

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