

Treating Obesity in a Vulnerable Clientele Living in Foster Families: A Systemic Solution

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Abstract

Obesity in a vulnerable clientele living in foster families such as persons treated with antipsychotic medications and/or mental retardation is a complex problem with serious health consequences. This study reports on a two-year family intervention that aimed at improving the health of this clientele. The target of the intervention was the entire obesogenics system. The intervention meetings were primarily with the cooks (here considered the experts) with additional attention to the extended system members such as the case workers and the treating physicians. Results show that consuming three portions of vegetables (excluding potatoes), using fruit as substitute for dessert and practicing physical activity at least four times per week lead to sustainable weight loss for the target clientele as well as the other members of the family. Results further suggest the effectiveness of interventions directed toward the person responsible for the meals in a family system and not solely the target clientele.

Keywords: Obesogenic system, weight loss, antipsychotic medication, mental retardation

1. Background

In the past two decades, obesity has reached epidemic levels all around the globe. Some populations are, however, more affected by this health problem than others. Such is the case of the vulnerable clientele living in foster families, a group composed of persons treated with an antipsychotic medication and persons with a mental retardation. To complicate things further, individuals with mental retardations are often treated with an antipsychotic medication to manage behavioral problems (Spreat & Conroy, 1998) and also show high levels of mental health problems (41% (Smiley et al., 2007)). With the goal of improving the health status of this vulnerable clientele, the present study uses a systemic family approach to the problem where the target is not only the obese individual but the entire family system. Specifically, the present research evaluates the impact on the health and lifestyle habits of the vulnerable clientele living in foster families of an intervention with the cooks, who control the food presentation.

Obesity: Causes and consequences Obesity is a complex multi-factorial phenomenon associated with lifestyle, genetics, cultural, social and environmental factors (Public Health Agency of Canada & Canadian Institute for Health Information, 2011). Worldwide, more than two billion people suffer from excess weight, more than 312 million adults are obese and 155 million children are either overweight or obese (Hossain, Kowar, & El Nahas, 2007). Life expectancy is negatively correlated with obesity and excess weight (Olshansky et al., 2005), which translates in up to 18 million deaths per year attributable to obesity (Hossain et al., 2007). Furthermore, obesity is associated with a large number of health issues such as type 2 diabetes and cardiovascular diseases (Silva, Laet, Nusselder, Mamun, & Peeters, 2006). Obesity in vulnerable individuals living in foster families is influenced by three inter-related elements: incidence, antipsychotic medication and family environment.

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First, in terms of incidence, the level of obesity (based on BMI : Body Mass Index) in this vulnerable population is nearly double that of the general population (Cohn, Prud'homme, Streiner, Kameh, & Remington, 2004; Melville, Hamilton, Hankey, Miller, & Boyle, 2007; Perron, Shidler, & Charest, 2011) and is a major factor explaining their reduced life expectancy (Brown, Barraclough, & Inskip, 2000; Melville et al., 2007; Newcomer, 2007; Tyrer, Smith, & McGrother, 2007). Second, the use of antipsychotic medication and atypical antipsychotics medications is believed to be related to obesity (Aquila & Emanuel, 2000; Bobes et al., 2007; Chwastiak et al., 2009; Green, Patel, Goisman, Allison, & Blackburn, 2000; Newcomer, 2007; Sicras-Mainar, Navarro-Artieda, Rejas-Gutiérrez, & Blanca-Tamayo, 2008). Furthermore, antipsychotic medications are sometime used to manage behavioral problems (Tanaka, Aita, & Hirano, 2006) in individuals with mental retardation. Also, moving from a organisational facility to a foster family has been shown to increase the probability of being prescribed antipsychotics (Bygdnes & Kristiansen, 2007). An additional problem related to the use of antipsychotic medications is the under-treatment of the physical problems they cause (Newcomer, 2007). Finally, the deinstitutionalisation (Dorvil & Guttman, 1997) of the members of this population, who rarely cook for themselves (Wirshing, Smith, Erickson, Mena, & Wirshing, 2006), transferred the food control from the institutions, which played a negligible role in the obesity problematic (Fox, Burkhart, & Rotatori, 1983), to the foster families. This led to a marked increase in the prevalence of obesity. Thus, in order to understand the obesity problem in this population, it is primordial to include the role of the context and the family in our analysis (Perron et al., 2011; Rimmer & Yamaki, 2006). Although serious, obesity is evitable and, as most chronic diseases, it is largely caused by lifestyle habits that can be changed (Lau et al., 2007; Paradis, 2007) such as physical activity levels, fruit and vegetable consumption, abstinence from tobacco and length of sleep (Vioque, Torres, & Quiles, 2000; World Health Organisation, 2000). This is as much true for the general population as it is for this vulnerable population (Brown et al., 2000).

Obesity: Treatment options

Since the 19th century, it is believed that obesity results from an imbalance between energy consumption (too high) and energy expenditure (too low) (Vigarello, 2010). Consequently, the two intervention targets are usually the food consumption and the physical activity (Am. Fam. Physician, 2003; Bray, 2000). However, some interventions only target food consumption with a perspective of restriction while others target a healthy relationship with food coupled with physical activity. With numerous popular diets, people are asked to ignore their bodies' hunger signals. However, this has been shown to lead to food obsessions (Polivy, 1996) and then to weight gain. Scientific evaluations of these diets are often biased for two reasons: (i) program drop-outs are not taken into consideration, leading to inflated estimates of success (Dansinger, Tatsioni, Wong, Chung, & Balk, 2007; Glenny, O'meara, Melville, Sheldon, & Wilson, 1997) and (ii) efficacy is usually evaluated in the short-term even though weight gain after a diet is well documented (Dansinger et al., 2007). A recent study showed that 64% of the people who followed restrictive diets gained more weight after the end of the study (Tomiya et al., 2010). Thus, it appears that the real challenge is not to initiate a change but to maintain it over a longer period. Other authors have suggested to focus on healthy food habits (Miller & Jacob, 2001) and an active lifestyle (Kuijjer, De Ridder, Ouwehand, Houx, & van den Bos, 2008), life changes that can be integrated in the daily routine (Munsch, Biedert, & Keller, 2003). These food and lifestyle changes have also been suggested for the vulnerable population living in foster families (Gothelf et al., 2002; Mauri et al., 2006; McCreadie, 2003; Osborn, Nazareth, & King, 2007). Effective programs appear to have a number of similar characteristics such as balanced diets, length of intervention of at least two years, integration of physical activity to ensure an active lifestyle as well as social support (Brownell, 1984; Dansinger et al., 2007; Glenny et al., 1997; Hill & Astrup, 2003; Mauri et al., 2006; McInnis, 2003; Phelan, Wyatt, Hill, & Wing, 2006; Public Health Agency of Canada & Canadian Institute for Health Information, 2011; Van Dorsten & Lindley, 2011). However, none of these programs take a systemic familial approach with this vulnerable clientele.

Systemic Familial Approach

One central element to the systemic family approach to a problematic such as obesity is its circular causality. This approach targets the entire family system instead of only the individual (Watzlawick & Nardone, 2000). In the case of foster families, "family" designates a group of individuals who share meals together as well as the members of their close social network. Thus, the systemic approach departs from the traditional approach where the individual is the only target and is often identified as the problem.

Instead, the systemic approach centers around the interactions between the individuals of a system (e.g., the patient and his family or the patient and his case worker) which are those who can ultimately create an obesogenic environment (Davison, Francis, & Birch, 2005; Swinburn, Egger, & Raza, 1999). From this perspective, the obesogenic environment is the principal cause of the persistence of the weight problem. Hence, we propose a shift from a linear causality hypothesis (the present is determined by past behaviors) to a circular causality hypothesis based on the current interactions between the members of the system. It is thus important for an intervention, such as the one of the present study, to focus on the interactions between the members of the system in order to help them find a new and more satisfying way to deal with the obesity problem. To achieve this, it is essential for the professional to develop a collaborative partnership with the members of the system in order for such an intervention to be successful (Gottlieb, Feeley, & Desorcy, 2007). This partnership is established through numerous actions aiming, for instance, at acknowledging the expertise and the preoccupations of the families (McLeod, Tapp, Moules, & Campbell, 2010). Highlighting the expertise of the families and listening to their preoccupation lead to a better collaboration through a better communication.

2. Present Research

The present study was influenced by the observations as well as the results of a previous two-year field study (Perron et al., 2011) which found only little impact of self-control on weight loss with a similar vulnerable clientele living in foster families. Thus, in the present study, the quantitative and qualitative food control (up to the table) was entrusted in another member of the family system, the cook. Specifically, the present study aimed at testing the impact of an intervention with the cooks, potential agents of change through their control over the food they offer. We hypothesized that the intervention with the cooks would lead to an increased offer of fruits and vegetables which should lead to a decrease in weight and an improvement in physiological measures such as blood pressure and cholesterol in the vulnerable clientele as well as the other members of the family system. Furthermore, we hypothesized that teaching the cooks about healthy lifestyle habits and physical activity would lead to a better lifestyle in the target clientele.

3. Method

3.1 Study Design

The present study used a pre-post experimental design covering a period of two years as well as a correlational design. The pre-post experimental part of the study aimed at detecting the longitudinal impact of the intervention with the cooks on a number of outcomes for the cooks themselves, their spouse and the vulnerable clientele. The initial evaluation occurred in April 2006 and the final evaluation occurred in May 2008. The correlational part of the study aimed at detecting relationships between the lifestyle measures, the obesity measures and the physiological parameters as assessed at the end of the study.

3.2 Sample

Because this study aimed at modifying the interactions between the clientele and the people around them, five groups of participants were included. First, 27 vulnerable individuals from the target population (12 females and 15 males) were recruited based on the following inclusion criteria: (a) had not to be taking a weight loss medication or be on a weight loss diet, and (b) had to be living in a foster family environment where all meals were prepared by a cook who is in charge of the family and who also accepted to take part in the study. Second, based on these criteria seven cooks were recruited. The seven cooks had to be preparing the meals for at least one vulnerable individual (individual with mental retardation and/or using antipsychotic medication) and not be on a weight loss diet. Third, 30 case workers working with the clientele in relation with a foster family were also included in the study. They were all related to a mental retardation rehabilitation center or a mental health center. Fourth, the treating physicians ($n = 17$) were also included in the study. Finally, the members of the biological family of the clientele were invited to participate, however only three accepted.

3.3 Procedure

In conformity with the family approach, the research intervened with foster family cooks, vulnerable individuals and their natural family members, physicians, and case workers. There were three types of interventions with the cooks of the foster family. An individual meeting at each foster home on six different occasions, 18 group meetings where all seven cooks were present and five social events (3 formal and 2 informal) to which the vulnerable individuals, the case workers and the community were also invited.

Table 1 describes the content of the meetings with the seven cooks. At every step, the research team strengthened the cooks' collaboration by validating that they are the experts of change in their family. The group meetings were led by the nurse (who encouraged without directing by taking a non-expert position) and the social worker responsible for the support to foster families. A number of professionals were also invited as additional resources such as a nutritionist, a kinesiologist and a chef. They each gave an hour long presentation on their respective field of expertise in relation with the aims of the present intervention. A group discussion followed the presentations and the cooks were encouraged to share their opinions, difficulties and strategies with each others. Furthermore, between 2 and 25 at home visits from a kinesiologists occurred over the course of the study in order to help establish a physical activity routine for the target clientele and the other members of the family system. Additionally, a nutritionist visited the families on one occasion in order to discuss recipes and ways to make the meals correspond to the specific needs of their families.

Table 1: Content of the Meetings with the 7 Cooks

Number of meetings	Content
1 (At home)	<ul style="list-style-type: none"> Presentation of the project: obtain informed consent Agree on a personal goal and express expectations Meet the vulnerable individuals in the presence of the cook
5 (At home)	<ul style="list-style-type: none"> Assessment of: <ul style="list-style-type: none"> - Food offering (cook) - Lifestyle habits (cook) - Obesity (cook and vulnerable individuals) - Antipsychotic medication (cook and vulnerable individuals) - Blood pressure (vulnerable individuals)
18 (group meetings)	<ul style="list-style-type: none"> List of the meeting themes: <ul style="list-style-type: none"> - The obesity problematic - How to help people move (kinesiologist) - Cook differently with foods that increase satiety - Food groups: fat, sugars, proteins - Reading the labels - How to make food choices by reading the labels - Principals of a balanced meal - How to incorporate this new knowledge in the families - Daily stress management - Elaboration of the ISO health list with the families - How to make every day recipes better - The new food guide - How to do the groceries without falling in the traps (in groceries) - How to cook and facilitate a healthy weight (in a kitchen with a professional chef)
Between 2 and 25 (at home)	<ul style="list-style-type: none"> - Establish a physical activity routine with a kinesiologist
1 (at home)	<ul style="list-style-type: none"> - How to modify my recipes to correspond to the specific needs of my family (individually with a nutritionist)
5 social gathering (3 formal and 2 informal)	<ul style="list-style-type: none"> - Picnic in a park - Award medals to the cooks in front of a public including journalists. - Award medals to the vulnerable individuals in front of a public including journalists. - Christmas dinner (2)

The same process as the group meetings was repeated with the case workers who are in close contact with the families in order to ensure that a coherent message would be sent out to the families. The language of the meetings were adapted to the case workers professional level but covered the same topics. A total of eight group meetings with the case workers were held between March 2006 and January 2007.

The physicians treating the vulnerable individuals were contacted by mail in order to obtain their consent to participate in the study. Physicians were in direct contact with the research team when the time came to transfer the physiological data. A total of 17 vulnerable individuals had a biological family member as their representative. The representatives were contacted by mail and were invited to an information session.

3.4 Measures

All variables were evaluated before the intervention and 24 months later at the end of the study. Most of the measures for the vulnerable clientele were reported by the cooks and some physiological measures were reported by the treating physician. Food offer. The food offered was assessed with a questionnaire detailing how often certain food items were offered by the cooks (Boyce et al., 2008). For instance, the cooks had to report how often they were serving beef each month. Physical activity. Physical activity practiced over a minimum of 10 consecutive minutes (World Health Organisation, 2007) was assessed with three measures: frequency (number of days per week where a physical activity is practiced for a minimum of 10 minutes), average length of time per week (sum of all the minutes of physical activity practiced for a minimum of 10 minutes divided by the frequency) and frequency of periods of 30 minutes of physical activity per week. Consumption of fruits and vegetables. After the researchers defined what a portion was, the cooks reported the average daily number of portions of fruits and vegetable consumed per person. Potatoes were not counted as a vegetable in this study. Abstinence from smoking tobacco. Cooks reported whether or not each vulnerable individual was smoking tobacco and, if yes, how many cigarettes per day were smoked. This information is well known to the person responsible for a foster family as they control the access to cigarettes. However, this number does not account for the cigarettes that may have been given by a peer while out of the home. Obesity. BMI and waist circumference (WC) of the vulnerable clientele were measured and calculated at the beginning and at the end of the study. Cooks and their spouses were also offered to have their BMI and WC calculated. For the two children included in the study, their weight and WC were represented on a growth curve expressed in percentile following published conventions (Fernández, Redden, Pietrobelli, & Allison, 2004; Hamill et al., 1979). These measures were collected at the time of the home visits. Antipsychotic medication. A pharmacological file given to the families by the pharmacists each month was used to determine the usage of antipsychotic medication by the vulnerable clientele. Physiological parameters. The blood sugar and lipid status were collected from medical files at the beginning and at the end of the study. Blood pressure was measured by the nurse at the time of the home visits.

3.5 Ethical Considerations

The ethics committee of the Université du Québec en Abitibi-Témiscamingue as well as of the organisations involved approved the research protocol of the present study. All seven cooks offered their informed consent to participate in this study.

3.6 Data Analysis

Paired sample t-tests were conducted in order to detect pre-post differences on the food consumption, lifestyle measures, obesity (BMI and WC), and a number of physiological parameters of obesity for the vulnerable clientele, as well as the cooks and their spouses. Pearson correlations were conducted between lifestyle measures, obesity measures and physiological parameters, as measured after the intervention.

4. Results

The final sample was composed of 7 cooks caring for 25 adults and two children (15 males and 12 females). The adults were aged between 31 and 72 years (mean = 50 years old). The children were 6 and 13 years old. Of the 27 vulnerable individuals in the initial sample, 26 were re-evaluated two years later for a retention rate of 96%. The retention rate was 100% for the foster families (i.e., the cooks and their spouses). See Tables 2 to 4 as well as Figure 1 for detailed results.

Table 2: Impact of the Intervention on the Food Choices (by Month)

Family	Baseline		Twoyearslater	
	vegetables	Fruit	vegetables	fruit
A	28,00	28,00	112,00	168,00
B	16,00	16,00	56,00	56,00
C	56,00	56,00	112,00	140,00
D	28,00	,00	28,00	84,00
E	56,00	84,00	112,00	112,00
F	84,00	140,00	140,00	70,00
G	28,00	98,00	112,00	84,00
Mean	42,29	60,29	96	102
SD	23,87	49,99	39,12	40,18

Food choices. Although the overall choices of food offered by the cooks were globally better at the end of the study, only the vegetable offer increased significantly ($t(6)=4.961$, $p<.01$) over the course of the study. Lifestyle. The meetings were successful in increasing the frequency of physical activity ($t(23)=3.114$, $p <.01$) and many vulnerable individuals reached the targeted 30 minutes per day of physical activity ($t(23)= 2.896$, $p <.01$). The meetings were also successful in increasing the consumption of fruits and vegetables ($t(25) = 5.029$, $p <.01$), vegetables alone ($t(25) = 4.482$, $p <.01$), and fruits alone ($t(25)= 4.129$, $p <.01$). At the end of the study, all vulnerable individuals were consuming the targeted minimum of 5 portions of fruits and vegetables each day. Furthermore, seven participants from the vulnerable population were smokers at the beginning of the study. After the intervention, one foster family became non-smoking which led three of its

Table 3: Change in BMI and W Cat the Beginning and Two Years Later

Beginning			Twoyearslater							
Family	Subject	Antipsycotic	BMI	WC	PA/Freq ^c	F/V ^D	BMI	WC	PA/Freq ^c	F/V ^D
E	1		39	119	1	7	34,5	108,5	4	8
E	2	√	27,7	99	1	7	24,2	93	7	8
E	3	√	30,3	110	7	8	27,5	98,5	7	8
B	4	√	24,3	100	5	1	24,7	104,5	4	2
B	5		21,1	84	7	,5	22	89,5	7	2
G	6	√	28,6	100	0	2	30,6	N/D ^c	0	3,5
G	7	√	21,8	83	0	0	23,8	80	2	8
G	8	√	17,9	81	7	1	18,8	82	3	4
G	9	√	41,5	128	0	4	40 ^b	123 ^b	0 ^b	4,5 ^b
G	10	√	29,5	105	7	5	27,3	97	6	8
G	11	√	32,9	117	2	3,5	26,4	92	0	7
G	12	√	23,4	89	7	4	22,4	91	7	10,5
D	14		34,8	117	3	3,5	31,6	107	7	5,5
C	15	√	24,4	89	5	5,5	21,7	82	7	8
C	16		28,8	97,5	3	3	28,3	96,5	4	6
C	17	√	33,3	114	0	7	32,6 ^b	96	4	10
C	18	√	50 ^a	82 ^a	0	5	50 ^a	59 ^a	7	8
A	19	√	55 ^a	67 ^a	0	6	55 ^a	80 ^a	0	10,5
A	20	√	22,6	78	0	4	22,6	78	0	6
A	21	√	26,2	99	0	0	21,1	87	7	4,5
A	22	√	40,6	128	7	3	35,9	124	7	7
F	23		30,2	90	1	8	24,1	74	7	9,50
F	24		20,7	79,5	5	4	18,3	69	5	7
A	25		24,3	83	2	7,5	21,8	81	5	8
F	26		21,6	87	5	8,5	21,4	88	7	7
F	27		23,7	84	3	10,50	21,3	81,5	7	9
E	29		40,6	132	0	10	40,3	123	1	8
Mean			27,86	98,48	3,2	4,79	25,97	92,30	5,08	7,04
Sd			6,41	16,36	2,78	3,04	5,71	14,16	2,39	2,32
N	27	17	24	23	24	26	24	23	24	26

Note. For children in percentile excluded from the calculation with BMI and WC. B One year later. C. Physical Activity frequency D Consommation de fruit and vegetable.

Table 4: Impact of the Intervention on the Cook and their Spouse

Family	Subject	Baseline	Twoyearslater
		BMI	BMI
A	Cook	30,86	28,79
A	Spouse	28,50	27,50
B	Cook	21	22,10
B	Spouse	47	40,00
C	Cook	26	24,68
D	Cook	40,3	35,20
D	Spouse	24,75	24,20
E	Cook	24,09	21,78
E	Spouse	27	25,06
N/ Mean	9	29,94	27,70
SD		8,42	6,16

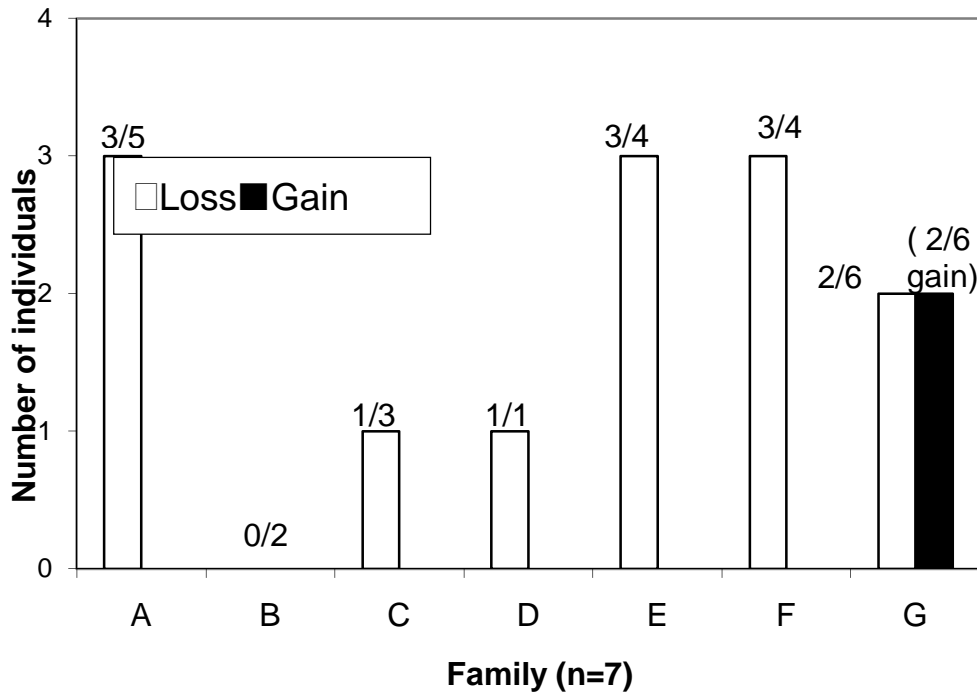


Figure 1: Number of Subjets of Vulnerable Clientele Living in Foster Families by Family Group Having Loss or Gain 1 BMI or More

Clients to quit smoking and a fourth to reduce his consumption to two cigarettes per day. The remaining two smokers were living in a smoking family and did not quit over the course of the study. Obesity. The average BMI dropped from 27.86 at the beginning of the study to 25.97 two years later. This decrease in BMI was found to be significant ($t(24) = -3.954, p < .01$). The WC also decreased significantly from 98.48 cm at the beginning of the study to 92.30 cm two years later ($t(23) = -3.654, p < .01$). Antipsychotic medication. The majority of the vulnerable clientele was taking an antipsychotic medication (63%). From this group, all but two (88%) were taking an atypical antipsychotic medication, such as Risperidone (43%) or Olanzapine (31%). No differences in initial weight and WC were found between those treated and those not treated with an antipsychotic medication. Both groups experienced a decrease in BMI and WC, however the BMI decrease was larger in the non-treated group ($t(9) = -3.128, p < .01$), than in the treated group ($t(14) = -2.577, p < .05$). For WC, the decrease was similar between the vulnerable individuals not treated with an antipsychotic medication ($t(9) = -2.617, p < .05$) and the vulnerable individuals treated with an antipsychotic medication ($t(13) = -2.518, p < .05$). Impact on families.

Vulnerable individuals reported a significant weight loss in five out of the seven families (see figure 1). One family reported both gains and losses while another reported stable weights. Six cooks reported having themselves loss weight while the seventh cook reported a small weight increase. Five cooks and four spouses accepted to report their weight (see table 4), and in this small group, a significant decrease in BMI was found ($t(8)=-2.766, p<.05$). When the families were statistically treated as one group (cooks, spouses, and vulnerable individuals), a significant decrease in BMI was again found ($t(33) = -4.882, p <.01$). Physiological parameters. Blood pressure of the vulnerable clientele decreased over the course of the study, a decrease that was significant for the adults' diastolic blood pressure ($t(21)= -2.557, p<.01$). The physiological parameters such as fasting blood sugar and lipid status showed an improvement but did not reach the significance level of $p < .05$. Life style, physical activity vs. weight. A significant negative correlation was found between variation in physical activity frequency and BMI ($r(n=23)= .436, p <.05$). The group of vulnerable individuals who reported doing physical activity at least four times per week showed a significant decrease in BMI and WC over the course of the study (BMI: $t(16)=-5.268, p < .01$; WC: $t(17)=-3.211, p <.01$). Furthermore, the frequency of physical activity was negatively correlated with cholesterol ($r(n=15) = -.685, p < .01$), triglyceride ($r(n=15)= -.649, p < .01$), LDL ($r(n=15) = -.595, p < .01$), and blood pressure (diastolic: $r(n=23) = -.458, p < .01$; systolic: $r(n=23)= -.406, p <.05$). Vegetables vs. weight. The consumption of vegetables was found to be correlated with a decrease in BMI ($r(n=23) = -.411, p < .05$). The group of vulnerable individuals consuming more than three portions of vegetables each day lost weight over the course of the study (BMI: $t(18) = -3.026, p < .01$) while those who only consumed one or two portions each day tended to gain weight, a finding that echoes past research (Perron et al., 2011). The consumption of vegetables and of fruits as deserts was negatively correlated with cholesterol (fruits only: $r(n=16) = -.630, p < .01$; vegetables only: $r(n=16) = -.437, p < .05$; fruits + vegetables: $r(n=16) = -.612, p < .01$) and LDL (fruits only: $r(n=16) = -.591, p < .01$; vegetables only: $r(n=16) = -.472, p < .05$; fruits + vegetables: $r(n=16) = -.601, p < .01$). The consumption of vegetables was also significantly correlated with the variations in HDL ($r(n=13)= .615, p < .05$). Case workers' perceptions. Qualitatively, the case workers who got involved in the meetings reported having developed a collaborative partnership with the vulnerable individuals and their foster families. They also reported having validated the cooks in their roles as experts and agents of change. Finally, they rated their relationships with the families as overall more positive.

5. Discussion

5.1 The Success of the Intervention

The results of the present study are highly encouraging as they suggest an effective intervention to manage the obesity problem found in a vulnerable population living in foster families. The proposed intervention treats the entire family system and not only the vulnerable individual by targeting the person in charge of the food offer: the cook. By doing so, the results showed that the intervention led to an increased offer of fruits and vegetables which led to a decrease in BMI and WC in all members of the family. Health advantages were also found on a number of physiological indicators such as blood pressure and lipid status. These present results lead to a number of implications which are discussed below. The success of the intervention seems to emanate from two actions: 1) giving the cooks knowledge of the impact of the food offer and healthy lifestyle habits on weight and 2) insuring that all members of the intervention system validate the cooks' role in controlling food offer and healthy lifestyle habits. Past research has shown the inefficacy of self-control regarding food intake especially when faced with a large food offer (Perron et al., 2011). To help the vulnerable population targeted in the present study control their weight, it is essential to consider the food that is offered them. Thus, empowering the cooks with information regarding nutrition, physical activity and lifestyle in relation with weight makes them effective agents of change. Here, the cooks did improve their food offer by increasing their offers of fruits and vegetables, a solution to obesity strongly suggested during the meetings. The increased offer of vegetables resulted in a significant decrease in obesity, especially in the families where the vulnerable individuals' BMI were the highest. In the present study, the targeted consumption of at least five fruits and vegetables per day was reached by all vulnerable individuals. However, it appears important for professionals to reinforce that potatoes are better classified as a starch than as a vegetable and thus that vegetables should be favored over potatoes. Also, the consumption of fruits was found to be correlated with lower cholesterol levels and LDL levels which suggest that eating fruits as deserts is an effective strategy for increasing health.

Furthermore, the results regarding the BMI of the cooks and their spouse as well as the BMI of the vulnerable clientele suggest that the family as a whole should be targeted by health professionals because health problems such as obesity affects the entire family (Wright & Leahey, 2007). In terms of physical activity, the results of the present study suggest that regular physical activity should be proposed because it is not the quantity but the regularity of physical activity that was found to lead to a lower BMI. This results echoed past research by Perron et al. (2011). Physical activity is generally maintained only when it becomes part of a daily routine. Physical activity on a daily basis is one of the biggest challenges with this population because of its high inactivity. Professionals and foster families should aim for a goal of at least 10 minutes every day. Regarding the use of tobacco, the high level of non-smokers (88%) in the present sample is surprising for this population because only a few years ago barely 27% were believed to be non-smokers (Brown et al., 2000). Living in a non-smoking environment seems to be an efficient way to promote a non-smoking lifestyle. One interesting result of the present study is that the vulnerable clientele treated with an antipsychotic medication also showed a decrease in BMI and in WC. However, our observations suggest that although BMI and WC follow the same trajectory and are highly correlated ($r = 0.888$, $n=26$, $p < .01$), the decline in WC takes longer before being observed compared to changes in BMI. They are nonetheless both important indicators when working towards long-term changes. It was previously shown that antipsychotic medications are associated with weight gain and a higher consumption of calories (Aquila & Emanuel, 2000; Gothelf et al., 2002). When we started the present study, a significant correlation between antipsychotic medication use and consumption of fruits was observed ($r = 0.335$, $n=27$, $p < .05$) which could partially explain the higher calorie intake. Thus, it is suggested to militate for a better management of fruit consumption in this population by promoting fruits as deserts and not as an equivalent to vegetables (Schulze, Fung, Manson, Willett, & Hu, 2006).

5.2 Familial Approach and Collaborative Partnership

The results show the importance of increasing the intervention target to include more members of the system such as the entire foster family, the case workers and the treating physicians. As members of an obesogenic environment, all these individuals can influence the health of the vulnerable population living in the foster families. In fact, even well-intentioned actions can contribute to the persistence of the obesity problem. Thus, it appears highly useful to find solutions with a circular perspective which considers the interactions between the members of the system. It is this perspective that brought the intervention nurse to find new solutions with the families to interrupt the never ending obesity cycle. For instance, many professionals and cooks like to reward this vulnerable population with sweets on the basis that they suffered enough and deserve some little pleasures. While understanding their rationales, the systemic approach invites the members of the system to develop other means than food to show their affection to the vulnerable individuals they care for. Most often than not, restrictive diets are not successful (Tomiya et al., 2010). So, for this reason, weight loss was not discussed during the meetings with the cooks as a goal to be reached. Instead, the intervention nurse- talked about health, light physical activity such as walking and eating more vegetables. In sum, promoting healthy lifestyle habits appears to be an effective strategy and probably more so than restrictive diets. Maximizing the collaboration of the cooks during the two years of the present study was done by recognizing their expertise and by formulating a goal and a personal objective with each of them. However, the collaboration was mostly maintained by the neutrality of the intervention nurse who generally assumed the position of non-expert. The effectiveness of the non-expert strategy leads us to question the usual way of intervening with this population that is the "expert intervention" where the patients are told what to do. Here, the cooks became the experts in terms of the management of the meals and the physical activity. We believe that intervening this way with this population is an effective way to insure collaboration between the different members of the family system.

5.3 Strengths and Limitations

The present research has a number of strengths and limitations. Its strengths included the fact that this research was conducted in the natural living environment of this vulnerable population which is an improvement over most interventions conducted in institutions (Green et al., 2000; Vreeland et al., 2003). Another strength: the present study used a longitudinal design that elapsed over a 24-month period with an extremely low abandon rate of 4% for the vulnerable individuals and 0% for the cooks. Its limits included the fact that this project was conducted with families who volunteered for the intervention, which might suggest that the positive results reported here are only applicable to families desiring changes. Another limit is the fact that the under diagnosis of mental health in the population with mental retardation restricted our ability to differentiate vulnerable individuals based on their diagnosis. Finally, some analysis were conducted on small sample sizes resulting in lowered statistical power which may have restricted our ability to detect some of the positive effects of the intervention.

5.4 Future Research

The widening of the field of observation from individual self-control to family control led to significant results. Family control is an interesting research area to study the changes in lifestyle for other clientele. Young children for instance, as the participants of the present study, are under the influence of the decisions made by their parents regarding the food they eat. Numerous interventions target the children but in light of the present results, family meetings directly targeting the parents (the cooks) could be highly effective. This strategy could also be adopted in programs that aim to change the food consumption and lifestyle habits of individuals with chronic health problems. Future research should evaluate the efficacy of family meetings targeting the cook of the family. The beliefs of the family should be integrated in future research and intervention programs for obesity. For instance, in informing clients about nutrition, it would be strategic to discuss pre-conceived ideas about underutilized food such as legumes and discuss how to change them.

6. Conclusion

This 2-year, pre-post experimental design research evaluated a family systemic intervention to reduce body weight in a vulnerable clientele (treated with antipsychotic medication or mental retardation) living in foster families. This intervention included at-home visits and group meetings with primarily the cooks of these foster families, encouraging them to use their knowledge and their central role in the family to improve the consumption of food and the lifestyle habits of this vulnerable clientele. The results show that weight reduction occurred when this population consumed, on a daily basis, more than three portions of vegetables (excluding potatoes), used fruits as desert substitute and increased their physical activity levels. In addition, the results indicate that it is important to include the different actors of the obesogenic system, the cooks, the case workers, the doctors and the other professionals, in order to insure the maintenance of healthy lifestyle habits associated with a reduction of obesity. The success of the present intervention challenges the traditional model of intervention where healthcare professions typically take an "expert" position. The family systemic intervention creates an effective collaboration with the family by reinforcing the expert status of the foster family cook, by asking health professionals to agree to redefine the family nurse borders. This collaborative partnership is essential to the success of such an intervention.

Declaration of Conflicting Interests

This study was carried out in the framework of doctoral study and is not the subject of any commercial agreement.

Funding

The researcher received funding of \$ 6,000 (without obligation) of the two institutions involved with vulnerable clients and their families (a rehabilitation center for intellectual disabled and a hospital). This money was used to pay professional recruiting and travel expenses and care of foster family.

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