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Blandine de Lauzon-Guillain [1,2], Monique Romon [3], Dara Musher-Eizenman [1], Barbara Heude [1,2], Arnaud Basdevant [4,5,6], Marie Aline Charles [1,2] and the Fleurbaix-Lavantie Ville Santé Study Group [7]

[1] INSERM, IFR69, U780, Villejuif, F-94807, France;

[2] Paris XI University, Orsay, F-91405, France;

[3] Nutrition Department, University Hospital, Lille, F-59000, France

[4] Inserm, Nutriomique U755, Paris, F-75004, France;

[5] Université Pierre et Marie Curie – Paris 6 – Faculté de Médecine, Paris, France;

[6] AP-HP, Pitié Salpétrière, Service de Nutrition, Hôtel-Dieu, Paris, F-75004, France

[7] Association Fleurbaix-Laventie Ville Santé, Laventie, F-62840 France.

Corresponding author: Blandine de Lauzon-Guillain

Mailing address:

Inserm U780

16 avenue Paul-Vaillant Couturier

94807 Villejuif cedex

FRANCE

Tel: (33) 1 45 59 51 01 Fax: (33) 1 47 26 94 54

e-mail address: delauzon@vjf.inserm.fr

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Abstract

The purpose of this study was to examine, in a general population, the resemblance in eating behavior between adolescents and their parents. This study was based on the first examination of a community-based epidemiologic study in Northern France. Subjects were offspring aged 14 to 22 years (135 boys and 125 girls) and their parents (174 fathers and 205 mothers). The TFEQ-R18 identified three aspects of eating behavior: cognitive restraint of eating, uncontrolled eating, and emotional eating. Familial resemblance in eating behavior was measured by partial Spearman's correlations, adjusted for age and body mass index.

Sons' uncontrolled eating was positively related to fathers' cognitive restraint of eating (r=0.36), but not to fathers' uncontrolled eating (r=0.07), nor to mothers' eating behavior. Sons' cognitive restraint of eating was related to no parental eating behavior scores. In daughters, cognitive restraint of eating was positively related to mothers' uncontrolled eating (r=0.26), but not to mothers' cognitive restraint of eating (r=0.13). Daughters' uncontrolled eating and emotional eating were positively associated with the same scores in mothers. Finally, daughters' eating behavior was not related to fathers' eating behavior.

To conclude, correlations in eating behavior were higher with the parent of the same gender and eating behaviors in adolescents seem to reflect opposition to parents' behavior more than familial resemblance.

Key words: eating behavior, familial resemblance, adolescence, TFEQ-R18, epidemiology

Running head: Familial resemblance in eating behavior

Introduction

Obesity shows familial aggregation, and it has been suggested that the genetic relationship accounts for most of the familial resemblance in body mass index among adults (Sorensen et al., 1992). However, the rapid secular increase in the prevalence of obesity cannot be attributable only to genetic factors. Shared environment and resemblance in behaviors may also be responsible for the familial aggregation of obesity.

The family has a major influence on the children's eating behaviors (Fulkerson et al., 2002). Previous studies underlined a familial aggregation in eating disorders (Whelan and Cooper, 2000), as well as in food intake (Faith et al., 2004). Moreover, familial resemblance in dietary intake depended on shared meals: the more meals family members shared, the stronger was familial resemblance in dietary intake (Hannon et al., 2003, Billon et al., 2002).

A great heritability of eating behavior was highlighted in twin studies (de Castro and Lilenfeld, 2005, Tholin et al., 2005). However, these studies were interested in resemblance on eating behavior of subjects of the same generation and few studies were conducted with an inter-generational design. Little is known about the influence of parental modeling in eating behavior on offspring's eating behavior, especially during adolescence. Adolescence, a transition towards independence and autonomy, is a critical period in the development of eating behavior, and eating habits formed in adolescence are likely to affect long-term behaviors (Story et al., 2002, Videon and Manning, 2003). Furthermore, as adolescent eating attitudes are known to be affected by the sociocultural pressure to be thin and by peer dieting attitudes (Fulkerson et al., 2002), the influence of parents on eating behavior could decrease at that time. Therefore, strong associations between parents and child behavior persisting in adolescent would favor targeting the family for the prevention of abnormal behavior and would also encourage the search for genetic factors.

The purpose of this study was therefore first to examine, in the general population, if restrained eating, uncontrolled eating and emotional eating were related during adolescence with parental eating behavior. As restrained eating and desinhibition of control may be associated and lead subject to a vulnerable weight cycle (Lowe, 1993), the second goal of this study was to determine whether a given aspect of adolescent eating behavior was influenced only by the same aspect of parental eating behavior or also by other aspects of parental eating behavior.

Research Methods and Procedures

Study design

Subjects were participants in the Fleurbaix-Laventie Ville Santé II (FLVS II) Study. The purpose of the FLVS II Study was to investigate the risk factors for weight and adiposity changes in the general population. This community-based cohort was constituted in 1999 on a voluntary basis and

included 1175 subjects, aged ≥8 y, from families living in two small cities of Northern France, Fleurbaix and Laventie and surrounding areas, who had participated in a previous study: the Fleurbaix-Laventie Ville Santé I. This first study was a follow-up of children involved in a nutritional education school program. It involved all 579 families who had at least one child in the last section of preschool and in primary school in 1992 in the cities of Fleurbaix and Laventie. The FLVS II Study was proposed to 393 families who were still living in the area and could be reached in 1999, and 294 (75%) agreed to participate. The main differences between families who agreed or refused to participate in FLVS II were: cities of residence were more likely to be Fleurbaix and Laventie than the smaller cities for participating families; participating families had a lower frequency of overweight children in 1992 (8% vs. 13% of overweight children, respectively, p=0.01). Other variables such as parents' overweight, age, and gender did not differ between the two groups. The study protocol of FLVS II was approved by the Ethic Committee of Lille in July 1998 and the data files were declared to the National Committee for the respect of freedom and rights in computerized data (CNIL).

Anthropometric data

Anthropometric data were collected at school by trained doctors. Weight was measured in light clothes to the nearest 0.1 kg, and height was measured to the nearest 5 mm. Body mass index (BMI) = weight in kg / (height in m)^2 was then calculated.

Three-Factor Eating Questionnaire –R18

Eating-related behaviors were assessed using a French translation of the Three-Factor Eating Questionnaire Revised 18-item version (TFEQ-R18) (Karlsson et al., 2000). The instrument is a shortened and revised version of the original 51-item TFEQ (Stunkard and Messick, 1985). The French translation was accomplished using common procedures for cross-cultural adaptation, including back translation by a native English speaker. The questionnaire refers to current dietary practice and measures three different aspects of eating-related behavior: cognitive restraint of eating (CR: 6 items), uncontrolled eating (UE: 9 items) and emotional eating (EE: 3 items). Cognitive restraint of eating represents a conscious restriction of food intake in order to control body weight or to promote weight loss; uncontrolled eating measures the tendency to eat more than usual due to a loss of control over intake; and emotional eating characterizes overeating during dysphoric mood states (i.e. when feeling lonely, blue or anxious). Each score ranges from 0 to 100, with higher score indicative of greater level in the eating behavior of interest. The applicability of the TFEQ-R18 to the French FLVS II population, and its internal validity has already been described (de Lauzon et al., 2004). Internal-consistency reliability coefficients (Cronbach's α) for each of the 3 scales were above the 0.70 standard and below the 0.90 limit recommended for individual assessment (CR: 0.84

in adults, 0.80 in adolescents; UE: 0.83 in adults, 0.80 in adolescents; EE: 0.87 in adults, 0.78 in adolescents).

Participants

Only subjects older than14 years answered the entire TFEQ-R18 and were therefore considered for this analysis. Of the 887 subjects older than 14 years who participated in the study in 1999, 14 individuals were excluded due to missing sociodemographic or anthropometric data, and 17 individuals did not complete the TFEQ-R18. Only 10 offspring (3%) were aged 23 to 27 y, whereas the rest was 14 to 22 y. Therefore, for analyses, we only considered offspring between the ages of 14 and 22. Of the 294 FLVS II families, 207 families included at least one offspring aged 14 to 22 years in 1999. In families including more than one boy or more than one girl in the targeted age range, one boy and one girl were randomly selected to estimate the familial resemblance in eating behavior. Therefore the independence between observations was respected since we conducted analyses separately in boys and in girls. One hundred and fifty-five parents were excluded from analyses because they had no offspring older than 14 y.

Thus, the final sample was composed of 174 fathers and 205 mothers (aged 34 to 67 years), 135 sons and 125 daughters (aged 14 to 22 years).

Statistical analysis

As eating behavior scores were not normally distributed, the differences in baseline characteristics between males and females were tested, in each generation, by a Kruskall-Wallis test. The relationship between parents' eating behavior and offspring's eating behavior was tested by partial Spearman's correlations adjusted for offspring's age, offspring's BMI, parental age and parental BMI. Fathers and mothers on the one hand, and sons and daughters on the other hand, were considered separately.

The Statistical Analysis Systems software package version 8.2 (SAS Institute, Cary, NC, USA) was used for the analyses.

Results

Gender differences. Fathers (**Table 1**) were older than mothers ($p<0.001$) and they were also heavier ($p<0.001$ for BMI). Sons and daughters were similar in age ($p=0.50$) and BMI ($p=0.77$). TFEQ-R18 scores were significantly different between genders, both in parents (Table 1) and in offspring (Table 2). Cognitive restraint and emotional eating reached higher levels in females than in males ($p<0.001$ in both groups). Uncontrolled eating tended to be stronger in sons than in daughters ($p=0.013$), but there was no difference between mothers and fathers ($p=0.23$).

*Correlations among TFEQ-R18 scores (**Table 2**).* Among parents, all TFEQ-R18 scores were significantly correlated two by two, whereas among adolescents cognitive restraint and uncontrolled eating were not significantly correlated (p=0.07 in sons; p=0.96 in daughters).

*Parent-offspring correlations (**Table 3**)*. Sons' restrained eating was not correlated with parents' eating behavior scores. Sons' uncontrolled eating (Figure 1) was moderatly correlated with fathers' restrained eating (r=0.36) as sons' emotional eating and fathers' restrained eating (r=0.26) or mothers' emotional eating (r=0.25).

The familial relationships in eating behavior scores were quite different in daughters. Daughters' eating behavior was not related to any aspect of their fathers' eating behavior. Daughters' uncontrolled eating and daughters' emotional eating were moderately related to the same aspects of eating behavior in mothers (r=0.22 and r=0.24 respectively). Moreover, daughters' restrained eating was moderately linked to mothers' uncontrolled eating, whereas other correlations between daughters' eating behavior and mothers' eating behavior were quite weak.

The correlations between parental eating behavior and offspring's were also performed without adjustment for child's BMI and parental BMI (data not shown). The results were very similar to those presented here.

*Father-mother correlations (**Table 4**)*. Eating behaviors scores were also significantly correlated between mothers and fathers, but all correlation coefficients were below 0.25.

Discussion

First, our study showed higher correlations in eating behavior between parents and offspring of the same sex. Second, parents-offspring correlations were stronger between aspects of eating behavior that could appear as opposite (e.g. cognitive restraint of eating and uncontrolled eating). Finally, emotional eating scale in offspring appeared to be associated unspecifically with several aspects of parental eating behavior.

The offspring's and parental eating behavior correlation coefficients were higher first among boys and father than among boys and mothers, and second among girls and mother than among girls and father. Such an identification with the parent of the same gender on eating behavior development was previously underlined (Elfhag and Linne, 2005) but only among mothers. Our results extended this gender difference in the correlation with fathers' eating behavior.

Our results also showed interesting associations between an aspect of eating behavior in adolescents and another aspect, that could be considered as opposite, in parents. Uncontrolled eating scores reached higher levels in boys, as in the Quebec Family Study where situational susceptibility and

especially hunger (both included in our uncontrolled eating score) were higher in boys than in girls (Drapeau et al., 2003). Sex differences for uncontrolled eating were not seen in adults. Growing adolescent boys may have greater susceptibility to huger because of high energy needs. Boys could also more easily acknowledge their susceptibility to external food solicitations. Uncontrolled eating was positively linked to fathers' restrained eating, but not to fathers' uncontrolled eating in our study. In contrast, restrained eating was more developed in girls, as also found in other studies (de Castro, 1995, Drapeau et al., 2003, Neumark-Sztainer et al., 2004, Provencher et al., 2003). This eating behavior was positively associated with maternal uncontrolled eating, but not with mothers' restrained eating. These opposite associations between adolescent eating behaviors and parental eating behavior may be specific of adolescence, and also a mark of adolescence process of autonomy (Arnett, 1999). Adolescents eating attitudes also appear to be more influenced by encouragement to diet, and negative input about their weight status from parents and peers, than by parental modeling in eating attitudes (Baker et al., 2000, Field et al., 2001, Hill and Franklin, 1998, Keel et al., 1997, Smolak et al., 1999). The parents' own eating behavior could be different from the advice they provide to their offspring, and parental modeling of particular eating-related behaviors may have unintended consequences on the eating behavior of their offspring. However, in cross-sectional studies, it is not possible, to determine a causal link between parental and offspring eating behaviors. Therefore, an influence of offspring's eating behaviour on parental eating behaviour cannot be excluded. Moreover, it should be noticed that eating behavior estimated by the TFEQ-R18 was reported and not assessed by an external examiner, and represent therefore perceived eating behavior, that could be different from actual eating behavior. Finally, a great number of correlations were analyzed in this study, then, some of the significant associations could be due to chance findings.

Offspring's emotional eating was correlated with several aspects of parental eating behavior (except between father and daughter). As experiencing negative affect (lonely, anxiety, feeling blue) is a prerequisite of endorsement of the emotional eating items, it is possible that when children have a high level of emotional eating it is a reaction to a more global problem within the family. This poor functioning within the family may also be reflected in disregulated eating, by different ways, on the part of the parents. However, this association between offspring's emotional eating and all parental eating behavior scores could also be partially explained by the high correlation of emotional eating with other TFEQ-R18 scores, which confuse the association between emotional eating and the other eating behaviour scales. To increase the internal validity of the emotional eating scale and decrease the correlation between this scale and the other scales of the TFEQ-R18, three new items have been

added, contributing to the TFEQ-R21 (Tholin et al., 2005). Unfortunately, the revised TFEQ-R21 was not available at the beginning of our study. The correlations between offspring's emotional eating and parental eating behavior should therefore be considered carefully, and other studies should confirm our results.

Whereas twin studies (de Castro and Lilenfeld, 2005, Tholin et al., 2005) and studies including relative pairs in multiple generations showed a great heritability of eating behavior, we did not find a strong resemblance in eating behavior within a family (Steinle et al., 2002). These differences may be explained by the study design. In fact, the levels of the correlation coefficients in eating behavior between parents and adolescents in our study was similar to those estimated in another study with an intra-generational design(Elfhag and Linne, 2005). In any case, the weak familial correlations in eating behavior indicate that family resemblance is not the only contributor to restrained eating, uncontrolled eating, and emotional eating in adolescents. Several studies have shown that peers, media, societal pressure, and food availability could have a significant impact on eating behavior among adolescents (Huon et al., 2000, Huon and Walton, 2000, Story et al., 2002). However, we were not able to test this hypothesis in the present study.
Even if snacking appears then to be common, in France, in adults as in children (Bellisle et al., 2003, Volatier, 2000). A recent study compared meal patterns in Southern France and Central England and found that the French were most likely to follow a regular meal pattern of three meals a day whereas the English eat more energy-dense snack foods (Pettinger et al., 2006). Those cultural discrepancies could have an impact on adolescents eating behavior and our results should therefore be confirmed in other population samples. Finally, in our study of the general population, eating behavior scores did not reach high levels (median always below the middle of the scale). Associations between eating behavior scores in parents and eating behavior scores in offspring might be different with extreme scores, as found in previous studies of transmission of eating disorders from mothers to children (Stein et al., 1994, Whelan and Cooper, 2000, Bulik et al., 2000, Elfhag and Linne, 2005).

In conclusion, in the general population of adolescents, eating behaviors seem to reflect opposition to parents' behavior more than parental resemblance. The presence of father-son relationships is noteworthy in a field where studies are often limited to the mother's influence. The weak familial correlations on eating behavior underline the interest of conducting studies with data on peer influences, media, societal pressures and food availability.

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Table 1

Gender differences in the parents' and offspring' group.

	Father	**Mother**	**Son**	**Daughter**
N	174	205	135	125
Age (y)	44.6 (41.8 - 48.6)	42.9 (40.3 - 45.8)[1]	16.4 (15.1 - 18.3)	16.8 (15.3 - 18.5)
BMI (kg/m^2)	25.7 (23.4 - 28.4)	23.6 (21.5 - 26.7) [1]	20.0 (18.2 - 22.8)	20.3 (18.6 – 22.0)
Eating behavior				
Cognitive restraint (0-100)	22.2 (5.6 - 33.3)	44.4 (27.8 - 55.6) [1]	16.7 (5.6 - 27.8)	38.9 (16.7 – 50.0)[2]
Uncontrolled eating (0-100)	25.9 (7.4 – 37.0)	25.9 (12.5 - 40.7)	40.7 (25.9 - 51.9)	33.3 (22.2 - 48.1)[2]
Emotional eating (0-100)	11.1 (0.0 - 33.3)	44.4 (22.2 - 66.7) [1]	22.2 (0.0 - 44.4)	44.4 (22.2 - 66.7)[2]

Values are medians (interquartile range).

[1]Significantly different from fathers' values (Kruskall-Wallis test, $p<0.05$).

[2]Significantly different from sons' values (Kruskall-Wallis test, $p<0.05$).

Table 2

Spearman's correlations between TFEQ-R18 scores within each subgroups

	Father	**Mother**	**Son**	**Daughter**
N	174	205	135	125
CR[1] and UE[2]	**0.26**	**0.18**	0.16	0.00
CR[1] and EE[3]	**0.34**	**0.23**	**0.22**	**0.25**
UE[2] and EE[3]	**0.60**	**0.66**	**0.43**	**0.48**

Significant Spearman's correlations ($p<0.05$) are indicated in bold.

[1]Cognitive restraint; [2]Uncontrolled eating; [3]Emotional eating.

Table 3

Spearman's correlations between eating behavior scores (CR: cognitive restraint, UE: uncontrolled eating and EE: emotional eating) in parents and in late adolescents. These correlations were adjusted for parent's age and BMI, and adolescent's age and BMI.

	Sons			**Daughters**		
	Cognitive restraint	Uncontrolled eating	Emotional eating	Cognitive restraint	Uncontrolled eating	Emotional eating
Fathers		(n=115)			(n=104)	
Cognitive restraint	0.16	**0.36**	**0.26**	-0.02	-0.01	-0.12
Uncontrolled eating	0.01	0.07	0.18	0.00	0.07	-0.03
Emotional eating	0.06	0.16	**0.20**	0.03	-0.06	-0.01
Mothers		(n=132)			(n=124)	
Cognitive restraint	0.04	0.17	0.17	0.13	-0.01	0.10
Uncontrolled eating	0.12	0.15	**0.18**	**0.26**	**0.22**	**0.20**
Emotional eating	0.07	0.15	**0.25**	**0.20**	0.12	**0.24**

Significant Spearman's correlations ($p<0.05$) are indicated in bold.

Table 4

Spearman's correlations between eating behavior scores (CR: cognitive restraint, UE: uncontrolled eating and EE: emotional eating) in fathers and in mothers. These correlations were adjusted for father's age and BMI, and mother's age and BMI.

	Mothers		
	Cognitive restraint	Uncontrolled eating	Emotional eating
Fathers		(n=170)	
Cognitive restraint	**0.22**	**0.17**	0.13
Uncontrolled eating	0.12	**0.19**	0.09
Emotional eating	**0.17**	**0.24**	**0.24**

Significant Spearman's correlations ($p<0.05$) are indicated in bold.

Figure 1. Graph of Spearman correlations, adjusted for parent's age and BMI, and adolescent's age and BMI