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## **Title. Associations between Parenting Styles and Children's Fruit and Vegetable Intake.**

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### **ABSTRACT**

This study investigated cross-sectional and cross-lagged associations between unhealthy dietary patterns at ages 4 to 9 years and parenting styles. Data from the Longitudinal Study of Australian Children K cohort comprising approximately 5,000 children in wave 1 (4-5 year), wave 2 (6-7 years) and wave 3 (8-9 year) were used for analyses. “Takeaway meals” and “high fat snacks” patterns were extracted through exploratory factor analysis. “Takeaway meals” pattern was positively associated with authoritarian mothers in boys at 6-7 years (OR 2.89) and girls at 8-9 years (OR 6.56), authoritative mothers in girls at 4-5 years (OR 1.99) and 8-9 years (OR 4.56), high levels of maternal control over their children behaviours in boys at 4-5 years (OR 1.57), high levels of paternal control over their children behaviours in boys (OR 1.74) and girls (OR 1.50) at 4-5 years and in girls at 6-7 years (OR 2.30), and authoritarian fathers in boys at 4-5 years (OR 1.69). “High fat snacks” pattern was positively associated with high levels of maternal control over their children behaviours in boys (OR 1.78) and girls (OR 1.63) at 4-5 years, authoritarian mothers in girls at 6-7 years (OR 2.49), authoritative mothers in girls at 6-7 years (OR 2.06), authoritative fathers in boys at 6-7 years (OR 2.19), permissive fathers in boys at 6-7 years (OR 1.99), and authoritarian fathers in boys at 6-7 years (OR 2.32). Authoritative fathers at 4-5 years were less likely to have girls consuming a “takeaway meals” four years later at 8-9 years (OR 0.19), whereas permissive mothers at 4-5 years were more likely to have girls consuming a “high fat snacks” two years later at 6-7 years (OR 2.22). The present study suggests investigating possible mechanisms underlying these associations may lead to the development of interventions aimed at reducing consumption of unhealthy foods.

**KEY WORDS:** Australia, children, cohort, parenting styles, takeaway meals, high fat snacks food.

### **INTRODUCTION**

The factors which impact upon children’s food choices are not well understood. During the early years of childhood, many factors influence children’s food choices. Given the fact that eating behaviours and food choices in children has mainly focused on individual level determinants such as attitudes, preferences, intentions and self-efficacy (S. Kremers, Visscher, Seidell, Van Mechelen, & Brug, 2005), research investigating environmental determinants of food choices in children is a major priority. One of the determinants that has attracted relatively high attention in recent research is that of parenting styles. Parenting styles, by definition, is an emotional term describing the relationship between a parent and a child across a wide range of situations (Franchini, Poínhos, Klepp, & de Almeida, 2011). Parenting style establishes the nature of the parent-child relationship, reflecting the association between general parenting styles and children’s emotional eating (Topham et al., 2011).

Parenting styles are generally described by dimensions of parental warmth and control (Darling & Steinberg, 1993), and divided into three major categories: permissive, authoritarian and authoritative (Rosenkranz & Dziewaltowski, 2008). Authoritarian parents (low warmth and high control) are firm, and they are likely to set strict limits for children, and to use punitive and forceful actions of enforcement (Dufour, 1997). Authoritative parents (high warmth and high control) are warm, firm, and accepting of children’s need for autonomy (Steinberg, 2001). Permissive parents (high warmth and low control) have less expectations of children’s self-control and self-regulate behaviour, potentially may give the child more freedom in decision making (Dufour, 1997).

Parenting styles play a significant role in determining children’s intake of unhealthy foods. In particular, permissive parenting has been positively associated with children’s unhealthy food intake (C. A. Vereecken, Keukelier, & Maes, 2004) (Blissett & Haycraft, 2008) (Hoerr et al., 2009). Permissive parents practice low monitoring of children’s unhealthy food intake, leading to an inability to self-regulate their eating, and therefore may increase body weight (Blissett & Haycraft, 2008). Authoritarian parenting characterised by restricting access to particular foods, is more likely to lead to children consuming more energy-dense foods (Polfuss & Frenn, 2012). Children of authoritarian parents were more likely to be obese (Rhee, 2008).

Conversely, authoritative parenting has been negatively associated with children’s intake of unhealthy foods (Cullen et al., 2000) (Gable & Lutz, 2000), and positively associated with children’s healthy food intake, including fruit and vegetable intake (S. P. J. Kremers, Brug, de Vries, & Engels, 2003) (Hubbs-Tait, Kennedy, Page, Topham, & Harrist, 2008) (De Bourdeaudhuij et al., 2009) (Sleddens, Gerards, Thijs, VRIES, & Kremers, 2012) (Forthun, 2012) (Zahra, Ford, & Jodrell, 2013) (Zahra et al., 2013) (Alsharairi & Somerset, 2014).

The overall purpose of this study was to extend the previous cross-sectional findings to include cross-lagged associations between parenting styles and intake of unhealthy foods in an Australian context using a large representative sample of Australian children. Therefore, the primary aim of this paper was to examine the associations between parenting styles and children's intake of unhealthy foods whilst controlling for child demographic characteristics.

## **METHODS**

### ***Study Population and Design***

This research was conducted through secondary analysis of data from Growing up in Australia: the Longitudinal Study of Australian Children. Briefly, the LSAC implemented a two-stage cluster sampling design. The purpose of a cluster sampling design was implemented to ensure that diverse observations could be gathered from within the community. Further, this strategy allows face-to-face interviews to be conducted cost-effectively. Stratification of postcodes was estimated by Australian Bureau of Statistics (ABS) in March 2004 to ensure proportionate geographic representation from states/territories and capital city statistical division ('met')/rest of state ('exmet') areas. The methods of data selection, collection, and analysis, as well as a detailed description of the LSAC dataset are outlined elsewhere (Soloff, Lawrence, and Johnstone 2005; Soloff et al. 2006; Mission and Siphthorp 2007; Data User Guide 2009; Siphthorp and Misson 2009).

The analyses for the present study used data from wave 1 (2004) wave 2 (2006) and wave 3 (2008) for children in the K cohort, aged 4-5 years at the time of recruitment in 2004. Of the 8391 children resident within postcode, 4911 (2494 boys, 2417 girls) took part at 4-5 years of age at wave 1 in 2004. Children in wave 2 and 3 were slightly lower, as a result of loss-to-follow-up, with 4437 (2258 boys, 2179 girls) and 4310 children (2200 boys, 2110 girls) retained in wave 2 and 3, respectively.

### ***Children's Intake of Unhealthy Foods***

The outcome measure assessed takeaway meals and high fat snacks intake when children were approximately 4-5, 6-7 and 8-9 years old. Takeaway meals and high fat snacks were emerged through exploratory factor analysis using ten food items in wave 1, and eleven food items in waves 2 and 3, based on the Kaiser criterion and the scree plot. A factor loading of 0.3 was used to test correlations between dietary factors derived from the original measurements using the varimax method. Through factor analysis, standardised food items within each factor were computed, and three dietary patterns emerged (fruits and vegetables, takeaway meals, and high fat snacks).

The LSAC collected data on consumption of various food items using a face-to-face interview (F2F) related to reported children's food and drink consumption in the preceding 24 hours. Parents provided information on their child's food intake. The response scale provided for each food item was (a) "not at all", (b) "once/day", (c) "more than once/day". These measures were coded into 0= (not at all, once/day) and 1= (more than once/day), so that a higher value represented children consuming "takeaway meals" and "high fat snacks" >1 once/day.

### ***Parenting Dimensions and Styles***

Parenting style was assessed using a validated face-to-face interview in waves 1-3. Questionnaires provided information about parenting dimensions (i.e. warmth, control and irritability). All variables showed very good reliability and adequate internal consistency ( $r = 0.61-0.83$ ).

The warmth score was assessed by collating twelve items (six for mothers, six for fathers) which measured warm affectionate behaviours towards their child. The latter was adopted from "the Child Rearing Questionnaire" (Paterson and Sanson 1999) (*example item*, "In the last six months how often did you...? Hug or hold this child for no particular reason"). Items were computed and recoded into three new responses 0= medium (sometimes), 1= low (never/almost never, rarely), 2= high (often, always/almost always). The control score was determined through the collation of ten items (five for mothers, five for fathers) which measured the frequency with which parents set and enforced clear expectations and limits for their children's behaviour (*example items*, "When parents spend time with their children, sometimes things go well and sometimes they don't. How often does the following happen...?", "When you give this child an instruction or request to do something, how often do you make sure that he/she does it"). Items were computed and recoded into three new responses; 0 = medium (about half the time), 1= low (never/almost never, less than half the time), 2= high (more than half the time, all the time). The irritability score was assessed by eight items (four for mothers, four for fathers) which displayed the frequency with which parents' interactions with the child entailed behaviours such as disapproval, lack of praise and anger (*example items*, "When parents spend time with their children, sometimes things go well and sometimes they don't. How often does the following happen...? How often do you feel you are having problems managing this child in general"). Items were computed and recoded into three new responses; 0= medium (about half the time), 1= low (never/almost never, less than half the time), 2= high (more than half the time, all the time). Both warmth and control scores were divided and combined to approximate the four categorical parenting styles (Wake et al. 2007): Authoritative

parenting (the combination of high warmth and high control); Authoritarian parenting (the combination of low warmth and high control); Permissive parenting (the combination of high warmth and low control); and Disengaged parenting (the combination of low warmth and low control).

### ***Statistical Analysis***

Data analyses were performed using Statistical Package for Social Science (SPSS) Version 22. The study measured the effect of parenting style on the outcome variable (takeaway meals and high fat snacks) obtained from exploratory factor analysis.

In cross-sectional analysis, multivariate logistic regression analyses were performed separately for boys and girls. The analyses examined how parenting style influenced the odds of a high score for consuming “takeaway meals” and “high fat snacks”. The outcome measure was transformed into binary variables (Reference category coded as 0). Analysis of cross-sectional data was adjusted for child demographic characteristics (age in month, ethnicity, main language spoken at home, number of people in the household, number of siblings of the study child in the household and number of other people in the household of the study child). The present study adjusted the associations between parenting styles and “takeaway meals” and “high fat snacks” for only the child demographic characteristics. The purpose of logistic regression analysis in this study was to identify potential confounding variables (child demographic characteristics) associated with the outcome variables (“takeaway meals” and “high fat snacks”). As a result, all significant or nearly significant variables ( $P < 0.05$ ;  $P < 0.01$ ) were included in the multivariate logistic regression analysis as confounding variables.

In longitudinal analysis, cross-lagged correlations were used separately for boys and girls to test whether parenting style can predict changes in “takeaway meals” and “high fat snacks” consumption over time (e.g. in subsequent waves). The multivariate logistic regression analysis measured the association separately between wave 1 (4-5 years; parenting style) and wave 2 (6-7 years) and wave 3 (8-9 years) (“takeaway meals” and “high fat snacks”), adjusting for child demographic characteristics at wave 2 and wave 3, and “takeaway meals” and “high fat snacks” wave 1.

## **RESULTS**

### ***Characteristics for Maternal and Paternal Dimensions and Styles***

The characteristics for maternal and parental dimensions and styles at all waves are summarised in Table 1. The majority of mothers and fathers were classified as permissive parenting style at wave 1 and 2. At wave 3, more than one quarter of mother and fathers were classified as authoritarian, authoritative and permissive parenting style. Mothers and fathers have medium warmth over their children behaviours at all waves.

#### **Insert Table 1**

*Characteristic for maternal and paternal dimensions and styles*

### ***Unhealthy Dietary Patterns***

Tables 2 and 3 show exploratory factor analysis results of K cohort.

Takeaway meals pattern was loaded highly on foods which are commonly prepared outside the home. A high positive loading was obtained for “hot chips/french fries” in all cohort waves. Takeaway meals pattern was also positively associated with “potato chips/savoury snacks” and “soft drink/cordial, not diet” in wave 1, and “meat pies, hamburgers, hot dogs, sausages or sausage rolls” in all cohort waves.

High fat snacks pattern was loaded highly on foods high in energy and fat. A high positive loading was obtained for “biscuits, doughnuts, cakes, pies or chocolate” in all cohort waves. High positive loading was also obtained for “potato chips/savoury snacks” and “soft drink/cordial, not diet” in waves 2 and 3.

#### **Insert Table 2**

*Factor-loading matrix for “takeaway meals” pattern in the K cohort*

#### **Insert Table 3**

*Factor-loading matrix for “high fat snacks” pattern in the K cohort*

### ***Associations between Parenting Styles, “Takeaway Meals”, and “High Fat Snacks” Patterns***

Tables 4-5 summarise cross-sectional results identifying parenting style associated with the intake of “takeaway meals” and “high fat snacks” patterns at 4-5, 6-7 and 8-9 years.

#### **Insert Table 4**

*Cross-sectional correlation between parenting style and “takeaway meals” intake pattern stratified by gender at 4-5, 6-7 and 8-9 years*

#### **Insert Table 5**

*Cross-sectional correlation between parenting style and “high fat snacks” intake pattern stratified by gender at 4-5, 6-7 and 8-9 years*

In exploring mothers' parenting dimensions and styles, high levels of maternal control over children's behaviours showed positive associations with “takeaway meals” intake in boys (OR 1.57; 95% CI, 1.09 to 2.25) at 4-5 years, and “high fat snacks” intake in boys (OR 1.78; 97% CI, 1.25 to 2.53) and girls (OR 1.63; 95% CI, 1.09 to 2.44) at 4-5 years. Mothers who displayed an authoritarian parenting style had higher odds of having boys at 6-7 years (OR 2.89; 95% CI, 1.29 to 6.48) and girls at 8-9 years (OR 6.56; 95% CI, 1.93 to 22.21) who consume a “takeaway meals” more than once per day, and girls at 6-7 years who consume “high fat snacks” (OR 2.49; 95% CI, 1.27 to 4.88) more than once per day. Having an authoritative mother showed positive associations with a “takeaway meals” intake in girls at 4-5 years (OR 1.99; 95% CI, 1.16 to 3.40) and 8-9 years (OR 4.56; 95% CI, 1.23 to 16.88), and a “high fat snacks” intake in girls at 6-7 years (OR 2.06; 95% CI, 1.16 to 3.67).

In exploring fathering, fathers who reported high control over their children's behaviours were more likely to have boys (OR 1.74; 95% CI, 1.22 to 2.146) and girls (OR 1.50; 95% CI, 1.04 to 2.16) at 4-5 and at 6-7 years (OR 2.30; 95% CI, 1.28 to 4.14) consuming “takeaway meals” more than once per day. Boys of authoritative fathers at 6-7 years had higher odds of consuming “high fat snacks” (OR 2.19; 95% CI, 1.21 to 3.96) more than once per day. Permissiveness in fathers showed positive associations with “high fat snacks” in boys at 6-7 years (OR 1.99; 95% CI, 1.10 to 3.61) more than once per day. Authoritarian fathers showed positive associations with a “takeaway meals” intake in boys at 4-5 years (OR 1.69; 95% CI, 1.02 to 2.80), and also with “high fat snacks” intake in boys at 6-7 years (OR 2.32; 95% CI, 1.27 to 4.20) and 8-9 years (OR 1.78; 95% CI, 1.02 to 3.10) (Appendix 5, Table 20).

Table 6 shows the results identifying whether parenting style is associated with changes in a “takeaway meals” intake pattern over time.

**Insert Table 6**

*Cross-lag correlation between parenting style at 4-5 years and “takeaway meals” pattern intake at 6-7 and 8-9 years stratified by gender*

Cross-lag correlation analyses showed that an authoritative parenting style among fathers at 4-5 years was associated with low intakes of “takeaway meals” more than once per day in girls four years later at 8-9 years (OR 0.19; 95% CI, 0.05 to 0.70), whereas a permissive parenting style among mothers at 4-5 years was associated with high intakes of “takeaway meals” in girls two years later at 6-7 years (OR 2.22; 95% CI, 1.01 to 4.90).

**DISCUSSION**

This study investigates the association between parenting styles, “takeaway meals” and “high fat snacks” intake during the early years of life. Results showed that high levels of maternal and paternal control over children's behaviours showed positive associations with intake of “takeaway meals” or “high fat snacks” in boys and girls at 4-5 and 6-7 years. This is in agreement with previous research findings (Brown & Ogden, 2004) (Arredondo et al., 2006), indicating positive associations between high parental control over children's behaviours and children's unhealthy food intake. Parents' use of control over their children's behaviours may have positive effects on the quality of children's diets by increasing their preferences for those foods (Birch, 1999) (Scaglioni, Salvioni, & Galimberti, 2008). Parent's use of control over their children's behaviours may also restrict access to energy-dense foods, making it more attractive to their children (Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002) (Faith, Scanlon, Birch, Francis, & Sherry, 2004). However, high parental control over children's behaviours may lead to negative emotional feelings towards eating these foods, and therefore, may trigger overeating (Fisher & Birch, 2000). The present study assumes that high levels of maternal and paternal control over children's behaviours may have negatively influence on the nutritional quality of children's diets by increasing their intake for “takeaway meals” and “high fat snacks”

An authoritarian style of parenting employed by mothers and fathers was found to be associated with higher odds of children consuming “takeaway meals” or “high fat snacks” in boys or girls at 4-5, 6-7 and 8-9 years more than once per day. Few studies support the contention that the authoritarian parenting style, characterised by restricting access to selected foods, was more likely to have the consequence of children consuming more energy-dense foods. Parents who exhibit an authoritarian style are firm, and they are likely to set strict limits for children, which in turn increases the likelihood of them consuming energy-dense foods (Fisher & Birch, 1999) (Lee, Mitchell, Smiciklas-Wright, & Birch, 2001). Authoritarian parents may practice high levels of restriction and pressure to eat, and thereby may find it difficult to control their children's intake of high energy food, and therefore may lead to an increase in their body weight (Polfuss & Frenn, 2012). The present study proposes that authoritarian mothers and fathers may restrict access to “takeaway meals” and “high fat snacks” food options and may pressure their children to eat certain types and amounts of food.

Findings from the present study indicated that authoritative parenting styles among mothers or fathers were positively associated with intake of “takeaway meals” or “high fat snacks” in boys or girls at 4-5, 6-7 and 8-9 years. One common assumption is that authoritative parenting has consistently been associated with better health outcomes for children, including a high intake of fruit and vegetables (S. P. J. Kremers et al., 2003) (Patrick, Nicklas, Hughes, & Morales, 2005)

(De Bourdeaudhuij et al., 2009) (Alsharairi & Somerset, 2014). Also, authoritative parenting is consistently related to a lower intake of unhealthy foods (Cullen et al., 2000) (Gable & Lutz, 2000). Authoritative parenting is warm and supportive. They set limit on children's eating energy dense foods variety but are responsive to the needs of them (Forthun, 2012). The present study indicates that authoritative mothers and fathers may influence the intake of unhealthy foods in older children. So far, no study has investigated the potential mechanisms underlying this, suggesting that further analysis as to possible mechanisms relevant to interventions targeting unhealthy foods is warranted.

Permissiveness in fathers was found to be positively associated with intake of "high fat snacks" in boys at 6-7 years. Previous research findings have generally demonstrated a positive association between permissive parenting style and children's soft drink and snack food consumption (C. A. Vereecken et al., 2004) (Hoerr et al., 2009) (C. Vereecken et al., 2009). One explanation might be that permissive parents may be less likely to control the food intake of their children (Dufour, 1997). Permissive parenting is emotionally close and supportive, but they don't set limit for their children's behaviour. They may give their children request to eat excessive amount of high energy foods (Forthun, 2012). Permissive parents also allow their children to watch television, which may lead to increased intake of unhealthy foods (Harris & Bargh, 2009). Permissive parents practice low monitoring of children's food intake, leading children to an inability to self-regulate their behaviour (Blissett & Haycraft, 2008), which may result in the present study to increase consumption of "high fat snacks".

The main cross-lag correlation findings indicated that permissive mothers at 4-5 years were found to have significant associations with higher odds of consuming "takeaway meals" two years later at 6-7 years in girls, whereas authoritative fathers at 4-5 years were found to have significant associations with lower odds of consuming "takeaway meals" four years later at 8-9 years in girls. These findings are consistent with the fact that the permissive feeding style is positively associated with children's unhealthy food intake (Vereecken et al., 2004a) (Blissett and Haycraft, 2008) (Hoerr et al., 2009). Parents who exhibited a permissive feeding style, practice low monitoring of children's unhealthy food intake, leading to an inability to self-regulate their eating, and therefore may increase body weight (Blissett and Haycraft, 2008). The present study assumes that permissive mothers may be less likely to control their daughters' diet, resulting in increased "takeaway meals" intake. In contrast, children raised by an authoritative parenting style have previously been found to be more likely to have healthy food choices (Kremers et al., 2003) (Hubbs-Tait et al., 2008) (De Bourdeaudhuij et al., 2009) (Sleddens et al., 2012). The study proposed that authoritative fathers may be an important determinant to make healthier food choices for children and reduce the intake of "takeaway meals".

There are some possible limitations that the present study has cited. The study acknowledged lack of a comprehensive measure of food items that only 11 food items were available in the present study. However, LSAC was able to show differences between dietary patterns using exploratory factor analyses of these food items. Using exploratory factor analysis to identify food patterns might be affected by subjective analytic decisions, including the labelling of food patterns, the number of food patterns identified, and the statistical analysis techniques applied (Paradis et al., 2006). The dietary patterns were tested as three factors: the 'fruit and vegetable' pattern, 'takeaway meals' pattern, and 'high fat snack' pattern. The authors did not combine 'takeaway meals' pattern and 'high fat snack' pattern because some of the food items did not load significantly on the appropriate food pattern. For example, at 4-5 years, "potato chips/savoury snacks" was loading highly in the "takeaway meals" pattern. These aspects may cause biased estimation of true relationships between parenting styles, 'takeaway meals' pattern and 'high fat snack' derived from exploratory factor analysis. Missing values were related to missing completely at random (e.g. not interested/too busy, not capable/moving/overseas, refused, and were ill/died), and therefore, imputation is not recommended (Heitjan and Basu 1996), and was not included in the present study. This limitation may reduce the likelihood of finding significant differences. The inclusion of child demographic characteristics in the controlling process may cause a key bias in identifying causal effects. The reliance on parents' self-reported measures of parenting styles and children's food intake may produce bias in over-reporting or underestimating of values. Recoding parenting styles and dietary patterns into new different response categories may affect the ability to detect cohort differences, and therefore, may decrease the likelihood of detecting significant differences.

The present study confirmed the previous cross-sectional findings for a positive association between unhealthy foods, authoritarian and permissive parenting style. This study extends the previous cross-sectional findings and confirmed new cross-lagged evidence for a positive association between permissive parenting style and children's "takeaway meals", and a negative association between authoritative parenting style and children's "takeaway meals". The present study also found new evidence of positive cross-sectional associations between authoritative parenting style, "takeaway meals" and "high fat snacks" patterns. In conclusion, this study suggests exploring possible mechanisms underlying such associations may lead to the development of interventions aimed at reducing consumption of unhealthy foods among Australian children.

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