



# Pacifier use and otitis media in infants twelve months of age or younger

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## Abstract

**Purpose:** The purpose of this study was two fold: to determine if within a selected population of infants the prevalence of otitis media was greater in pacifier users than in non-pacifier users, and to reveal if an association existed between otitis media and pacifier use.

**Methods:** The study consisted of 200 children, 12 months of age or younger. Parents were surveyed regarding children's pacifier habits, day care attendance, feeding habits, thumb sucking habits, exposure to parental smoking, and parental education level.

**Results:** The prevalence of otitis media in pacifier users (36%) was larger than that of non-pacifier users (23%),  $P < 0.05$ . A logistic regression analysis determined an association existed between otitis media and pacifier use, bottle feeding, thumb sucking, and day care utilization,  $P < 0.05$ . No association was discovered between otitis media and breast feeding, parental smoking and parental education level.

**Conclusion:** The risk of developing otitis media in an infant is two times greater if a pacifier is used and five times greater if bottle fed or attending a day care facility. (*Pediatr Dent* 21:256-261, 1999)

Use of non-nutritive sucking devices has been reported as far back as the 15th century. Christensen and Fields described non-nutritive sucking as consisting of sucking fingers, pacifiers, or other materials. Such sucking is considered a part of fetal and neonatal child development. For example, Christensen and Fields reported that the fetus can develop sucking and swallowing habits 13-16 weeks in utero.<sup>1</sup> In addition, Niemela et al. found that the infant's need for sucking is greatest during the first six months of life. After that period, the use of the pacifier becomes a habit which makes the infant feel secure.<sup>2</sup>

This century, researchers have looked at many different types of non-nutritive sucking devices, however, pacifiers and their effect on children's oral-facial complex have received the most attention in the literature. Several studies have reported the influence of pacifiers on abnormalities of the jaw and teeth. Niemela et al. reported the pacifier to cause mild defects to the dentition and occlusion. However, they further found that the occlusion will adjust spontaneously if the child stops using the pacifier before age five.<sup>2</sup> More recently, in a study by Adair et al., 218 children between the ages of 24-59 months were evaluated in regards to their occlusion. In this study, pacifier users

were compared to non-users. Adair found a higher prevalence of anterior open bites, posterior crossbites, increased overjet and class II canines and molars in those children who were pacifier users.<sup>3</sup>

In addition to malocclusion, the relationship of pacifiers to other oral diseases has been studied. For example, Manning et al. as well as Sio et al. determined that levels of *Candida albicans* were higher in children using pacifiers compared to those who were non-users.<sup>4,5</sup>

Another area of interest has been the incidence of otitis media in combination with pacifier use. Otitis media, which is defined as an inflammation of the middle ear, has been reported to be one of the most common diseases in young children. In a study performed by Kero et al., 25% of the children investigated had an attack of otitis media before reaching six months of age.<sup>6</sup> Teele et al. discovered that 62% of the children in their study experienced at least one episode of otitis media by the age of one year.<sup>7</sup> A study by Niemela et al. tested 944 five year olds with a history of otitis media, and/or a history of a pacifier habit. The authors concluded that the children who had used pacifiers had a greater risk of otitis media than children who had never used pacifiers. The mean number of otitis media attacks was 5.3 annual occurrences in children who had used pacifiers and 4.6 in children who had not used pacifiers.<sup>2</sup> In a follow-up study by Niemela et al., the occurrence of otitis media and pacifier use was recorded in 845 children attending day care centers during a fifteenth-month period. They concluded that the use of a pacifier was responsible for twenty-five percent of the attacks of otitis media in children younger than three years old. The use of a pacifier did not influence the incidence of otitis media in children four years of age or older. Furthermore, the authors suggest that pacifiers be used only during the first ten months of life when the need for sucking is the strongest.<sup>8</sup>

Although these studies have shown a clear relationship between otitis media and pacifier use in children, what causes otitis media is still unclear. Niemela et al. reported the risk factors for otitis media were breast feeding, parental smoking, thumb sucking, using the nursing bottle, and social class. However, malfunction of the eustachian tube was found to be the most common etiology.<sup>8</sup>

The anatomy of the eustachian tube is closely situated to the nasopharynx. Normally, the eustachian tube is closed. The

tube opens during actions such as swallowing, yawning, or sneezing. This active and passive opening protects the middle ear cavity from reflux of secretions from the nasopharynx. Bluestone reports active opening of the eustachian tube is the result of contraction of the tensor veli palatini muscle. If the tube becomes abnormally patent, a reflux of secretion from the nasopharynx occurs in addition to the loss of equilibrium pressures. Consequently, an otitis media occurs.<sup>9</sup>

Therefore, the question remains: how does a pacifier influence this pathogenesis of eustachian tube malfunction? The teat of a normal pacifier will reach to the junction of the hard and soft palate in an infant. The sucking action, in turn, will lift the soft palate. The rising of the soft palate will contract the tensor veli palatini muscle. As a result, the eustachian tube becomes actively patent, providing an ideal situation for the manifestation of an otitis media.<sup>9</sup>

It is important to note that Niemela found that thumb sucking did not affect the incidence of otitis media, concluding that sucking itself was not the true cause of otitis media. Instead the pacifier was deemed the cause of the consequent ear infection.<sup>8</sup>

It appears from previous epidemiological studies, that otitis media is extremely common in children less than 12 months of age. Furthermore, Niemela et al. has clearly shown a relationship between pacifier use and otitis media in children of older age groups.<sup>8</sup> However, a review of the literature revealed that there have not been any studies documenting pacifier use and otitis media exclusively in children under 12 months of age.

The purpose of this study was two fold: to determine if within a selected population of infants twelve months of age or less, the prevalence of otitis media is larger in pacifier users than in non-pacifier users and to reveal if an association exists between pacifier use and otitis media, as well as other possible risk factors such as bottle feeding, breast feeding, day care attendance, parental smoking, thumb sucking, and parental education level.

## Methods

Two hundred children from the Pediatric Group Practice, at the Randolph Minor Clinic of the Medical College of Virginia Hospitals of Virginia Commonwealth University were recruited for this study. To be included in the study, candidates were required to be 12 months of age or less, otherwise healthy, possess a current medical record, and under the regular care and supervision of a Pediatric Group Practice physician. Past medical records were reviewed retrospectively to determine if a child had been diagnosed with an otitis media. Diagnosis of otitis media was made by practitioners utilizing similar criteria via physical exam coordinated with reported signs and symptoms. Additionally, the number of attacks of otitis media in each child was recorded. Data regarding the childrens' pacifier habits, length of time pacifier was used per day, day care utilization, breast feeding, bottle feeding, parental smoking, thumb sucking, and parental education level was obtained by means of a questionnaire completed by the parent or legal guardian. The survey presented as a series of seven yes or no questions, and was based on several pilot surveys. The child's age, race, and gender were ascertained from the questionnaire. All parents/guardians received an explanation of the study and were given the opportunity to ask questions. If the parent/

guardian agreed to participate in the study, the survey was completed.

The mean time for pacifier use per day in pediatric patients was determined from a previous pilot study to be five hours. Based on this conclusion, to be considered a pacifier user for this study a child must have consistently used the pacifier greater than or equal to five hours per day.

Parents/guardians who reported having a high school diploma, or less were categorized in the low education level. Those parents/guardians claiming a college degree or higher were placed in the high education level.

Descriptive statistics were used to review and present a portion of the results. A Pearson Chi-square analysis was used to determine if a statistically significant difference existed between the prevalence of otitis media in pacifier users and non-pacifier users. The association between the response variable of otitis media and the explanatory variables of pacifier use, bottle feeding, breast feeding, day care utilization, parental smoking, thumb sucking, and parental educational level was tested by use of a logistic regression analysis. The relative risk of the explanatory variables was described via odds ratios determined from the logistic regression. The value of  $P < 0.05$  was regarded as significant for all statistical tests utilized. All statistics were completed utilizing the program JMP<sup>®</sup> 3.15 (SAS Institute Inc.; Cary, NC)

## Results

Two hundred questionnaires were compiled over a six month time period for this study. No parents/guardians refused to participate, thus a 100% response rate was obtained.

This study was comprised of 99 males (49%) and 101 females (51%). The mean age of the children who participated was 5.1 months. There were 150 African-Americans (75%), 43 Caucasians (22%), 4 Hispanics (2%), 2 Asians (.5%), and 1 child who's race was not divulged by the parent/guardian. Statistical analysis revealed no significant difference between any of these tested variables.

The mean age of children who had been diagnosed with at least one case of otitis media was 8.3 months. The mean age of children who had never experienced an episode of otitis media was 3.9 months. The mean age of pacifier users was 5.9 months, while the mean age of non-pacifier users was 4.7 months.

Overall there were 54 children, 27% of the population, that had been diagnosed with at least one case of otitis media. There were 29 children who suffered from one attack of otitis media, 17 from two attacks, 4 from three attacks, 1 from four attacks, and 3 from five or more attacks. Sixty-seven children (34%) were determined to be pacifier users. Sixty-six percent of the population studied, or 133 children, were found to be non-pacifier users.

Twenty-four of the 67 children (36%) who used the pacifier had experienced at least one episode of otitis media. Likewise, 30 of the 133 children (23%) who did not use the pacifier were afflicted as well. Consequently, the prevalence of otitis media in pacifier users (36%) was found to be larger than the prevalence of otitis media in non-pacifier users (23%) (Table 1). The Pearson Chi-squared analysis found this difference to be statistically significant ( $P = 0.04$ ) (Table 2).

The response rates for the other possible risk factors associated with otitis media are listed in Table 3. Only 70 (35%) of

**Table 1. Response Rates for Otitis Media and Pacifier Use Used for  $\chi^2$  Analysis and Prevalence**

Otitis Media	Pacifier use	Responses (N)
Yes	Yes	24
Yes	No	30
No	Yes	43
No	No	103
Total		200

the respondents reported to have been breast fed, while 177 (89%) were bottle fed. A value greater than 100% was calculated as some individuals were reported as having been both breast fed and bottle fed. Thirty-two (16%) of the children attended day care, 106 (53%) of the parents/guardians reported smoking in the home while the child was present, and 98 (49%) of the responses indicated a thumb sucking habit. One hundred fifty-two (76%) of the parents/guardians were in the low education level, while 48 (24%) were in the high category. All of these variables, as well as pacifier use were analyzed to determine if an association with otitis media existed.

The logistic regression analysis revealed at the 0.05 significance level that an association existed between pacifier use and otitis media ( $P=0.04$ ). This association remains significant after controlling for other confounding variables (risk factors). Additionally, an association could be found between otitis media and the variables of bottle feeding ( $P=0.05$ ), day care utilization ( $P=0.001$ ), and thumb sucking ( $P=0.02$ ). No association between otitis media and the explanatory variables of sex, race, breast feeding, parental smoking, and parental/guardian educational level were determined (Table 2).

The regression analysis revealed that children who attended day care or were bottle fed were five times more at risk to suffer from an attack of otitis media within their first year of life. In addition, children who used the pacifier were two times more at risk to develop an otitis media, while children who sucked their thumbs were found to be less than half at risk to become afflicted with otitis media.

## Discussion

Otitis media continues today to be one of the most commonly diagnosed childhood illnesses in the US.<sup>10,11</sup> Researchers have demonstrated the prevalence of otitis media ranging anywhere from 62%-84% in the child patient.<sup>2,7,10,11,12</sup> However, others have found the prevalence to be slightly lower—20%-45%.<sup>6,8</sup> Marchant et al. reported that in 77% of the cases, an initial episode of otitis media occurred during the first year of life.<sup>12</sup> In a study completed by Watase et al. 4000 children, or 20% of the annual population at the Medical College of Virginia Hospitals of Virginia Commonwealth University Department of Pediatrics Clinic, presented with otitis media in 1997.<sup>13</sup> This study found a similar trend as approximately 27% of the children under one year of age reported to the Pediatric Group Practice at the Medical College of Virginia Hospitals of Virginia Commonwealth University with otitis media.

In addition to pacifier use, this study investigated the association of other known risk factors and otitis media. Research concerning the relationship between bottle feeding and otitis media has been controversial. Some report no association be-

**Table 2. Logistic Regression/Relative Risk/Odds Ratios**

Risk factor	P-value	Odds ratio/Relative risk
Pacifier use	0.04*	2.09
Breast fed	0.30	
Bottle fed	0.05*	5.08
Day care	0.0001*	5.69
Parental smoking	0.52	
Thumb sucking	0.02*	0.45
Education level	0.97	

\*Significance  $P<0.05$ .

tween bottle fed infants and otitis media.<sup>8,14-16</sup> However, other studies have shown a strong correlation.<sup>7,17,18</sup> The results of this study tend to follow the latter. A clear association between bottle feeding and otitis media was revealed. In fact, infants in this study that were bottle fed possessed a five times greater risk for developing an otitis media. The anatomy of the eustachian tube, as well as the position in which the child is bottle fed, are the main components of the theory that bottle fed children suffer from more attacks of otitis media. The infants' eustachian tubes are positioned more horizontally than in the adult. In most instances, the infant is placed in a supine position during bottle feeding. Researchers theorize that as the milk or formula is swallowed the horizontal nature of the eustachian tube allows more reflux of the liquid into the middle ear cavity, initiating an acute otitis media.<sup>9,13</sup>

In contrast, it has been suggested that children who are breast fed are protected from attacks of otitis media. There have been several possible explanations for this protective effect. Children who are breast fed are usually positioned upright, rather than supine. Thus, liquid is not able to pool in the horizontally positioned eustachian tube.<sup>10</sup>

Others speculate that the high level of secretory IgA found in breast milk prevent the entrance of foreign antigens into the middle ear cavity.<sup>10,18</sup> Despite the evolution of these theories, research concerning the protective effect of breast feeding on otitis media has been mixed. Several researchers have documented that children who are breast fed suffer from fewer attacks of otitis media.<sup>6-7,10,11,14,16,17-20</sup> While others have reported no safe guarding effect of breast feeding.<sup>8,15,21,22</sup> This

**Table 3. Response Rates for Other Risk Factors**

Risk factor	Yes N (%)	No N (%)
Breast fed	70 (35)	130 (65)
Bottle fed	177 (89)	23 (12)
Day care	32 (16)	168 (84)
Parental smoking	106 (53)	94 (47)
Thumb sucking	98 (49)	102 (51)
	Low N (%)	High N (%)
Education level	152 (76)	48 (24)

study found no association between breast feeding and the increased prevalence of otitis media, lending support to the idea that breast fed children experience fewer episodes of otitis media.

Children who attend daycare centers have also been shown to undergo more attacks of otitis media than those who do not.<sup>6, 10, 11, 15-19</sup> Children tend to be in close proximity during daycare thus they are more susceptible to debilitating illnesses, including otitis media. This present study found a similar trend. The children in our study that attended daycare were over five times more likely to develop otitis media than those who did not attend daycare.

Most research concerning parental smoking and otitis media has shown a positive relationship between the two variables.<sup>10, 11, 14-15, 17, 19, 23-24</sup> Mucous hyper-secretion leading to eustachian tube obstruction, diminished ciliary function and altering of the anti-microbial function of the body by smoke are some of the possible mechanisms by which tobacco smoke might influence the occurrence of otitis media.<sup>23</sup> Still others have found no correlation between parental smoking and otitis media.<sup>6, 8</sup> Similarly, this study also did not find an appreciable association between these two variables.

Poverty and low socioeconomic status have long been associated with overall poor health and increased occurrence of otitis media.<sup>6, 11, 15-16</sup> Children of low income households tend to practice poor personal hygiene habits and are at a greater risk for disease. However, a recent study has found no such relationship.<sup>8</sup> Most of these previous studies determined socioeconomic status from factors such as parental education level as well as total income produced. This study evaluated socioeconomic status on parental education levels and found no relationship with otitis media.

The incidence of thumb sucking in children has received great attention in the literature in the past few decades. Thumb sucking rates as low as 6%-8% have been reported.<sup>2, 13</sup> However, other investigations have demonstrated slightly higher rates ranging from 32%-45%.<sup>25, 26</sup> The results of this study showed a 49% thumb sucking prevalence. In contrast to the incidence of thumb sucking, research concerning the relationship between thumb sucking and otitis media has been lacking. To date, only one study has attempted to investigate this association and found no relationship between thumb sucking and otitis media.<sup>8</sup> This study contradicts this finding as an association did exist between these variables. It is quite possible that as a child sucks his/her thumb, as is theorized with the pacifier, the tensor veli palatini muscle could contract causing an abnormally patent eustachian tube. Furthermore, secretions will again constantly enter the middle ear cavity and an otitis media may occur. Young children also consistently contact unsanitary locations with their thumbs/fingers. The contaminated digit becomes a medium by which microbes, including those that cause otitis media, are introduced into the oral cavity and nasopharynx. It is important to note, however, that the association between thumb sucking and otitis media is relatively weak statistically. In fact, children who suck their thumb were only one-half as likely to contract otitis media as those who did not. Furthermore, since our study excluded children older than 12 months, it is possible that a relationship between thumb sucking and otitis media exists exclusively in children under 1 year. Further investigation is warranted before thumb sucking can be strongly linked to otitis media.

The overall prevalence of pacifier use in this study was found to be 34%. This percentage correlates well with those previously published. Rates have varied anywhere from 2-72%.<sup>13, 25-26</sup> The results of this study indicate that the prevalence of otitis media was greater in pacifier users than non-pacifier users. Furthermore, a strong association was noted between pacifier use and otitis media. This study supports the conclusions drawn by Niemela et al. who also found a positive relationship between these variables.<sup>8</sup> In addition, in a previous study, these same authors demonstrated the relative risk of pacifier users for developing an otitis media was 1.5.<sup>2</sup> Similarly, this study found a relative risk of 2.0. Although the information in the present study substantiates that presented in previous investigations, some differences exist. Niemela makes the recommendation that pacifier use be restricted to the first ten months of life when the need for sucking is strongest and otitis media is uncommon. In both Niemela studies, a specific age group of less than one year was not studied. Associations were based primarily using older age groups (2-3 years). In the population of infants studied in the present investigation, otitis media appeared to be somewhat common as three out of every ten infants suffered from at least one attack of otitis media. Therefore, in lieu of this fact, as well as the presence of a strong association between pacifier use and otitis media, parents ideally may want to discontinue pacifier use at an age earlier than ten months despite the difficult nature of this task.

The main theory behind pacifier use initiating otitis media in children has centered around the idea that sucking the pacifier causes a patent eustachian tube via contraction of the tensor veli palatini muscle.<sup>9</sup> However, other suggestions have been made in linking pacifier use to otitis media. For example, as is the case with thumb sucking, the child's pacifier may come in contact with unsanitary locales and may become a vehicle in which microorganisms can enter a child's oral cavity. Eventually, these organisms may reach the nasopharynx and ultimately the eustachian tube. Additionally, it has been proposed that sucking the pacifier increases the discharge of saliva, which itself is an important medium for the spread of microbes.

Although several statistically significant results are presented in this study, a number of shortcomings should be addressed. Five hours of use was chosen as dichotomy point between pacifier use and non-pacifier use. However, this choice was made utilizing data from only one pilot study. Perhaps a better method for determining a divider between pacifier and non-pacifier use would have been to first determine the age at which the pacifier habit began, then multiply duration of habit (in months) by a parental estimate of daily pacifier use (in hours). Consequently, a more quantitative measure of pacifier use would have been determined with a uniformly applied error. Along these same lines, this study did not determine if the pacifier habit occurred before, concurrent, or subsequent to the first otitis media. Otitis media occurring after initiation of a pacifier habit would help confirm if the pacifier was indeed a risk factor for otitis media. In addition, the risk of otitis media might be less in children using a pacifier for less than five hours.

The results of this study also found the mean age of children who had been diagnosed with at least one otitis media to be 8.3 months. This was over four months older than children who had never been diagnosed with otitis media (3.9 months). Therefore, it is quite possible that increase in age may

have influenced occurrence of otitis media independent of pacifier use. All of the above mentioned shortcomings need re-examination in future investigations.

It is also important to note that an inherent limitation in a study such as this is reliability of parental reporting. The fact that 76% of the parents in this report were placed in a low education level further substantiates this theory.

This study has shown a clear association between otitis media and pacifier use in infants less than one year of age. Nowak and Casamassimo recently describe a method in which preventive oral health care should begin by talking with parents during infancy using developmental milestones and functional considerations. This process was appropriately named anticipatory guidance.<sup>27</sup> These authors maintain that discussion of pacifier use and other oral habits should take place during the ages of six months to two years. Clinicians should utilize this excellent opportunity to discuss not only dental implications of pacifier use, but also the possible risks of otitis media associated with pacifier use. The other possible risk factors of otitis media should be discussed as well (i.e., bottle feeding, thumb sucking, and daycare attendance). Anticipatory guidance already maintains the importance of cessation of nursing bottle use by the age of one year to reduce the occurrence of nursing bottle decay. Additional information regarding the relationship between bottle feeding and otitis media could be discussed as well. Furthermore, in the same manner as bottle feeding is approached, clinicians could conveniently utilize anticipatory guidance to incorporate a plan encouraging discontinuation of pacifier use sooner than ten months of age.

Otitis media continues to be a debilitating and costly disease for children. Many times, recurrent infections introduce other disease processes such as bronchiolitis and many times costly and time consuming myringotomies are inevitable.<sup>28</sup> Early intervention, via anticipatory guidance, may prevent this physical, psychological, and financial strain on the parents and children.

## Conclusions

1. Prevalence of otitis media was higher in pacifier users than in non-pacifier users.
2. Significant associations existed between otitis media and pacifier use, bottle feeding, thumb sucking, and daycare attendance.
3. No association was found between otitis media and breast feeding, parental smoking, and parental education level.
4. The risk of developing otitis media in an infant is two times greater if a pacifier is used and five times greater if bottle fed or attending a day care facility.

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## ABSTRACT OF THE SCIENTIFIC LITERATURE



### A SSESMENT OF OROPHARYNGEAL DISTANCE USING MAGNETIC RESONANCE IMAGING

Oropharyngeal airways are commonly used in management and maintenance of a patent airway in sedated children or those under general anesthesia.

Although deceptively simple, adequate performance of the oropharyngeal airway is dependent on proper size selection. Too small a device causes airway obstruction with the base of the tongue, too large can cause impingement of the epiglottis also resulting in obstruction. This study used MRI to measure the distance from the teeth to the prevertebral pharyngeal space. The authors then created an algorithm to predict this distance based on weight, age, and gender. MRIs of 200 patients (0-17 years of age) were reviewed and two measurements were obtained. L1=distance from teeth to prevertebral tissues and L2=distance from L1 to the tip of the epiglottis. The sample was then randomly divided in half and an algorithm created based on one group and then applied to the other group to assess its efficacy. The algorithm was  $L1=5.51+0.25(\text{age})-0.01(\text{age squared})+0.02(\text{weight})+0.12$ .

The study found that while oral airways are designed with the assumption that the position of the epiglottis is related to the oropharyngeal length, this is not true. The authors suggest that oropharyngeal airway length may be longer than suspected, indicating use of longer oral airways than what is usually accepted. They also concluded that the use of the predictive algorithm will provide a more rational method for determining proper oral airway size.

**Comments:** While the algorithm may seem excessive, the study does emphasize the importance of correct size choice when using oral airways. Since pediatric dentists may not routinely use these devices, the article provides a brief "how-to" on their use. **FKH**

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**Assessment of oropharyngeal distance using magnetic resonance imaging. Greenberg RS, Zahurak M, Belden C, Tunkel DE. *Anes Analg* 87:1048-51, 1998.**

## ABSTRACT OF THE SCIENTIFIC LITERATURE



### FOOD PURCHASE PATTERNS AT THE SUPERMARKET AND THEIR RELATIONSHIP TO FAMILY

The purpose of this study was to develop a process for evaluating the food purchases of families utilizing supermarket receipt data. One hundred and five families representing collectively 138 children and 225 adults contributed data to this study. Participants provided food purchase receipt data for at least six weeks. Total sample food purchases were categorized into 11 distinct groups: add-on and cooking fats; baked goods; beverages; breads; cereals; dairy; entrees/meats; meat, fish, and poultry; pasta, rice, and grains; produce; and snacks. An evaluation of the contribution of the various food groups to energy, fat, and fiber purchases for individual families was calculated. The families at highest risk for poor nutrition were those identified as having more children, lower socioeconomic status, or younger age of the primary shopper. The results suggest that evaluating the food purchases of shoppers and their families using a receipt collection system can help researchers identify problem food groups or specific demographic groups who could benefit from nutrition intervention.

**Comments:** Although the applications of this study for evaluating an individual child patient's dietary intake might be limited in the private practice setting, the authors suggest that the food purchase system was advantageous when compared to traditional food consumption methods such as diet diaries because it is less dependent upon literacy, memory, accurate estimation of portion sizes, and knowledge of composition of mixed foods. **SJF**

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**Food Purchase Patterns at the Supermarket and Their Relationship to Family . Rankin JW, et al: *J Nutr Educ* 30(2):81-88, 1998.**

27 references