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Research Article
Paternal Education Level and Emotional Regulation in Parental Feeding were Associated with Cognitive Performance in a Sample of Preschoolers in Selangor

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Abstract

Objective: This study aimed to determine factors associated with cognitive performance among preschoolers in Selangor. **Materials and Methods:** A total of 167 preschoolers (80 boys and 87 girls) and their parents from eight selected kindergartens were included in this study. Information on socio-demographic background, children's eating styles and parental feeding practices was provided by parents. A Raven's Coloured Progressive Matrices (R-CPM) was used to assess the cognitive performance of preschoolers. The BMI-for-age (BAZ), height-for-age (HAZ) and weight-for-age (WAZ) of preschoolers were determined based on their measured body weight and height. **Results:** A majority of the preschoolers attained average cognitive performance levels (95.6±12.1). Bivariate results showed that a high number of parental years of schooling (father: $r = 0.154$, $p<0.05$; mother: $r = 0.155$, $p<0.05$), a high monthly household income ($r_s = 0.170$, $p<0.05$), high satiety responsiveness ($r = 0.165$, $p< 0.05$) and high emotional regulation in parental feeding ($r = 0.170$, $p<0.05$) were associated with better cognitive performance of preschoolers. In multivariate analysis, fathers who attained a higher number of years of schooling ($\beta = 0.155$) and parents with higher emotional regulation in parental feeding ($\beta = 0.171$) contributed to better cognitive performance among preschoolers. **Conclusion:** Parents play important roles in improving the cognitive performance of their children. Therefore, parental involvement in future health promotion programs, particularly in feeding practices, is needed to improve the cognitive performance of preschoolers.

Key words: Cognitive performance, eating styles, mental health, parental feeding practices, preschoolers

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Rapid technological innovation and global competition have led to an increased demand on the individual to sustain a high cognitive performance[1]. Cognitive performance refers to the brain's performance of mental processes[2]. It is necessary to protect children as they would be helpful for the development of economy and society in future[3]. The cognitive performance of children plays a crucial role as an early determinant of health during adulthood, whereby at the early age of seven years, an increase in children's cognitive performance was significantly associated with two-thirds of the odds of general illnesses in adulthood4. Many studies have reported that poor cognitive performance in children is associated with increased risks of all cardiovascular diseases, some cancers, mental illnesses such as depression and mortality later in life[5-8]. These findings indicate that the cognitive performance of the children should be considered a priority health issue as it may impact on health later in life, consequently it affects the global growth in economic and social in the future.

Environmental factor such as socioeconomic status (SES), including the household family income and parental educational attainment, is common factors that investigated in relations to the cognitive performance of individual[9]. Individuals with high SES had significantly better cognitive performance than those with low SES[10]. Several studies also found that a positive relationship could emerge either between parental income and cognitive performance or between educational level of parents and cognitive performance of children[11-14].

The nutritional status also is an indicator of cognitive performance[15]. Adequate intake of nutrients plays an important role in cognitive development[16]. Studies have found that undernourished children, including those with stunting and wasting, have poor cognitive performance and school achievement[15,17,18]. A similar result has been found among overnourished children, whereby children's overweight status was significantly associated with poor cognitive performance levels[19,20]. Nevertheless, other studies have shown that malnutrition was not significantly correlated with cognitive performance[21-23]. Therefore, more studies are required to determine the association between nutritional status and cognitive performance among children to provide a better understanding of this relation.

Furthermore, eating styles are significantly correlated with the cognitive process in human brains; most previous studies have revealed that less restraint in eating was significantly correlated with better cognitive performance among adolescents and adults[24,25]. This result was consistently found in a study conducted among children[26]. In addition, a study determined a direct relationship between parental feeding practices and the cognitive performance of children[13]. In particular, Mohd Taib *et al.*[13] revealed that children whose parents perceived greater responsibility in feeding tasks and imposed more restrictions on unhealthy foods performed better in cognitive assessments. However, research focusing on the relationships among children's eating styles, parental feeding practices and children's cognitive performance, remains limited.

The present study aimed to determine the associations of parental feeding practices, eating styles and nutritional status of the children, as well as socio-demographic background with cognitive performance among a sample of preschoolers in selected kindergartens in the state of Selangor, Malaysia.

MATERIALS AND METHODS

Study design and respondents: This cross-sectional study was conducted in eight selected kindergartens in the Petaling Perdana district, Selangor, Malaysia. A list of 32 kindergartens in Puchong in the Petaling Perdana district was obtained from the Department of Community Development, Selangor. Of the 32 kindergartens, eight kindergartens were randomly selected. A total of 270 pairs of preschoolers and their parents were invited to take part in the present study. The information sheet and consent form were distributed to each parent. Among 270 respondents, 53 were excluded from this study (89 parents did not give their consent; 5 preschoolers were not Malaysians; 9 preschoolers were absent during the data collection). Overall, 167 parents and preschoolers participated in this study. The present study obtained approval from the Ethics Committee for Research Involving Human Subjects (JKEUPM) and received permission from the Department of Community Development (KEMAS), Selangor.

Measurements

Socio-demographic background: Information on participants' socio-demographic background consisted of two parts. The first part included parents' information, such as educational level, occupational status and family income. The second part included children's information, such as date of birth, age, sex and ethnicity. All of these data were completed by the parents.

Cognitive assessment: This study used Raven's Coloured Progressive Matrices (R-CPM)[27] to assess the cognitive performance of preschoolers. The R-CPM is a puzzle with an

abstract pattern and consists of three sets (set A, set AB and set B) that were arranged from easiest to the hardest. The overall number of R-CPM items was 36; thus, each set was composed of 12 items. Each item has one missing piece of the puzzle with six alternative answers provided and only one correct answer is needed. Each correct answer was given a score of 1 and each incorrect answer was given a score of zero. The total raw score was calculated, converted into a standard score based on Raven's CPM norm table and classified into one of six levels of cognitive performance: extremely low (<70), borderline (70-79), low average (80-89), average (90-109), high average (110-119) and superior (120-129). This R-CPM assessment was conducted in one-to-one manner between the preschooler and the trained researcher. The estimated time required to complete this assessment for each preschooler was between 15 and 30 minutes.

Anthropometric measurements: The body weight and height of preschoolers were measured using a digital weighing scale and stadiometer to the nearest 0.1 kg and 0.1 cm, respectively. Both measurements were taken twice and the average result was obtained. The z-scores of the BMI-for-age (BAZ), weight-for-age (WAZ) and height-for-age (HAZ) were calculated using both the WHO Anthro Software (aged below 5 years old) and the WHO Anthroplus Software (aged 5 years and above). The BAZ of the preschoolers was classified into several categories based on the WHO Growth Standard 2006[28] and the WHO Growth Reference 2007[29] according to age and sex. The WAZ and HAZ were categorized based on the WHO Growth Standard 2006[28].

Eating styles: The child's eating styles were determined using the Child Eating Behaviour Questionnaire (CEBQ)[30]. The CEBQ consists of 35 items that are grouped into eight subscales: food responsiveness; enjoyment of food; emotional overeating; a desire to drink; satiety responsiveness; slowness in eating; emotional undereating; and food fussiness. Each item was evaluated by parents using five optional ratings (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always). Higher total scores on the subscales indicate the usual eating styles practiced by the preschoolers. The internal consistency of the CEBQ subscales in the previous local study ranged from 0.70-0.85[31], while the Cronbach's alphas ranged from 0.30-0.80 in the present study.

Parental feeding practices: The parental feeding practices were assessed using the Comprehensive Feeding Practices Questionnaire (CFPQ)[32]. The CFPQ consists of 12 subscales with 39 items. The 12 subscales included monitoring (i.e. parents tracks less healthy foods), child control (i.e. parents allow child of control eating behaviour), emotional regulation (i.e. parents use foods to regulate child emotion), encouragement of balance and variety (i.e. parents motivate child of eat healthy food), food as a reward (i.e. parents use foods as a gift for the child of good behaviour), involvement (i.e. parents eat together with the child during meal), modeling, pressure to eat (i.e. parents pressures child to eat more food at meals), restriction for health (i.e. parents control intake of less healthy food for child health), restriction for weight control (i.e. parents restrict food intake for child weight management), teaching about nutrition (i.e. parents provide nutrition knowledge to the child during meals) and healthy environment (i.e. parents make healthy foods available in-home). Each item in each subscale was evaluated by parents using a five-point Likert scale. The scores for each item of each subscale were summed to obtain the total score for each subscale. Higher total scores on the subscales reflect a higher intensity of the specific parental feeding practices towards their children. The internal consistency of the CFPQ in the previous study ranged from 0.45-0.90[32] and in the present study, it ranged from 0.54-0.88.

Statistical analysis: The data were analyzed using IBM SPSS version 20. All categorical variables were presented as frequencies and percentages, whereas all continuous variables were presented as means and standard deviations. Pearson product-moment correlation and Spearman's rho correlation were used to determine the association between the independent variables and cognitive performance. Multiple linear regression (MLR) with the stepwise method was used to determine the contribution of factors towards cognitive performance. The level of significance was set at $p<0.05$.

RESULTS

Table 1 shows the distribution of characteristics of the preschoolers, including socio-demographic background, nutritional status, eating styles, parental feeding practices and cognitive performance. The proportions of boys (47.9%) and girls (52.1%) participating in the present study were similar, with a mean age of 5.4±0.5 years old. Most of them were Malay (92.8%). The average number of years of schooling was 14.0±2.8 years for fathers and 13.7±2.8 years for mothers. The monthly household income was grouped into three categories: low (<RM 2300), moderate (RM 2300-RM 5599) and high (≥RM 5600) income per month, based on the Household Income Survey (HIS) by the Economic Planning Unit (EPU)

Table 1: Characteristics of preschoolers (n = 167)

Variables	Mean±SD	No.	Percentage
Socio-demographic characteristics			
• **Sex**			
Boy		80	47.9
Girls		87	52.1
Age (years)	4.5±0.5		
Paternal year of schooling (n = 162)	15.0±12.5		
Maternal year of schooling (n = 165)	13.7±2.8		
Monthly household income status[Δ]			
• **<RM2300**			
RM2300-RM5599			
≥RM 5600		108	64.7
		36	21.6
		23	13.8
Nutritional status			
BMI-for-age (z-score)	-0.04±1.4		
Weight-for-age (z-score)	-0.50±1.5		
Height-for-age (z-score)	-0.80±1.1		
Eating styles			
Enjoyment of food	3.40±0.8		
Desire to drink	2.80±1.1		
Food responsiveness	2.60±0.8		
Emotional overeating	2.10±0.7		
Satiety responsiveness	3.20±0.6		
Food fussiness	3.10±0.6		
Emotional undereating	2.90±0.8		
Slowness in eating	2.90±0.6		
Parental feeding practices			
Healthy environment	4.10±0.8		
Modelling	4.10±0.8		
Encourage balance and variety	4.00±0.7		
Teaching about nutrition	3.90±0.9		
Monitoring to eat	3.60±0.9		
Restriction to eat for health	3.60±1.2		
Involvement	3.60±0.9		
Pressure to eat	3.00±1.0		
Food as reward	3.00±1.0		
Child control	2.90±0.7		
Restriction to eat for weight	2.70±1.0		
Emotional regulation	2.40±0.9		
Cognitive performance levels	95.60±12.1		
Extremely low (<70)		1	0.6
Borderline (70-79)		11	6.6
Low average (80-89)		21	12.6
Average (90-109)		108	64.7
High average (110-119)		18	10.8
Superior (120-129)		6	3.5
Very superior (≥130)		2	1.2

*Indian, Sabah's Bumiputra, Sarawak's Bumiputra, Indigenous people (*Orang asli*), [Δ]Household Income Survey (HIS), conducted by EPU and Department of Statistic (RMK-10) (Ministry of Human Resources, 2010), RM: Ringgit Malaysia

and the Department of Statistics[33]. Approximately three in five preschoolers were classified as being in a low-income family (64.7%), with a total household income of less than RM 2300.00 per month (Table 1).

The average BAZ, WAZ and HAZ of preschoolers are shown in Table 1. In the present study, the prevalence of the possible risk of overweight, overweight and obesity among the preschoolers was found to be 3.6, 5.4 and 7.2%, respectively; these findings were more prevalent among boys (5.0% possible risk of overweight, 7.5% overweight and 7.5% obesity) than among girls (2.3% possible risk of overweight, 3.4% overweight and 6.9% obesity). The results also showed

that 5.4% of preschoolers were underweight, while 1.2% were severely underweight. In terms of HAZ, this study found that one in ten preschoolers were considered stunted (10.8%) and 1.8% of them were severely stunted.

Regarding preschoolers' eating styles, the enjoyment of food subscale had the highest mean score (3.4±0.8) compared to other subscales (Table 1). In other words, the majority of preschoolers usually ate in response to environmental food cues, such as the feeling of hunger, the smell of food and their emotional state and they typically increase their rate of eating in response to that cue. For the findings on parental feeding practices, a healthy environment (4.1±0.8) and modeling subscales (4.1±0.8) had the highest average scores compared to the other subscales (Table 1). Hence, most of the parents provide balanced and healthy food in-house and they commonly eat healthy food together with their child.

As shown in Table 1, the present study found that many of the preschoolers were classified as having average cognitive performance levels (64.7%), with an average cognitive performance score of 95.6±12.1. Approximately one in five preschoolers was classified as having lower cognitive performance (borderline = 6.6%; low average = 12.6%; extremely low = 0.6%), while 14.3% of them were considered to have higher cognitive performance (high average = 10.8%; superior = 3.5%).

Table 2 shows that parental years of schooling (father: $r = 0.154$, $p<0.05$; mother: $r = 0.155$, $p<0.05$), monthly household income status ($r_s = 0.170$, $p<0.05$), satiety responsiveness ($r = 0.165$, $p<0.05$) and emotional regulation ($r = 0.170$, $p<0.05$) were positively correlated with preschoolers' cognitive performance. These results revealed that preschoolers with highly educated parents, from high-income families, have a good response to satiety and whose parents managed their emotions using food had significantly better cognitive performance. However, the present study found that the following factors were not correlated with preschoolers' cognitive performance: sex, age, BAZ, WAZ, HAZ, enjoyment of food, a desire to drink, food responsiveness, emotional overeating, food fussiness, emotional undereating, slowness in eating, healthy environment, modeling, encouragement of balance and variety, teaching about nutrition, monitoring of eating, restriction to eat for health and weight, involvement, pressure to eat, food as a reward and child control (Table 2).

The multiple linear regression analysis with a stepwise method found that emotional regulation ($\beta = 0.171$) and paternal years of schooling ($\beta = 0.155$) significantly contributed to the cognitive performance of preschoolers ($R = 0.229$, $F = 4.524$, $p<0.05$) (Table 3). This finding indicated that parents who have good feeding practices in regulating their children's emotions and fathers with high education levels contributed significantly to the higher cognitive performance of preschoolers.

Table 2: Factors associated with the cognitive performance of preschoolers (n = 167)

Variables	r/r_s	p-value
Socio-demographic characteristics		
Sex[b]	-0.142	0.068
Age (years)[a]	0.038	0.629
Paternal year of schooling[a]	0.154	0.048*
Maternal year of schooling[a]	0.155	0.045*
Monthly household income status[b]	0.170	0.028*
Nutritional status[a]		
BMI-for-age (z-score)	-0.022	-0.780
Weight-for-age (z-score)	0.006	0.938
Height-for-age (z-score)	0.043	0.579
Eating styles[a]		
Enjoyment of food	0.031	0.690
Desire to drink	0.001	0.986
Food responsiveness	0.007	0.933
Emotional overeating	0.031	0.687
Satiety responsiveness	0.165	0.033*
Food fussiness	0.042	0.591
Emotional undereating	0.066	0.395
Slowness in eating	-0.043	0.578
Parental feeding practices[a]		
Healthy environment	-0.099	0.201
Modelling	0.047	0.548
Encourage balance and variety	0.053	0.499
Teaching about nutrition	-0.015	0.846
Monitoring to eat	-0.052	0.508
Restriction to eat for health	0.056	0.474
Involvement	0.095	0.222
Pressure to eat	0.100	0.201
Food as reward	0.078	0.314
Child control	0.062	0.427
Restriction to eat for weight	0.048	0.540
Emotional regulation	0.170	0.028*

[a]Pearson product-moment correlation, [b]Spearman's rho correlation, *Significant was at $p<0.05$

Table 3: Factors contributed towards the cognitive performance of preschoolers (n =167)

Variables	Standardized coefficients (Beta)	t	ΔR^2	p-value
(Constant)	34.354			0.0001*
Emotional regulation	0.171	2.255	0.029	0.025*
Paternal years of schooling	0.155	2.037	0.024	0.043*

$R = 0.230$, $R^2 = 0.053$, $F = 4.583$, $p<0.05$

DISCUSSION

The present study found that the mean score of preschoolers in the cognitive assessment was 95.6±12.1, which reflected that one in five was considered to have an average cognitive performance level. Compared to the previous study conducted in Peninsular Malaysia[13], the present cognitive score among preschoolers was slightly lower.

This study has shown that more years of parental schooling and high monthly household income were weakly and significantly correlated with better cognitive performance among preschoolers. This result was consistent with those of previous studies, whereby highly educated parents[12,13] and higher family income[34] were significantly associated with better cognitive outcomes among children. A possible explanation for this association is that parents from different educational and financial backgrounds have different living conditions and different home-teaching strategies, which may impact children's cognitive development and performance[35].

The present study showed that preschoolers who have high satiety responsiveness have better cognitive performance than those who have low satiety responsiveness. A low satiety responsiveness may result in increased intake of calorie-rich foods that are high in sugar, salt and fat but low in fiber[36,37], in which this poor nutrient intake may affect poor cognitive development and brain performance[16]. Nevertheless, the nutrient intake of preschoolers was not assessed in the present study.

In addition, the current study reported that high emotional regulation in parental feeding practices was significantly associated with better cognitive performance among preschoolers. This result was in line with the study of Graziano and Reavis, in which the academic performance of the children was significantly associated with emotional regulation. Behavioral self-regulation problems are suggested as a potential mechanism that can explain the association between emotional regulation and the cognitive performance of children[38,39]. Children with behavioral self-regulation problems usually have difficulty dealing with their own negative emotions, which can affect their ability to concentrate, to plan or to complete the task and ultimately affect the overall cognitive performance[38,39]. This mechanism indirectly explains that parents in the present study who are skilled at regulating their child emotions using food helped their children to have better cognitive performance.

The multiple linear regression result of the present study reported that more paternal years of schooling and high emotional regulation of parental feeding practices significantly contributed to the better cognitive performance of preschoolers. This finding determined that educational levels among fathers influence cognitive performance of preschoolers more than educational levels among mothers. In addition, parents who are skilled in regulating children's emotions by using foods are more focused on children's cognitive performance than on other feeding practices.

CONCLUSION

In conclusion, one in five preschoolers in the present study has an average level of cognitive performance. More paternal years of schooling and high emotional regulation of parental feeding practices were significantly associated with better cognitive performance among preschoolers. Therefore, the promotion of healthy feeding practices among parents and the educational status of fathers should be noted in health intervention programs to improve cognitive performance levels of children.

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