ความฉลาดทางสติปัญญา และความฉลาดทางอารมณ์ที่มีผลต่อค่าดัชนีมวลกายใน เด็กวัยเรียน กรณีศึกษาจังหวัดนครปฐม

Intelligence Quotient and Emotional Quotient Affecting Body Mass Index Among School-Age Children: A Case Study of Nakhon Pathom Province

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บทคัดย่อ

การวิจัยนี้มีวัตถุประสงค์เพื่อ 1) ศึกษาระดับความฉลาดทางสติปัญญา และความฉลาดทางอารมณ์ในเด็กวัย เรียน กรณีศึกษาจังหวัดนครปฐม 2) เปรียบเทียบระดับความฉลาดทางสติปัญญา และความฉลาดทางอารมณ์ในเด็ก วัยเรียน จำแนกตามปัจจัยส่วนบุคคล และ 3) ปัจจัยส่วนบุคคล ปัจจัยครอบครัวและสังคมที่มีอิทธิพลต่อค่าดัชนีมวล กายในเด็กวัยเรียน กลุ่มตัวอย่างที่ใช้ คือ เด็กอายุระหว่าง 6-11 ปี จำนวน 266 คน ที่ได้รับการสุ่มเลือกในแต่ละ ห้องเรียนจากโรงเรียน 3 แห่งในเขตเมืองของจังหวัดนครปฐม ในประเทศไทย โดยใช้เทคนิคการ คัดเลือกตาม สะดวก เครื่องมือที่ใช้ คือ แบบประเมิน Test of Nonverbal Intelligence Fourth Edition (TONI-4) และ แบบ ประเมินความฉลาดทางอารมณ์สำหรับเด็ก 6-11 ปี กรมสุขภาพจิต กระทรวงสาธารณสุข วิเคราะห์ข้อมูลโดยสถิติ บรรยาย การทดสอบค่าที (Independent Samples t Test) การทดสอบความแปรปรวนทางเดียว (One-Way ANOVA) และการวิเคราะห์สถิติสมการถดถอยเชิงพหุ (Multiple Regression Analysis) ผลการวิจัย พบว่า กลุ่ม ตัวอย่างผู้ปกครองไม่ถึง ร้อยละ 5 ที่มีการศึกษาอยู่ในระดับสูง และด้านสถานภาพทางครอบครัวและสังคม ร้อยละ 21.43 มีรายได้ครัวเรือนต่อเดือนต่ำกว่า 10,000 บาท นอกจากนี้ ระดับการศึกษาของผู้ปกครองที่ต่างกัน ทำให้เด็ก วัยเรียนมีดัชนีมวลกาย และความฉลาดทางสติปัญญาแตกต่างกัน (p<0.05) ขณะที่ระดับรายได้ของครัวเรือนที่ ต่างกัน ทำให้เด็กวัยเรียนมีความฉลาดทางอารมณ์และความฉลาดทางสติปัญญาแตกต่างกัน (p<0.05) อย่างไรก็ ตาม ปัจจัยส่วนบุคคล ได้แก่ อายุ ความฉลาดทางอารมณ์ และความฉลาดทางสติปัญญา มีผลต่อค่าดัชนีมวลกายของ เด็กวัยเรียน ในพื้นที่เขตเมืองของจังหวัดนครปฐม อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 (p<0.05)

คำสำคัญ: ความฉลาดทางอารมณ์/ ความฉลาดทางสติปัญญา/ ภาวะน้ำหนักเกิน/ เด็กวัยเรียน

Abstract

This study 1) measured the level of intelligence quotient (IQ), emotional quotient (EQ), and body mass index (BMI) in school-age children 2) compared the intelligence quotient (IQ) and emotional quotient (EQ) in school-age children according to personal factors and 3) investigated the individual, family and social factors affecting body mass index in school-age children in Nakhon Pathom Province. A total of 266 children aged 6-11 years old were randomly selected in each classroom from three schools in urban areas of Nakhon Pathom Province in Thailand using the convenience method for selection. IQ scores were assessed using the

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fourth edition of the test of nonverbal intelligence (TONI-4), and emotional intelligence (EQ) assessed by the emotional intelligence assessment questionnaire for children aged 6-11 years old, Department of Mental Health (DMH), Ministry of Public Health, Thailand. The data was analyzed by using descriptive statistics, independent Sample t-Test, One-way ANOVA, and multiple regression. The results showed that not more than 5% of parents had higher education level and 21.43% of the family and social status have a family income below 10,000 Thai Baht per month. Moreover, the parents' education level is shown to impact BMI and IQ, while income status of family shows effects on EQ and IQ, also. However, individual factors, such as age in years, emotional quotient (EQ) and intelligence quotient (IQ) affected the body mass index in school-age children of urban areas of the Nakhon Pathom Province, Thailand ($p<0.05$).

Keyword: Emotional quotient/ Intelligence quotient/ Obesity/ School-age children

1. Introduction

Obesity in school-age children has become a major problem in the health status of Thailand, which in turn increases the probability of overweight and obese condition in adolescence and relates to non-communicable diseases (NCDs) [1]. In 2018, the annual report of the department of health found that 13.3% of school-age children between 6-14 years are overweight and obese [2]. According to the statement of ministry of public health in 2021 shows that in sector 5 (Kanchanaburi, Nakhon Pathom, Ratchaburi, Suphanburi, Prachuap Khiri Khan, Phetchaburi, Samut Songkram, and Samut Sakhon) consists of 13.35% of children who have obesity and starting to have obesity. In addition, the proportion in Nakhon Pathom can be counted as 14.74% [3]. The situation is an increasing number of children who have obesity. The beginning stage of obesity and obesity is a silence threat to adult's health. Additionally, it can rapidly appears due to the heredity, receiving too much energy for long period of time, and having less body movement. For the children who have obesity and are starting to have obesity, obesity can affect the development in terms of physical and mental and socialization. Moreover, 25% of children who have obesity will continue being obese, and 75% of teenagers [4].

Many researchers have reported the negative relationship between intelligence quotient (IQ) and obesity; for example, Kanazawa (2014) [5] found that the relationship between IQ and BMI or obesity was significantly negatively associated with childhood. Similarly, Freidl et al. (2013) [6] reported that for a sample of adolescents (ages between 14-17) both overweight and obese (BMI >40 or BMI >35), BMI is significantly negatively correlated with intelligence (-0.250), measured by the Wechsler Abbreviated Scale. On the other hand, emotional intelligence has become linked with the ability to manage one's own emotions, and EQ is thus associated with eating disorders and attitudes leading to overweight condition and obesity in children [7,8]. Three articles investigated the relationship between BMI and EQ of children. While, Swami et al. (2010) [9] showed that high emotional intelligence correlated significantly positive with body image. Same as Movahhedi (2019) [10] proved that overweight children show a significant difference in lowering emotional intelligence than normal children. And, Nurmohamadian and Boland (2016) [11] found out that emotional intelligence is related to body mass index. However, it is not clear that emotional intelligence (EQ) and intelligence quotient (IQ) correlate with obesity/overweight; by contrast, the obesity/overweight may bear some relation to IQ and EQ. At present, a few studies have been conducted relating to the BMI, EQ, and IQ of children in urban areas of Thailand. For proving all this, this research aimed to investigate the relationship between intelligence quotient (IQ), emotional quotient (EQ) and obesity of school-age children in urban Nakhon Pathom Province, Thailand. This result of study can be described and

related to the factors for the health status increase of the risk of obesity in adolescence, which would hopefully lead to successful prevention and treatment policy.

Research objective

1. To study the level of intelligence quotient (IQ), emotional quotient (EQ) and body mass index (BMI) in school-age children.

2. To compare the intelligence quotient (IQ) and emotional quotient (EQ) in school-age children according to personal factors.

3. To investigate the individual, family and social factors affecting body mass index in school-age children in Nakhon Pathom Province.

2. Materials and Methods

Population and Samples

A population of 550 schoolchildren aged between 6–11 years from three schools in urban areas of Nakhon Pathom Province, Thailand. A convenience sample of 266 students who were studying at Grad 1 to Grad 6 in Nakhon Pathom Province, Thailand. The sample of this study was calculated by the G* power program for linear multiple regression [12]. The minimum sample determined was 222 samples with effect size of 0.3 at a power $(1-\beta)$ of 0.99 and level of significance $\alpha=0.01$. This effect size of parameters for calculation was followed by Freidl et al. [6]. However, a drop-out rate of 20% is expected in a final sample of 266 samples.

Instruments

Body Mass Index (BMI) was measured by formula: BMI = Weight/(height $(m)^2$) for evaluate the status of overweigth/obesity [13]. Subsequently, BMI percentiles were classified into four groups: underweight (<5th BMI percentile), normal (5-84th), overweight (85-94th BMI percentile), and obesity (≥95th BMI percentile). Demographic variables were divided into two parts: general information of parents and general information about child, as self-reported

by the parent and then subsequently validated by data obtained from the research.

In addition, intelligence quotient assessment (IQ) is a highly reliable measure of general intellectual functions pertaining to the overall ability of cognitive functions [14].

IQ scores were assessed by using the fourth edition of the test of nonverbal intelligence (TONI-4) [15] that requires no examination. TONI-4 measures intelligence, aptitude, abstract reasoning, and problem solving. The tests were administered to the children individually in a comfortable room that was well lit and free from noise. Based on the raw scores, the subjects were classified into one of five non-verbal IQ categories; <71 (extremely low); 71-79 (borderline); 80-89 (below average); 90-110 (average); 111-120 (high average); 121-130 (superior); and >130 (very superior). The TONI-4 scale has good reliability and its Cronbach's alpha for TONI-4 was 0.96. Next, emotional quotient (EQ) pertains to the ability to motivate oneself and the ability to manage emotions well in relationships with others [16]. EQ scores were assessed by emotional intelligence assessed by emotional intelligence assessment questionnaire, Department of Mental Health (DMH), Ministry of Public Health, Thailand. The EQ scores were classified by T-scores Norms; 40≤: need to develop, 41-55: should be develop and ≥56: good emotional quotient. The EQ scale has good reliability and its Cronbach's alpha for EQ was 0.87.

Data Analysis

Participant characteristics were presented as frequency and percentage for categorical data, and mean and standard deviation for numerical data. We compared obesity status using the crude prevalence of weight categories, adjusting for age between 6-11 gave similar findings among school-age children of urban areas in Thailand. Testing of continuous variables was made by t-test for two comparisons or by one-way analysis of variance for multiple comparisons. In addition, the relationship between

IQ, EQ, individual factors, family, and social factors affecting BMI were tested using a linear regression model. All cases of the study were considered at the significant level as p-value<0.05.

Ethics in Research

This research was approved by the committee on human rights related to human experimentation of ethics in research by the Mahidol University (IRB) under protocol number (MU-IRB 2013/125.04 10) in Thailand.

3. Results and Discussion

The background characteristics of the sample are shown in Table 1. Of all the 266 students aged between 6-11 years evaluated, 51.88% were female (n = 138) and 48.12% (n = 128) male. The majority of the samples, 26.69% (n = 71) were 10 years old, and the remaining 21.43 % (n = 57) were 6 years old. Of those who completed the survey, 24.06% (n = 64) were grade 5, 26.69% (n = 71) grade 4, 22.93% (n = 61) grade 3, 4.90% (n = 13) grade 2, and 21.42% (n = 57) grade 1. Among the samples, the majority of father's education (81.20%) was below bachelor's degree, and 77.07% of mother's education was below bachelor's degree. Survey samples were asked to identify their income status, which found 41.98% with income 10,000-20,000 Thai Baht, 37.59% higher than 20,000 Thai Baht, and 21.43% below 10,000 Thai Baht.

The majority of samples, 60.20%, were normal, 21.40% were considered underweight, 11.30% were obese, and the remaining 7.10% were overweight (Table 3). The test of nonverbal Intelligence (TONI-4) measures one's intelligence quotient (IQ). The majority of samples, 70.30%, were average, 14.30% were above average, and 8.30% were below average. The emotional quotient (EQ) of samples found 45.90% were below average, 27.80% were poor, and the remaining 25.90% were overweight. The majority of samples, 60.20%, were normal, 21.40% were considered underweight, 11.30% were obese, and the remaining 7.10% were overweight (Table 3).

In order to achieve the research goal, after the descriptive analysis of variables, t-test and ANOVA were presented to compare background characteristics of the sample as to which factors were significantly associated with the IQ and EQ in school-age children (Table 1-2). For example, there was a significantly lower IQ for children whose family income was below 10,000 Thai Baht, and 10,000-20,000 Thai Baht in comparison with higher than 20,000 Thai Baht (p<0.05). For EQ, there were significantly higher scores for EQ for children with higher income status (p<0.05).

Table 5 presents the relationship between intelligence quotient (IQ), emotional quotient (EQ) and obesity in school-age children using a multiple linear regression model. Before analyzing multiple regression, Multicollinearity testing is a priority use, that can test the correlation between variables. As shown in Table 4, there is a statistically significant positive correlation between age of student and BMI (r = -0.163, p<0.01). While, the correlation coefficient is significant with negative correlation between EQ and BMI (r = 0.214, p<0.01).

The regression analysis findings show that individual factors, family, and social factors are significant predictors for BMI (R^2 = 0.18, F = 2.119, and p = 0.024). R^2 value means 18.00 % of the variance in that individual factors, family and social factors is explained by BMI.

The age in years was positively (b = 0.460) associated with BMI at the level of significance of 0.05. While EQ and IQ were considered, an inverse association was observed between BMI score as presented in Table 5.

Table 1 Baseline characteristics of participants and mean and standard deviation of EQ score with different variables (N = 266)

Variable	N (%)	EQ ($\bar{x}$ ± S.D.)	P-value
1. Gender			
Male	128 (48.12)	43.60 ± 8.55	0.036*[a]
Female	138 (51.88)	45.74 ± 8.01	
2. Age			
6 years	57 (21.43)	44.32 ± 8.92	
7 years	13 (4.89)	47.37 ± 5.66	
8 years	30 (11.28)	44.65 ± 6.98	0.000*[b]
9 years	39 (14.66)	48.89 ± 7.79	
10 years	71 (26.69)	44.64 ± 8.34	
11 years	56 (21.05)	41.69 ± 8.14	
3. Father's education			
Below bachelor's degree	216 (81.20)	44.04 ± 8.33	0.233[b]
Bachelor's Degree	45 (16.92)	47.33 ± 7.78	
Higher bachelor's degree	5 (1.88)	51.74 ± 7.78	
4. Mother's education			
Below bachelor's degree	205 (77.07)	46.88 ± 8.53	0.016[b]
Bachelor's Degree	50 (18.80)	47.29 ± 6.63	
Higher bachelor's degree	11 (4.14)	48.77 ± 8.69	
5. Income status			
Below 10,000 Thai Bath	57 (21.43)	43.87 ± 7.36	0.040[b]*
10,000-20,000 Thai Bath	109 (41.98)	44.52 ± 8.55	
Higher 20,000 Thai Bath	100 (37.59)	46.44 ± 9.63	

EQ=Emotional quotient; a=t-test for two comparisons; b=one-way analysis of variance for multiple comparisons; S.D.=standard deviation,*p<0.05

Table 2 Baseline characteristics of participants and mean and standard deviation of IQ score with different variables (N = 266)

Variable	N (%)	IQ ($\bar{x}$ ± S.D.)	P-value
1. Gender			
Male	128 (48.12)	101.06 ± 9.67	0.105[a]
Female	138 (51.88)	103.23 ± 11.93	
2. Age			
6 years	57 (21.43)	104.45± 12.33	
7 years	13 (4.89)	108.23 ± 6.82	
8 years	30 (11.28)	101.47 ± 6.07	0.002*[b]
9 years	39 (14.66)	106.49 ± 13.05	
10 years	71 (26.69)	101.34 ± 10.93	
11 years	56 (21.05)	96.69 ± 8.14	

IQ=Intelligence quotient; a=t-test for two comparisons; b=one-way analysis of variance for multiple comparisons; S.D.=standard deviation,*p<0.05

Table 2 Baseline characteristics of participants and mean and standard deviation of IQ score with different variables (N = 266) (Cont.)

Variable	N (%)	IQ ($\overline{x}$ ± S.D.)	P-value
3. Father's education			
Below bachelor's degree	216 (81.20)	100.55 ± 10.61	0.016[*b]
Bachelor's Degree	45 (16.92)	109.51 ± 9.48	
Higher bachelor's degree	5 (1.88)	104.33 ± 10.50	
4. Mother's education			
Below bachelor's degree	205(77.07)	99.94 ± 10.07	0.045[*b]
Bachelor's Degree	50(18.80)	109.34 ± 9.89	
Higher bachelor's degree	11(4.14)	107.40 ± 9.89	
5. Income status			
Below 10,000 Thai Bath	57 (21.43)	99.26 ± 9.44	0.028[*b]
10,000-20,000 Thai Bath	109 (41.98)	100.82 ± 10.34	
Higher 20,000 Thai Bath	100 (37.59)	108.27 ± 10.94	

IQ=Intelligence quotient; a=t-test for two comparisons; b=one-way analysis of variance for multiple comparisons; S.D.=standard deviation,*p<0.05

Table 3 The level body mass index (BMI) in school-age children

BMI range	N	%
Under weight	57	21.40
Normal	160	60.20
Over weight	19	7.10
Obese	30	11.30

Table 4 Pearson correlation on the relationship between age, IQ, EQ, and BMI in school-age children (N = 266)

Factors	IQ	Age	EQ	BMI
IQ	1	-0.221	0.232**	-0.037*
Age		1	-0.086	0.214**
EQ			1	-0.163**
BMI				1

**p-value<0.01, *p-value<0.05

Table 5 Determinants of the relationship between IQ, EQ, individual factors, family and social factors, and BMI by regression model

Factors	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
Intercept	14.759	3.737		3.949	0.000
Individual Factors					
Sex: Male (Ref.)	0.623	0.600	0.069	1.038	0.300

Ref.=reference group; *p<0.05

Table 5 Determinants of the relationship between IQ, EQ, individual factors, family and social factors, and BMI by regression model (cont.)

Factors	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
Age in years	0.460	0.169	0.183	2.730	0.007*
IQ	−0.017	0.030	0.039	−0.553	0.041*
EQ	−0.071	0.038	−0.127	−1.892	0.044*
Family and social factors					
Father's education: Below bachelor's degree (Ref.)					
Bachelor's Degree	0.411	1.208	0.029	0.340	0.734
Higher bachelor's degree	0.011	1.328	0.001	0.008	0.993
Mother's education: Below bachelor's degree (Ref.)					
Bachelor's Degree	−0.914	1.104	−0.071	−0.828	0.409
Higher bachelor's degree	2.457	2.277	0.071	1.079	0.282
Income status: Below 10,000 Thai Bath (Ref.)					
10,000-20,000 Thai Bath	0.980	1.028	0.108	0.953	0.342
Higher 20,000 Thai Bath	1.569	1.029	0.172	1.525	0.129
R /R^2/ Adjusted R^2	0.296 / 0.18/0.088				
F	2.119				
P value	0.024*				

Ref.=reference group; *$p<0.05$

Discussion

The results of this study also indicated that two major factors (IQ and EQ) affect BMI of the school-age children in urban areas of Nakhon Pathom Province, Thailand. This study had evidence that IQ and EQ were the major determinants for lower BMI of the school-age children in urban areas. The survey results showed that only 1.90% of fathers and 4.20% of mothers had higher than bachelor's degree. More than one-fifth (Table 1) of the family and social status has a family income below 10,000 Thai Baht per month. In addition, parents' education showed impact on BMI and IQ while income status of family shows effect on EQ and IQ also. Moreover, 11.30% of the school-age children in urban areas of Nakhon Pathom Province had obese status (≥95th BMI percentile), 27.80% low score for EQ, and 8.30% had below average group for IQ when compared to usual cut points. On the other hand, when we considered the baseline characteristics of the school-age children, we found that the personality trait factors such as sex were not associated with BMI, but age in years is related to BMI because of physical growth and cognitive development followed by age.

We found that individual factors such as age in years, IQ and EQ were significantly related to BMI (Table 2). This study's findings provide additional evidence for supporting the presence of a relationship between IQ and BMI. Studies of Salahodjaev and Azam (2015) [17] and Freidl et al. (2013) [6] found a negative link between IQ and obesity. Movahedi and Movahedi (2019) [10] indicated that high BMI lead to overweight and obesity are associated with a higher EI score in both genders, which shows the importance of weight effect on emotional intelligence. Generally, intelligence quotient (IQ) is a cognitive ability which leads to the decisions showing behavioral tendencies [18]. Especially, for individuals of the school-age children

of high IQ there is a well-established link to classify about characteristics of food, including calories, as a result of food labels, diet advertising and publicity about obesity or BMI [19]. Similarly, Savanna-IQ Hypothesis found that intelligence is positively associated with eating more healthy foods behavior [5]. Therefore, we can conclude that the school-age children of low IQ have more likely to opportunity to increase BMI.

In addition, findings of another in this study were to determine the relationship between emotional quotient (EQ) and obesity in school-age children. Table 2 showed that school-age children of high emotional quotient (EQ) will still significantly decrease the likelihood of obesity or BMI (p<0.05). Similarly, Sutin et al. (2015) [20]; Nurmohamadian and Boland (2016) [11] found that the emotional quotient (EQ) is significantly negative with BMI. In other words, as emotional intelligence (EQ) increases, BMI decreases. However, emotional intelligence is an important factor related to thought and emotion of persons [9]. Moreover, the individuals' emotion regulation has a powerful effect on eating behaviors and food choices [21]. In other words, people with high emotional intelligence can effectively control emotional eating compared to those with low emotional intelligence.

Moreover, it seems that a cycle could be observed between emotions and eating patterns and as a consequence overweight and obesity would be the result. Emotional characteristics have been related to both body weight and health behaviors. Multiple studies also suggest that negative emotions (e.g. negative mood) may negatively affect eating patterns [10]. Recent theoretical in psychology Satoshi Kanazawa has this theory, which he calls the Savanna-IQ Interaction Hypothesis suggest that general intelligence evolved to solve problems, more intelligent individuals may be more likely to acquire and espouse evolutionarily novel preferences and values that our ancestors did not possess than less intelligent individuals are. Thus, relative to their less intelligent counterparts, more intelligent children are more likely to grow up to espouse the evolutionarily

novel values of left-wing liberalism or atheism [22]. Finally, both IQ and EQ in school-age children are cognitive abilities which lead to eating behaviors. The IQ of individuals is a self-regulating process while emotional intelligence (EQ) can be more persuasive to focus efforts on eating behaviors. Thus, other cognitive skills in children which relate to aspects of BMI or obesity problems remain possible avenues for future research.

Conclusion

The survey results showed that only 1.88% of fathers and 4.14% of mothers had higher than bachelor's degree and one-fifth of the family and social status have a family income below 10,000 Thai Baht per month. Parents' education showed impact on BMI and IQ while income status of family showed effect on EQ and IQ also. Moreover, individual factors, such as age in years, emotional quotient (EQ) and intelligence quotient (IQ) negatively correlated with BMI in school-age children of urban areas of the Nakhon Pathom Province, Thailand. In other words, school-age children with high emotional quotient (EQ) and high intelligence quotient (IQ) have greater opportunity to decrease BMI/obesity

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