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School Meals Program and Its Impact Towards Student's Cognitive Achievement

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Abstract: Nutrition food is one of the factors influencing student academic development. By providing a good nutrition for children in school is one of the way to increase economy development in Indonesia. School meals program has important role in order to improve children participation and children performance in school. Some previous research founds that nutrition food ables to increase children cognitive. However, those have not taken into account the direct impact of school meals program on children cognitive. Therefore, this study aims to analyze the direct impact of school meals program toward children cognitive. The data was taken from Indonesia Family Life Survei (IFLS) wave 5. This study is conducting Propensity Score Matching method to knowing the impact of school meal program on children cognitive. The result shows that school meal program has impact to increase children cognitive score on mathematic. It shows that these program has impact on children score by 0.2 point higher than children in school without school meal program.
Keywords: School Meal Program; Cognitive Score; Impact Evaluation; Indonesia
JEL Classification: I28

Introduction

One of the goals of Sustainable Development Goals (SDGs) is alleviating femine and malnutrition for children in the world. One of ten peoples are starving and almost 1 of 3 peoples lack of access of nutrition food, whilst there is 149,2 million of children under 5 years olds are stunting. These are duet to malnutrition. According Riset Kesehatan dasar (Riskesdas), Indonesia in 2018 have prevalence number of underweight, stunting, and wasting are 17.8 percent, 30.8 percent, and 10.24 percent respectively. Thus, Indonesia becomes one of the country with a fairly high prevalence of stunting compared to other middle-income countries such as Nigeria by 36.7 percent, Bangladesh by 15.2 percent, India by 23.7 percent and Nepal by 15.9 percent (Ministry of Health of Republic of Indonesia, 2019). Malnutrition has negative impact to viability of life, health and children growth. Stunting is chronic malnutrition and has impact on the long-term such as lack of cognition and mental, susceptible to disease, low of economy productivity, low of reproduction quality. Wasting is accute malnutrition and high frequency of susceptible to disease (World Food Programme (WFP), 2020). Therefore, the problem of malnutrition for children is main attention in developing countries because its impact on human capital affects economic growth in the long-term.

Some previous researches shows that nutrition of food impacts on outcome children in school (Roberts et al., 2022; Frisvold, 2015; Fang & Zhu, 2022). Nutrition food containing double micronutrient suplement able to raise nutritional balance and increase the growing of children malnutrition so that increase the cognitive ability (Roberts et al., 2002). Moreover, children who lack of zinc is higher risk to be exposed anemia. Anemia impacts on lack of concentration for study (Taras, 2005). It supported by Anthea Webb as Director for World Food Programme, she said that nutrition food has impact on decreasing children to be exposed on anemia. It leads to student to have more energy and more focus when they are studying (Win, 2017). Bellisle (2004) and Sorhaindo and Feinstein (2006) finds that nutrition food containing protein, carbohidrate and glucose impacts on increasing cognitive, concentration, and energy. Sorhaindo and Feinstein (2006) also finds that malnutrition on zinc, Vitamine B, omega-3 fatty acid have impact on its (Wilder Research, 2014).

The health problem of children in Indonesia must be alleviated immediately considering the result of Indonesia education have not rapid progress. Baswedan (2014) said that Indonesia's ranking in Trends in Internasional Mathematics and Science Studies (TIMSS) and Program for Internasional Students Assessment (PISA) is lower compared than other developing countries. According to TIMSS, Indonesia is on 40th of 42th countries in 2011. While, Indonesia education based on PISA show that Indonesia on 64th rank of 65th rank in 2012 and 71th rank of 76th rank countries in 2018 (OECD, 2015). It leads to Indonesia's students lower on mathematics, science, and literacy knowledge so that health problem on children should be eradicated.

School Meals Programmes aims to malnutrition alleviation for children in school. This programme conducted into two ways, first, meals is giving to children in school (in-school feeding) and family who has school children would be given a food (take-home ratios). In-school feeding categorized into 2 which is programme provides breakfast, lunch, or combined of them, and these programme provides biscuits or high energy snacks, while take-home rations has a function as conditional cash transfer. School meals programmes has some objectives such as meeting social needs and providing social safety nets during crises, efforts to improve learning and education outcomes, and efforts to improve nutrition (Bundy et al., 2009).

School Meals Programmes in Indonesia was first released in 1997 with the main target is elementary school children. In 2011, the programme was handed over to Government as decentralization process. World Food Programme (WFP) in Indonesia was collaborated with local government by providing breakfast to more than 30.000 childrens in school. School Meals Programme is local food-based in 2012 and 2015. These programme was implemented in 27 district in 27 provinces. In 2016, Ministry of Education and Culture released the School Children's Nutrition Programme (PROGAS) aimed to improving balance nutrition, healthy behavior and children's learning abilities. These programe is providing a nutritious food encompasses 25 percent of the recommended daily intake for children in 3 times a week. In addition, these programme is using local food especially for empowering local communities. These programme is also providing nutrition health education in order to establish healthy and clean life (World Food Program, 2018).

School meals programme aims to increase food nutrition for children in order to improve their performances in school. It based on some previous researcher found that nutrition food has impact on children performance on school. Chakraborty and Jayaraman (2019) by using Intent-to-Treat (ITT) found that children who was given meals on school in the long-term has impact on mathematic and reading score higher than children has meals on school in the short-run. Moreover, Kaur (2021) by using instrumental variable found that school meals programme is not only able to increase children school participation but it prevents drop children out of school in India. In line with Iddrisu et al. (2022) founds positive relation among school participation and school attendance in Ghana whereas its programme affected by political involvement. It leads to negative impact on school meals programme so as able to decrease children school participation and attendance. McEwan (2013) by using regression discontinuity design found that school meals programme in Chili measured by calorie intake per day is not significant on participation and cognitive ability. Taylor and Ogbogu (2016) found that school meals programme has impact on increasing children learning in-and-out of class. It is also supported by increasing input in school such as quality of teacher, number of teacher, teacher attendance and teaching aids (Wang & Cheng, 2022).

School meals programme has impact on increasing children cognitive ability in school. Galloway et al., (2009) by using tobit regression found that children who get meals in school has impact on increase their learning so their mathematic score higher 28.5 percent than children who did not get school meals, while it is also able to increase mathematic score consistently. It is encouraged by increasing awareness of food nutrition and decreasing consumption on unhealthy food (Frisvold , 2015). By using two-stage least square (2SLS), Mostert (2021) found that school meals programme able to increase cognitive ability by reducing vulnerability of disease. While these programme has impact to increase children's concentration and their participation in class. (Hochfeld et al., 2016). Moreover, Wang and Cheng (2022) by using ordinary least square found that nutrition improvement programme in China has impact on children cognitive by increasing education expenditure such as book, uniform, education insurance, but extracuriculer and other activities out of school has no impact on children cognitive.

Some studies in Indonesia found that school meal program positively affects children's performance and nutrition in school (Muslimatun et al., 2014; Satoto et al., 2012; World Food Programme, 2016; Sekiyama et al., 2018). World Food Programme (2016) evaluates the school meal program in Papua and Nusa Tenggara Timur provinces using a qualitative and quantitative approach. They have two groups that have the same socioeconomic characteristic as a comparison to assess the program with a quantitative approach. As a result, they find the enrollment and attendance enhancement of students exposed to the school meal program. They use a qualitative approach to explore the reasons behind the results. Teachers who are respondents in observations guessed the school meal program enticed students to participate in school. Based on students' responses, they reported that the school meal program boosted their energy, mitigated hungriness, and made them concentrate more. Therefore, Muslimatun et al. (2014) determines school meal programme conducted in Jakarta and Tangerang has impact not only on reduce anemia prevalence and iron, but also increase cognitive abilities on language skill, verbal

reasoning, concentration, and short-term memory except Tangerang city and West Jakarta has no impact on verbal reasoning and memory. In line with Satoto et al. (2012) explores school feeding program impacts on academic performances by using score of mathematics and Indonesian Language which were measured using specific scholastic performance testing. Sekiyama et al. (2018) assess the impact of school feeding programs in Indonesia using the Wilcoxon signed-rank test and the Mann-Whitney U test. They discover the increasing energy and nutrient intake of students who study in schools with school feeding programs. Students who were exposed by school feeding program have more energy and student's weight over than children without the programme so that it has impact on learning process by children. The results imply that the school meal program gives benefits to the students.

The school meal program is one way to improve nutrition for children in Indonesia which is currently still low. By providing nutrition food for student, it is one way to increase Indonesia's economic development. Children who are pyhsically health and have good nutrition will be more active to participate in school longer and learn more lesson which is leads to higher productivity when they grow up (Rosso, 2009). Besides, children with physical health have impact on student attendance in class so that it affects children's cognitive achievement (Wisniewski, 2010). Therefore, student with malnutrition affects declining on cognitive abilities through psychological changing or reduce their ability to be active in learning. Short-term hunger caused by children who do not eat before school or children who are well nourished has an effect on difficult to focus and doing many tasks (Bundy et al., 2009).

Based on the explanation above, some researchers found a relationship between the development of children's nutrition and the food supplement program implemented in school and the effect of good nutrition on children's cognitive development. Based on previous research conducted in Indonesia, there has been no impact evaluation assessment of school meal program on children's cognitive achievement, such as mathematics, science, and literacy scores. Therefore, this study aims to analyze the impact of school meal programs on children's mathematics cognitive achievement by using Propensity Score Matching estimation.

Research Method

This study used secondary data obtained from Indonesian Family Life Survei in 2014 (IFLS 5). This study used Household book contains data on socioeconomic characteristics, the Facility Book contains data on school characteristics, and the Community Book contains data on characteristics of an region. Interviews and questionnaires at the household level were conducted from September 2014 to March 2015, while the facility and community level were conducted in March 2015 (Strauss et al., 2016).

A counterfactual calculation is needed to calculate the impact of a program. This leads to know the condition of a group affected by the program if the program is not applied to that group (Gertler et al., 2016). Holland in the study conducted by Heinrich et al. (2010)

said that it is impossible to make observations on the same two units and they are in different conditions at the same time. The first step to estimate counterfactual is moving from individual level to group level. Although we can not find perfect clones among them but we can pairing them from the same characteristics between groups. In addition, we must also ensure that the characteristics of the groups are not effected by the program being implemented (Gertler et al., 2016).

Based on study conducted by Gertler et al., (2016), Propensity Score Matching method is one of way to estimate conterfactual. This method is using to calculate the impact of student with School Meal Programme (PMT-AS) because the data availables only for one year. This study used propensity score matching method to match several characteristics among treatment group and control group (Heinrich et al., 2010).

This study chooses the nearest meighbors matching method by matching the characteristics between two groups which are closer. This method does not not have to compare one by one between individuals in the two groups, but other individuals can compare with previous individuals who have match characteristics. This study used individual and regional socio-economic characteristics, and also school characteristics to calculate propensity score as study conducted by Buttenheim et al. (2011) to calculate the impact evaluation of PMT-AS in Laos.

Heinrich et al. (2010) said it is important to know the effect of these characteristics on the program being implemented by using a limited dependent variable, i.e. the variable is valued 1 if a program is implemented and valued 0 if the program is not implemented. This study used the logit method as a Equation 1:

$$PMTAS_{ijk} = \alpha_{ijk} + \beta_1 age_{ijk} + \beta_2 women_{ijk} + \beta_3 lnparent's\_income_{ijk} + \beta_4 lnschool\_passinggrade_{jk} + \beta_5 Poverty_k + u_{ijk}$$

Equation 1

Equation 1 shows the PMT-AS logit model. The PMT-AS variable is dummy variables valued 1 if the student is in school with PMT-AS and it is valued 0 if student is in school without PMT-AS. Age variable is age of students. Women variable is dummy variable valued 0 if studen is a girl and 0 if the student is a boy. The parent's income variable is the income of student's parent for the last 12 months which is calculated by usiing natural algorith equation. This study assumes parents a head of the family. The passing grade is the average of passing grade in school which is calculated into natural algorithm. This study uses natural algorithm calculation to make distribution of the normal two variables. The poverty variable is the number of poor people in the area of observation. The notations i, j, and k indicates the identity number of student, school, and district. IFLS follows BPS by using area enumeration to determining regional boundaries (Strauss et al., 2016).

After getting the match between the two groups using the propensity score matching, we can calculate the impact of evaluation of PMS-AS with the Equation 2:

$$\widehat{ATE} = E(Y|D = 1) - E(Y|D = 0)$$

Equation 2

This equation is explained and derived by Heinrich et al. (2010) in their research entitled An Primer for Applying Propensity-Score Matching. The notation E(Y | D = 1) is the average result or expected value of the potential outcome in the group where the program is applied, while E(Y | D = 0) is the average result or expected value of the potential outcome in the group which is not applied.

Result and Discussion

This chapter shows the calculations described in the previous chapter. This study will first show the results of the descriptive statistics followed by the results of the PMT-AS logit model. This leads to know some characteristics that affect the implementation of PMT-AS in a school. In addition, this chapter is also discusses each variable with previous theories and research.

After cleaning and processing the data, the study had an observation sample of 1,844 students from 242 regions and 178 regions. This data contains 94 children received PMT-AS, while the remaining 1,750 children did not receive the program. This study found that the student received the program from the characteristics of the school that provided PMT-AS. This study only observed public school and children aged 6 to 15 years who were still in the year of the questionaire was filled out. Cognitive value of mathematics is using to limit the study.

Table 1 shows the descriptive statistic of variables used in the study. The average age of students was 9 to 10 years both for students who received PMT-AS and those who did not receive the program. This observation has almost the same rasio of male and female students. Based on cognitive score, the students who did not receive PMT-AS had an average score of 1 out of 5 points, while student who received PMT-AS had an average score of 2 points. In addition, the average income of parents for 12 years around Rp 17,000,000 to 18,000,000. Based on parents' education level, children who did not receive PMT-AS have father with at least graduated from high school around 3 percent and the remaining have education level is below. While the percentage of mother's education level is smaller only about 1 percent of graduated from high school. Those percentage is not too different from students who receive PMT-AS, which is the percentage of father education who had at least graduated from high school was 6 percent. These groups shows also none of mother's education had minimum high school level.

Table 1 Descriptive Statistic

Variables	Observation	Mean	Minimum	Maximum
PMT-AS = 0				
Age	1.750	9,846286	6	14
Dummy of gender	1.750	0,508	0	1
Parent's income (12 last month)	1.750	18.100.000	500.000	500.000.000
Dummy of Father's education (Senior High School (SMA =1))	1.750	0,0314286	0	1
Dummy of Mother's education (Senior High School (SMA=1))	1.750	0,0182857	0	1
Cognitive Score	1.750	1,246933	0	5
Average of Passing Grade Score	1.750	25,63686	12,09	99,98
Average of number of student in a class	1.750	32.06489	2,666667	166,3333
Number of poor people per area	1.750	1.605,337	40	18.000
PMT-AS = 1				
Age	94	9,882979	7	13
Dummy of gender	94	0,5744681	0	1
Parent's income (12 last month)	94	17.700.000	500.000	90.000.000
Dummy of father's education (Senior High School (SMA=1))	94	0,0638298	0	1
Dummy of Mother's education (Senior High School (SMA=1))	94	0	0	0
Cognitive score	94	2,778857	0	5
Average of Passing Grade Score	94	21,22362	18,81	22,5
Average of number of student in a class	94	38,44504	2	54
Number of poor people per area	94	1.907,979	261	3.860

Data Processed: Stata

The average passing grade in the two groups are not much different around 25 points from school without PMT-AS, while group of school with PMT-AS has 22 points. For knowing the average passing grade, this study looks also at the data on the number of student per class in the two groups. The average number of students per class is 32 people for student who did not receeue PMT-AS whilst the average number of student per class is 38 people for student who receive PMT-AS. Based on regional level, this study looks at the number of poor people in the observation area. The average number of poor people in the student area without PMT-AS are 1,605 people while there are 1,907 of poor people in the student area with PMT-AS.

Table 2 shows the effect of PMT-AS to children's cognitive by using logit model. This study knows the variables affected the program in school by using standard error values and p-values. Age and gender did not have an effect on the implementation of PMT-AS in school. Parent's income and the average passing grade have negative effect on PMT-AS. It leads to children with higher parent's income tend to school without PMT-AS. while children without PMT-AS tends to have passing grade higher than children with PMT-AS. In

addition, the area with higher number of poor people tends to PMT-AS implementation in school where is located in those area.

Table 2 Estimation result of Logit on PMT-AS

Variables	Coefficient	Standard error	P-value
PMT-AS			
Age	-0,0050548	0,0646573	0,938
Dummy of gender	0,318962	0,2172405	0,142
Parent's income (ln)	-0,4284521***	0,1039509	0,000
Average of passing grade score per school (ln)	-2,623215***	0,6674913	0,000
Number of poor people	0,0001135*	0,0000578	0,05
Constant	11,74151	2,805469	0,000

Data processed: Stata. Significant Level: ***1%, **5%, *10%

Buttenheim et al. (2011) shows that age of children has significant effect on PMT-AS. On contrast, Table 2 shows that age of children do not have significant effect on PMT-AS. However, Buttenheim et al. (2011) found the effect of PMT-AS on children's cognitive in the two regions has significant effect but the other two regions do not have significant effect in Laos. Moreover, female does not has significant effect on PMT-AS which is in line with Buttenheim et al. (2011).

The next step is knowing the effect of PMT-AS on mathematical score after calculating the effect of PMT-AS on children's cognitive by calculating propensity score. In Table 3, it shows that PMT-AS has impact on increasing student's mathematic score about 0.2 point. The result based on student interviews conducted in the South Middle East Region shows that students understand better on the lesson and concentrate more when they are not hungry. It is supported by the provision of the Local Food-Based School Meals Program (LFBSMP) in school (World Food Programme, 2016). This result implies that PMT-AS boosts students' ability to solve mathematical problems. Macronutrient intakes in the meal are the mechanism of this result. PMT-AS provides foods that contain carbohydrates, protein, and fat. Dietary macronutrients impact cognitive function in the brain, such as protein can improve executive function and working memory (Muth & Park, 2021).

Table 3 Estimation Result of PMT-AS on Children's Cognitive

Mathematic score	coefficient	AI Robustt Standard error	P-value
ATE			
PMT-AS (1 vs 0)	0,191974	0,0413294	0,000

Data processed: Stata

Based on estimation above, it shows that the supplementary food program for children give more benefit especially for children from poor family compare than children with high economy status. It leads to family with high economy status tend to put their children in school without supplementary food program from government. Student's parents with higher income have the probability to school their children in school with no school feeding program. These program is more implemented on areas with high number of poor people. In line with Mostert (2021), it found that supplementary food program has more

impact on rural areas than urban areas whilst people with lower economic status are more in rural areas than urban areas. In addition, the supplementary food program for children has function as a social safety net in the conditional cash transfer targeting families with low economic status (Bundy et al., 2009). It is supported by Wang and Chen (2022) found that children who receive suplementary food program in school able to increase their cognitive through education investment of the family such as purchasing books, uniforms, education, insurance, etc.

The Indonesian governement in collaboration with the World Food Program helps some remote areas such as eastern part of Indonesia by providing free meals to student. The eastern part of Indonesia has a high poverty raye and children low development caused by malnutrition in those area (Win, 2017). These fact is match with the study showing that high number of poor people will have a tendency to PMT-AS implementation.

The supplementary food program in school has impact on families with children receiving its program by shifting expenditure on nutritious food to school expenditure which can be support school needs so that it has impact on increasing children's school performance. Moreover, Kaur (2021) found that supplementay food program in schools is not only able to increase children's participation in school but it is able to prevent children to leaving school. It is caused by economic factor encouraging the family to send their children in school. This study also found that supplementary food is not able to increase women participation in school. Contrast with Kaur (2021), it is found that supplementary program for children in India school able to increase female participation in school in order to reduce education gender gap.

The supplementary food program in Indonesia can increase children's mathematical cognitive abilities. These results are supported by several studies which found that good nutrition will affect student thinking ability, behavior, academic ability, and health (Wilder Research, 2014). In fact, Frisvold (2015) found that student who attend school with breakfast program and the percentage of students who are eligible to receive meals in school excedd the regional percentage standard have higher math scores around 8 percent to 9 percent. These program has positive impact on increasing children cognitive if these program is carried out continuously. It because children who receive supplementary food program in school are able to improve learning performance through increasing concentration and participation in class (Hochfeld et al., 2016; Galloway et al., 2009). Moreover, the supplementary food program is able to improve children's health through the provision of nutritious food in order to reducing the risk of absenteeism in school which has impact on children's cognitive achievement.

Conclusion

This study aims to knowing the impact of suplementary food on students' mathematical cognitive scores. According to previous studies, it shows discussing the effect of suplementary food program on children's health and education participation rates. However, some previous studies do not view directly about the effect of supplementary

food on students' cognitive scores. Therefore, this study aims to see the direct impact of supplementary food program on students' cognitive score. It is based on fact that Indonesia's PISA score lower than other developing countries.

This study indicates a positive effect of supplementary food program on students' cognitive scores while the impact is still low, about 0.2 points. Therefore, the increase in students' cognitive scores is not only affected by supplementary food program, but some variables outside the model influence students' cognitive. For future research, we need to assess other variables. The supplementary food program is a better way to support student learning by improving food nutrition, although it still needs some students and parents to increase students' scores. The school feeding program (PMT-AS) effectively enhances the students' learning and nutrition. Education and health for children are critical capital for development in the long term. Governments need to provide this program to other schools, especially those lacking facilities and rural areas.

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