Original

Study of Energy Intake of Children with or without School Lunch in Hanoi, Vietnam

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Abstract: ***Background:*** In the urban areas of Vietnam, the obesity rate of children is increasing rapidly. Over the past few years, Vietnam has implemented a school meals program to address this problem. However, students are free to decide whether to get school lunch or not. Students who do not eat lunch at school tend to consume sweet drinks, sweet confections, greasy snacks etc. that are energy rich, more often than other students do. The objective of this study was to confirm the hypothesis that students without school lunch consume higher energy, especially from snacks, when compare with students with school lunch. ***Methods:*** We asked approximately 200 fifth grade students (10 years old) with or without school lunch for more than 3 years at a public elementary school to cooperate in our research. From over 100 children who agreed, we randomly selected 50 children who ate school lunch and 50 who didn't eat school lunch. We rented smartphones for the students and asked them to send photos of all the food and beverages that they consumed for three days (two weekdays, one weekend day or holiday). From those photos, we estimated the weight of the food and then calculated the energy intake. ***Results:*** The average energy intakes (kcal) of children who ate school lunch and those who did not eat it were respectively 1902 and 2075 on weekday one, 1907 and 2108 on weekday two, 2107 and 2120 on the weekend day ($p<0.05$), and 1972 and 2101 on average for three days ($p<0.01$). The average energy intake (kcal) of three days from snacks was 235 for student with school lunch and 401 for student without school lunch ($p<0.01$). The reason for the higher energy intake among children who did not eat school lunch was the large influence of snacks during the day. The average BMI of children with school lunch was 17.1, and of children without school lunch was 18.5 ($p<0.05$). ***Conclusion*:** In comparison with children with school lunch, children without school lunch had higher energy intake from their snacks, resulting in higher total energy intake.

Key Words: School lunch, energy intake, snack.

INTRODUCTION

Since the Vietnam War ended in 1975, the Vietnamese economy has entered a period of peaceful development. Along with the country's socio-economic growth, Vietnam has achieved remarkable results in improving nutritional status and child health. However, in this period, eating habits have also changed. In particular, children's diet and lifestyle are affected in various ways, such as the trend toward consuming a lot of fast food and processed foods that are less healthy, the trend toward drinking carbonated soft drinks and energy drinks, and the trend toward eating snacks and street food which do not guarantee food safety. Consequently, childhood obesity has been rapidly increasing. In 1995, the prevalence of obesity among primary school children in Ho Chi Minh City was 1.4% (*1*) and rose to 52.7% in 2016 (*2*). In Hanoi, the prevalence also increased rapidly from 3.3% in 1995 to 40.6% in 2013 (*3, 4*).

Over the past few years, Vietnam has implemented a school meals program to address this problem. The school lunch implementation rate in Vietnam is high, up to 93% (*5*), but it is not required by law and children can decide to eat lunch at school or return home to eat. Many children prefer to go home because they don't like the taste of school meals. When they go home for lunch, on the way, they can easily buy junk food from the vendors – who are waiting for the hungry children – around the school. The children who have school lunch are not able to go outside to buy snacks. So, we thought that children without school lunch may have higher energy intake, especially from snacks, when compared with children with school lunch. Therefore, we conducted this study to confirm this hypothesis in order to show directly the effect of school lunch on dietary behavior and obesity of children

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METHODS

Study design. This was a cross-sectional study conducted between January 2018 and March 2018 at a public elementary school in Hanoi where all the children came from middle-income families. We divided students into two groups: students who took school lunch and students who did not for more than 3 years, then asked them and their parents to cooperate in the research. 63 out of 94 students who took school

lunch and 89 out of 106 students who did not take school lunch agreed to participate. In each group, we randomly selected 50 children (25 boys and 25 girls).

The protocol had been approved by the ethics committee of primary school in January 2018. The study complied with the ethical principles provided by Declaration of Helsinki. Before we conducted the research, all the parents and children were introduced to the nature of the project, signed a consent form and were instructed on how to record dietary items and send them to the researchers.

Anthropometric measurement. Weight and height were measured at baseline, in light clothing and without shoes. Body mass index (BMI) was computed as the ratio of weight (kg) per height squared (m^2). The nutritional status was determined based on BMI reported in WHO 2007 (*6*): obesity >+2SD; overweight >+1SD; normal -2SD≤ Z-score ≥ +1SD; thinness <-2SD; severe thinness <-3SD.

Nutrition survey. Three-consecutive-day nutrition surveys which included two weekdays and one weekend day were conducted by the photograph method. We rented smartphones, gave one to each child before the survey and took it back after the survey. We asked the children to take pictures of all the foods and drinks they consumed, before and after eating, then send the photos to the researchers every day. The size of dishes and energy intake were estimated and calculated using Calorie Smile Vietnam version software.

Calorie Smile Vietnam version (*7*) is a nutrition support software which was made for Vietnamese people. The basic method is that subjects take photos of their food, send them to the Calorie Smile software with/without some notes, and then the dietitians evaluate their dietary pattern. Calorie Smile Vietnam Version software has been integrated with the Vietnam food composition table (*8*), the nutrition value of 500 popular dishes from Hanoi area (*9*) and the nutrition value of 400 popular street foods from the Ho Chi Minh City area (*10*). When subjects' meals are different or they eat items other than those in the data base, adjustments can be made according to the "Photo book to estimate the weight of food" (*11*), so the dietitians can analyze users' meals easily and quickly. It has been reported that the Calorie Smile Vietnam version software was able to accurately estimate the weights of food portions and to give results comparable to the actually consumed amounts (*12, 13*).

Statistical analysis. Microsoft Excel was used to analyze the data. The variables were compared by unpaired Student *t*-test. P-values of less than 0.05 were considered statistically significant for all the analyses.

RESULTS

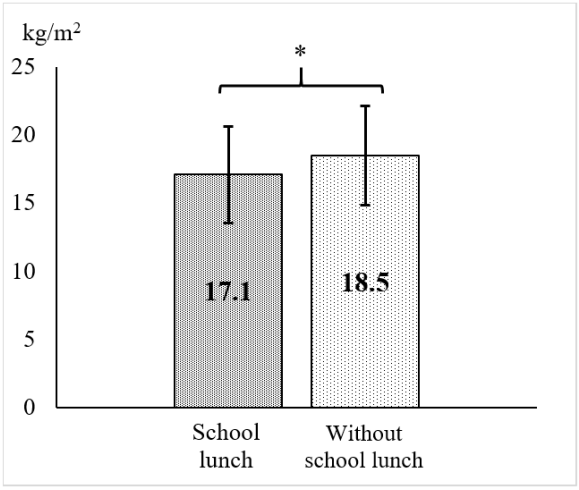

Fig. 1. The average BMI of students with or without school lunch for more than 3 years (25 boys and 25 girls in each groups) (*p<0.05, unpaired student t-test)

The average BMI of subjects is shown in Fig.1. Most children had normal nutrition status; however, students without school lunch had higher BMI than students with school lunch (p<0.05).

Fig.2 shows the average energy consumption of subjects by days and group. The average energy consumption of the group without school lunch when compared with the group with school lunch was higher on weekdays (p<0.05) but was similar on the weekend. On average for the 3 days, students without school lunch consumed 2101 kcal, higher than students with school lunch, who consumed 1972 kcal (p<0.01)

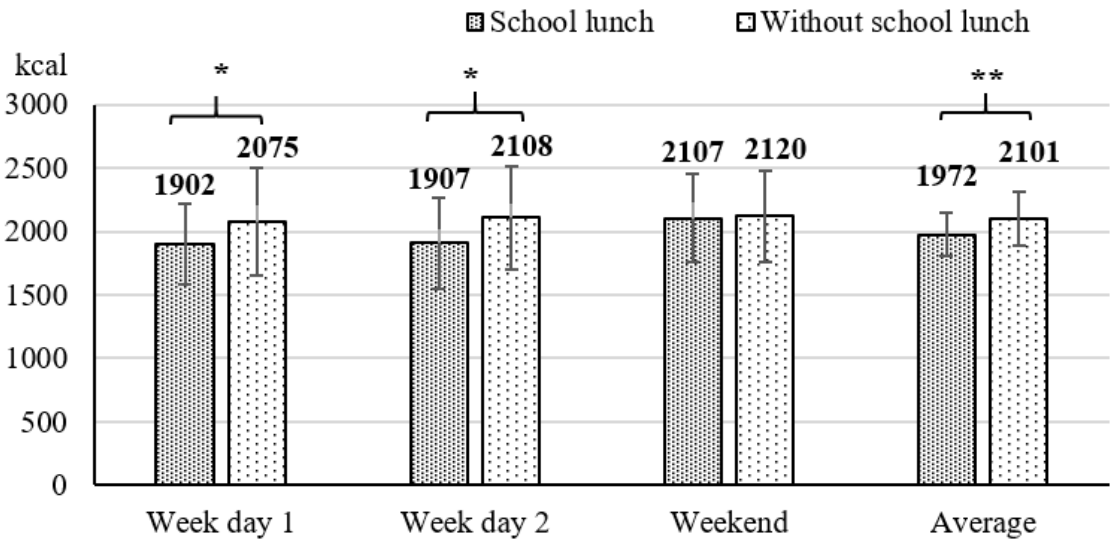

Fig. 2. Average energy consumption of subjects by days and group
(Significantly different by unpaired Student *t*-test, *p<0.05, **p<0.01)

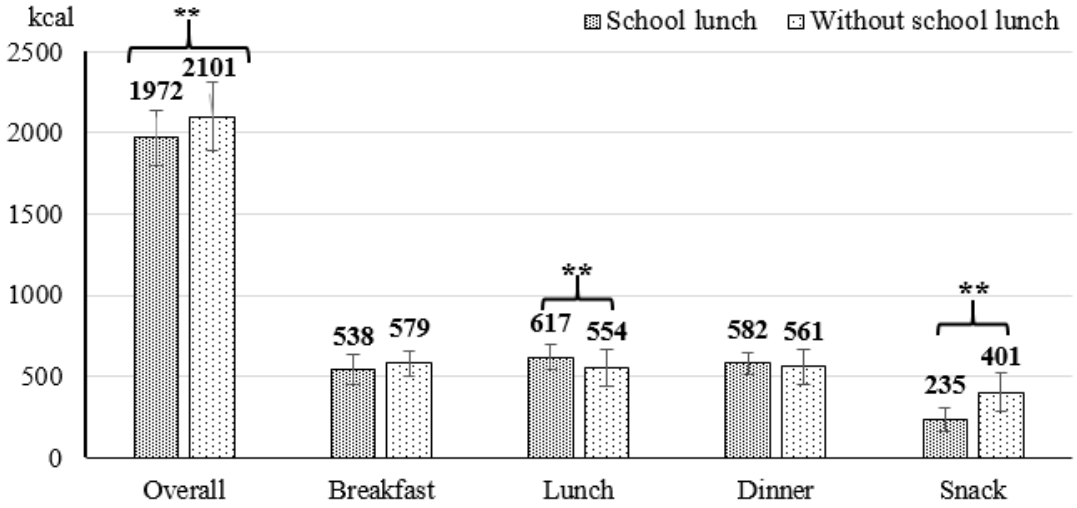

Fig. 3. Average energy intake of subjects by meals and group for 3 days.
(Significantly different by unpaired Student t-test, **p<0.01)

Fig.3 presents the average energy intake of subjects by meals and group. The energy intake of both groups was similar at breakfast and dinner but was different at lunch and snack. Children with school lunch had higher energy intake at lunch and lower energy intake at snack, when compared with children without school lunch (p<0.01)

Fig.4 shows the average energy intake from snacks by time and group. On weekdays, children tended to eat more snacks from 11am-1pm and 5-7pm and on weekends, children ate more snacks in the afternoon, especially from 5-7pm. Children with school lunch ate fewer snacks than children without school lunch on weekdays.

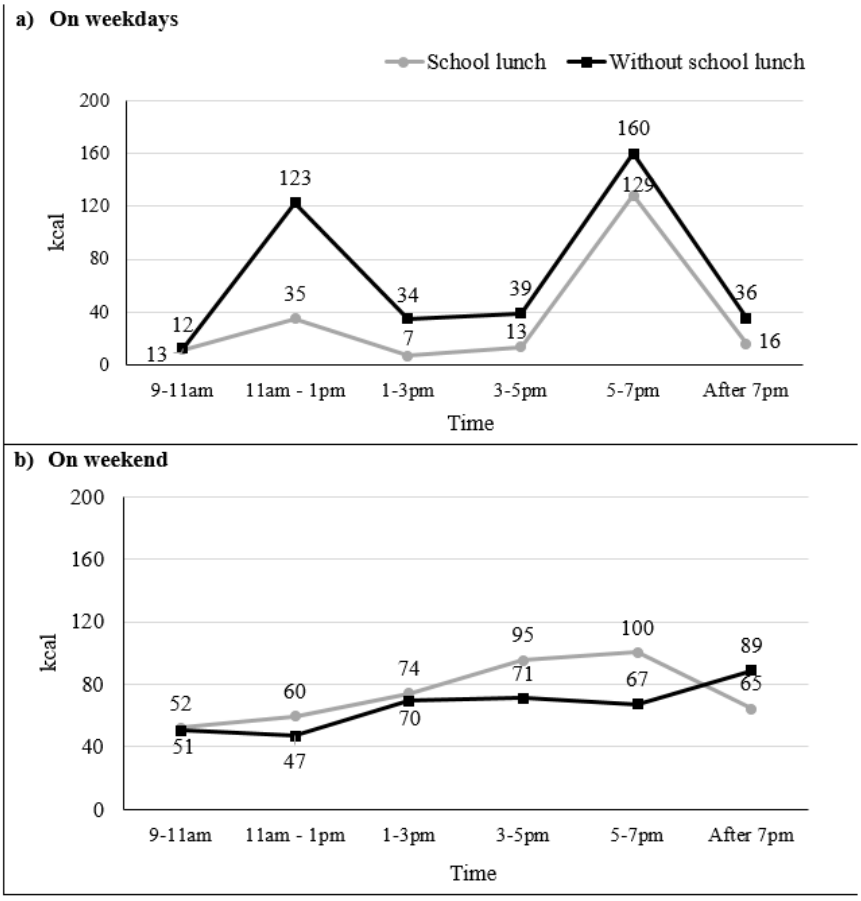

Fig. 4. Average energy intake from snacks by time and group.

DISCUSSION

The present study found that children without school lunch had higher BMI, higher total energy intake, and higher energy intake from snacks when compared with children with school lunch.

Subjects' conditions in our two research groups were quite similar: They are the fifth-grade students at the same primary school, have similar economic conditions, which helped reduce confounding factors. In addition, the student ate or did not ate school lunch for more than 3 years and the BMI data is the result of several years, hence, we could point out that the school lunch is a factor that influences the nutrition status of children.

All subjects were fifth graders, so they were able to do the nutrition survey on their own. Self-reported food records are common methods of obtaining dietary intake data however, those methods are riddled with limitations including the time-consuming, and errors in estimates of portion size (*14-16*). Our study used the photography method which was reported could improve accuracy over standard self-report methods and reduce the burden on children (*17)*. Children only took pictures of their food, send it to the researchers and researchers estimated and analyzed those portions. Therefore, the nutrition survey results in this study were accurate.

According to the nutrition survey results, we found that while children with school lunch had energy consumption on weekdays lower than on the weekend day, children without school lunch had almost the same energy consumption every day. In Vietnam, people usually like their children to be chubby; they think a chubby child is healthy and beautiful (*18*), so when their children are at home, they give them a lot of food. This explains why the energy intake on weekdays and on the weekend was different. In addition, children without school lunch had an average energy intake throughout the week higher than those with school lunch. It seems that school meals can help control children's total energy consumption and keep it in moderation.

In terms of snacks, in this study, we considered a snack as everything children ate or drank between the main meals. Snacks, which are rich in fat and added sugar, such as potato chips, fast food, candy, ice cream, and sweetened beverages, were often consumed. Student tended to eat snack at the times that school ends for the morning and afternoon. Therefore, the reason for snacking may be that after a long time in school, children feel hungry and want to eat something tasty and rich in calories. Along with that, there are many shops and local vendors outside school selling many unhealthy snacks that look very attractive and are also very cheap, so children have ample opportunity to purchase them with their pocket money or to ask a family member to purchase them. For children with school lunch, at lunch (11am-1pm) they cannot leave the school to buy snacks, which is why energy from snacks was low. But for children without school lunch, they ate a lot of snacks during this break and as a result, they could not eat much at lunch, so the

energy intake at lunch for them was lower than for the children with school lunch. Thus, we could said that school meals and school environment also helped prevent snacking in children.

From those results, we considered whether it is preferable for children to have school lunch. School lunch has been considered as a factor in controlling obesity rates in children in Japan; however there has been no evidence yet. This study may be the first study to show the effect of school lunch on the energy intake of children. School lunch not only provides lunch for children but also conveys an understanding of portion size, meal balance and gratitude for the food and for the people who make it (*19–21)*. Therefore, school lunch may be important in controlling overweight. Especially important is the role of the dietitian in the school, not only to develop menus for children, but also to develop educational programs to teach children (*21*). Coordination with the education from the family is also necessary. Parents can restrict junk food or absolutely not allow children buy it when they go to school.

However, the number of dietitians in Vietnam is still very limited, so menus are drawn up by the cooks, who often lack knowledge about nutrition (5). Therefore, the school lunch menu is repeated, and the price is considered more than the nutritional aspect. This means that students do not really like the school lunch. That is the main reason why many children do not eat at school, not because of other factors such as price or family environment.

As a limitation of this study, any difference in physical activity between children who ate school lunch and those who do not, which is thought to affect meal intake, could not be assessed in this study, so it was not possible to examine this. The other limitation of this study was that the results are from only one school, and it will be necessary to analyze how accurately this school represents Vietnam as a whole. It is desirable to spread school lunches and establish a school dietitian system in Vietnam so that children can enjoy a nutritious school lunch.

In conclusion, this study showed that in comparison with children with school lunch, children without school lunch had higher energy intake from their snacks, resulting in higher total energy intake.

ACKNOWLEDGMENTS

We would like to extend our great appreciation to the primary school where we conducted this study as well as all the participants of the study; US-Japan Medical Science Program, Jumonji University for giving the best condition to complete the study; and to Prof. Andrew Durkin, emeritus professor at Indiana University, for careful proofreading of the paper.

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