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RESEARCH ARTICLE

Nutritional Value of Lunches Served in The Remote Rural Area Child-Care Centers in Chiang Mai, Thailand

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Abstract:

Introduction:

Child-care centers (CCCs) typically offer lunch to preschool children. The nutritional composition of lunches served in remote rural area CCCs was compared with 40% of the recommended Thai dietary reference intake (DRI) for children aged 3 to 5 years.

Methods:

Nine CCCs in Chiang Dow district, Chiang Mai Province, Thailand, were selected for the study. Lunch content was evaluated by weighing each food item served to children on two consecutive days. Nutrients were determined by the INMUCAL nutritional analysis software version 3.0. Average nutrient content of the lunches was compared with 40% of the recommended Thai DRI using a one-sample *t*-test.

Results:

Average nutrients in lunches served in CCCs in Chiang Dow district, Chiang Mai Province, did not meet 40% of the daily DRI nutritional recommendations. The lunches were statistically deficient in energy, protein, carbohydrate, fat, dietary fiber, iron, vitamin B1 and calcium. The cholesterol content was significantly higher than the daily DRI recommendations, while vitamin A, vitamin B2, vitamin C and iron contents were comparable with DRI recommended levels ($p<0.05$).

Conclusion:

CCC lunches in remote rural areas did not meet 40% of the daily Thai DRI nutritional recommendations. Lunch menus served in CCCs must be improved to provide appropriate nutrients and ensure the healthy growth and development of preschool children.

Keywords: Child-care center, Lunch, Nutritional value, Remote rural area, Preschool children, Healthy food.

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1. INTRODUCTION

The establishment of healthy food and eating behaviors in the context of food selection, preparation and supply both at home and in child-care centers (CCCs) is important for the growth and development of preschool children [1]. Poor eating habits are connected to the development of obesity, type 2 diabetes, cancer and other chronic diseases causing major public health problems [2, 3]. Thai school lunch guidelines recommend 40 grams of fruit, 40 grams of vegetable, 90 grams of rice and starchy food and 30 grams of meat as the daily Dietary Reference Intake (DRI) for preschool children [4], who generally have inappropriate intake levels of energy and macronutrients and do not consume enough vegetables or whole grains on a daily basis. Over 98% of Thai preschool children consume fats and sweets at higher levels than the daily DRI [5]. Previous studies reported that preschool children generally fail to meet dietary requirements; 94% fail to consume the recommended daily serving of vegetables, while over 99% consume added fats and sweets surpassing daily limits [2]. A well-balanced nutrient-dense diet is necessary for healthy growth and development [6, 7]. Undernourishment among preschool children is a problem in Thailand, and the recent National Nutrition Survey has demonstrated that in preschool children, the prevalence of underweight and stunting is 5.3% and 6.6%, respectively [5]. Eating habits are important

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because they have a long-term impact on dietary patterns [8].

Several studies reported on various factors that impacted the nutritional status of preschool children, including innate dietary preferences [4], child-rearing practices [7], and food availability at home or in CCCs [4, 7, 9]. Schools, including CCC settings, influence the eating habits of students [10 - 12]. In rural areas, especially remote rural areas, CCC services are different, with reduced state oversight and regulations, lower education and specialized training of caregivers and higher child-to-caregiver ratios that all impact access to resources and training [13]. In Thailand, more than one million preschool children are enrolled in daycare centers [14], where they eat lunch and stay for up to 8 hours every day. Menus and nutritional requirements are enforced by the government regulating authority, such as the Bureau of Nutrition, Department of Health, and Ministry of Public Health of Thailand. However, providing lunch is not a requirement for all CCCs and specific menus in each CCC are different.

The northern Thai province of Chiang Mai is known for its typical mountainous characteristics. There are some ethnic populations living in these areas with low economic status. In daytime, most parents leave their children in a day care center where care givers take care of the children [15]. A report by the Department of Local Administration, Chiang Mai Province listed 660 CCCs, with more than 100 in remote rural areas [16], while a preliminary survey conducted by Health Center Region 1, Chiang Mai revealed that each center operates various lunch management programs. No standardized lunch menus are stipulated by the authority, and these are organized by the CCC staff based on the budget received. Cooking ingredients chosen for lunch menus are readily available and inexpensive. Menus are typically created for each four-week period. Several strategies and activities have been implemented to improve healthy eating among preschool children in CCCs [17]. However, very few studies have specifically analyzed the nutrient contents of remote rural CCC lunches in Thailand. Those areas are known to be more than 200 kilometers from the city. The majority of the population is ethnic. There is a distinct style of life that differ from that of most city dwellers. The objective of this study was to determine the nutrient content of lunches served compared to 40% of the recommended daily DRI for children aged 3 to 5 years in CCCs in remote rural areas in Chiang Mai Province, Thailand.

2. MATERIALS AND METHODS

2.1. Study Area

This cross-sectional study was conducted in June 2021 in CCCs in Chiang Dow district, Chiang Mai Province, Thailand. The CCCs were eligible to participate in the study if they provided whole-day care to children 3 to 5 years old, served lunch that did not follow the standard menus of the relevant authority and were located in remote rural areas 150 kilometers from the Chiang Mai Metropolis. Nine CCCs met the inclusion criteria and participated in this study. Permission to conduct the study was obtained from the director of CCCs.

2.2. Menu Analysis

Study samples were lunches served to preschool children at CCCs in the Chiang Dow district that provided rotating meal items on typical teaching days. Samples were taken randomly without prior notification over a period of 18 days (two days at each school). This prevented bias from preferentially scooping food to increase nutrient content. Each day, two lunch trays were packed in different food containers and placed in styrofoam to ensure that the food was kept chilled during shipment to prevent spoilage and nutritional changes before processing.

The samples were delivered to the Nutrition Department of Health Center Region 1, Chiang Mai and the elements of each food item, such as meat, vegetable, fruit and rice, were separated. Then, each element was weighed using a one-decimal scale in grams. After that, each ingredient was entered in the daily food ingredient record form.

The calorific and nutrient contents of the samples were determined using INMUCAL nutritional analysis version 4.0, a nutrition analysis software developed by the Institute of Nutrition, Mahidol University. Macro and micronutrient contents were compared with 40% of the daily recommended Thai DRI [4, 16].

2.3. Statistical Analysis

Descriptive statistics, including mean, standard deviation and frequency, were calculated to analyze the characteristics of the CCC lunch menus. Overall mean and standard deviation of the macro and micronutrient contents of the CCC lunches were calculated. The Shapiro–Wilk test was used to assess the normal distribution of the data. Average nutrient contents of the CCC lunches were compared with 40% of the recommended daily Thai DRI for each nutrient for children aged 3 to 5 years using a one-sample *t*-test. All statistical analyses were conducted using STATA version 16 software.

2.4. Ethical Approval

The Ethics Research Committee of the Faculty of Public Health, Chiang Mai University, approved this study (approval code: ET013/2021).

3. RESULTS

3.1. Characteristics of Participating CCCs

Characteristics of the nine participating CCCs are shown in Table **1**. The number of children in each center ranged from 10 to 44 **(**mean ± SD, 24.80±10.90), with the average number per CCC of 16.64 **(**SD=3.86). The average number of caregivers per CCC was 2.30 **(**SD=1.25). Most of the staff members responsible for menu planning were caregivers (66.67%). Each CCC rotated its menu every four weeks and most provided four food items each day. The average cost of lunch was 21 Thai Baht.

Table 1. Descriptive characteristics of CCCs (n=9).

Characteristics of CCCs	Number
Average number of preschool children per CCC, mean ±SD	24.80±10.90
Min	10
Max	44
Average number of preschool children per CCC, mean ± SD	16.64±3.86
Min	10
Max	22
Average number of caregivers per CCC, mean ± SD	2.30±1.25
Min	1
Max	5
Staff member responsible for menu planning, n (%)	
CCC director	3(33.33)
Caregiver	6(66.67)
Rotation time of lunch menu, n (%)	
Every four weeks	9(100)
Number **of food items on the menu each day (include snack but exclude milk), n(%)**	
Four types of foods	4(44.45)
Three types of foods	3(33.33)
Two types of foods	2(22.22)
The cost of lunch, n(%)	
<20 Baht	2(22.22)
20-30 Baht	7(77.78)
Average cost of lunch (Baht), **mean ±SD**	21.10±2.12

Table 2. Comparison of nutrient contents of CCC lunch menus with 40% of the daily recommended Thai dietary reference intake (DRI).

Nutrient	40%DRI[a]	Mean±SD	p-value[b]
Energy (kcal)	480	338.18±110.84	0.048[c]
Protein (g)	14.10	10.48±13.79	0.029[c]
Fat (g)	14.40	9.95±3.76	0.007[c]
Carbohydrate (g)	73.20	48.37±18.00	0.003[c]
Dietary fiber (g)	3.60	2.09±0.68	0.000[c]
Vitamin A (RE)	173.20	178.72±39.34	0.145
Vitamin B1 (mg)	0.24	0.14±0.05	0.000[c]
Vitamin B2 (mg)	0.24	0.25±0.25	0.909
Vitamin C (mg)	16.00	13.32±7.17	0.307
Iron (mg)	2.44	2.44±1.96	0.995
Calcium (mg)	280.00	146.09±22.18	0.000[c]
Cholesterol (mg)	120.00	146.51±22.67	0.008[d]

[a] DRI=Dietary Reference Intake for Thai preschool children aged 3 to 5 years.
[b] A one-sample *t* test compared the mean nutritional value of lunch menus with 40% DRI.
significance was set at $p<0.05$.
[c] Significantly less than recommended levels.
[d] Significantly greater than recommended levels.

3.2. Nutritional Values of CCC Lunch Menus

Overall nutritional values of CCC lunches as mean and standard deviations compared with 40% of the Thai DRI are shown in Table **2**. Lunches served in CCCs were statistically substantially insufficient in energy, protein, carbohydrate, fat, dietary fiber, iron, vitamin B1 and calcium compared to 40% of the daily DRI, while contents of vitamin A, vitamin B2, vitamin C and the iron did not deviate from the DRI recommendations.

4. DISCUSSION

Results demonstrated that lunches provided in remote rural area CCCs in Chiang Mai, Thailand were insufficient in essential nutrients required for healthy growth and development. The recommended values of 40% DRI for energy, protein, carbohydrate, fat, dietary fiber, iron and vitamin B1 are 480 kcal, 14.10 g, 73.20 g, 14.40 g, 3.60 g, 2.44 mg, 280.00 mg and 0.24 mg, respectively. The CCC lunches in remote rural areas in Chiang Mai were statistically deficient in energy (338.18±110.84 kcal), protein (10.48±13.79 g), carbohydrate (48.37±18.00 g), fat (9.95±3.76 g), dietary fiber (2.09±0.68 g), iron (2.44±1.96 mg), vitamin B1 (0.14±0.05 mg) and calcium (146.09±22.18 mg), while cholesterol content (146.51±22.67) was higher (120.00 mg). Contents of vitamin A (178.72±39.34 mg), vitamin B (0.25±0.25 mg), vitamin C (13.32±7.17 mg) and iron (2.44±1.96) did not differ from the

recommended DRI values. Results concurred with Martins *et al*. (2021), who reported that meals served in schools in the city of Porto, Portugal, did not meet international dietary guidelines for energy and macronutrients. Most meals served contained nutrient values below the age-specific lower limit [18]. Research concerning dietary adequacy in Indian rural preschool children discovered that protein and vitamin A adequacy levels were slightly higher among regularly nourished children, but the differences were not statistically significant [19]. However, similar studies focusing on CCCs are limited. This study, therefore, compared results against studies in both CCCs and elementary schools. Our findings were similar to previous studies showing that school meals frequently did not provide sufficient energy and nutrients [20 - 23].

Many factors have been reported to influence the nutritional content of CCC lunches, especially in remote rural areas. One important factor is that CCCs in Thailand do not have a dedicated nutritionist or dietitian [24]. Personnel generally responsible for organizing CCC lunches are caregivers who do not have adequate knowledge of food and nutrition and spend most of their time caring for the children. As a result, they do not have enough time to properly organize the lunch menu [25]. Briley *et al*. identified two key elements that directly influenced CCC lunches: food cost and staff perception of children's food preferences. Staff who believed or assumed that children disliked rice, meat, fruit or vegetable were more likely to serve smaller portions to reduce waste and save cost [26]. Another key factor impacting the nutritional content of CCC lunches was an insufficient budget to execute wellness initiatives [26, 27]. Chomnard *et al*. also highlighted financial pressure as an important factor affecting the procurement of food materials, both in quantity and quality [23].

Regional differences in consumption culture have previously been reported. Food preferences, traditional foods and lifestyles differ by region; therefore, food served in CCCs may be affected by culture [28, 29]. Among children in remote rural areas, acculturation and low socioeconomic status are significantly associated with health-related behaviors [30]. Additionally, various sociocultural factors such as beliefs and cultural taboos influence the foods children eat [31]. Yhoung-Aree *et al*. stated that in rural communities of Northern Thailand, sociocultural and economic limitations often obstructed the use of common protein sources such as pork, beef, poultry, milk and egg [32]. The northern region of Thailand is mountainous with plateau areas and transportation issues, access to natural water resources and a longer dry season all contribute to poor food distribution and uncertain availability of common proteins [32, 33] that impact the implementation of good nutritional quality lunches in CCCs and influence dietary preferences.

Carbohydrate is a primary source of energy, while protein and fat provide an equivalent amount of energy. These nutrients are important for children's activities and development. Carbohydrates give energy to body cells, especially the brain, which is a glucose-dependent organ [34], while protein is essential for body tissue growth, repair and maintenance. The percentages of carbohydrates, fat and protein contributing to energy consumption are consistent with dietary guidelines, which state that carbohydrate, fat and protein supply 45-65%, 25-40% and 10-35% of energy, respectively [34, 35]. Inadequate food intake results in an insufficient supply of important nutrients, particularly macronutrients. Caregivers are a major target group for health professional teams to support children's optimal nutritional status and healthy eating habits [36].

Nutritional quality is negatively related to metabolic disease [25, 37]. Several studies showed that high-quality school lunches increased productivity by 3.4 times, increased alertness, increased reading and comprehension scores, decreased authorized absenteeism by 14% and optimized child cognitive and behavioral functions, especially for children with poor dietary quality or low socioeconomic status [25, 38 - 41]. Therefore, it is vital to improving the quality of lunches served in CCCs.

Modifying CCC lunch menus to contain adequate nutrients will establish future health promotion and ensure that school meals meet the 40% target of the Thai DRI. This will reduce the risks of both chronic degenerative and dietary deficiency disorders as part of a larger effort to implement prevention-oriented health objectives in CCCs. The role of CCC nutritionists or caregivers is very important to achieve these goals for health promotion and disease prevention via the intake of an appropriate diet. Caregivers' knowledge of appropriate foods in their right proportions given to preschool children is necessary to improve the nutritional wellbeing of the children. Incidentally, many caregivers do not have adequate knowledge about the nutrient composition of certain foods that should be given to preschool children [42]. Thus, it is essential to provide caregivers with the necessary knowledge to help them modify their feeding practices of preschool children [43]. Prior studies have recommended the use of multiple strategies and various methods to promote the caregiver's nutritional knowledge. For example, the use of nutritional education programs and social media open up multiple options to add a new dimension to learning and knowledge processes [43].

5. STUDY STRENGTHS

This study had several strengths. First, lunch sample data were collected by trained dieticians, providing accurate food sampling and nutritional analysis. Second, randomly collecting lunch samples without prior notification prevented bias from preferentially scooping food to increase nutrient content. Finally, to the best of our knowledge, this is the first study analyzing the nutritional adequacy of lunches served in CCCs in remote rural areas of Thailand.

6. STUDY LIMITATIONS

There were several study limitations. First, the data was related to a small sample size of nine CCCs in only one remote rural district in Thailand. Lunch menus at each school were only observed on two consecutive days, and this may not accurately represent the usual fare served to children or consider seasonal variability. Observing lunch menus on multiple days would provide better data concerning nutrient

content. Second, this investigation compared nutrient intake, not food group, which is the focus of the new nutrition standards. Third, while research focusing on a single district can help to improve local policy and practice, such a restricted focus may limit generalizability to other parts of the country. Finally, we analyze the food served but do not analyze the food actually consumed. Therefore, to know the actual amount of nutrients that children receive. Future research should analyze the nutrient content of the foods that children actually consume.

CONCLUSION

Results indicated that CCC lunches served in a remote rural area of Chiang Mai, Thailand, did not meet the nutritional guidelines required for healthy growth and development of children. Menu planning must be improved. These concerns can be addressed by involving a registered dietitian or nutritionist to ensure that CCC lunches are a beneficial resource for regulators and parents by providing appropriate nutrients for the growth and development of preschool children. The Thai Government should implement policy decisions about CCC meals for preschool children, especially in rural areas, to ensure the provision of diverse and nutritious meals.

ABBREVIATION

CCCs = Child-care Centers

AUTHORS' CONTRIBUTIONS

JW was responsible for conceptualization and methodology. SY, KK, and TL contributed to data curation and investigation. JW performed the statistical analysis and wrote the original draft. This study was supervised by JW and SY. JW, SY, KK, and TL participated in editing manuscripts. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Ethics Research Committee of the Faculty of Public Health, Chiang Mai University, approved this study (approval code: ET013/2021).

HUMAN AND ANIMAL RIGHTS

No animals were used for studies that are the basis of this research. All human procedures followed were in accordance with the guidelines of the Helsinki Declaration of 1975.

CONSENT FOR PUBLICATION

Written informed consent was obtained from guardians of the children.

STANDARDS OF REPORTING

STROBE guidelines have been followed.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the finding of this study are available within the article.

FUNDING

No funding was received from any institution or department.

CONFLICT OF INTERESTS

The authors declare no conflict of interest, financial or otherwise.

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