

## Source of energy intake of Papuan and non-Papuan high-school students in Jayapura: their association with risk for overweight/ obesity

Endah Sri Rahayu<sup>1</sup>, Bernadette Josephine Istiti Kandarina<sup>2</sup>, Madarina Julia<sup>3</sup>

<sup>1</sup>Department of Nutrition, Politeknik Kesehatan Kementerian Kesehatan Jayapura

<sup>2</sup>Department of Biostatistics, Epidemiology, and Population Health, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada

<sup>3</sup>Department of Child Health, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada

### ABSTRACT

**Background:** The worldwide prevalence of obesity is increasing. Obesity is associated with many factors, including the consumption pattern of energy-producing food, i.e. carbohydrate and fat, which is, most likely associated with ethnicity. In Riskesdas 2007, Jayapura held the highest prevalence of obesity in adults in Indonesia. Jayapura lived the Papuan and Non-Papuan descents population. **Objective:** To determine the association between energy intake, the contribution of carbohydrate and fat to energy intake in overweight/ obesity in Papuan and non-Papuan high-school students. **Methods:** This cross-sectional study involved 150 Papuan and 150 non-Papuan students from three high schools in the district. Body mass index (BMI) derived from the measurement of body weight and height were grouped into overweight/obesity and not-overweight/ obesity. Source of energy was estimated using 3 (three) days non-consecutive 24 hours of food recall questionnaire. Energy intake and the contribution of carbohydrate and fat to energy intake were analyzed with an independent t-test and Chi-Square test. **Results:** The prevalence of overweight/ obesity was similar between Papuan and non-Papuan students (22.0 vs. 23.0%). The two groups had a similar amount of energy intake, however, the contribution of carbohydrate and fat to the total energy intake was significantly different. Obese/ overweight students had a significantly higher intake of energy, however, within the same ethnic group, the contribution of carbohydrate and fat in obese/ overweight students did not significantly differ. **Conclusions:** High energy intake was associated with overweight/ obesity in both groups. The contribution of carbohydrates to total energy intake was higher in Papuan. However, the contribution of carbohydrate and fat to energy intake was not associated with overweight/ obesity in both groups.

**KEYWORDS:** contribution of carbohydrate; contribution of fat; energy intake; obesity; overweight; Papuan

### INTRODUCTION

Obesity has become a world wide health problem. The World Health Organization (WHO) estimated an increase of 2.8 million deaths correlated to overweight and obesity in the last 5 years (1). Overweight and obesity in children and adolescents is especially important, because early overweight/obesity may lead to more serious consequences in adulthood (2,3).

Riskesdas 2007 showed the prevalence of overweight/ obesity in adult in Indonesia (age >15 years) were 23.5%. Jayapura had the highest prevalence, i.e. 35.9%, and was

increasing (4-6). As Papuan had different ethnicity compared to the rest of Indonesia, it is interesting to learn why they had higher prevalence of overweight/ obesity.

Overweight/ obesity was known to be related to multiple factors, among others, energy intake, activity pattern, and also, probably, genetic susceptibility (7). There had been many controversies about the role of certain nutrients for obesity. Carbohydrate had been always regarded as nutrients that caused obesity (8,9). As food consumption pattern were more likely associated with ethnicity, the objective of this study was to determine

**Corresponding author:** Madarina Julia, Department of Child Health, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Jalan Farmako, Sekip Utara, Yogyakarta, Indonesia, e-mail: [madarinajulia@ugm.ac.id](mailto:madarinajulia@ugm.ac.id)

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the association between energy intake, contribution of carbohydrate and fat to energy intake in overweight/obesity in Papuan and non-Papuan high-school students.

## METHODS

### Study design and participants

This cross-sectional study involved 15-18 years old Papuan and non-Papuan adolescents from the three high schools in the district of Abepura, Jayapura. The students were grouped into Papuan when both their parents were purely of Papuan descents, and Non-Papuan when both their parents were not Papuan.

The calculated minimal sample size, with a confidence interval of  $Z\alpha=95\%$ , were 146 for each group. The study invited 150 Papuan and 150 non-Papuan high school students who met the inclusion and exclusion criteria. The inclusion criteria were either Papuan or non-Papuan, born in Papua or living in Papua since childhood and within 15-18 years old. The exclusion criteria were being underweight, following a special diet, and having physical features which may influence antropometric measures. Ethical approval were obtained from the Medical and Health Research Ethics Committee, Faculty of Medicine, Universitas Gadjah Mada/ Dr. Sardjito Hospital. Informed consents were signed by parents.

### Measures

*Body mass index (BMI).* All participants underwent antropometric assessments: weights were measured using a calibrated weighing scale to the nearest 0.1 kg (Camry EB9003), heights were measured using a microtois (GEA SH-2A), in a standardized methods. All enumerators, who were D3 students in nutrition, were already trained for antropometric measurements. Data collection were directly supervised by the principle investigator. BMI were calculated as height (in meter) divided by squared weight (in kg). The BMI were then grouped into overweight/ obese and not overweight/ obese using WHO 2007 reference curve, i.e.  $Z\leq+1SD$ : not overweight;  $Z>+1SD$ : overweight/ obese.

*Source of energy intake.* Energy intakes and their sources (carbohydrate or fat) were estimated using 3 (three) 24 hours food recalls: 2 (two) working days and

1 (one) weekend). The data were converted into grams and kilocalories (kcal) using Nutrisurvey 2007, on which the nutrient contents of local food had been already added. Average of the three recalls were used in the final analyses. Energy intakes in kcal were compared to the recommended dietary allowance (RDA) for age and gender. The results were grouped into: high ( $>100\%$ ), sufficient (70-100%), and low ( $<70\%$ ) of the RDA.

### Data analysis

Comparison of continuous variables were performed with independent samples t-test. Statistical analysis for dichotomous variables were performed with Chi-Square. We estimated the odds ratio (OR) and their 95% confidence interval (95%CI) for overweight/ obesity related to feeding pattern and ethnicity group. We also calculated Mentel Haenszel OR between the Papuan and the non-Papuan group in relation with their feeding pattern. Statistically significant value were set at  $p<0.005$ .

## RESULTS

The prevalence of overweight/ obesity were 22% in Papuan adolescents and 23.3% in the non-Papuan. The difference was not statistically significant. **Table 1** showed that the non-Papuan students were younger, were more likely to have more educated parents who were more likely to work in the formal sectors.

**Table 2** showed that there was no difference in energy intakes between both ethnicity, however, the Papuan had significantly higher intake of carbohydrate and less fat. **Table 3** showed that there was no significant difference in the proportion of adolescents who consume high, sufficient or low energy intake, however, the source of the energy was significantly different. Most of the Papuans had most of their energy intake from carbohydrate, while the non-Papuan eat more fat.

**Table 4** showed comparison of energy intake and contribution of carbohydrate and fat to energy intake by nutritional status and ethnic group. The table showed that both in Papuan and non-Papuan, overweight and obese adolescents consume more energy from carbohydrate and fat. However, the difference in the contribution of carbohydrate and fat to energy intake were more related

**Tabel 1. The characteristics of the respondents**

Characteristics	Papuan (n=150)		non-Papuan (n=150)		p
	n	%	n	%	
Age (years)					
15 – 16	95	63.3	117	78.0	0.005
17 – 18	55	36.7	33	22.0	
Sex					
Male	55	36.7	56	37.3	0.91
Female	95	63.3	94	62.7	
Nutritional status (BMI-for-age z-scores)					
Normal (-2SD to $\leq$ +1 SD)	117	78.0	115	76.7	0.78
Overweight/ Obesity ( $>$ +1SD)	33	22.0	35	23.3	
Level education of father					
High (diploma or university degree)	64	42.7	125	83.3	<0.001
Middle (junior or high school)	61	40.6	16	10.7	
Low (elementary school or less)	25	16.7	9	6.0	
Level education of mother					
High (diploma or university degree)	42	28.0	119	79.3	<0.001
Middle (junior or high school)	66	44.0	19	12.7	
Low (elementary school or less)	42	42.0	12	8.0	
Occupation of father					
PNS/TNI/POLRI	74	49.3	67	44.0	<0.001
Entrepreneur	21	14.0	60	40.6	
Labor/peasant/fisherman	31	20.7	13	8.7	
Unemployment	24	16.0	10	6.7	
Occupation of mother					
PNS/TNI/POLRI	36	24.0	37	24.7	0.006
Entrepreneur	15	10.0	33	22.0	
Labor/peasant/fisherman	17	11.3	4	2.7	
Unemployment	82	54.7	76	50.6	

PNS = civil servant; TNI = Indonesian National Armed Forces; POLRI = State Police of the Republic of Indonesia

**Tabel 2. Energy intake and the contribution of carbohydrate and fat to energy intake by ethnic group**

Variable	Group		p
	Papuan (n=150)	non-Papuan (n=150)	
	Mean $\pm$ SD	Mean $\pm$ SD	
Energy intake in kcal/day	1998.5 $\pm$ 390.62	2005.1 $\pm$ 365.6	0.88
Energy intake in %RDA	87.2 $\pm$ 17.7	87.3 $\pm$ 16.3	0.96
Carbohydrate in kcal/day	1122.1 $\pm$ 249.7	1042.8 $\pm$ 234.5	0.005
Carbohydrate in % of energy	56.3 $\pm$ 7.2	52.0 $\pm$ 6.3	<0.0001
Fat in kcal/day	658.0 $\pm$ 215.5	714.1 $\pm$ 186.1	0.017
Fat in % of energy	32.7 $\pm$ 7.9	35.5 $\pm$ 7.4	0.0009

RDA = recommended dietary allowance

to the ethnicity instead of the nutritional status because this table showed that the contribution of carbohydrate and fat to energy intake between the overweight/ obese group vs. the non-overweight/ obese group within the ethnicity were not significantly differ. Similar conclusions were observed from **Table 5**.

## DISCUSSION

Our study showed that the prevalence of overweight/ obesity were similar between Papuan and non-Papuan students (22.0 vs. 23.0%). The two groups had similar amount of energy intake, however, the contribution of carbohydrate and fat to the total energy intake were

**Table 3. Proportion of energy intake and the contribution of carbohydrate and fat to energy intake by ethnic group**

Variable	Papuan (n=150)		non-Papuan (n=150)		OR	p
	n	(%)	n	(%)		
Energy intake in % RDA						
High (>100)	39	26.0	32	21.3	0.93	0.8
Sufficient (70-100)	85	56.7	95	63.3	1.26	0.5
Low (<70)	26	17.3	23	15.4	1	
Carbohydrate in % energy						
Sufficient or high (≥50)	122	81.3	95	63.3	2.52	0.0005
Low (<50)	28	18.7	55	36.7	1	
Fat in % energy						
High (>30)	94	62.7	122	81.3	0.38	0.0003
Low or sufficient (≤30)	56	37.3	28	18.7	1	

RDA = recommended dietary allowance

**Table 4. Energy intake and the contribution of carbohydrate and fat to energy intake by nutrition status**

Variable	Overweight/ obesity		p
	Yes (n=33)	Not (n=117)	
	Mean ± SD	Mean ± SD	
<b>Papuan</b>			
Energy intake in kcal/day	2226.3 ± 379.5	1934.0 ± 370.6	0.0001
Energy intake in %RDA	101.1 ± 18.0	83.3 ± 15.6	<0.0001
Carbohydrate in kcal/day	1228.8 ± 286.3	1092.0 ± 230.9	0.005
Carbohydrate in % of energy	55.2 ± 7.7	56.7 ± 7.0	0.29
Fat in kcal/day	753.1 ± 225.4	631.2 ± 205.8	0.004
Fat in % of energy	33.6 ± 7.9	32.5 ± 8.0	0.49
<b>Non-Papuan</b>			
Energy intake in kcal/day	2249.2 ± 393.7	1930.8 ± 323.1	<0.0001
Energy intake in %RDA	97.4 ± 19.3	84.3 ± 13.9	<0.0001
Carbohydrate in kcal/day	1188.3 ± 251.4	998.5 ± 211.1	<0.0001
Carbohydrate in % of energy	52.8 ± 5.1	51.7 ± 6.7	0.39
Fat in kcal/day	811.7 ± 192.3	684.3 ± 174.4	0.0003
Fat in % of energy	36.0 ± 5.3	35.4 ± 6.9	0.62

RDA = recommended dietary allowance

significantly different. The Papuan had significantly higher contribution of carbohydrate to the total energy. This study had observed that obese/ overweight students had significantly higher intake of energy, however, within the same ethnic group, the contribution of carbohydrate and fat in obese/ overweight students did not significantly differ.

Overweight/ obesity was the result of high total energy intake and low energy output. It was also called positif energy equilibrium (10). This was seen in the Papuan and non-Papuan overweight/ obesity group. High total energy intake was associated with overweight/ obesity in both groups. Similar association were observed

in other studies. Adolescents with higher total energy intake had a 6.9 times higher risk of overweight and obesity (11,12).

Ethnical background was found as modifiable factor of energy intake and was related to overweight/ obesity. Papuan with a high energy intake had a 15.52 chance of overweight/obesity, while non-Papuan had a 6.4 chance of overweight/ obesity. As risk for overweight/ obesity might be associated not only with food consumption pattern or energy intake, other risk factors difference of both groups, such as, probably activity pattern or genetic pattern, might be the explaining

**Tabel 5. Association between energy intake and the contribution of carbohydrate and fat to energy intake with overweight/obesity**

Variable	Overweight / obesity				OR (95% CI)	p
	Yes		Not			
	n	%	n	%		
Energy intake in % RDA						
<b>Papuan</b>						
High (>100)	22	66.7	17	14.5	15.52 (3.01 – 147.47)	<0.0001
Sufficient (70-100)	9	27.3	76	65.0	1.42 (0.26 – 14.36)	1.0
Low (<70)	2	6.0	24	20.5	1	
<b>Non-Papuan</b>						
High (>100)	19	54.3	13	11.3	6.94 (1.68 – 33.45)	0.002
Sufficient (70-100)	12	34.3	83	72.2	0.68 (0.18 – 3.25)	0.510
Low (<70)	4	11.4	19	16.5	1	
Carbohydrate in % of energy						
<b>Papuan</b>						
Sufficient or high ( $\geq 50$ )	25	20.5	97	79.5	0.65 (0.24 – 1.90)	0.350
Low (< 50)	8	28.6	20	71.4	1	
<b>Non-Papuan</b>						
Sufficient or high ( $\geq 50$ )	27	28.42	68	71.58	2.33 (0.92 – 6.64)	0.050
Low (< 50)	8	14.6	47	85.5	1	
Fat in % of energy						
<b>Papuan</b>						
High (> 30)	21	63.6	73	63.4	1.05 (0.44 – 2.59)	0.890
Low or Sufficient ( $\leq 30$ )	12	36.4	44	37.6	1	
<b>Non-Papuan</b>						
High (> 30)	32	26.2	90	73.8	2.96 (0.81 – 16.26)	0.080
Low or Sufficient ( $\leq 30$ )	3	10.7	25	89.3	1	

RDA = recommended dietary allowance

factor for the difference in risks. The possibility to be overweight was higher in Papuan than non-Papuan. Generally obesity is correlated to inequilibrium of energy in the body, genetics and biologic factors. So that subjects with a balanced energy take have a smaller possibility to experience overweight/obesity (7).

Carbohydrate is the main energy source for our body and contributes to the total surplus of energy hence increasing bodyweight (7). Independent sample t-tests exposed that energy from carbohydrates intake in Papuan were higher than non-Papuan. This shows that carbohydrate rich foods were mainly consumed by Papuan.

The result of the bivariable analysis did not show any correlation between carbohydrate energy contribution. Even though there was no correlation, from the recall 24 hours in 3 days in a row it was found that both groups had a high sugar intake. In average both study groups ingested  $\pm 10$ -30 grams sugar per meal.

Previous researches showed that the decrease of simple carbohydrates in form of liquid sugars was more effective in weight reduction than other ways to reduce intake. Limitation of soft drinks could decrease the obesity on children (13,14).

The insignificant result in this research could be caused by not what kinds of carbohydrate by the participants. BMI was positively correlated to glicemic index of specific carbohydrates and was not related to the amount or percentage of carbohydrate intake (15). In another studies a negative correlation was found between carbohydrate and protein energy contribution and total energy intake (16).

## CONCLUSIONS

High energy intake was associated with overweight/obesity in both groups. Contribution of carbohydrate to total energy intake was higher in Papuan. However, the

contribution of carbohydrate and fat to energy intake were not associated with overweight/ obesity in both groups.

#### *Declaration of conflicting interests*

The authors declare that they have no competing interests.

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