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# Energy and nutrient density. nutrient density intake and nutrient contribution of lunch among employees at foundation

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## ABSTRAK

***Latar Belakang:*** *Salah satu syarat keselamatan dan kesehatan kerja adalah dengan memenuhi kebutuhan gizi guna meningkatkan derajat kesehatan pekerja. Perencanaan menu perlu memperhatikan kualitas atau keragaman pangan. Semakin tinggi keanekaragaman makanan yang dikonsumsi akan diikuti dengan semakin terpenuhinya kebutuhan zat gizi seseorang yang selanjutnya akan berpengaruh pada produktivitas kerja pegawai.*
***Tujuan:*** *Menganalisis densitas energi dan zat gizi pangan. densitas energi konsumsi. densitas asupan zat gizi. dan kontribusi zat gizi makan siang pada pegawai Yayasan Islam Asy-Syukriyyah Tangerang*
***Metode:*** *Penelitian ini merupakan penelitian cross-sectional. Pengambilan sampel dilakukan dengan teknik total sampling dengan jumlah responden sebanyak 74 pegawai. Analisis bivariat menggunakan uji statistik Korelasi Spearman.*
***Hasil:*** *Sebagian besar responden berusia 31 – 50 tahun (middle adult) dan sebagian besar status gizi responden adalah gizi lebih. Hasil uji korelasi menunjukan ada hubungan antara densitas asupan vitamin A. vitamin C. zat besi makan siang pegawai dengan kontribusi vitamin A. vitamin C. zat besi makan siang pegawai (p-value=0.0001. p-value=0.0001. p-value=0.0001). Tidak ada hubungan antara densitas asupan protein dan kalsium makan siang pegawai dengan kontribusi protein dan kalsium makan siang pegawai (p-value=0.051. p-value=0.087).*
***Kesimpulan:*** *Ada hubungan antara densitas asupan vitamin A. vitamin C. zat besi makan siang dengan kontribusi vitamin A. vitamin C. zat besi makan siang. Hal ini dikarenakan kurang beragam dan berkualitasnya pangan yang digunakan pada menu makan siang. Sehingga zat gizi seperti vitamin dan mineral tidak terpenuhi.*

**KATA KUNCI***: densitas asupan zat gizi; densitas energi dan zat gizi pangan; densitas energi konsumsi; kontribusi zat gizi; pegawai*

## ABSTRACT

***Background:*** *One of the requirements for occupational health and safety is to fulfill the nutritional needs to improve the health status of workers. Menu planning needs to pay attention to the quality and diversity of food. The higher the variety of food consumed. the more nutritional needs can be fulfilled and affect employees' work productivity.*
***Objectives:*** *To analyze energy and nutrient density. energy density intake. nutrient density intake. and nutrient contribution of lunch in employees at Asy-Syukriyyah Islamic Foundation Tangerang.*
***Methods:*** *This study was a cross-sectional study. Sampling was done by a total sampling technique with a total of 74 employees. Bivariate analysis using Spearman's Correlation statistical test.*
***Results:*** *Most of the respondents were 31 – 50 years old (middle adult). and most of the respondents' nutritional status was overweight. The correlation test results showed a relationship between vitamin A. vitamin C. iron density intake of employee's lunch with vitamin A. vitamin C. and iron contribution of employee's lunch (p-value = 0.0001. p-value = 0.0001. p-value=0.0001). There was no relationship between protein and calcium density intake of employee's lunch with protein and calcium contribution of employee's*

*lunch (p-value=0.051. p-value=0.087).*
***Conclusions:*** *There is a relationship between the nutrient density intake (vitamin A. vitamin C. iron) with the nutrient contribution (vitamin A. vitamin C. iron) of lunch. This result is because of the lack of diversity and quality of food used on the lunch menu. So. the nutrients such as vitamins and minerals are not fulfilled.*

**KEYWORDS***: employees; energy and nutrient density; energy density intake; nutrient density intake; nutrient contribution*

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## INTRODUCTION

The number of Indonesian workers in August 2020. if compared to August 2019. increased by 2.36 million to 138.22 million people (1) . A workplace can make one of the efforts to improve the health status of workers by implementing occupational safety and health requirements. namely the fulfillment of workers' nutritional adequacy while working (2). Every company that employs a workforce of 50 – 200 people must provide a space/place to eat. and if the force is more than 200 people. the company must provide a canteen to fulfill nutritional needs (3).

Workers can achieve maximum work productivity by creating a conducive work atmosphere to improve the health and stamina of workers. A workplace can achieve improved health and energy by organizing food for workers (3). If food organizing facilities in the workplace are not available. it can lead to lower food consumption for workers and lead to unfulfilled energy and other nutrients as needed (4). Food intake that is not fulfilled will have an impact on decreasing endurance. concentration. ability to work. and increasing the risk of certain diseases (5).

The contribution of nutrition from lunch will affect the total consumption of nutrients. which will impact nutritional status (6). The lunch provided should contribute 2/5 of the total daily consumption. According to Drajat Martianto. energy and nutrient contributions are divided into breakfast by 25%. lunch by 30%. dinner by 25%. and morning and evening intervals of 10% each daily nutritional requirement (7).

The preparation of menus for employees needs to consider the quality or diversity of food for workers. The more diverse the food is consumed. the more nutritional adequacy is fulfilled (8). In this study. most of the foods provided were high in carbohydrates. Some days on the menu do not offer vegetable side dishes and are replaced with other side dishes. Most of them contain more carbohydrates. such as corn cakes. potato cakes. vegetable cakes. and anchovies' cake. The concept of quality consumption with nutrient density can be applied in everyday life to assist in choosing the right amount of food according to the principle of balanced nutrition. This concept aims to help identify foods containing sufficient nutrients at relatively affordable costs to minimize expenditure while still obtaining adequate nutritional intake from these foods (9).

Then the concept of density of nutrient intake is developed. which can describe the adequacy of individual and household nutrients (9). Nutrient density intake can also be used to determine the quantity and quality of nutritional intake from food (10).This study aims to analyze the relationship between nutrient density intake (protein. vitamin A. vitamin C. calcium. and iron) of employee's lunch with nutrients contribution of employee's lunch.

## MATERIALS AND METHODS

This research was a quantitative study with an analytic cross-sectional study design. Sampling was done by using the total sampling technique.

This study was conducted from September – October 2020. This study was approved by the Esa Unggul University Health Research Ethics Committee number: 0023-21.023/DPKE-KEP/FINAL-EA/UEU/II/2021.

The inclusion criteria in this study were research respondents. respondents aged 19 – 50 years. respondents who were employees of the Asy-Syukriyah Islamic Foundation Tangerang. and consuming lunch provided by the food organizer. The exclusion criteria in this study were absence at the time of the research and employees who were not active or were on leave. Based on the inclusion and exclusion criteria. the total sample of this study was 74 respondents. Data were collected with a characteristic respondent questionnaire and food record of lunch form for two days.

The energy consumption density of lunch is obtained by comparing the amount of energy intake from lunch with the total weight of lunch food (kcal/g). The energy density score is calculated using the DED (Dietary Energy Density) method by comparing the amount of energy and weight of food items per food ingredient. Nutrient density data were obtained using the NRF 9.3 (Nutrient Rich Food 9.3) method. The nutrient density of the respondent's lunch was obtained from the number of certain nutrients in the lunch compared with the lunch food's nutritional adequacy rate by 30%. Furthermore. the ratio results are compared with the amount of energy in the food per 100 kcal. The nutrient density intake is determined by FAO. which then changes the daily kcal to lunchtime by dividing the lunch nutrient intake and lunch energy intake then multiplying by 30% of 1000 kcal.

The data processed and analyzed with NutriSurvey 2007. Microsoft Excel 2010. and SPSS 20.0 for Windows. The bivariate analysis using the Spearman correlation test.

## RESULTS AND DISCUSSION

### Description of The Characteristic of Research Respondents

The characteristics of respondents are shown in **Table 1**. Based on age. the highest number of respondents was found in the age group of 31 - 50 years (middle age). The number of respondents in this study was 74 employees composed of 56.8% male and 43.2% female. Most of the respondents' nutritional status was over. with 44 respondents (59.5%) and most respondents' workload were in the normal category. with 48 respondents (64.9%).

**Table 1. Respondent Characteristics**

| Variables | Total | |
|---|---|---|
| | n | % |
| Age | | |
| 19 – 30 Years (Young Adult) | 32 | 43.2 |
| 31 – 50 Years (Middle Adult) | 42 | 56.8 |
| Gender | | |
| Male | 42 | 56.8 |
| Female | 32 | 43.2 |
| Nutritional Status | | |
| Less | 2 | 2.7 |
| Normal | 28 | 37.8 |
| Over | 44 | 59.5 |
| Workload | | |
| Overload | 2 | 2.7 |
| Normal | 48 | 64.9 |
| Underload | 24 | 32.4 |

### Overview of Energy and Nutrient Density of Lunch

The results of energy and nutrient density can be seen in **Table 2**. Dietary Energy Density (DED) and Nutrition Rich Food (NRF) 9.3 Index Value relationship between energy density scores and nutrient density scores.

The types of food on the lunch menu that have the best nutritional quality compared to other kinds of food in the Asy-Syukriyyah Islamic Foundation Tangerang based on the NRF 9.3 method are fruits with a higher nutrient value than energy density. Most of the ingredients used by food organizers for lunch have a higher energy density than nutrient density. It causes the nutrient density score of food to be lower than energy density which indicates. It means the quality of the lunch menu is in the poor category.

**Table 2. Median Score DED and NRF 9.3 Index Value**

| Type of Food | n | DED | IQR | NRF 9.3/100 kcal | IQR |
|---|---|---|---|---|---|
| Food Sources Carbohydrates | 6 | 1.66 | 0.82 | 0.23 | 0.45 |
| Meat. Poultry and Fish | 8 | 2.85 | 1.86 | 1.09 | 0.40 |
| Eggs | 2 | 1.71 | 0.16 | 0.41 | 0.19 |
| Legumes | 7 | 2.06 | 1.33 | 0.68 | 0.62 |
| Leaf Vegetable | 4 | 0.12 | 1.01 | 0.16 | 0.99 |
| Fruit Vegetable | 11 | 0.26 | 0.31 | 0.12 | 0.16 |
| Fruits | 8 | 0.53 | 0.31 | 1.27 | 1.34 |
| Snack | 8 | 1.22 | 0.98 | 0.70 | 1.62 |
| Other Food | 2 | 2.21 | 1.59 | -0.51 | 0.51 |
| Fat/Oil | 2 | 7.50 | 9.26 | -0.94 | 0.51 |

**Figure 1**. showed that the higher the median value of nutrient density on the x-axis. the lower the median value of energy density on the y-axis means the better the food quality. Meanwhile. the larger the circle size indicates the many types of food found on the lunch menu at Asy-Syukriyyah Islamic Foundation Tangerang. In this study. fruits have the best quality compared to other kinds of food. Meanwhile. based on a large amount of food per type of food. fruit vegetables are the type of food group with the most considerable food.

The results of the research on the nutrient density based on an approach using the NRF 9.3 index. all types of food are included in the category of quintile 1 (score <1) and quintile 2 (1 - 10). which means quality food at the lunch menu is still in the poor category

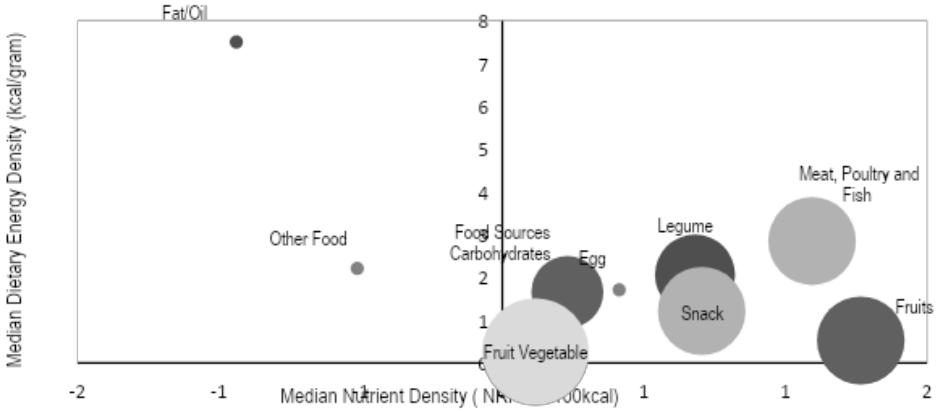


**Figure 1. Median Score Nutrient Rich Food (NRF 9.3) and Dietary Energy Density (DED)**

## Overview of Energy Consumption Density of Lunch

The results of the energy consumption density respondents' lunch can be seen in **Table 3**. Based on the table. the energy consumption density is divided between the genders. Most of the respondent's density consumption energy in the male group was low. namely 29 respondents (39.2%). Most of the respondents' energy consumption density in the women's group is lack. namely 19 respondents (25.7%).

**Table 3. Energy Consumption Density of Lunch**

| Variable | Gender | Category | n | % |
|---|---|---|---|---|
| Energy Consumption Density | Male | Low (<1.7) | 29 | 39.2% |
| | | Medium (1.7 – 2.1) | 10 | 13.5% |
| | | High (>2.1) | 3 | 4% |
| | Female | Low (<1.6) | 19 | 25.7% |
| | | Medium (1.7 – 2.0) | 11 | 14.9% |
| | | High (>2.0) | 2 | 2.7% |
| | | Total | 74 | 100 |

**Overview of Nutrient Density Intake of Lunch**

The results of protein. vitamin A. vitamin C. calcium. and iron density intake respondent's lunch can be seen in **Table 4**.

Based on the table. it can be seen that the average value nutrient density intake of respondent's lunch are protein density intake is 11.79 grams/300 kcal. vitamin A density intake is 190.76 µg RE/300 kcal. vitamin C density intake is 12.14 mg/300 kcal. calcium density intake is 52.57 mg/300 kcal. and iron density intake is 1.52 mg/300 kcal.

**Table 4. Nutrient Density Intake of Lunch**

| Nutrient Density Intake | Average±SD | Min – Max |
|---|---|---|
| Protein | 11.79±1.98 | 5.7 – 17.8 |
| Vitamin A | 190.76±113.81 | 43.1 – 504.9 |
| Vitamin C | 12.14±6.99 | 2.6 – 51.3 |
| Calsium | 52.57±26.32 | 17.4 – 165.5 |
| Iron | 1.52±0.51 | 0.8 – 3.8 |

**Overview of Nutrient Contribution of Lunch**

The results of the nutrient contribution of lunch can be seen in **Table 5**. Based on this table. we can see that most of the consumed of protein and vitamin A respondent's lunch are fulfilled (≥30%) while most of the contributions of vitamin C. calcium. and iron respondent's lunch does not fulfill (<30%). The contribution of vitamin A at lunch can be fulfilled because the food ingredients used contain quite a lot of that nutrient. such as carrots. bean sprouts. spinach. chicken eggs. and mango.

**Table 5. Nutrient Contribution of Lunch**

| Contribution | Category | n | % |
|---|---|---|---|
| Protein | Fulfilled | 21 | 28.4 |
| | Not Fulfilled | 53 | 71.6 |
| Vitamin A | Fulfilled | 23 | 31.1 |
| | Not Fulfilled | 51 | 68.9 |
| Vitamin C | Fulfilled | 56 | 75.7 |
| | Not Fulfilled | 18 | 24.3 |
| Calcium | Fulfilled | 73 | 98.6 |
| | Not Fulfilled | 1 | 1.4 |
| Iron | Fulfilled | 49 | 66.2 |
| | Not Fulfilled | 23 | 33.8 |

**Table 6. Relationship between Nutrient Density Intake and Nutrients Contribution of Lunch**

| Nutrient Density Intake of Lunch | Nutrients Contribution of Lunch | |
|---|---|---|
| | p-Value | Korelasi (r) |
| Protein | 0.051 | 0.228 |
| Vitamin A | 0.0001* | 0.764 |
| Vitamin C | 0.0001* | 0.513 |
| Calcium | 0.087 | 0.200 |
| Iron | 0.0001* | 0.647 |

*significant relationship at the 0.05 level table (2-tailed)

### Analysis of Energy and Nutrient Density of Lunch

Energy and nutrient density is an instrument developed to identify the total energy and nutritional composition of food to be used as new in selecting foods that contain sufficient energy and nutrients according to each individual. The nutritional density of foods was assessed using the NRF 9.3 method (based on nine essential nutrients and three restricted nutrients). which has the highest accuracy value based on the validity test conducted using the HEI (Healthy Eating Index) score comparison (9). Based on **Table 2**. it is known that the type of food on the lunch menu of employees at this foundation has the best nutritional quality compared to other kinds of food is fruit. Fruits have a higher nutrient density score than their energy density.

Foods with the lowest nutritional quality on the lunch menu for employees at this foundation include ace (fried vermicelli). mashed potato cakes. tofu meatballs. fried tempeh. vegetable cakes. anchovies cakes. Snacks such as ice cream. candy. cookies. high-calorie drinks. and chiki are foods with the category of “high-calorie. low nutrient-dense foods.” while vegetable products. fruits. and grains/tubers are included in high nutrient-dense foods (10). Vegetables and fruit had the highest nutrient density or highest NRF score. while fats and sweet foods had the lowest scores. which means that the food group of vegetables and fruit had good nutritional quality (9). The food nutrient density score can be used to determine the density or diversity of nutrients in food consumed by individuals or populations (11).

In this study. the nutrient density scores of the respondents’ food were included in the category of quintile one and quintile two. which means that the quality of the food is still in the poor class. This is evidenced by the fact that most foodstuff groups have a more excellent energy density score than the nutrient density score of food. Drewnowski (2010) states that if the lower the energy density score is followed by. the higher the nutrient density score. the better the food quality and vice versa (9). High food nutrient density scores and low food energy density scores with the right portion can significantly affect individual nutrient intake. (12).

Research by Ekaningrum et al. (2017) shows that the higher the nutrient density of food. the more expensive the food price is (13). Research by Nuzrina and Wiyono (2010) shows that people prefer foods with high energy density. such as fried foods. fatty meat. rice. and flour. compared to fresh and low energy density foods because food prices with high energy density are more affordable than food prices with a low energy density (14).

### Analysis of Energy Consumption Density of Lunch

The energy consumption density is obtained by dividing the calorie content of food by weight (15). Each food has an energy density value. Energy density is classified by gender. Based on the research results. the energy consumption density in the male and female groups is in a low category. This indicates no difference between the energy density of lunch consumption between men and women in this study. Vegetables and fruit are a type of food group that has a low energy density. This is because the water contained in the fruit is high but has insufficient energy to reduce the energy density value (16). In this study. some respondents have a

low energy density for their lunch consumption. This can be due to the total weight of the food. which is higher than the whole food energy. and decreasing the energy density value.

**The Relationship of Nutrient Density Intake and Nutrient Contribution of Employee's Lunch**

Bivariate analysis of variables is known to use the Spearman Correlation test conducted on respondents totaling 74 employees to see the relationship between nutrients (Protein. Vitamin A. Vitamin C. Calcium. Iron) and nutrients contribution of an employee's lunch.

The result of the study in the table above is that there is no significant relationship between protein density intake and protein contribution of employee's lunch at the foundation with a weak positive relationship direction (p-value=0.051. r=0.228). This result means that when the density of protein intake is high. protein contribution is fulfilled. The result of this study is not in line with Fauzi's (2014) research that there is a significant relationship between protein density intake and protein adequacy level (17). Most of the protein contribution respondent's lunch in this study has been fulfilled. The highest protein intake contributor of the lunch menu in this foundation is animal side dishes. The side dishes of protein sources provided are primarily from animal sources because sometimes there are days when the organizer does not offer side dishes of vegetable protein sources.

The table above shows a significant relationship between the vitamin A density intake of lunch and the vitamin A contribution of lunch in employees at this foundation with a solid positive relationship direction (p-value=0.0001. r=0.764). This result means that when the density of vitamin A intake is high. vitamin A contribution is fulfilled. There is a significant relationship between vitamin C density intake of lunch and vitamin C contribution of lunch in employees at this foundation with a solid positive relationship direction (p-value=0.0001. r=0.513). This result means that when the density of vitamin C intake is high. vitamin C contribution is fulfilled.

The Spearman correlation test in Table 6 shows no significant relationship between the calcium density intake of lunch and the calcium contribution of lunch in employees at this foundation with a weak positive relationship (p-value=0.087. r=0.200). This result means that when the density of calcium intake is high. calcium contribution is fulfilled. However. there is a significant relationship between the iron density intake of lunch and the iron contribution of lunch in employees at this foundation with a solid positive relationship direction (p-value=0.0001. r=0.647). This result means that when the density of iron intake is high. the iron contribution is fulfilled.

The results of the study on vitamin A. vitamin C. and iron are in line with the results of Fauzi's (2014) study that there is a significant relationship between the density of intake of vitamin A. vitamin C. and iron with adequate levels of vitamin A. vitamin C. and iron. But for protein and calcium. the results of this study are not in line with the results of Fauzi's (2014) study that there is a significant relationship between the density of protein and calcium intake and the adequacy of protein and calcium levels (17). The absence of a relationship can be caused because almost all respondents consume the same types and portions of side dishes such as legumes and animal side dishes. After all. the food organizer has proportioned them.

Zulaikhah (2012) states that the higher the density value of specific nutrient intake. the more the respondent consumes food rich in particular nutrients (18). The more diverse the food is finished. the more nutritional adequacy is fulfilled (8). The food organizer in this study. when making the menu. has not paid attention to the variety of balanced nutrition menu arrangements. and the pieces of fruit provided can be said to be too small. Also. there are days when the organizer does not give vegetables food and replace them with fried vermicelli to affect the density of intake and contribution of vitamin A. vitamin C. calcium. and iron during lunch.

Low intake of vitamins and minerals from fruits and vegetables causes low-density calcium. iron. and vitamins. especially vitamins A and C (19). Fruits and vegetables are rich in vitamins and minerals (20). Lack of consuming types of food

sources of vitamins and minerals can affect the density of these nutrient intakes (17).

Density intake of vitamin A. vitamin C. iron. and calcium that is not fulfilling at lunch can also be because the organizer does not provide legume side dishes. They replace them with wheat flour such as vegetable cakes. corn. corn cakes. and anchovies cakes. Which means the energy is higher than the nutrients. Also. there are days when the menu was served using the same processing technique in one meal. such as frying. which makes these foods high in calories. Oil is a dense energy source and can help increase calories in food (21) so that the total intake of vitamin C. calcium. and iron is lower than the total intake of energy consumed. Research by Ekaningrum (2016) shows that the average density of calcium intake is low due to the low total calcium intake compared to the total energy intake consumed (19). The higher the density value of nutrient intake. the more the respondent destroys certain nutrients (17). A good density of nutrient intake can indicate a good level of nutrient adequacy (10).

The unfulfilled nutrient density of vitamin and mineral intake can be caused by the lack of variety in the food used in the lunch menu served by the food organizer so that nutrients such as vitamins and minerals are not fulfilling. The low intake of vitamins. calcium. and iron in some respondents resulted in a low density of nutrient intake. which in turn caused the contribution of iron. calcium. and vitamins to be unfulfilled—especially vitamin A and vitamin C.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the bivariate analysis results. there is no relationship between protein and calcium density intake of lunch with protein and calcium contribution of employee's lunch. There is a relationship between the vitamin A. vitamin C. iron density intake of an employee's lunch with the vitamin A. vitamin C. iron contribution of an employee's lunch. The type of food that has the best food quality among other foods is only fruit. So. food organizers must prepare a more creative menu with more diverse food ingredients and appropriate portions to improve food quality and nutrients contribution of employee's lunches. The type of food that has the best food quality among other foods is only fruit. so it is necessary to prepare a more creative menu with more diverse food ingredients and appropriate portions to improve food quality and contribute energy and nutrients to employee lunches.

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