CONFERENCE PROCEEDING

Applications of Linear Programming on Diet Problem for A&W's Sets Menu in Malaysia

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ABSTRACT

The diet issue with the A&W food sets menu in Malaysia is developed mathematically in this study. The goal of the model is to calculate the most calories from the A&W food menu sets that a person can eat each day and yet meet all their nutritional needs. All daily food set menus in this mathematical model satisfied a person's requirements for total calories, carbohydrates, protein, and fats. An integer linear programming model is proposed and solved using the Excel Solver method based on the diet problem.

Keywords: *linear programming, diet problem, optimal solution*

INTRODUCTION

Linear programming is a method to do optimization just using the simple way. There are a few basic components of linear programming which consist of decision variables, constraints, data, and objective functions. With this method, it can achieve the best result of choices, and it's very helpful for us to get a good decision and conclusion. Linear programming can determine the best outcome of a linear function and solve all complex problems in less time with simplicity. It also figures out that this method was used across applications and websites. Thus, linear programming will be used to get the optimal solution which will be the shortest route. On the other hand, the linear programming method is very useful to solve programming issues involving a business to obtain suitable optimal solutions with given constraints. In conclusion, most of the optimization works happen on linear programming for solving complex problems and we can say that linear programming is the best method for making simple assumptions.

Nurul et al. (2021) solve a diet problem with a McDonald's set menu in order to determine the best costs and satisfy a person's daily caloric and nutritional needs. The cons are in this study, show how much risks include obesity and diabetes. This is because most fast food is high in sugar, salt, saturated fat, trans fats, processed ingredients, and calories. It is also generally low in antioxidants, fibre, and many other nutrients. The diet problem of minimizing vitamin A will be solved by using the graphical method and excel solver. Muhammad and Nurul (2020) obtained are optimal solution, where both methods show similar results to each other. However, because

the result produced by the Excel solver is in decimal values, it provides a value that is more accurate than the graphical method. Cons in this study is because of Vitamin A can become harmful if ingested in excess. Preformed vitamin A has a safe upper intake limit of 3,000 mcg, which is more than three times the current daily recommendation. Nur et al. (2021) have been examining the nutrition issue for decades because it is crucial to our quality of life and health. Nowadays, people frequently purchase fast food without realizing that the meals may not provide the body with all the nutrients it needs. The objective of this study is to construct the mathematical modelling of the diet problem based on the Malaysian KFC fixed menu. The cons is people is not aware of their balanced diet in their food.

Table 1. MATERIALS AND METHODS/ METHODOLOGY

Notation	Explanation
x_i	Sets menu for food in A&W
c_i	Calories for the set menu x_i
p_i	Carbohydrates for the set menu x_i
q_i	Protein for the set menu x_i
r_i	Fats for the set menu x_i
s_i	Sugar for the set menu x_i
t_i	Salt for the set menu x_i

The integer linear programming for the diet problem of A&W's menu is shown as below:

Max $c_1x_1 + c_2x_2 + \cdots + c_{24}x_{24}$
(1)

Subject to

$c_1x_1 + c_2x_2 + \cdots + c_{32}x_{32} \leq 2500/2200$
(2)

$p_1x_1 + p_2x_2 + \cdots + p_{32}x_{32} \leq 375$
(3)

$q_1x_1 + q_2x_2 + \cdots + q_{32}x_{32} \leq 63$
(4)

$r_1x_1 + r_2x_2 + \cdots + r_{32}x_{32} \leq 80$
(5)

$s_1x_1 + s_2x_2 + \cdots + s_{32}x_{32} \leq 36/24$
(6)

$p_1x_1 + p_2x_2 + \cdots + p_{32}x_{32} \leq 23$
(7)

$x_1, x_2, x_3, \ldots, x_{24} \geq 0$
(8)

RESULTS AND DISCUSSION

The diet problem with the A&W food sets menu in Malaysia is developed mathematically in this research. The aim of the mathematical model is to calculate the amount of calories from the A&W food menu sets that a person can eat each day and fulfilled all of their nutritional needs for men and women categories. All daily food set menus chosen from this mathematical model satisfied a person's requirements for total calories, carbs, protein, and fats. An integer linear programming model is proposed and solved by using the Excel Solver method based on the diet problem. From the results, men and women both obtained different results. The results obtained are 2490 Kcal and 2200 Kcal for men and women respectively. Tables 2 show the recommended daily A&W set menu that satisfies the requirement for daily nutrients:

Table 2. Number of recommended sets need to be taken for men and women

Men		**Women**	
Set Menu	**Number of sets need to be taken**	**Set Menu**	**Number of sets need to be taken**
(Onion Rings)	2	(Chili Cheese Fries)	2
(Chili Cheese Fries)	3	(Crunchy Shrimp)	1
(Kid's Fry)	1	(French Fries)	4

The amount of calories calculated by using the Solver tool in Microsoft Excel is maximal while satisfying all the daily nutrient requirements, indicating that the solution obtained is optimal.

CONCLUSION

The data in this study were subjected to the linear programming method in order to determine the best solution to the diet problem in this research. The optimal solution was found by using the Excel Solver. A linear programming approach can be more productively used to resolve many problems. It could also be considered a helpful tool to help in decision-making processes in a variety of situations. In this instance, customers may simply make choices when placing orders from restaurant menus. As conclusion, in this research, men and women fulfilled the required number of calories and nutrients, which is good for keeping a healthy lifestyle.

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