The interaction between inflammatory properties of diet and genetic variation in body weight regulation

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IMPACT

A low-calorie diet has been a long-standing practice among nutritionists and dieticians as a core component of a weight loss program. The concept is when our diet provides less energy than needed, our body will start to break down fat to fulfill the energy demand. With regards to calorie counting, several methods have been developed in several decades such as calorie restriction (reducing 300 kcal/day), a low-calorie diet (1500 kcal/day), and a very low-calorie diet (800 kcal/day). However, these methods also showed that the pitfall of an energy deficit diet is the tendency to weight regain after weight loss is achieved.

Study Objectives and Conclusion

Scientific findings in recent years have indicated that there are several mechanisms that lead to weight regain, one of them is inflammation. Inflammation is a signal produced by cells in our body that has an influence on the behaviour of other cells, including immune cells. Traditionally, inflammation is seen as immune reaction to pathogen infection. However, in recent years it has become evident that inflammation also has an influence on other elements of human physiology including energy and substrate metabolism. The impact of inflammation on metabolism might explain its role in the mechanism of weight regain following weight loss.

The main objective of this research is to investigate whether inflammation play a role in body weight regulation based on population and intervention studies. In this thesis, we support other evidence that inflammation plays a role in body weight regulation. Inflammation can be triggered by several factors including diet and genetics. In a weight loss program conducted in The Netherlands, we showed that when dietary intake was more likely to increase inflammation, individuals were more likely to gain weight following weight loss. We further created a new dietary regime for weight loss with the aim not only to reduce calorie intake but also to reduce inflammation, a low calorie-low inflammatory diet (LCID). Although we showed that the new diet may reduce inflammation over a short period of time, this diet did not significantly improve body weight loss compared to the conventional low-calorie diet.

Because diet is not the only factor that triggers inflammation, we further evaluated whether genetic variation might play a role in the interaction between diet and weight gain. In this study, we showed that the individual response to a diet was influenced by variations in selected pro-inflammatory genes. These genes encode proteins that are direct pro-inflammatory signals. The weight regain response to a high protein diet or a low glycemic index diet, which were previously shown to reduce weight regain, was different according to genetic variation.
Potential Scientific Contribution
There are several main messages to society that can be obtained by the studies in this dissertation. First, dietary modification to reduce calorie intake and inflammation is possible by not only focusing on reduction of the amount of food consumed but also on improved dietary habits. This can be done by selecting foods that are high in nutrients such as vitamins (vitamin A, B, C, and E) and minerals (magnesium, zinc, selenium), which are anti-inflammatory, and reducing consumption of foods that have pro-inflammatory properties (such as energy-dense, high saturated and trans fat foods). Such efforts have been successfully reported in the Mediterranean diet.

Second, if reproducible, this finding can be further developed into a personalized nutrition approach for weight management. Despite controversies among academia, dietary recommendations based on gene variations are currently being developed in real-world setting by several tech start-ups. There are “personalized nutrition” services that integrate data of gene variations in dietetic consultation or nutritional services. International tech company such as Nutrigenomix, DNAfit, DNAnudge, and Gini have successfully developed their own nutrigenetic approach for personalized nutrition. The rise of direct to customer genetic testing, such as 23andme, may give personalized nutrition a place in the future of dietetics. In Indonesia, there are 2 providers of personalized nutrition services based on genetic variation, namely Kalbe Nutrigen-me and Prodia Nutrigenomics. While the services are available, scientific studies are needed to expand our current knowledge on gene-diet interaction as well as providing accurate information regarding dietary recommendations based on genetic profiles.

The “personalized nutrition” approach using genetic information raises some social challenges. It has been criticized that current marketing strategies seem to overpromise the result of personalized nutrition to their clients. On the other side, the area of service seems to lack regulation at the national and international level. Further action is needed by governments, academics and industry in the regulation and commercialization of personalized nutrition.

Target Audience of The Scientific Findings
Obesity is global health problem that costs millions of dollars for treatment as well as treatment of diseases related to obesity. This research aimed to contribute to alleviating this problem by development of a weight loss program using a different approach, by dietary modification and genetic analysis. Results from this study can be used by those who work in the health sector as well as wellness industry. This study focused on one of the most challenging problems facing obesity treatment, namely the weight regain following weight loss.

Dietitians and nutritionists are two major target audiences for this study. We provided information on modification of the diet during a weight loss program. This included the role of inflammation on weight regain and how an individual can
response differently due to its genetic background. This information is aimed to educate practitioners in the health and wellness industry to not only focus on reducing calorie intake but also to improve the diet quality. Fellow scientists working in the areas of nutrition and nutrigenetics all around the world are also target audience of this study. It is hoped that results from this study can be used as a basis for the development of methods to reduce inflammation during a weight loss program.

**Activities for Result Dissemination**

The main outlet of this research is the scientific publication of the studies that are currently done within this thesis. This will provide scientific insight on how the studies were conducted and conclusions that were generated and their strengths and limitations. Results from this study has been presented at several conferences including *Asia Pacific Nutrigenomic and Nutrigenetic Conference* (China, 2020), *NuGO Week* (United Kingdom, 2018), *Dutch Nutrition Science Day* (The Netherlands, 2018), *European Conference on Obesity* (Austria, 2018). I also wrote a book with title “Diet Mediterania: Teori dan Aplikasi Bagi Masyarakat Indonesia” or “Mediterranean diet: Theory and Application for Indonesians”. The book is a guide on how to adapt Mediterranean diet principle to Indonesians. The Mediterranean diet itself has been an important insight with respect to the dietary approach to reduce inflammation which inspired the development of the low-calorie-low-inflammatory diet.

In addition to the book and journals, I also plan to create a 10 minutes education video for 3 topics: 1) the influence of dietary habits on inflammation; 2) the importance of keeping inflammatory low when dieting; and 3) individual response to diet based on gene variations. The video will be an animated version of this thesis and made in English and will be broadcasted my YouTube page “Gizi Gama”. By doing this, I can provide information from this research freely to the public, practitioners in the health and wellness industry, as well as fellow academics.