

# Weight Loss with Atkins Diet

Che Norhalila C.M. and Siti Khadijah J.

**Abstract**— This comprehensive study examined the effectiveness of the Atkins diet on weight loss and the factors that influencing greater impact on weight loss. The Atkins diet works when the dieter drastically restricting carbohydrate intake which later forces the body to burn fat in order to produce energy. The cross-sectional study was conducted and the 132 respondents involved were selected using simple random sampling. Before practicing the diet, about 97.73 percent of the respondents have BMI problem. The method used for each objective is t-test and Multiple Linear Regression. The findings exhibit that there is a statistically difference in weight loss between gender and showed that there is a difference between BMI after the respondents followed the Atkins diet program. The water consumption and exercising daily contributes significantly to the weight loss. Thus, a combination of diet, water consumption and exercising will give greater impact on weight loss.

**Index Terms**—Atkins diet, exercise, water consumption, weight loss.

## I. INTRODUCTION

A staggering number of obese people in the world have raised a major concern to many world leaders and health organizations. There is more than 1.9 billion people age 18 years and above were overweight in 2014 and over 600 million out of these numbers were obese [1]. In 2013, there are 42 millions of children under the age of 5 were overweight. The number of worldwide obesity has more than doubled since 1980 [1]. Overweight and obesity are thought to be an important killer to the world's population compared to underweight [1].

Malaysia has been ranked as the heaviest in South East Asia with the highest adult obesity [2]. A latest study by The Lancet, 45.3% Malaysian were reported the heaviest followed by South Korea (33.2%), Pakistan (30.7%) and China (28.3%). The study also showed that overweight and obesity were highest among female (49%) compared to men (44%) [2]. Indians were recorded the highest in overweight followed by Malays, Chinese and Aboriginals [3]. Childhood obesity in Malaysia is also on the rise. According to the National Health and Morbidity Survey [4], 3.9% out of 0.3 million children below 18 years old are obese. Obese children might develop medical problems such as cardiovascular health, diabetes and mental health [5].

Many have addressed their concern on curbing overweight and obesity. Various diet programs, health products, dietary

supplements and weight management products are invented and produced to aid overweight and obese people. Since growing spending and demand on losing weight, many have developed numerous diet programs to fulfil economic demand. One of the diet programs are Atkins diet which was created and founded by a cardiologist, Dr. Robert C. Atkins. His first major work, *Diet Revolution* prescribing a low-carbohydrate diet was published in 1972. Later in 1992, he improved and rewrites his work and published his second book, *Dr. Atkins' New Diet Revolution* which stayed more than six years in the New York Times bestseller list [6]. This diet not only helps people to reduce weight, it also helps people with risk factors such as diabetes, heart disease and hypertension and relieves gastrointestinal problems, certain allergies, chronic pain and weak immune system [6]. Since this diet is remarkably prolific, many are curious and scrutinized of its effectiveness.

## II. ATKINS DIET

### A. The Concept of Atkins Diet

The Atkins diet emphasizes eating low carbohydrates with high protein and fat intake [7]. It also promotes long-term weight-loss and weight-maintenance [6]. In this diet program, simple carbohydrates such as white flour, white rice and sugar are highly restricted or are not to be consumed at all [7]. The basic Atkins principle or theory is that weight problem occurs due to the carbohydrates we consume not how much the fat we consume [8]. Many people with overweight and obesity problem may be resistant towards insulin when the conversion of carbohydrates into glucose as energy fuel for the body does not work properly [6]. He suggested that to curb insulin resistance, one need to strictly restrict carbohydrates [8]. There are foods that are allowed or should be refraining from consuming during each phase of the programs. In other words, food such as processed food, packaged foods, junk foods and food with high sugar must be eliminated or refrain from eating them [6].

### B. How Does the Atkins Diet work?

Atkins diet works when carbohydrate intake is less than 20 grams a day, which later the body will enter a process called ketosis. Ketosis is a state where the body with less carbohydrate will burn fat stored in the body in order to produce energy [6]. According to Dr. Atkins, ketosis will affect insulin production where it will prevent more fat from being stored due to excessive intake of carbohydrates. He stated that, once the body enters the ketosis state, the body begins efficiently using fat as fuel and the cravings for foods will subside and thus losing weight is much more effective than before [6].

Manuscript received July 25, 2016. This work was supported in part by the U.S. Department of Commerce under Grant BS123456 (sponsor and financial support acknowledgment goes here).

C. M. Che Norhalila is with the Univeristi Teknologi MARA Negeri Sembilan, Seremban. She is a lecturer with the Faculty Computer and Mathematical Sciences, Department Statistics, Persiaran 3/1, 70300 Seremban, Negeri Sembilan, Malaysia. (e-mail: cheno849@ns.uitm.edu.my).

J. Siti Khadijah was with Univeristi Teknologi MARA Negeri Sembilan, Seremban. Final year student in statistics. (e-mail: khadijahjasni@live.com).

### C. *The Four-Phases of Atkins Diet*

The Atkins diet has four-phases of eating plan. Types of foods and carbohydrate intakes are varied on every phase. The first phase is Induction, followed by On-going Weight Loss (OWL), then Pre-maintenance and lastly Life-time maintenance.

Induction phase is the first phase in Atkins diet and it usually last less or more than two weeks depending on the dieter's weight goal aim [6]. This phase is the most restricted carbohydrate intake which dieters are not allowed to take not more than 20 grams of carbohydrate per day and it is also the most important key to start losing weight as it will turn the body into a ketosis state where it switched from carbohydrate burning metabolism to fat burning [6].

The second phase is the 'On-going weight loss' which the daily carbohydrate intake is increased by 5 grams a week by week [6]. As the level of carbohydrate intake increases, the rate of losing weight is slower [6]. It is recommended to add carbohydrates very slowly, stay for two or more weeks at 5 grams and increase carbohydrate consumption steadily [6].

As the level of carbohydrates intake increases over time and the dieters move to the next phase which is pre-maintenance phase, they will stop losing weight [6]. This phase is designed to avoid sudden change of eating habit or worse went back to the old way of eating. Moreover, pre-maintenance will let the dieters know the level of carbohydrates that the body can tolerate in the future and to prevent any weight gain after the program [6].

The final phase: The Life-time maintenance phase where the dieters reached the weight loss goal and discover the highest level of carbohydrates that the body can tolerate to maintain the rest of their life [6]. However, if in the future the dieters gain weight, they need to return to induction phase for a few days to start the ketosis back [6].

## III. RESEARCH METHODOLOGY

### A. *Study Design*

This survey is a cross-sectional study or also known as one-shot studies because it involves conducting a survey of population elements at one point in a time. In this survey, it takes six months to collect the data of the respondents. Data of this survey are collected from users of Facebook who joined Kelab Diet Atkins (Malaysia). The target population in this study is all Facebook users who joined the Kelab Diet Atkins (Malaysia) and follow the Atkins Diet during the study conducted. There are some criteria that need to be observed in order to select the respondents in this study. All Facebook users who joined Kelab Diet Atkins (Malaysia) and who are consistent in practicing the diet during the study conducted. However, those who are not consistent in practicing the diet and have serious health problems that could effect to physical functioning such as restricted movement are excluded in this study.

### B. *Sampling Technique*

Simple random sampling is used as a sampling technique. By using this technique, each sample from the population has an

equal chance of being selected as a sample. There are many Atkins' diet group in the Facebook, however the only group that is interested in this study is the Kelab Diet Atkins (Malaysia). The researcher has posted an advertisement on Atkins Diet in that group in order to obtain the number of practitioners who are interested and willing to participate in answering the questionnaire about this study. Practitioners who are interested to join need to give their full name before the questionnaire is posted privately to them via Facebook messenger. The time taken to collect the overall data and receive feedback from the respondents take about six months.

### C. *Sample Size Calculation*

According to Sekaran [9], sample size is important to generalize to population based on the representative of the sample. Table Krejcie and Morgan [10] for 250 populations of practitioners of Atkins diet, a sample of 152 is required in this study.

### D. *Statistical Analysis*

Pilot study was conducted before the actual study conducted to get prior information and to testing adequacy of the questionnaire. Descriptive statistics is used in order to get the frequency and percentage from the results obtained based on the gender. Independent sample t-test was used to investigate whether there is a significant different between gender on their weight loss. However, the dependent t-test was used to the compare the difference between BMI before and after practicing the diet. The assumptions on the normality, the homogeneity of variance and presence of outliers were tested.

Multiple linear regression used to find the predictors that contributes significantly to the weight loss with Atkins diet. Assumptions of normality, linear relationship between independent and dependent, constant variance and multicollinearity were conducted and satisfied.

In medical, Campbell [11] stated that the typical values for  $\alpha$  are 0.1, 0.05, and 0.01. For all the tests conducted in this study is said to be statistically significant if p-value is  $\leq 0.05$ .

## IV. RESULTS

### A. *Response Rates*

The response rate was 89.5% since the questionnaire returned to the researcher within the six months is only 136 from 152. However, there were four questionnaires, three from male and one from female respondents that were discarded since there were some unanswered questions. When 25% of the items unanswered in the questionnaire, it will be good to left aside without include in the analysis [9]. Therefore, only 132 questionnaires had been included in the analysis.

TABLE I: RESPONSE RATES FOR GENDER

Gender	Distributed Questionnaire (Sample Size)	Returned Questionnaire (Response Rate)	Discarded	Included in analysis
Male	62	53 (85.5)	3	50
Female	90	83 (92.2)	1	82
Total	152	136 (89.5)	4	132

### B. Demographic Profile

The data is analyzed and the results are summarized in the Table I in number and percentages. The total respondents are 132 where 82 of the respondents are female and the remaining 50 are male. The youngest female respondent is 15 years old and the oldest is 48 years old. For male respondent, the youngest age is 18 years old and the oldest is 38 years old. Most of the respondents are between 20 to 29 years old which consist of 54 female respondents and 36 male respondents. Only four of the female respondents are aging between 40 to 49 years old. There is no male respondent aging between 40 to 49 years old. Overall, the respondents who are still single are the highest which are 91 respondents, 53 of them are females and 38 are males. Female respondents who are already married consist of 29 respondents which are higher than male respondents that only consist of 12 respondents, totaling up to 41 married respondents. Most of the respondents are students, which consist of 30 females and 15 males. The respondents who are self-working consist of 17 respondents, 10 of them are males and seven are females. Only nine respondents are unemployed which eight of them are females and one male. It can be seen here that highest female respondents are among students, consisting of 30 respondents and the lowest female respondents are self-working, which are seven respondents while the highest male respondents are working in a private sector which consists of 16 respondents and the lowest male respondent are unemployed which only consist of one respondent.

Based on BMI before weight loss, only three respondents which are females having normal weight and most of the respondents have obese type II which consist of 52 females and 40 males. BMI of the respondents that have normal weight after losing weight have increased to 22 for female and 11 for male. There is no underweight male respondent and only one underweight female respondent. Besides that, the female and male respondents that have obese type II have decreased to 17 respondents for each gender, while the female respondents that have obese type I also have decreased to 26 respondents and 15 for male respondents. Overall, both male and female respondents mostly drink two liters in a day, 13 and 20 respondents respectively. The numbers of respondents with highest water consumption which are 4.0 liters are 11 males and 10 female respondents. However, the respondents need to meet the requirement of water consumption according to their weight. Most of the respondents took 16 to 30 minutes to finish their exercise which consist of 34 females and 12 males. 25 female prefer to do their exercise three times per week, and 16 males four times per week. However, there are also respondents that did not exercise at all which are one male and eight female respondents.

TABLE II: DEMOGRAPHIC PROFILE OF BOTH GENDER

Demographic Profile	Male	Female
Gender	50 (37.9)	82 (62.1)
Age		
10-19 years old	1 (2.0)	6 (7.3)
20-29 years old	36 (72.0)	54 (65.9)
30-39 years old	13 (26.0)	18 (21.9)
40-49 years old	0 (0.0)	4 (4.9)
Marital Status		
Single	38 (76.0)	53 (64.6)
Married	12 (24.0)	29 (35.4)
Occupation		
Government	8 (16.0)	20 (24.4)
Private	16 (32.0)	17 (20.7)
Self-working	10 (20.0)	7 (8.5)
Student	15 (30.0)	30 (36.6)
Unemployed	1 (2.0)	8 (9.8)
BMI Before		
Normal weight	0 (0.0)	3 (3.7)
Overweight	2 (4.0)	6 (7.3)
Obese I	8 (16.0)	21 (25.6)
Obese II	40 (80.0)	52 (63.4)
BMI After		
Underweight	0 (0.0)	1 (1.2)
Normal weight	11 (22.0)	22 (26.8)
Overweight	7 (14.0)	16 (19.5)
Obese I	15 (30.0)	26 (31.7)
Obese II	17 (34.0)	17 (20.7)
Water Consumption		
1.0 liter	2 (4.0)	10 (12.2)
1.5 liters	6 (12.0)	15 (18.3)
2.0 liters	13 (26.0)	20 (24.4)
2.5 liters	7 (14.0)	15 (18.3)
3.0 liters	11 (22.0)	8 (9.7)
3.5 liters	0 (16.0)	4 (4.9)
4.0 liters	11 (22.0)	10 (12.2)
Frequency Exercise (per week)		
No exercise	1 (2.0)	8 (9.8)
1 time	4 (8.0)	10 (12.2)
2 times	5 (10.0)	14 (17.0)
3 times	11 (22.0)	25 (30.5)
4 times	16 (32.0)	6 (7.3)
5 times	10 (20.0)	13 (15.9)
6 times	2 (4.0)	2 (2.4)
7 times	1 (2.0)	4 (4.9)
Length of exercise (in minutes)		
No exercise	1 (2.0)	8 (9.8)
1 – 15 minutes	7 (14.0)	16 (19.5)
16 – 30 minutes	12 (24.0)	34 (41.5)
31 – 45 minutes	14 (28.0)	19 (23.2)
46 – 60 minutes	16 (32.0)	5 (6.0)

C. Comparing the weight loss between gender.

Table III shows the mean and standard deviation of weight loss for both gender. The mean of weight loss for male is 21.2520 kg higher than female, 15.5988 kg. Independent t-test confirmed that there is a significant difference between male and female since the p-value is less than 0.05.

TABLE III MEAN AND STANDARD DEVIATION OF WEIGHT LOSS

Gender	Mean	Standard Deviation	t	p-value
Male	21.2520	12.7969	2.879	0.005
Female	15.5988	9.6522		

D. Comparing the BMI after follow Atkins diet.

Mean of BMI before the respondents practicing Atkins diet is 33.6368 kg and it show decreasing BMI after that, which is 26.8929 kg. Dependent sample t-test used to compare the difference between BMI before and after. Table IV shows the p-value is 0.05. Hence, it can be concluded that Atkins diet is an effective diet plan to help overweight and obese people to lose their weight.

TABLE IV: MEAN AND STANDARD DEVIATION OF BMI

BMI	Mean	Standard Deviation	t	p-value
Before	33.6368	6.5114	18.367	0.000
After	26.8929	4.9889		

E. Multiple Linear Regression.

Multiple linear regression was used to identify which factors contribute significantly to the weight loss after practicing Atkins diet. Eight predictor variables used in the equation which include age, gender, marital status, weight before, height, daily water consumptions, frequency of exercise per week and length of exercise per session. The assumptions of multiple linear regression were tested and shows the variance is constant, the errors are uncorrelated, normally distributed and no multicollinearity exists.

From eight predictor variables, three variables are categorical variables, gender, marital status and length of exercise per session. To incorporate qualitative variables into regression models, dummy variables should be created. However, gender and marital status only have two categories, so dummy variable created for length of exercise per session only.

Based on the output obtained using multiple linear regression, only three predictor variables are significantly contributing to the weight loss. There is weight before (p-value = 0.01), daily water consumptions (p-value = 0.000), and length of exercise per session (p-value = 0.000). Equation (1) is the estimated regression function for weight loss.

Based on the equation, this indicates that when the other variables are held constant, when weight before is increase by 1kg, the average weight loss will increase by 0.71 kg. For every one-liter increase in the daily water consumption, the weight loss will increase by 9.969kg, while other predictor variables are held constant. The weight loss is found to be 3.841kg higher if they do the exercise between 46 to 60 minutes compare with

other lengths of exercise. The R-square for this model is 0.874 indicates that 87.4% of the total variation in weight loss is explained by the weight before, daily water consumptions and length of exercise. The adjusted R-square is equal to 0.871.

$$\hat{Y} = -13.390 + 0.71X_1 + 9.969X_2 + 3.841X_3 \quad (1)$$

where;

$\hat{Y}$  is the weight loss

$X_1$  is the weight before

$X_2$  is the daily water consumptions

$X_3$  is the length of exercise  $\begin{cases} 1 & 46 - 60 \text{ minutes} \\ 0 & \text{otherwise} \end{cases}$

V. COMPARISON WITH OTHER STUDIES

Atkins diet is one of the popular diets that have been practiced by many people around the globe including Malaysia. Many studies were conducted to substantiate Dr. Robert C. Atkins' claim and that Atkins diet can induce greater weight loss. A study conducted by Foster *et al* [12] stated that this diet produced a greater weight loss with absolute difference of 4% compared to conventional diet. Moreover, a latest study by Caminhotto *et al* [13] supported other previous study and that after 14 days the study's subject on diet with 20 grams per day of carbohydrate intake, their BMI and triglycerides decreased significantly which indicates Atkins diet is effective in losing greater weight loss. The results of this study which focuses on effectiveness of Atkins diet are compatible with previous studies.

There are several factors influencing and contributing to the effectiveness of Atkins diets. In this study, gender, age group, water consumption and exercising are factors to determine their influence in promoting greater weight loss. There is significant difference of weight loss between male and female since male has the advantage in having more lean muscle tissues and testosterone to achieve greater weight loss [15]. A previous study was conducted to improve methods for long-term weight management where overweight and obese adults aged more than 25 years old were selected which the result showed that male loses weight significantly greater than female [16]. In our study, the average weight loss for female and male are 15.60kg and 21.25kg and it showed the difference in mean between male and female where male is higher than the female by 5.65 kg.

The second factor influencing weight loss in Atkins is age where younger people lose more weight than older people. This is because hormonal changes and deterioration of muscle tissues which led to rigidity and limits the strength and endurance during exercise in older people [16]. A previous study conducted by the National Control Registry to compare young and old adults on weight loss where the result showed that younger adults successfully lose weight compared to older adults [17]. Nonetheless, other previous study showed a contradiction result where older people lost more weight compared to younger adults [18]. In our study, there is no significance difference of age group on influencing greater weight loss. Hence, regardless of age, losing weight is achievable when one's has greater motivation and supports.

The third factor influencing greater weight loss is difference of water intake per day. Drinking water helps in losing weight where it will restrain hunger and boost metabolism up to 3% [19]. Moreover, drinking lots of water will help in removing excess water weight and remove unwanted toxins which beneficial in reducing more weight [20]. Besides that, it is recommended by registered dietician and nutrition expert Susan Bowerman, for every 25 kilogram of body weight, drink 1 litre of water per day [21]. A previous study was conducted to test the association of increasing in water intake and weight loss where the result showed significant weight loss when increasing the water intake [22]. In our study, those consume 1 litre of water for every 25 kilograms of their body weight achieved significant weight loss than those who fail to follow the recommendation. Thus, increasing water intake daily will lead to greater weight loss.

The last factor influencing greater weight loss is exercising. People lose more weight when they combine diet with exercising. A previous study was conducted on the effect of diet and exercising on weight loss alone or combined where those who exercise consistently and improve their diet lost 11% from their original weight while those who only improved their diet lost 8.4% of their original weight and others who only exercise regularly lost 2.4% from their original weight [23]. Moreover, the amount of exercise also determines greater weight loss and maintains weight loss. Overweight and obese people should at least exercise with moderate intensity for 150 minutes per week to improve their health and 200 to 300 minutes for long-term weight loss as recommended by The American College of Sports Medicine (ACSM). According to a previous study by Donnelly *et al* [24], it is highly recommended to exercise for more than 250 minutes per week for greater weight loss. Based on our study, there is a significant difference in length of exercise where exercising between 46 to 60 minutes per day will influence weight loss. Thus, exercising is vital in promoting greater weight loss in Atkins diet.

## VI. CONCLUSION

Obesity is a major problem in Malaysia because its prevalence and severity to all different ages throughout the country and it has increased substantially for the last few decades. This increase might relate to urbanization and improvement of socioeconomic status where more sedentary lifestyle with less physical activities and unhealthy dietary habits are adopted. Thus, there is an urgent need for a strategy to apprehend this problem and solve it. In this paper, we suggest that Atkins diet might be effective in promoting weight loss since promoting awareness might induce the understanding that health is important and several factors need to be considered and approach in order to successfully reduce weight.

## ACKNOWLEDGMENT

The authors wish to thank Kelab Diet Atkins (Malaysia) (Facebook) for the indirectly contributes in this research. We also extend our deepest gratitude to the input of individuals who were particularly critical to the initiation and implementation of this study.

## REFERENCES

- [1] Organization, W. H. (2015). Obesity and overweight. [Online] Available from <http://www.who.int/mediacentre/factsheets/fs311/en/> [Accessed April 23].
- [2] Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., Mullany, E. C., Biryukov, S., Abbafati, C., Abera, S. F., Abraham, J. P., Abu-Rmeileh, N. M. E., Achoki, T., AlBuhairan, F. S. Z., Alemu, Z. A., Alfonso, R., Ali, M. K., Ali, R., Guzman, N. A., Ammar, W., Anwar, P., Banerjee, A., Barquera, S., Basu, S., Bennett, D. A., Bhutta, Z., Blore, J., Cabral, N., Nonato, I. C., Chang, J.-C., Chowdhury, R., Courville, K. J., Criqui, M. H., Cundiff, D. K., Dabhadkar, K. C., Dandona, L., Davis, A., Dayama, A., Dharmaratne, S. D., Ding, E. L., Durrani, A. M., Esteghamati, A., Farzadfar, F., Fay, D. F. J., Feigin, V. L., Flaxman, A., Forouzanfar, M. H., Goto, A., Green, M. A., Gupta, R., Hafezi-Nejad, N., Hankey, G. J., Harewood, H. C., Havmoeller, R., Hay, S., Hernandez, L., Husseini, A., Idrisov, B. T., Ikeda, N., Islami, F., Jahangir, E., Jassal, S. K., Jee, S. H., Jeffreys, M., Jonas, J. B., Kabagambe, E. K., Khalifa, S. E. A. H., Kengne, A. P., Khader, Y. S., Khang, Y.-H., Kim, D., Kimokoti, R. W., Kinge, J. M., Kokubo, Y., Kosen, S., Kwan, G., Lai, T., Leinsalu, M., Li, Y., Liang, X., Liu, S., Logroscino, G., Lotufo, P. A., Lu, Y., Ma, J., Mainoo, N. K., Mensah, G. A., Merriman, T. R., Mokdad, A. H., Moschandreass, J., Naghavi, M., Naheed, A., Nand, D., Narayan, K. M. V., Nelson, E. L., Neuhouser, M. L., Nisar, M. I., Ohkubo, T., Oti, S. O., Pedroza, A., et al. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, **384** (9945), 766-781.
- [3] Khambalia, A. Z. & Seen, L. S. (2010). Trends in overweight and obese adults in Malaysia (1996–2009): a systematic review. *Obesity Reviews*, **11** (6), 403-412.
- [4] Ho, B., Jasvinder, K., Gurpreet, K., Ambigga, D., Suthahar, A., Cheong, S., & Lim, K. (2014). Prevalence, awareness, treatment and control of diabetes mellitus among the elderly: The 2011 National Health and Morbidity Survey, Malaysia. *Malaysian Family Physician: The Official Journal of the Academy of Family Physicians of Malaysia*, **9**(3), 12–19.
- [5] Chee, P. W. (2014). Weight issues: Fighting flab from young. [Online] Available from <http://www.thestar.com.my/Lifestyle/Health/2014/04/13/Weight-issues-Fighting-flab-from-young/> [Accessed April 23].
- [6] Atkins, R. C. Dr. Atkins' New Diet Revolution. HarperCollins, 2002.
- [7] Wallace, J. J. a. R. (2014). The Atkins Diet. [Online] Available from <http://www.healthline.com/health/atkins-diet#Overview1> [Accessed May 1].
- [8] Scott, J. R. (2015). An Overview of The Atkins Diet. [Online] Available from <http://weightloss.about.com/od/theatkinsdiet/a/atkinsoverview.htm> [Accessed May 1].
- [9] U. Sekaran, *Research Methods for Business: A skill building approach*, 4<sup>th</sup> ed. Southern Illinois University, USA: Wiley, 2003.
- [10] R.V. Krejcie and D.W. Morgan, "Determining the Sample Size for Research Activities" *Educational and Psychological Measurement*, vol.30, pp.608, 1970.
- [11] M.J. Campbell, *Medical Statistics: A common sense approach*, 3<sup>rd</sup> ed. Chichester: John Wiley.
- [12] Foster, G. D., Wyatt, H. R., Hill, J. O., McGuckin, B. G., Brill, C., Mohammed, B. S., Szapary, P. O., Rader, D. J., Edman, J. S. & Klein, S. (2003). A Randomized Trial of a Low-Carbohydrate Diet for Obesity. *New England Journal of Medicine*, **348** (21), 2082-2090.
- [13] Caminhotto Rde, O., da Fonseca, F. L., de Castro, N. C., Arantes, J. P. & Sertie, R. A. (2015). Atkins diet program rapidly decreases atherogenic index of plasma in trained adapted overweight men. *Arch Endocrinol Metab*, **59** (6), 568-71.
- [14] Zelman, K. M. (2005). Weight-Loss Wars: Men vs. Women. [Online] Available from <http://www.webmd.com/diet/weight-loss-wars-men-vs-women> [Accessed June 1 2015].
- [15] Gullion, C. M., Stevens, V. J., Brantley, P. J., Appel, L. J., Ard, J. D., Champagne, C. M., Dalcin, A., Erlinger, T. P., Funk, K., Laferriere, D., Lin, P.-H., Loria, H., Jack F., Catherine M., Samuel-Hodge, C., Vollmer, W. M. & Svetkey, L. P. (2008). Weight Loss During the Intensive Intervention Phase of the Weight-Loss Maintenance Trial. *American Journal of Preventive Medicine*, **35** (2), 118-126.

- [16] Selner, M. (2012). Weight Loss and Age. [Online] Available from <http://www.healthline.com/health/weight-loss-and-age#Overview1> [Accessed June 1 2015].
- [17] LaRose, J. G., Leahey, T. M., Hill, J. O. & Wing, R. R. (2013). Differences in motivations and weight loss behaviors in young adults and older adults in the National Weight Control Registry. *Obesity (Silver Spring, Md.)*, 21 (3), 449-453.
- [18] Svetkey, L. P., Clark, J. M., Funk, K., Corsino, L., Batch, B. C., Hollis, J. F., Appel, L. J., Brantley, P. J., Loria, C. M., Champagne, C. M., Vollmer, W. M. & Stevens, V. J. (2014). Greater weight loss with increasing age in the weight loss maintenance trial. *Obesity (Silver Spring)*, 22 (1), 39-44.
- [19] Hutch, E. (2013). Lose Weight: The One Easy Tip That Works — Jillian Michaels. [Online] Available from <http://hollywoodlife.com/2013/02/15/celebrity-body-workout-plan-free-fitness-tips/> [Accessed June 1 2015].
- [20] Griffin, S. (2013). How to Get Rid of Water Retention Fast [Online] Available from <http://www.livestrong.com/article/164356-how-to-get-rid-of-water-retention-fast/> [Accessed June 1 2015].
- [21] Bowerman, S. (n.d). Five things you should know about water [Online] Available from <http://www.discovergoodnutrition.com/2011/06/five-things-you-should-know-about-water/> [Accessed June 1 2015].
- [22] Stookey, J. D., Constant, F., Popkin, B. M. & Gardner, C. D. (2008). Drinking water is associated with weight loss in overweight dieting women independent of diet and activity. *Obesity (Silver Spring)*, 16 (11), 2481-8.
- [23] Foster-Schubert, K. E., Alfano, C. M., Duggan, C. R., Xiao, L., Campbell, K. L., Kong, A., Bain, C. E., Wang, C.-Y., Blackburn, G. L. & McTiernan, A. (2012). Effect of Diet and Exercise, Alone or Combined, on Weight and Body Composition in Overweight-to-Obese Postmenopausal Women. *Obesity*, 20 (8), 1628-1638.
- [24] Donnelly, J. E., Blair, S. N., Jakicic, J. M., Manore, M. M., Rankin, J. W. & Smith, B. K. (2009). Appropriate Physical Activity Intervention Strategies for Weight Loss and Prevention of Weight Regain for Adults. *Medicine & Science in Sports & Exercise*, 41 (2), 459-471



**Che Norhalila Che Mohamed** was born Pasir Puteh, Kelantan on November 29, 1984. She completed a Master of Science in Applied Statistics (2007-2009), Bachelor of Science (Hons) Statistics (2005-2007) and Diploma in Statistics (2002-2005), Universiti Teknologi MARA, Shah Alam.

Currently served as a lecturer at two campuses in Faculty Computer Science and Mathematics, Universiti Teknologi MARA, Negeri Sembilan (2014-present) and Universiti Teknologi MARA, Johor (2010-2014) Before that, she served as a Quality Management System (QMS) Officer at Top Glove Corporation Bhd for 2 years. Prior to that, she had experience as a home-tutor and data analyst.

Ms. Che Norhalila is currently supervising a degree students for their final year project since 2014. More interested on health science and humanities research.



**Siti Khadijah Jasni** was born in Butterworth, Penang on February 22, 1993. She graduated with a diploma in Statistic from MARA University of Seri Iskandar, Perak, Malaysia in 2014 and completed a bachelor degree in Statistic from MARA University of Seremban Tiga, Negeri Sembilan, Malaysia in 2016.

In 2016, she joined the Department of LCD engineering at HOYA Electronics Sdn. Bhd at Kulim, Kedah as a PRACTICAL TRAINEE. Her first publication, Effectiveness of the Atkins Diet as a Treatment of Weight Reduction, Seri Iskandar, Perak: *Journal of Natural Sciences Research*, 2013 concerning on overall effectiveness of Atkins Diet in inducing weight loss.