Of the Three Classifications of Healthy Lifestyle Habits, Which One is the Most Closely Associated with the Prevention of Metabolic Syndrome in Japanese?

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Abstract

Objective Metabolic syndrome is associated with a high risk of cardiovascular morbidity and mortality. The predominant cause of metabolic syndrome is an unhealthy lifestyle. Healthy habits are represented by Breslow’s 7 healthy practices, Morimoto’s 8 items and Ikeda’s 6 healthy habits. This study was done to determine which set of healthy habits was most likely to result in a reduced risk of developing the metabolic syndrome.

Methods From April 1, 2000 through March 31, 2007, 6,765 males and 2,789 females underwent a medical check-up at Jikei University Hospital in Japan. They completed a simple, self-administered lifestyle questionnaire based on the 3 classifications of healthy habits. The responses were divided into 3 groups (poor, moderate and favorable) according to each of the healthy habit criteria. The incidence of metabolic syndrome was defined in participants who were newly diagnosed during the follow-up using Japanese-specific diagnostic criteria. The Kaplan-Meier cumulative 7-year incidence was calculated. Kaplan-Meier curves were compared using the long-rank test adjusted for age.

Results In females, Breslow’s, Morimoto’s and Ikeda’s healthy habits showed significant differences in the incidence between poor and moderate groups, and between poor and favorable groups. In males, a significant difference was observed among the poor, moderate and favorable groups for Ikeda’s healthy habits. However, no significant difference was observed for Breslow’s healthy practices. Morimoto’s items only showed a significant difference between the poor and moderate groups.

Conclusion Among the 3 models tested, Ikeda’s healthy habits were the most useful for decreasing the risk of metabolic syndrome in Japanese.

Key words: metabolic syndrome, healthy habits, lifestyle, Japanese


Introduction

Lifestyle-related disease is a generic term for medical conditions characterized by hypertension, dyslipidemia and diabetes caused by complex interactions among long-term life habits, genetic factors and environmental factors. Therefore, the onset and progression of lifestyle-related disease involve everyday life habits. In 1965, Breslow et al focused on 7 habits, i.e., smoking, drinking alcohol, physical exercise, weight management, sleep, breakfast consumption and snacking, for the prevention of lifestyle-related disease (1). For 9 years, Breslow followed subjects who practiced these healthy habits and compared them to subjects who did not practice the habits. The results showed that there was a several-fold difference in mortality, and that the younger the age, the greater the impact of healthy habits on mortality.

However, Breslow conducted his study in America, where cultural backgrounds, lifestyles and life habits are markedly different from Japan. Morimoto introduced health indices

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Table 1. Breslow’s 7 Healthy Habits

1. Never smoked cigarettes
2. Drink no more than 4 drinks at a time
3. Often or sometimes engage in active sport, swim or take a long walk, or often garden or do physical exercise
4. Reported weight within a range of 5% under and 19.99% over the desirable standard for men, or not more than 9.99% over for women
5. Usual hours of sleep 7 or 8
6. Eat breakfast almost every day (6 or 7 days per week)
7. Eat between meals once in a while, rarely or never

Based on life habits and health status that were more suitable for Japanese (2). Of 18 habits, Morimoto identified 8 major ones and established a system that categorizes health habits into the following 3 grades: poor (0-4 habits), moderate (5-6 habits) and favorable (7-8 habits).

In 1991, Ikeda proposed the health promotion motto ichimu, ni-shou and san-ta (3), the English translation of which is “none of one, less of two and more of three.” The “one” behavior is smoking. The “two” behaviors are intake of food and alcohol. The “three” behaviors are exercise, rest and enjoyable pursuits. The significance of the last 2 items is that adequate rest and participation in enjoyable hobbies or activities with family and friends are effective ways of reducing stress.

Metabolic syndrome (MetS) is a common lifestyle-related disease that is characterized by excess accumulation of visceral fat (4-7). MetS accelerates arteriosclerosis and induces cerebrovascular and cardiovascular disorders and is a major health issue in the 21st century. In April 2005, a committee of specialists from 8 Japanese Societies specified the diagnostic criteria of MetS risk factors appropriate for Japanese (8).

We previously reported that unfavorable lifestyle habits such as overeating, fast eating, excessive drinking and lack of exercise are closely related to MetS (9). However, there have not been any comprehensive studies investigating the relationship between healthy habits and MetS. Hence, the objectives of the present study were to clarify: 1) that adherence to each of the 3 previously reported classifications of healthy habits can prevent MetS and 2) which of the 3 classifications is the most closely associated with the prevention of MetS.

Methods

All participants completed a simple, self-administered questionnaire (in Japanese) regarding lifestyle habits. To ascertain the number of healthy habits, the following investigation was done. Each item required only a “yes” (good: coded 1) or “no” (bad: coded 0) response, with positive responses indicating a healthy habit; for example “no smoking” was coded as 1. Thus, the higher the number of points, the healthier the person’s lifestyle. The subjects were divided into the following 3 groups with respect to the 7 healthy habits proposed by Breslow (Table 1) (poor [Breslow score or B-score, 0-3 points]; moderate [B-score, 4-5 points]; and favorable [B-score, 6-7 points]). In addition, the subjects were divided into 3 groups with respect to the 8 healthy habits proposed by Morimoto (Table 2) (poor [Morimoto score or M-score, 0-4 points]; moderate [M-score, 5-6 points]; and favorable [M-score, 7-8 points]), and with respect to the 6 healthy habits proposed by Ikeda (Table 3) (poor [Ikeda score or I-score, 0-2 points]; moderate [I-score, 3-4 points]; and favorable [I-score, 5-6 points]).

Following this simple questionnaire, anthropometrical examinations, including height, weight and waist circumference, were performed by trained observers. Brachial blood pressure was measured in the sitting position. Systolic and diastolic blood pressure was measured with a fully automated sphygmomanometer, BP203RV-2 (Nippon Colin, Komaki, Japan). Blood samples were collected after overnight fasting (no food intake for more than 12 h). After these examinations, a medical doctor conducted interviews to confirm the answers in the questionnaires.

The criteria for the diagnosis of MetS are as follows (8):
Abdominal obesity, or waist circumference ≥85 cm in men and ≥90 cm in women, is obligatory for a diagnosis of MetS. In addition to abdominal obesity, any 2 of the following 3 abnormalities should be present: 1) dyslipidemia: tri-
glyceride ≥150 mg/dL or HDL-cholesterol <40 mg/dL, or the use of antilipidemic medication; 2) hypertension: systolic blood pressure ≥130 mmHg or diastolic blood pressure ≥85 mmHg, or the use of antihypertensive medication; and 3) hyperglycemia: fasting plasma glucose ≥110 mg/dL or the use of hypoglycemic medication. Table 4 shows the subjects’ baseline characteristics according to the scoring scheme.

Statistical analysis

All data were processed into coded words at Jikei University and analyzed at the Central Research Laboratory, Hitachi, Ltd. All statistical analyses were performed on a personal computer with the Statistical Package for Social Sciences (SPSS) for Windows (SPSS Japan Inc., version 11.0, Tokyo, Japan). The results are shown as means ± standard deviation (SD). The outcome of interest of the study at follow-up examination was the incidence of MetS in participants who were free of MetS at baseline. Kaplan-Meier estimates of the cumulative event rate in participants were used. The Kaplan-Meier cumulative 7-year incidence was calculated. Kaplan-Meier curves were compared using the log-rank test adjusted for age. Participants with incomplete data were excluded from analyses. A P-value of less than 0.05 was considered indicative of statistical significance.

Role of the funding source

The sponsors of the study had no role in study design, data collection, data analysis, data interpretation or writing of the report.

Results

Of the 2,789 female participants, new-onset MetS was observed in 0.2% at the end of the first year of the observation period, 0.6% (accumulation) at the end of the second year, 0.9% at the end of the third year, 1.1% at the end of the fourth year, 1.4% at the end of the fifth year, 2.2% at the end of the sixth year, and 2.2% at the end of seventh year. Of the 6,754 male participants, new-onset MetS was observed in the first through seventh years, respectively, in 1.8%, 5.4%, 8.5%, 11.5%, 14.3%, 17.1%, and 19.2%. Men developed MetS at a significantly greater rate (incidence, 19.2%, n=689) than women (2.2%, n=29) (p<0.0001).

Figure 1 shows the Kaplan-Meier estimates of cumulative rates of MetS according to the Japanese-specific MetS criteria adjusted for age in the participants who were categorized into the 3 Breslow groups. In women, the 7-year incidence rate of MetS in the poor group was significantly higher than in the moderate group (p<0.0001). Also, the poor group had a significantly higher incidence than the favorable group (p=0.0001). There was no difference between the moderate and favorable groups. In men, there was no significant difference in incidence of MetS among the 3 groups of B-scores (Fig. 1).

The Kaplan-Meier estimates of cumulative rates of MetS according to the Japanese-specific MetS criteria adjusted for age are shown in Fig. 2 for the participants who were categorized into the 3 Morimoto groups. In women, the 7-year incidence rate of MetS in the poor group was significantly higher than the moderate group (p=0.0418). Also, the poor group had a significantly higher incidence than the favorable group (p=0.0247). But there was no difference between the moderate and favorable groups. In men, only the 7-year incidence rate of MetS in the poor group was significantly higher than the moderate group (p=0.0297) (Fig. 2).

Figure 3 shows the Kaplan-Meier estimates of cumulative rates of MetS according to the Japanese-specific MetS criteria adjusted for age in the participants who were categorized into the 3 Ikeda groups. In women, there was a significant difference in incidence of MetS between poor and moderate groups, and between poor and favorable groups. In men, the 7-year incidence rates of MetS were significantly different among the 3 groups for Ikeda’s 6 healthy habits (Fig. 3).

The relationship of each health habit with the incidence of MetS was investigated. The incidence of MetS in subjects who scored 0 (high) for alcohol in Breslow’s, Morimoto’s and Ikeda’s health habits was significantly higher than for

Table 2. Morimoto’s 8 Healthy Habits

1. Exercise: twice a week or more
2. Alcohol consumption: sometimes or never
3. Smoking status: nonsmoking
4. Sleeping pattern: 7 or 8 h/night
5. Nutritional balance: balanced
6. Eat breakfast: every day
7. Working pattern: ≤9 h/d
8. Subjective stress: moderate

Table 3. Ikeda’s 6 Healthy Habits

1. No smoking
2. Less food intake (do not overeat oneself)
3. Less than 150 g/wk of alcohol
4. Sufficient physical activity: regular exercise at least once a week
5. Sufficient rest: at least 6 d/week off work
6. Sufficient participation in a hobby or activity other than work
Table 4. Characteristics of the Study Subjects at Baseline

<table>
<thead>
<tr>
<th></th>
<th>Favorable 7-5 points</th>
<th>Moderate 6-5 points</th>
<th>Poor 0-4 points</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>female</td>
<td>male</td>
<td>female</td>
</tr>
<tr>
<td>Number (%)</td>
<td>3678</td>
<td>19(0.8%)</td>
<td>418</td>
</tr>
<tr>
<td>Age, y</td>
<td>49.0±7.8</td>
<td>44.3±8.2</td>
<td>45.4±8.3</td>
</tr>
<tr>
<td>Mean points</td>
<td>62.6±0.6</td>
<td>62.6±0.4</td>
<td>45.2±0.5</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>23.2±1.7</td>
<td>20.2±1.9</td>
<td>23.2±2.5</td>
</tr>
<tr>
<td>BMI≥25, %</td>
<td>17.4%</td>
<td>0.7%</td>
<td>21.7%</td>
</tr>
<tr>
<td>WC, cm</td>
<td>83.2±5.5</td>
<td>72.4±7.0</td>
<td>83.0±7.0</td>
</tr>
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<td>WC≥85, men, %</td>
<td>36.6%</td>
<td>37.6%</td>
<td>38.9%</td>
</tr>
<tr>
<td>WC≥80, women, %</td>
<td>0.7%</td>
<td>2.0%</td>
<td>4.8%</td>
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<tr>
<td>Systolic BP, mmHg</td>
<td>122.1±13.2</td>
<td>112.2±14.2</td>
<td>119.4±12.6</td>
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<tr>
<td>Systolic BP≥130, %</td>
<td>24.5%</td>
<td>10.5%</td>
<td>17.9%</td>
</tr>
<tr>
<td>Diastolic BP, mmHg</td>
<td>77.5±9.0</td>
<td>69.8±9.0</td>
<td>75.4±9.1</td>
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<tr>
<td>Diastolic BP≥85, %</td>
<td>19.5%</td>
<td>6.0%</td>
<td>14.3%</td>
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<tr>
<td>BP under treatment, %</td>
<td>2.4%</td>
<td>0.2%</td>
<td>1.2%</td>
</tr>
<tr>
<td>FPG, mg/dL</td>
<td>99.7±19.1</td>
<td>90.8±8.8</td>
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<td>FPG≥110, %</td>
<td>10.3%</td>
<td>3.8%</td>
<td>7.9%</td>
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<tr>
<td>Diabetes under treatment, %</td>
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<td>1.2%</td>
<td>1.3%</td>
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<tr>
<td>Triglyceride, mg/dL</td>
<td>114.7±77.1</td>
<td>70.6±35.8</td>
<td>122.3±86.1</td>
</tr>
<tr>
<td>Triglyceride≥150, %</td>
<td>17.4%</td>
<td>2.9%</td>
<td>21.7%</td>
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<tr>
<td>HDL-cholesterol, mg/dL</td>
<td>59.6±14.0</td>
<td>74.0±15.5</td>
<td>57.4±13.7</td>
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<td>HDL-cholesterol&lt;40, %</td>
<td>5.2%</td>
<td>0.2%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Dyslipidemia under treatment, %</td>
<td>3.4%</td>
<td>1.9%</td>
<td>2.2%</td>
</tr>
</tbody>
</table>

Values are means±S.D. BMI: body mass index, WC: waist circumference, BP: blood pressure, FPG: Fasting plasma glucose; HDL-cholesterol: high-density lipoprotein cholesterol.
Figure 1. Cumulative incidence curves for metabolic syndrome according to Breslow’s classification of healthy habits, from entry in the study in April 2000. The subjects were categorized into 3 groups, favorable (B-score 6-7) (dotted line), moderate (B-score 4-5)(broken line), and poor (B-score 0-3) (solid line) for Breslow’s score. In female subjects, the 7-year incidence rates of metabolic syndrome in the poor groups were significantly higher than those in the moderate group (p=0.0011, log-rank test). In male subjects, there was no significant difference in the incidence of metabolic syndrome among the three groups of B-scores.

Discussion

Of the 3 classifications of healthy lifestyles factors, which is the most closely associated with the prevention of MetS? When the favorable, moderate and poor lifestyle groups were compared within each list, Ikeda’s health habits showed the greatest differentiation among groups in the incidence of MetS at 7 years, compared with Morimoto’s and Breslow’s classifications.

As Japan has developed socioeconomically, the prevalence of diseases has changed from predominantly acute to mainly lifestyle-related chronic diseases. Lifestyle-related diseases are defined as diseases that develop as a result of lifestyle habits such as poor diet, inactivity, insufficient rest, smoking and drinking alcohol. Today, lifestyle-related diseases account for two-thirds of all deaths and one-third of health expenditures in Japan.

The incidence of Mets increased as aging. Thus, Kaplan-Meier curves were compared using the long-rank test adjusted for age. After adjusting of age, the significant difference appeared between the poor and moderate groups, female poor and favorable groups of Morimoto’s classification.
Figure 2. Cumulative incidence curves for metabolic syndrome for Morimoto’s classification of healthy habits, from entry in the study in April 2000. The subjects were categorized into three groups, favorable (M-score 7-8) (dotted line), moderate (M-score 5-6) (broken line), and poor (score 0-4) (solid line) for Morimoto’s score. In both males and females, there was no significant difference in the incidence of metabolic syndrome among the three groups.

Breslow’s 7 healthy habits

Breslow’s study was historically significant because it was the first to show that lifestyle factors markedly affected the health status of healthy working people. Breslow proposed the 7 healthy habits more than 30 years ago. Since then several problems with it have been documented. One study found that people who practiced Breslow’s healthy habits tended to have high blood pressure, and that Breslow’s healthy habits were not necessarily appropriate for hypertension prevention in Japan (10). This is because Breslow’s healthy habits do not take into account stress, which develops hypertension. Three of the seven habits deal with obesity (breakfast consumption, snacking and proper body weight maintenance); and vigorous physical activity is considered important. A Japanese study found that there were no marked differences in mortality in relation to the practicing number of Breslow’s healthy habits (11). Ohtsuki (12) also found no correlation between practicing Breslow’s healthy habits and blood pressure. In the present study, there was no significant difference in the incidence of MetS among men in the poor, moderate and favorable groups and there was no significant difference in the incidence of MetS among women in the moderate and favorable groups.

Morimoto’s 8 healthy habits

In 1987, Morimoto (2) proposed new health indicators designed particularly for Japanese (Table 2). Lifestyle is assessed based on 8 healthy habits in 3 groups: poor (0-4 points), moderate (5-6 points) and favorable (7-8 points). Morimoto used a multiple logistic model to determine the contribution of the 8 healthy habits to the onset of diseases occurring over a 6-year period from 1984 to 1989. The results showed that the relative risk for cardiovascular diseases
Figure 3. Cumulative incidence curves for metabolic syndrome for Ikeda’s classification of healthy habits, from entry in the study in April 2000. The subjects were categorized into three groups, favorable (I-score 5-6) (dotted line), moderate (I-score 3-4) (broken line), and poor (I-score 0-2) (solid line) for Ikeda’s score. In the female subjects, there was a significant difference in the incidence of metabolic syndrome between moderate and favorable groups of I-scores. In the male subjects, the 7-year incidence rates of metabolic syndrome showed significant differences among the three groups for Ikeda’s six healthy habits.

in low-scoring patients was significantly high at 2.0 (range, 1.0-3.5). Psychological stress was also observed to be a particularly important factor for the onset of other common diseases (2). Breslow’s 7 healthy habits did not include any stress-related factors, and as a result, Morimoto’s healthy habits are more relevant. Thus, the number of significant intergroup differences was higher for Morimoto’s factors than that for Breslow’s healthy habits.

Ikeda’s 6 healthy habits (ichi-mu, ni-shou and san-ta)

We have previously discussed the effectiveness of this motto in preventing waist circumference (13), hypertension (10), diabetes mellitus (14), hypertriglyceridemia (15) and atherosclerosis (16) in the cross-sectional study. The close correlation has been shown between MetS and Ikeda’s healthy habits in the cross-sectional study (17). In the present study, only Ikeda’s healthy habits showed a significant difference in the incidence of MetS among men in the poor, moderate and favorable groups. The differences among favorable, moderate and poor groups of waist circumference and triglyceride at the baseline were bigger than other classifications. “Less food intake (do not overeat)” in Ikeda’s habits may prevent accumulation of visceral fat (13). Ikeda’s classification may be more powerful to select MetS, compared with other classifications. Thus, the number of significant intergroup differences was the highest for Ikeda’s factors among the 3 classifications of healthy habits.

Breslow, Morimoto and Ikeda all promote nonsmoking as a beneficial factor. As smoking increases insulin resistance and is associated with central fat accumulation, smoking increases the risk of MetS and diabetes, and these factors increase the risk of cardiovascular disease (18).

To evaluate a person’s diet, Ikeda proposed using the amount of food that means to have a habit of doing not overeat oneself, Breslow proposed using the frequency of
breakfast and eating between meals and Morimoto proposed using the frequency of breakfast and nutritional balance. For Ikeda’s classification, the incidence of MetS in men who scored 0 on the amount of food was significantly higher than for those who scored 1 (less food intake). Overeating causes the accumulation of visceral fat and the development of MetS.

There was little difference in the amount of alcohol recommended among Breslow, Morimoto and Ikeda, although, there were significant differences between scores of 1 (low) and 0 (much) in the 3 classifications. Heavy alcohol consumption (> or=30 g/d) was associated with significantly higher odds ratios for high blood pressure and high triacylglycerol in men and high fasting blood glucose and high triacylglycerol in women (19). Odds ratios for the MetS and its components tended to increase with increasing alcohol consumption.

Morimoto advocated a work day that was 9 hours or less. In the present study, there was no difference in the incidence of MetS between people who overworked and those who did not. The incidence of MetS in men who scored 0 (less than 6 d/mo off work) in Ikeda’s system was significantly higher than for those who scored 1 (at least 6 d/mo off work). Stress-related neuroendoctrine dysregulation and overconsumption of highly-palatable high caloric foods are likely to contribute to obesity. Stress responses include activation of the sympathetic nervous system and stimulation of epinephrine and cortisol release (20). These hormones may, over the long term, reduce insulin sensitivity leading to the development of central obesity. From the present results, reduced holidays rather than long working may develop stress and MetS.

One limitation of the study was that we did not investigate the number of calories eaten or expended in physical activity. Other limitations were: 1) MetS was diagnosed with Japanese-specific criteria and 2) the subjects lived in small area in Japan and therefore the results may not be generalizable.

The present study compared 3 classifications of healthy habits by assessing the relationship between adherence to the healthy-habit groupings and the prevention of MetS. The results showed that the number of statistically significant intergroup differences was the highest for Ikeda’s method, which examines 6 healthy habits. Thus, Ikeda’s classification appears to be the most effective in preventing MetS for people who adhere to his recommendations. In conclusion, of the 3 classifications, Ikeda’s showed the most differences in the incidence of MetS according to adherence to the number of healthy habits, thus suggesting that Ikeda’s 6 healthy habits may be the most associated with the prevention of MetS.

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References