Original Article

Influence of awareness of the Japanese Food Guide Spinning Top on eating behavior and obesity

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The purpose of the present study was to investigate the influence of awareness of the Japanese Food Guide Spinning Top on eating behavior and obesity in Japan. Participants were 1,558 Japanese male and female adults (40.2±12.2 years) who had been registered with a social research company. The cross-sectional questionnaire survey was conducted via the Internet in November 2007. Potential respondents were invited to complete the survey via e-mail, which contained a link to the survey Uniform Resource Locator (URL). The measures were awareness of the Japanese Food Guide Spinning Top, eating knowledge scores, eating attitude scores, and eating behaviors scores, according to the recommendations of the Health Japan 21 and the Food Balance Guide Spinning Top. Obesity was assessed by self-reported body mass index (BMI) and waist circumference. The relationships between awareness of the Japanese Food Guide Spinning Top, eating knowledge scores, eating attitude scores, eating behavior scores, and obesity were analyzed using path analysis. Path analysis revealed that awareness of the Japanese Food Guide Spinning Top was associated with BMI and waist circumference via eating behavior scores. In addition, eating knowledge scores and eating attitude scores were mediators of the association between awareness of the Japanese Food Guide Spinning Top and eating behavior scores. These results suggest that promotion of the Japanese Food Guide Spinning Top would be a useful strategy to encourage healthy eating and prevent obesity in the Japanese population.

Key Words: health promotion, food guide, campaign, nutrition survey, obesity

INTRODUCTION

Obesity is a risk factor for cardiovascular disease, type 2 diabetes mellitus, and other chronic conditions.[1] In particular, central obesity, as assessed by waist circumference, is an early step in the aetiological cascade, which leads to the metabolic syndrome.[2] Eating behavior contributes to the development of obesity.[3] Therefore, healthy eating is an important lifestyle choice for obesity prevention.[4]

In 2005, the Japanese government developed the Japanese Food Guide Spinning Top as a tool for promoting healthy eating.[5,6] The most significant aspect of this Guide is that it estimates the quantity of food consumed in a daily diet in terms of dish quantities rather than the food quantities. This Gudie uses the analogy of a spinning top.[6] In addition to outlining the optimal food intake for Japanese people, the Japanese Food Guide Spinning Top also provides messages that aim to enhance awareness of the benefits of healthy eating.[5]

Communication campaigns have been shown to be one of the most effective strategies for changing the eating behaviors in a large number of people.[7] Communication campaigns to promote eating behavior change are managed in a stepwise process; first, awareness of the campaign message is raised. This then leads to increased knowledge and a change in attitudes.[8,9] Thus, the effect of campaigns is often evaluated by the change in awareness, knowledge, attitude, and behavior.[10] Since 2006, the Japanese government has continuously conducted nationwide campaigns to promote the awareness of the Japanese Food Guide Spinning Top among the Japanese population. Awareness of this Guide increased from 26.0% in 2006 to 40.7% in 2007.[11,12] However, it remains unclear whether awareness of this Guide has any influence on eating behavior or the incidence of obesity in Japan.

Although the effects of previous nutrition campaigns have been reported in the literature, most studies evaluated the campaign's effect on eating behavior. Few previous studies had investigated the impact of a nutrition campaign on health outcomes such as changes in body weight and waist circumference that occurred as a consequence of eating behavior change. Additionally, almost all of the previous studies limited their focus to the direct relationship between eating behavior and one of either awareness or knowledge or attitudes towards healthy eating.

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Manuscript received 19 May 2010. Initial review completed 7 December 2010. Revision accepted 20 January 2011.

For example, the "Face the Fats" campaign reported that the increased awareness of trans fats was directly associated with improved grocery shopping behavior among Americans.[13] Awareness of the campaign would have influenced behavior by changing mediators such as knowledge and attitude.[8] Therefore, it is necessary to examine the direct and indirect associations among awareness, eating knowledge, eating attitudes, eating behavior, and health outcomes. However, in Japan and other East Asia countries, few studies have examined the effect of nutrition campaigns on eating behavior.[14]

Thus, the present study examined the relative impact of awareness of the Japanese Food Guide Spinning Top on eating behavior and obesity in Japanese people using path analysis. In addition, this study aimed to assess the associations between awareness, eating knowledge, eating attitudes, and eating behavior according to the conceptual model.[10]

MATERIALS AND METHODS

The study protocol was reviewed and approved by the ethics committee of Waseda University.

Dissemination campaign for the Japanese Food Guide Spinning Top

The Japanese Food Guide Spinning Top was formulated by the Ministry of Health, Labour and Welfare and the Ministry of Agriculture, Forestry and Fisheries in 2005. In 2006, the campaign for this Guide was started by the latter ministry.

The campaign consisted of placing advertisements showing an image of a famous Japanese actress in magazines and on trains, and holding events aimed at students, young people, middle-aged males, nurturers, the elderly, and people living alone. The Japanese Food Guide Spinning Top was disseminated at supermarkets, convenience stores, restaurants, schools, kindergartens, transportation facilities, and public facilities.[15]

Participants

The participants of the present study consisted of 1,726 male and female respondents to an Internet-based cross-sectional survey, which was conducted via a Japanese Internet research service organization. The organization owns approximately 260,000 voluntarily registered samples, has detailed sample socio-demographic attributes available, and is able to target specific attributes according to survey requirements. The sample size and targeted attributes in this study were as follows: approximately 1,700 male and female adults aged 20-79 years, with an equal number of males and females in each age bracket. A total of 5,667 potential respondents were randomly selected from the registered samples of the Internet research organization in accordance with our required sample size and attributes, and they were invited to participate in an Internet-based survey by the Internet research service organization via e-mail. This e-mail contained a link to a Uniform Resource Locator (URL) to the protected area of a website. Potential respondents could then log on to this protected area using their own login ID and password. Reward points valued at 80 yen were provided by the Internet research service organization as an incentive to participate. The response rate was 30.5%.

Measurements

Awareness of the Japanese Food Guide Spinning Top

Participants were asked the following question: "do you know the Japanese Food Guide Spinning Top?" Response choices comprised of a 4-item Likert scale. For awareness, "I know the contents" and "I have heard of it, but I do not know the contents" were categorized as *awareness*, whereas "I have not heard of it" or "The first time I have heard of it is via this survey" indicated *no awareness*. For analysis, awareness was scored as 1 and no awareness was scored as 0.

Body mass index (BMI) and waist circumference

BMI was calculated from self-reported height and weight. Self-reported height and weight have been demonstrated to be highly correlated with the objective measurement.[16]

For waist circumference, participants were asked, "does your waist circumference meet the criterion (male ≥85cm, female ≥90cm)?"[17] Participants were asked to answer "yes", "no" or "I do not know". These responses were dichotomized as "yes" (abdominal obesity) and "no" (non-abdominal obesity). "I do not know" responses were excluded from the analysis. For analysis, abdominal obesity was scored as 1 and non-abdominal obesity was scored as 0.

Eating behavior, eating attitudes, and eating knowledge

Eating behavior, eating attitudes, and eating knowledge were assessed by 31 questions (yes/no response were coded 1 and 0, respectively), as shown in Table 1. Total scores were in the range 0-16 for eating behavior, 0-4 for eating attitude, and 0-11 for eating knowledge.

Model

The model used was modified from the Conceptual Model of Campaign Impact.[10] This model comprises of campaign exposure, knowledge, attitude, and practice. The current study considered campaign exposure in the sense that it provided awareness of the campaign. Body mass index and abdominal obesity were added to the original conceptual model of campaign impact[10] to examine whether awareness of the Japanese Food Guide Spinning Top would influence obesity with eating behavior acting as the mediator (Figure 1). The model sought to assess the relationships among the predictor variable (awareness), moderating variables (eating knowledge, eating attitude, and eating behavior), and outcome variables (BMI and abdominal obesity).

The present study hypothesized that awareness of the Japanese Food Guide Spinning Top would increase eating knowledge, and affect eating attitude, and eating behavior. Consequently, eating behavior would directly decrease BMI and abdominal obesity.

Statistical analyses

For statistical analysis, data were analyzed for 1,558 individuals who provided complete information relating to the current study variables. Path analysis was conducted using Analysis of Moment Structures (AMOS 16.0; SPSS

Table 1. Question items of Eating behavior, Eating attitudes, Eating knowledge

	Question items	Respondents %
Eating behavior	1. Are you abstaining from fatty food?	39.3
	2. Are you abstaining from salty food?	39.0
	3. Are you eating a lot of vegetables?	50.1
	4. Do you eat breakfast?	68.5
	5. Do you check nutrient labels when eating out or purchasing foods?	15.3
	6. Do you take your time while eating?	21.6
	7. Do you only eat as much as you need?	29.5
	8. Are you eating well-balanced meals?	30.9
	9. Are you eating a combination of grain dishes (rice, bread, noodles), fish and meat dishes (meat, fish, eggs, soy-bean) and vegetable dishes?	36.1
	10. Are you eating an appropriate amount of milk and milk products?	41.1
	11. Are you eating an appropriate amount of fruit?	36.3
	12. Do you enjoy eating appropriate amounts of snacks and soft drinks?	38.0
	13. Do you enjoy drinking an appropriate amount of alcohol?	34.3
	14. Are you eating your required amount of calories?	16.5
	15. Are you trying to reach or maintain your ideal weight?	48.3
	16. Are you trying to eat the best meals as possible?	26.3
Eating attitudes	17. Do you think eating fatty food is not good for your health?	68.3
	18. Do you think eating salty food is not good for your health?	77.5
	19. Do you think low vegetable consumption is not good for your health?	85.5
	20. Do you think eating breakfast is important?	82.1
Eating knowledge	21. Do you know your ideal weight?	55.8
	22. Do you know your ideal meal composition and amount?	20.8
	23. Do you know nutrient labels can be found on restaurant menus and food products at stores?	45.6
	24. Do you know what a well-balanced diet contains?	33.2
	25. Do you know that dishes can be classified into grain dishes, fish and meat dishes, and vegetable dishes?	38.8
	26. Do you know how much grain dishes, fish and meat dishes, and vegetable dishes you should eat?	17.7
	27. Do you know how much milk/dairy products you should eat?	18.5
	28. Do you know how much fruit you should eat?	16.4
	29. Do you know how to eat appropriate amounts of snacks and soft drinks?	14.1
	30. Do you know what is an appropriate amount of alcohol?	29.9
	31. Do you know how many calories you should eat?	21.7

Questions 1-5, 16-20, 21 and 23 relate to the eating behavior recommended by Health Japan 21.[34]
Questions 8-14 and 24-31 relate to the eating behavior recommended by The Japanese Food Guide Spinning Top.[5]
Questions 6, 7, 15 and 22 are those used in The National Health and Nutrition Examination Survey.[22]

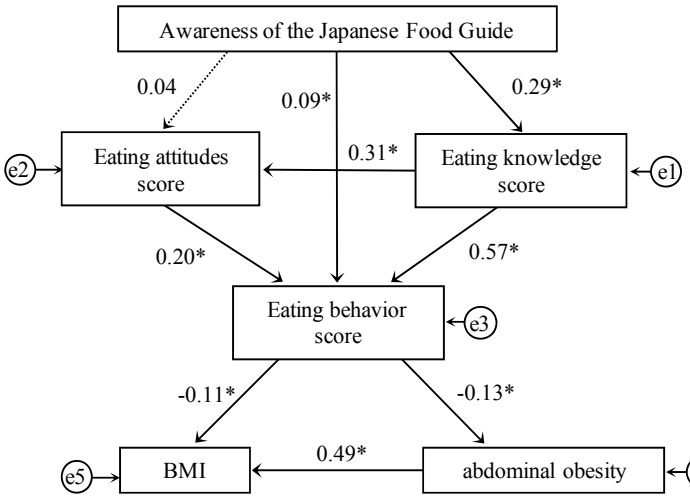

Figure 1. Testing the model, BMI and abdominal obesity are added to Conceptual Model of Campaign Impact.[10] The indices of fit for the tested model indicated a good fit (GFI:0.995, AGFI:0.984, RMSEA:0.041, CFI:0.991). Solid line shows significant (*p<0.001), and dotted line shows non-significant associations.

Inc., Chicago, IL, USA). Four additional goodness-of-fit indices were calculated: Goodness-of-Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). Values for the GFI, AGFI, and CFI were >0.9 which indicates an acceptable fit between the model and data. Values for RMSEA were ≤0.05 and this indicates a close approximate fit, whereas ≥0.10 for

RMSEA represents a poor fit. Statistical significance was set at $p<0.05$.

RESULTS

Basic characteristics of respondents

Table 2 presents the distribution of gender, age, BMI, marital status, educational status, employment status, and household income level of the respondents. The respondents were 1,558 Japanese adults (774 males and 784 females), with a mean age of 40.5 (SD 12.1) years (range, 20-75 years). Overall, 65% of the respondents were married; 29% of the respondents had less than a high school graduate level of education, whereas 47% had graduated from college or graduate school. A total of 57% were employed, and 44% of the respondents had a household income of less than 5 million yen and 13% earned more than 10 million yen per year. Responders were more likely to be younger, have a higher educational status and household income level than the general Japanese population.[18-22]

Testing the model

The results of model are shown in Figure 1. The indices of fit for the tested model indicated a good fit (GFI=0.995, AGFI=0.984, RMSEA=0.041, and CFI=0.991). The data in Figure 1 show a significant path from increase in awareness of the Japanese Food Guide Spinning Top, leading to increases in eating knowledge score and eating behavior score; there was, however, a non-significant path from awareness to eating attitude score. Figure 1 shows strong paths from increases in eating knowledge score to increases in eating behavior score (0.57). Although the path was weaker, there were significant paths for increases in eating knowledge score to increases in eating attitudes score (0.31) and then eating behavior score (0.20). In addition, there was a significant path from eating behavior score to BMI (-0.11) and abdominal obesity (-0.13). Increased eating behavior scores were likely to lead to decreased BMI and abdominal obesity, although the path coefficient was weak.

DISCUSSION

Since 2006, the Ministry of Agriculture, Forestry and Fisheries has disseminated the Japanese Food Guide Spinning Top to the Japanese population as a tool for promoting healthy eating.[15] Thus, the purpose of this study was to examine the comprehensive associations among awareness of this Guide, eating knowledge, eating attitudes, eating behavior, and obesity using path analysis in Japanese adults.

The present study revealed that the awareness of the Japanese Food Guide Spinning Top indirectly influenced BMI and abdominal obesity via eating behavior changes among Japanese adults. The results suggest that promotion of the Japanese Food Guide Spinning Top would be an effective strategy to establish healthy eating patterns and to prevent obesity in the Japanese population. In the stepwise process to behavior change, awareness of key health messages is an important first step.[23] Stables *et al*. observed the positive association between message awareness and vegetable and fruit consumption.[24] The results of the present study replicate and clearly strengthen the findings of previous studies.[13,24]

Table 2. Basic characteristics for total respondents and general Japanese adults

	Respondents (n=1558)		General Japanese † ‡
	n	%	%
Gender			
Male	774	49.7	48.4
Female	784	50.3	51.6
Age groups			
20-29 years	368	23.6	15.9
30-39 years	395	25.4	19.0
40-49 years	405	26.0	16.3
≥50 years	390	25.0	48.8
BMI (kg/m^2)			
<25.0	1283	82.3	79.6
≥25.0	275	17.7	20.4
Marital status			
unmarried	542	34.8	35.5
married	1016	65.2	64.5
Educational status			
≤high school graduate	447	28.7	67.7
2 years college or equivalent	381	24.5	12.6
≥college graduate	730	46.9	15.5
Employment status			
unemployment	670	43.0	44.0
employment	888	57.0	56.0
Household income level (yen)			
<5,000,000	678	43.5	53.8
5,000,000-9,999,999	671	43.1	30.7
≥10,000,000	209	13.4	11.3

BMI, body mass index† Reference gender, age, marital status, and employed status: 2005 Population Census of Japan;[18,19] education status: 2000 Population Census of Japan;[20] household income levels: 2006 National Livelihood Survey;[21] BMI: 2005 National Health and Nutririon Examination.[22]

‡ All data of those age 19 and below were excluded.

In the present study, awareness of the Japanese Food Guide Spinning Top was associated with healthy eating behavior. The most significant feature of this Guide is that it is based on the "dish" format rather than the "food" format; the analogy of a spinning top.[6] When specifying the amount of food eaten, the following 3 viewpoints can be considered: 1) nutrition-based, 2) food-based, and 3) dish-based.[5] According to a previous study that reported on the 5+ a day campaign, awareness of the campaign and the campaign logo was not associated with fruit and vegetable intake.[25] However, the dish-based method is easily understood not also by those who prepare meals but also by those who eat them.[6] Thus awareness of the Japanese Food Guide Spinning Top with its visual message could help people to better understand "what" and "how much" they should eat; and this could lead to eating behavior change.

A few previous studies have investigated the impact of awareness on health outcomes such as body weight and waist circumference that occur as a consequence of behavior change.[26,27] The relationship between awareness of a message and health outcomes remains controversial. Patterson *et al.* observed that knowledge of food composition and diet recommendations was not related to weight change among adults residing in the US, this is different from the findings of this study.[28] The present study demonstrated that awareness of the Japanese Food Guide Spinning Top was associated with BMI and abdominal obesity via significant eating knowledge. However, obesity and central obesity are associated with various other factors, such as increased age, marital status, parental obesity, a low level of physical activity, and a low level of education.[29] The present study, and other previous studies, did not adjust for these factors to investigate the impact of campaign awareness on health outcomes. Thus, future research may need to address the question of direct associations among obesity, eating knowledge, and eating behavior, with adjustment for these other factors.

According to Cavill and Bauman, mediators such as knowledge and attitudes associate awareness with behavior change.[8] Therefore, it is necessary to examine the direct and indirect associations of awareness, eating knowledge, eating attitudes, eating behavior, and health outcomes in the cascading sequence. The present study found that eating knowledge and eating attitude were mediators. Eating knowledge, in particular, was an essential mediator of association with awareness of the Japanese Food Guide Spinning Top and eating behavior. Beaudoin *et al*. indicated that a media campaign appeared to have stimulated improvements in attitudes towards a healthy diet,[30] although this study did not examine eating knowledge. Another study observed that nutrition knowledge in university students was positively associated with label-reading behavior, and that its affect was mediated by attitudes in the path model.[31] However, previous studies did not examine both the direct and indirect relationships among awareness, eating knowledge, eating attitude, and eating behavior. Regarding physical activity, the previous study that used structural equation modeling observed that awareness and understanding indirectly influenced behavioral change, whereas awareness did not directly influence attitudes.[32] The model of the present study observed 2 pathways from awareness to eating behavior through eating knowledge. However, awareness of the Japanese Food Guide Spinning Top had no direct effect on eating attitudes, suggesting that the influence of awareness on behavior is mediated by knowledge. Thus, improvement in eating knowledge may play an important role in changing eating behavior. The present results clearly replicate and strengthen previous findings.[32]

The present investigation had a number of limitations. First, waist circumference was assessed using self-reported values. Although self-reported waist circumference was found to be adequate for the assessment of the prevalence of overweight and obese subjects, and of increased waist circumference in an overweight population,[33] self-reported anthropometrics are biased. The second limitation is that eating knowledge, eating attitude, and eating behavior were assessed using only the original questionnaire, for which reliability and validity were not evaluated. Therefore, the reliability and validity of the questionnaire were unclear. However, question items were based on the healthy eating recommended by the Japanese Government policies.[5,22,34] Moreover, this was conducted in an Internet setting. Internet-based surveys used monitor registration, a purposive sampling method, and thus are associated with sampling errors. Rhodes *et al*. stated that individuals who are younger, more educated, and have a higher income have greater access to the Internet.[35] Therefore, the basic characteristics of the respondents might be biased, implying that the findings under such a setting might not be sufficiently applicable to the general population.

The present study demonstrated that awareness of the Japanese Food Guide Spinning Top influenced eating behavior and obesity. The present findings imply that increasing awareness of the Japanese Food Guide Spinning Top will lead to improvements in healthy eating and the prevention of obesity in the Japanese population. The present study also demonstrates the effectiveness and usefulness of a communication campaign for healthy eating in the Japanese population. Further longitudinal studies are necessary to examine the effect of awareness on eating behavior and health outcomes.

ACKNOWLEDGMENTS

This work was supported by the Waseda University Grant for Special Research Projects (Project number: 2007B-235) and a Grant-in-Aid for Scientific Research (21-57091). This work was conducted as part of the Global COE Program ― Sport Sciences for the Promotion of Active Life ― at Waseda University.

AUTHOR DISCLOSURES

The authors declare that they have no competing interest.

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Original Article

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日本飲食指南認知度對飲食行為與肥胖的影響

本研究目的在於調查日本國人飲食行為與肥胖是否受到飲食指南認知所影響。研究對象為 1558 位曾經參與過社會研究的日本成年人(平均年齡 40.2±12.2 歲)。於 2007 年 11 月透過網路而做的橫斷型調查，以電子郵件邀請可能參與的研究對象，連結至執行調查的網路位址，填寫網路問卷。根據日本 21 世紀健康促進指引(Health Japan 21)及食物平衡指南，測度飲食指南認知度及飲食知識、態度及行為的得分。參與者自我提供的身體質量指數與腰圍用來評估肥胖程度。利用路徑分析(path analysis)探討飲食指南認知度、飲食知識、態度及行為得分與肥胖的關係。路徑分析結果顯示，飲食指南認知度與身體質量指數及腰圍有相關，且是透過飲食行為表現。此外也發現，飲食知識與態度是飲食指南認知與飲食行為關聯性的中介者。這些結果顯示，倡導日本飲食指南為有利的策略，可鼓勵日本國民健康的飲食及預防肥胖。

關鍵字：健康促進、飲食指南、宣導活動、營養調查、肥胖