Original Article

Intuitive eating and the nutrition transition in Asia

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Current models of the nutrition transition focus on demographic changes and economic development. A further influence may be the adoption of western-based perceptions of beauty that lead to potentially harmful eating behaviours which contribute to overweight, obesity, and eating disorders. This paper proposes a comprehensive model of the nutrition transition that includes western influences on perceived attractiveness and subsequent eating styles. An exploratory test of this model for Asian countries explores differences in intuitive eating as a function of economic development and the adoption of western standards of beauty. The intuitive eating scale (IES), a measure of food consumption that is primarily characterized by the satisfaction of physical hunger, was used to evaluate agreement with intuitive eating principles in the US and four Asian countries (Japan, Thailand, the Philippines, and China). Although intuitive eating scores in the US and Thailand failed to follow predicted patterns on two of the four IES subscales, scores for the other two IES subscales and the total IES score followed predicted patterns for Asian countries. Intuitive eating appears to be a valid, measurable concept that is correlated with economic development and levels of western influence in Asian countries. The tentative findings of this exploratory study support further evaluation of cultural influences as an important component of the nutrition transition.

Keywords: Asia, intuitive eating, traditional diet, eating habits, nutrition transition, cross-cultural studies, obesity.

Introduction

The nutrition transition

A global nutrition transition, characterized by declining dietary intakes of grains, fibres, fruits and vegetables, and rising consumption of fat, sugar, animal proteins, and sodium, is occurring at accelerated rates throughout the developing world.[1] The accompanying surge of obesity and diet-related noncommunicable diseases (DR-NCDs) poses a serious public health threat that deserves immediate attention.[2] Specifically, the nutrition transition is associated with rapidly escalating rates of diabetes, hypertension, stroke, cardiovascular disease, some types of cancer - and excessive growth in associated health care costs.[3-5] Consequently, many developing countries are facing a double burden of disease that includes unresolved infectious maladies that are now occurring in tandem with diet-related chronic disease. This double burden will exact a demanding toll both physically and economically from developing societies.[6, 7]

The underlying causes of the nutrition transition are generally attributed to demographic and economic changes that result from development, modernization, urbanization, and greater contact with western influences.[8] Economic development typically leads to alterations in eating preferences due to shifts in income, prices, food availability, advertising, and exposure to mass media.[9] High rates of urbanization lead to altered food production and preparation patterns at the household level. Home-grown traditional foods give way to more energy dense animal products, processed foods, and store bought convenience items.[10] In addition, an unprecedented global availability of inexpensive fats and oils has resulted in more rapid nutrition transitions for many low and mid-income countries that are now occurring at lower levels of the gross

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national product than previously.[9] A shift from labour intensive agricultural occupations to more sedentary manufacturing and service-related occupations further disrupts the energy balance and contributes to rising levels of overweight and obesity.[8] Finally, a legacy of low birth weights and childhood undernutrition in many developing regions, including Asia, may have created metabolic adaptations that further exacerbate the development of adult obesity and susceptibility to DR-NCDs (fetal origins hypothesis).[11]

Cultural influences

Aside from demographic and economic factors, another possible contributor to the nutrition transition includes cultural influences that determine perceptions of attractiveness and resulting eating styles (Fig. 1).[12] Prior to significant progress in the nutrition transition, for example, eating styles seem to be relaxed, generally healthy, and associated with the physical satisfaction of hunger using a staple, traditional diet (intuitive eating). Overeating is unusual, probably due to a lack of opportunity, but also because of a lack of richness in the diet. A relatively healthy, yet sparse, diet results in a lean body shape, even though a more plump body size may be culturally preferred at this point because of its association with wealth, power, and beauty.[13] As the nutrition transition progresses, however, eating styles shift from an intuitive focus on hunger satisfaction to a broader interest in social associations and the gratification of pleasure (social and environmental eating). Eating out, eating a richer diet with more fats and animal products, and using energy dense foods to enhance social interactions becomes more common. The shift in eating styles from intuitive to social/environmental eating may be a contributing factor to the rising levels of body mass index that characterize the nutrition transition.

Ironically, at the very time that body sizes are increasing due to energy imbalances associated with the nutrition transition, the culturally preferred size reverses from plump to very thin due to western media influences.[14] At this point a restrained eating style based on intentional caloric restriction (dieting) begins to replace social and environmental eating.[15] Physically, restrained eating stimulates a famine survival response characterized by a decrease in basal metabolic rates, reduced energy expenditure, increased fat storage potential, and negative changes in blood lipid profiles - all of which may encourage future weight gain and/or susceptibility to DR-NCDs.[16] Metabolic changes that control energy balances may further dictate that any future weight gains involve greater deposits of harmful visceral fat.[17] Psychologically, dietary restriction often creates a sense of deprivation that is accompanied by binge eating, an increasingly dysfunctional relationship with food that involves mood regulation (emotional eating),[18] and an increased likelihood of eating disorders.[19-21] Thus, the shift to restrained eating, although intended to enhance attractiveness by reducing body size, may actually be a contributing agent to further weight gains that represent even greater health risks within the nutrition transition.

Objectives

To be complete, an interactive model of the nutrition transition must include not only the influences of economic development and modernization, but also cultural influences that determine body size preferences and subsequent eating styles (Fig. 1).[12] The purpose of this exploratory study was to begin to assess cross-cultural differences in the first eating style depicted in this comprehensive model - intuitive eating. Intuitive eating is characterized by food consumption that is primarily motivated by the physical satisfaction of hunger. It was hypothesized that the degree of intuitive eating would differ between countries that were in different stages of the nutrition transition, that had experienced different levels of economic development, and that had been exposed to different levels of western media and cultural influences. Specifically, it was expected that countries with the highest levels of economic development and the greatest levels of westernization would have the lowest intuitive eating scores. Conversely, the countries with the least development and western influence would have the highest level of intuitive eating.[14] Confirmation of this hypothesis would add support for a model of the nutrition transition that includes cultural influences on perceived attractiveness and subsequent eating styles. Public health and nutrition programs may be more effective if they are

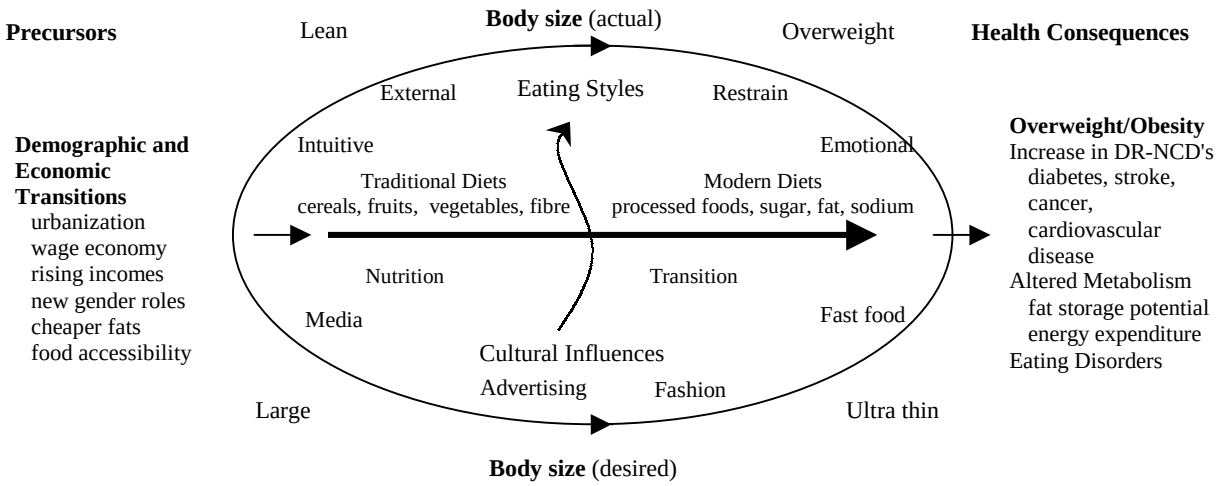


Figure 1. The nutrition transition, eating styles and public health consequences

able to understand and address this previously neglected aspect of the nutrition transition.[22, 23]

Methods

Population and sample

The target population for this study was college students in several Asian countries and the United States. College students were chosen because they are often at the forefront of the nutrition transition due to experimentation with new dietary traditions, attempts to enhance personal status, counter-culture impulses, and exposure to western media in urban centres.[24] Convenience samples were taken from undergraduate general education courses at selected universities and colleges in Japan, Thailand, China, the Philippines, and the United States.

Instrument

Data was collected using the Intuitive Eating Scale (IES). The IES was developed in the US to measure intuitive eating behaviours among college students. As mentioned above, intuitive eating refers to an eating style that is characterized by food consumption that is primarily driven by physical hunger satisfaction. The IES has four subscales that represent different constructs or assumptions in relation to intuitive eating, including: an anti-dieting orientation (anti-dieting subscale); an internal motivation for eating based on the physical satisfaction of hunger (intrinsic subscale); limited social, environmental, and emotional eating (extrinsic subscale); and a self-care orientation that emphasizes health and fitness over fashion and beauty (self-care subscale) (Appendix). Initial testing of the IES yielded acceptable alpha coefficients for each subscale (0.42-0.93), and adequate test/retest reliability for each subscale (0.56-0.87).[25]

For this study, the IES was translated into Chinese, Thai, Japanese, and Tagalog. Reverse translation and pilot testing was used to finalize translations and ensure that perceived meaning and comprehension matched the intent of the instrument. In order to evaluate the cross-cultural relevance of the IES, factor analysis and test/retest coefficients were calculated for each subscale based on samples from each country. In addition to the IES, demographic and personal data was collected including gender, age, year in school, frequency of dieting, residence, height, and weight.

Data collection

IES and demographic data were collected using paper and pencil surveys. Surveys were administered to general education students on each campus by course instructors and research assistants who were trained in data collection methodologies. It was explained to students that participation was voluntary with no penalty for non-participation. Survey completion required approximately 5-10 minutes. Response rates on each campus exceeded 90%. Approval for research involving human subjects was obtained from the appropriate Institutional Review Board (IRB) prior to data collection. Once collected, data was entered into Excel files by research assistants and then rechecked for accuracy.

Statistics

Based on analysis of previous US data, the factor solution for the IES yielded four factor groupings that replicated

Table 1. Frequency distributions of demographic, diet, and BMI according to country*

Variable	US		Thailand		Philippines		Japan		China	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Gender										
Men	227	58.4	207	40.4	176	27.0	41	9.0	128	40.6
Women	162	41.6	305	59.6	476	73.0	416	91.0	187	59.4
Age										
< 19	98	25.2	153	29.9	261	40.4	87	19.0	67	21.7
19-22	184	47.3	236	46.2	261	40.4	236	51.6	231	74.8
> 22	107	27.5	122	23.9	124	19.2	134	29.3	11	3.6
Area of Residence										
Rural	60	15.9	45	8.9	142	23.4	80	17.6	80	25.7
Suburban	239	63.2	50	9.9	0	0.0	186	41.0	52	16.7
Urban	79	20.9	409	81.2	466	76.6	188	41.4	179	57.6
Education										
Freshman	223	57.0	202	40.2	235	36.6	270	59.0	200	64.7
Sophomore	101	25.8	77	15.3	116	18.0	0	0.0	95	30.7
Junior	48	12.3	106	21.1	150	23.3	0	0.0	0	0.0
Senior	19	4.9	115	22.9	113	17.6	188	41.1	12	3.9
Graduate	0	0.0	3	0.6	29	4.5	0	0.0	0	0.0
How often do you diet per year to lose weight?										
< 1	301	78.6	284	58.9	146	35.3	206	49.5	281	94.6
1-2	32	8.4	40	8.3	85	20.6	49	11.8	6	2.0
> 2	50	13.0	158	32.8	182	44.1	161	38.7	10	3.4
Body Mass Index										
Normal	307	79.5	468	92.9	503	92.1	376	96.7	280	90.3
Overweight	59	15.3	21	4.2	29	5.3	11	2.8	6	1.9
Obese	20	5.2	15	3.0	14	2.6	2	0.5	24	7.7

*Distributions for each variable significantly differed among countries, with the chi-square $P < 0.0001$.

subscale construction, including: intrinsic eating, extrinsic eating, anti-dieting, and self-care.[25] Factor loadings for each item, alpha coefficients for each subscale, and test-retest correlation coefficients for each subscale were replicated in this paper for samples from each country to ensure the cross-cultural validity and reliability of items and subscales. Cronbach's alpha was used to indicate how well the items in each subscale correlate with one another. Pearson correlation coefficients were used to indicate the strength of the linear association between each subscale item between an initial evaluation and then a second administration of the same questionnaire approximately two weeks later. The number of participants who matched between the test and retest administrations of the questionnaire was a subset of the initial number completing the questionnaire (285 for the US, 99 for Thailand, 317 for the Philippines, 94 for Japan, and 94 for China). Except for test-retest correlation coefficients, findings reported in this paper are based on the participants in the first administration of the questionnaire. Finally, analysis of covariance was used to estimate mean level of agreement with intuitive eating subscales adjusted for selected covariates.

Data were assessed using the Statistical Analysis System (SAS) software for personal computers, release 8.2.[26] Tests of significance were based on the 0.05 level against the two-sided null hypothesis of no association. To adjust for an inflated probability of committing a type 1 error because of multiple comparisons, the Bonferonni correction was used to adjust the level of significance.

Results

A total of 2,334 students completed the questionnaire: 391 from a western US university, 515 from a northern Thailand university, 653 from a central Philippine university, 458 from a south-central Japanese university, and 317 from a university in south China. Bivariate analyses of associations between demographic, diet, and BMI variables are shown by country in Table 1. The frequency distribution for each variable differed among the countries, but there were some consistent patterns across countries. For example, participants from the US were more likely to be men, while other countries had proportionately more women than men. Participants from Thailand, China and the Philippines were also more likely to reside in urban areas than those from Japan and the US

Table 2. Intuitive eating subscale factor loadings, Cronbach's alpha coefficients, and test-retest correlation coefficients according to country

	US	Thailand	Philippines	Japan	China
	N = 391	*N* = 515	*N* = 653	*N* = 458	*N* = 317
Intrinsic Eating					
1	.572	.552	.593	.789	.784
4	.577	.517	.437	*	*
10	.628	.492	.677	*	.784
13	.640	.623	.650	.789	*
Cronbach's alpha	.420	.221	.382	.389	.371
Test-retest	.560	.505	.357	.606	.430
Extrinsic Eating					
7	.726	.644	.480	.656	.646
16	.627	.480	.467	.695	*
19	.628	.612	.568	.438	.707
22	.725	.547	.590	.694	.729
25	.762	.692	.726	.740	.704
26	.733	.496	.696	.425	*
Cronbach's alpha	.792	.609	.629	.665	.645
Test-retest	.708	.738	.475	.667	.584
Anti-dieting					
2	.670	.471	*	*	.408
3	.712	.720	*	.633	.681
5	.771	*	*	.676	*
8	.755	.731	.637	.673	.616
9	.775	.773	.628	.714	.734
11	.771	.680	.600	.541	.571
14	.826	.730	.761	.806	.487
15	.832	.774	.700	.711	.663
17	.670	.682	.596	.575	.500
18	.739	.536	*	.687	.650
23	.703	*	.600	.604	.630
24	.735	.631	.517	.621	.696
29	.685	*	.568	.599	*
Cronbach's alpha	.928	.869	.801	.878	.825
Test-retest	.866	.881	.599	.837	.847
Self-care					
6	.795	.678	.662	.562	.675
12	.606	.636	.689	.687	.551
27	.740	.704	.695	.753	.748
30	.541	.497	*	.454	.589
Cronbach's alpha	.589	.498	.437	.471	.524
Test-retest	.672	.670	.454	.610	.610

*Items with less than a 0.4 loading on the intended factor were sequentially deleted and the factor analysis reassessed.

who were more likely to live in suburban settings. While there were distributional differences in age, BMI, and education variables between countries, the majority of participants from all countries were in the 19-22 age range, had a normal body mass index, and were freshman or sophomores. The US had the highest percentage of participants in the overweight or obese categories, but the lowest percentage of dieting to lose weight.

Factor groupings for the Intuitive Eating Scale originally identified in the US data were retained for each of the other countries (Table 2). However, individual subscale items with a factor loading less than 0.4 were sequentially deleted from respective subscales, and the factor analysis reassessed for each of the other four countries. The result was a more valid subscale measure that was limited to items that were culturally relevant to each country. In support of the cross-cultural validity of the IES and its subscales, a majority of items were retained for all subscales in all countries. Out of 27 possible scale items, a total of three items were deleted for Japan and Thailand, five were deleted for the Philippines, and six for China.

There was no identifiable pattern in the items that were deleted across countries, but the majority of deleted items overall came from the anti-dieting subscale (10 of 17). In spite of deleted items, this subscale retained the most robust alpha and test/retest coefficients across countries. Four of the 17 deleted items came from the intrinsic eating subscale which exhibited weaker alpha and test/retest coefficients across countries - perhaps due in part to the smallness of the subscale (four items). The six item extrinsic subscale only lost two items, both from the China sample, and maintained adequate alpha and test/retest coefficients across country samples. Finally, the self-care subscale lost only one item in the Philippine sample resulting in modest alpha coefficients and test/retest reliability coefficients for country samples. In general, most items in most subscales exhibited high loadings on the intended factor (well above 0.4) and were relevant to participants in the countries surveyed. The anti-dieting and extrinsic eating subscales maintained the highest alpha and test/retest coefficients across country samples while the self-care and intrinsic subscales (with lower item counts) attained somewhat lower but useful values.

IES subscales are scored such that higher scores represent agreement with the intuitive eating principle measured by that subscale. Items are scored on a five-point Likert-type scale with possible values ranging from 1 to 5. For this study mean scores were calculated for each subscale by country, and for each demographic and lifestyle category. A high intrinsic eating score indicates

Table 3. Adjusted mean level of agreement with intuitive eating subscales according to country and selected demographic and lifestyle variables*

Variable	Intrinsic Eating	Extrinsic Eating	Anti-dieting	Self-care	Total
Area					
US	*2.55*	*3.37*	*3.68*	*3.33*	*3.40*
Thailand	*3.29*†	*2.70*†	*2.86*†	*3.74*†	*3.04*†
Philippines	*3.41*†	*2.94*†	*3.02*†	*3.69*†	*3.16*†
Japan	*3.05*†	*2.91*†	*2.92*†	*3.03*†	*2.95*†
China	*3.23*†	*3.03*†	*3.24*†	*3.48*	*3.30*
Gender					
Men	3.07	*3.16*	*3.35*	*3.55*	*3.12*
Women	3.14	*2.82*	*2.94*	*3.35*	*3.03*
Age					
< 19	*3.01*	3.02	3.12	*3.42*	3.16
19-22	*3.10*	2.94	3.13	*3.41*	3.14
> 22	*3.22*†	3.00	3.18	*3.53*	3.21
Area of Residence					
Rural	*3.05*	2.97	*3.15*	3.47	3.16
Suburban	*3.18*†	2.98	*3.20*	3.47	3.21
Urban	*3.10*	3.02	*3.09*	3.42	3.14
Education					
Freshman	3.18	2.97	3.16	*3.53*	3.19
Sophomore	3.15	2.96	3.19	*3.42*	3.18
Junior	3.13	3.03	3.18	*3.53*	3.21
Senior	2.99	3.06	3.28	*3.40*	3.22
Graduate	3.10	2.93	2.91	*3.38*†	3.06
How often do you diet per year to lose weight?					
< 1	3.12	*3.09*	*3.57*	*3.65*	*3.44*
1-2	3.10	*3.01*	*3.11*†	*3.38*†	*3.14*†
> 2	3.11	*2.86*†	*2.75*†	*3.33*†	*2.94*†
Body Mass Index					
Normal	3.19	2.97	*3.36*	*3.61*	*3.30*
Overweight	3.12	2.87	*3.04*†	*3.43*†	*3.09*†
Obese	3.01	3.11	*3.04*†	*3.32*†	*3.12*†

*All mean estimates were adjusted for the other variables listed in the table. Variables that statistically contributed to the fit of the model at the 0.05 level of significance are italicised. †Significantly different from the first mean in each group (referent), based on a Bonferonni correction at the 0.05 level of significance for multiple comparisons.

food consumption that is primarily guided by hunger satisfaction. A high extrinsic eating score suggests low levels of eating in response to emotional needs or social pressures. A high anti-dieting score represents low levels of intentional dietary restriction. Finally, a high self-care score indicates a concern for health and fitness over beauty and fashion. A total IES value is calculated by averaging scores from each subscale to identify overall adherence with the main principles of intuitive eating. Mean level of agreement with intuitive eating subscales according to country and selected demographic and lifestyle variables are presented in Table 3. Each of these means is adjusted for the other variables appearing in the table. Variables significantly contributing to the fit of each model are bold-typed.

There was a significant difference among countries in the level of agreement with each of the intuitive eating subscales. The US and Japan tended to score lower in intrinsic eating, with other countries scoring somewhat higher. The US scored highest and Thailand lowest on the extrinsic and anti-dieting subscales. Thailand and the Philippines were highest on self-care, with Japan and the US lowest. Overall, the US and China had the highest total IES scores and Japan, the Philippines, and Thailand had lower scores.

Other demographic and lifestyle variables considered in the models were each significant for one or more of the subscales, but not all. Gender was related to three of the four subscales and the total IES score, with men scoring higher than women. Those participants over the age of 22 tended to score higher on intrinsic eating and self-care, and suburbanites tended to do slightly better in intrinsic eating and anti-dieting. Those who diet less than once per year scored higher on extrinsic, anti-dieting, and self-care subscales, and on the total IES. Finally, a normal body mass index was associated with higher anti-dieting, self-care, and total IES scores.

Adjusted mean levels of agreement with the intuitive eating statements (total IES score) are presented by country and frequency of dieting (Fig. 2), and by country and BMI (Fig. 3). One of the key principles of intuitive eating is a self-regulation of food intake that is based on hunger satisfaction, and that actively denies pressure to base calorie and fat intake on restrictive dieting guidelines. As seen in Figure 2, total IES scores were negatively associated with dieting frequency. Frequent dieters scored significantly lower than infrequent dieters on the total IES in all countries.

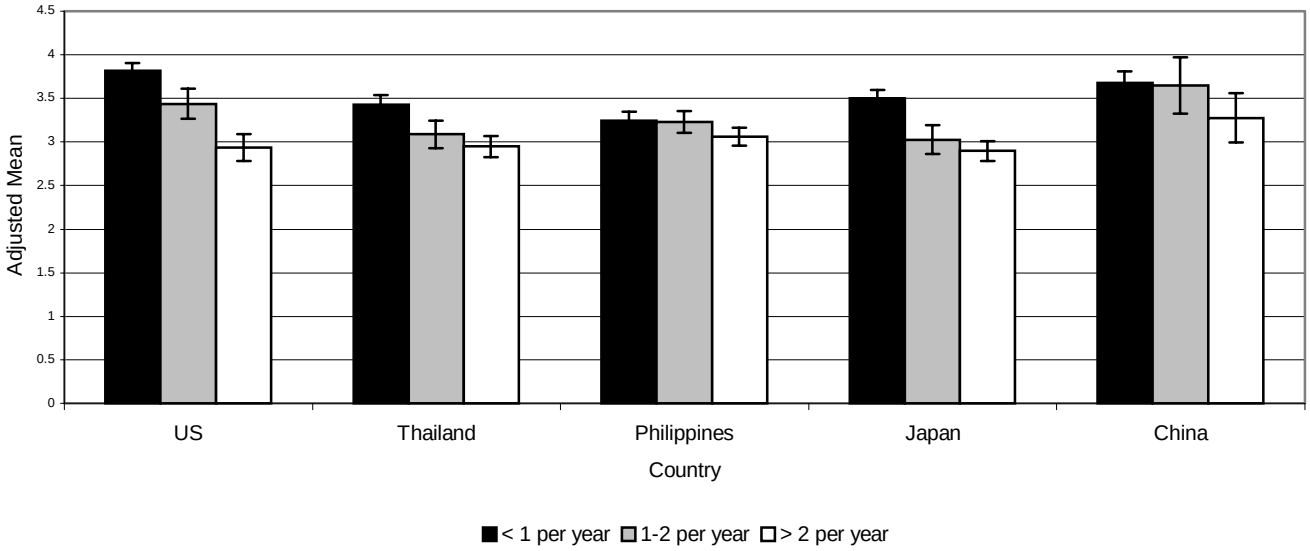
It has been hypothesized further that intuitive eaters are more likely to have a normal body weight than those who do not eat intuitively. This assumption was generally supported in this study, with all countries reporting higher levels of intuitive eating among normal weight participants, as compared with overweight or obese participants. The one exception was China where IES scores failed to differ significantly between BMI categories.

Discussion

Culture, beauty, and eating behaviour

Beauty in the west tends to focus on thinness and sexuality,[21] but traditional Asian standards for beauty are more open to a number of behavioural and psychological variables with less emphasis on physical appearance and a greater tolerance, if not preference, for fatness - at least in some countries.[21,27] Exposure to western media almost inevitably leads to the adoption of western standards of beauty, and subsequently to greater levels of dietary restriction and eating disorders.[21] The longer the exposure to western influences, the greater the degree of body dissatisfaction,[28] low self-worth,[29] unhealthy eating habits,[24,30] and obesity.[31]

Unlike thinness as a standard of beauty, the adoption of western cuisine has been uneven across Asian countries. In almost all cases, however, the level of fat



*Means adjusted for gender, age, area of residence, and class in school.

Figure 2. Adjusted mean level of agreement with intuitive eating (total across subscales) according to diet and country*

consumption has increased and overnutrition is on the rise (regardless of cuisine preference).[32] Even in countries such as Japan, that have resisted many elements of the western diet, levels of obesity seem to be rising substantially for many groups, especially children and those in rural areas.[33] Only young women, with very high rates of dieting (and growing rates of eating disorders), are not gaining weight in Japan.[34] In fact, reducing the growing prevalence of underweight women in metropolitan Japan has become a national health priority that is being implemented in tandem with obesity prevention policies for other subgroups.[33]

The conflict between the growing acceptance of thinness as a standard of beauty, and increasing levels of overweight that accompany energy dense diets, is a largely unstudied element of the nutrition transition. It is possible that the growing rates of obesity (and excessive thinness) are in part related to the changes in standards of attractiveness and subsequent alterations in eating styles.[21] This study employed a cross-cultural design to evaluate differences in intuitive eating styles as one element of the nutrition transition that is culturally sensitive.

Principles of intuitive eating

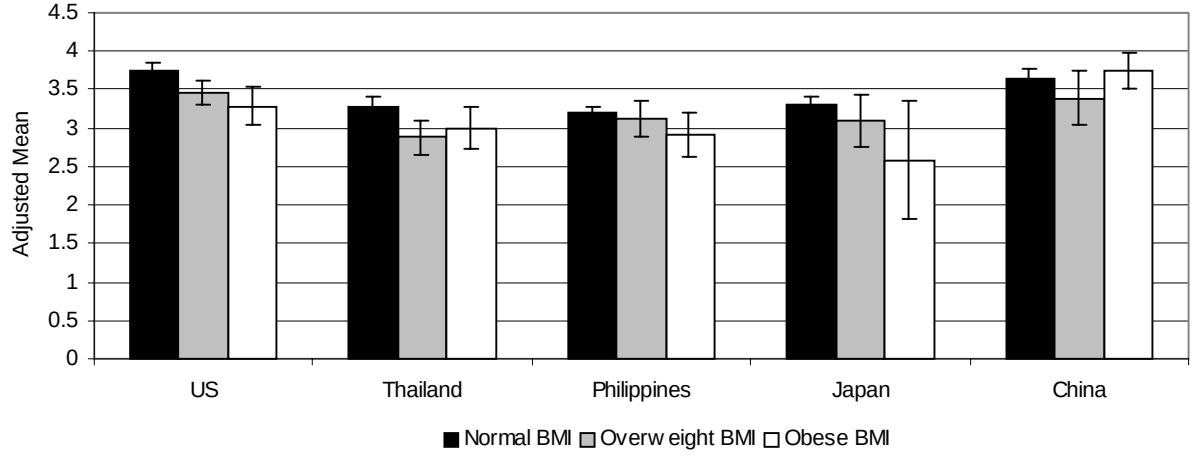
In general, this study provided some support for the concept of intuitive eating as a valid and measurable variable. It has been theorized that intuitive eating represents a natural state of eating that occurs primarily in response to hunger satisfaction and is characterized by lower levels of social, environmental, and emotional eating. Further, it has been proposed that intuitive eaters are less likely to engage in dieting behaviour and more likely to be a normal weight.[25] In this cross-cultural sample, intuitive eaters were less likely to be restrictive dieters in all countries, and were more likely to have a normal BMI in four of the five countries surveyed. These findings remained consistent when the entire sample was pooled. Those with the lowest level of dieting, and those with normal BMI were more likely to have higher scores for most IES subscales and for the total IES. As found in previous research, gender was a significant factor in this study with men typically scoring higher than women.[14, 25] Other demographic factors such as age, area of residence, and year in college were less clearly associated with intuitive eating values.

Research hypothesis

The primary focus of the current research was to identify cross-cultural patterns in intuitive eating as a function of economic development and exposure to western ideals. In terms of economic development, per capita gross domestic product (GDP) is one possible measure. By this yardstick, the US ranks first ($36,000) followed in order by Japan ($24,900), Thailand ($6,700), the Philippines ($3,800), and China ($3,600).[35] This order would only be slightly altered in terms of exposure to western values and ideals. The US would be first again followed by Japan, and the Philippines (with ongoing ties to the US) might be next, with Thailand and China following in that order. While this ranking may be somewhat subjective, it is nevertheless useful in interpreting the findings of this study.

Intrinsic eating

The initial hypothesis of the current research was that IES scores would be negatively correlated with economic development and western influence. This hypothesis is generally supported, but with notable exceptions. When testing this hypothesis against individual IES subscales, it seems to hold true for intrinsic eating (Table 3). As predicted, the US scored significantly lower on intrinsic eating than all other countries, followed at a distance by Japan. China, Thailand, and the Philippines all scored higher on this subscale with comparatively similar scores. Of all the IES subscales, intrinsic eating is perhaps the one that is most closely associated with the concept of natural eating in response to hunger satisfaction that would theoretically be characteristic of less developed societies with low levels of western exposure. Lower scores for the US and Japan, and higher scores for China, Thailand, and the Philippines is consistent with the proposed hypothesis.



*Means adjusted for gender, age, area of residence, and class in school.

Figure 3. Adjusted mean level of agreement with intuitive eating (total cross subscales) according to BMI and country*

Self-care

The self-care subscale, which measures the emphasis on physical health and fitness as opposed to fashion and beauty, also supported the expected trend. Japan had the lowest score followed by the US - suggesting that in these cultures there is a relatively higher premium on fashion and beauty. China, Thailand, and the Philippines all scored higher on this subscale, indicating a relatively greater value being placed on physical health and fitness. Other research has shown that Japan is similar to the US in placing a greater emphasis on physical appearance (i.e. thinness) when defining beauty,[36] but Filipinos are more likely to prefer fatness,[37] and the Chinese tend to consider behavioural and psychological attributes as being more important than thinness or other physical attributes.[27]

Extrinsic and anti-dieting

The extrinsic eating and anti-dieting subscales failed to support the research hypothesis. On both subscales the US scored significantly higher than other countries, rather than lower as expected. After the US, China had the next highest scores (an expected finding), but Thailand had the lowest scores for both subscales (an unexpected finding). Scores for Japan and the Philippines fell somewhere in the middle for both subscales. The low anti-dieting scores for Japan and Thailand have been supported in other studies that report high rates of dieting in these countries.[34,38]

If the anomaly of the US is momentarily set aside, the research hypothesis was generally supported in terms of total IES scores for Asian countries. Aside from the US, there was a direct, negative correlation between total IES scores and economic development. China with the lowest per capita GDP and least western exposure was expected to have the highest IES scores, followed in order by the Philippines, Thailand, and Japan. If the US is excluded, this was the exact order found for total IES scores with Japan posting the lowest total IES scores and China the highest.

Alternate hypotheses

One possible reason for unexpectedly high US scores on the extrinsic, anti-dieting, and total IES scores may be an anti-dieting sentiment that has been reported for some US college students (which supports the high anti-dieting score).[39] Because of negative connotations currently associated with "dieting," most US students will actively deny being "on a diet." And yet most will be trying to manage their body size by restricting dietary intake.[40] As such, the high scores on the anti-dieting subscale may be an artifact of semantics and cultural attitudes toward dieting, rather than a true reflection of actual dietary restraint. In Japan restrictive dieting seems to be more socially acceptable (if not normative), and hence the lower scores on the anti-dieting subscale may be more accurate for that culture.[40,41]

Unexpectedly high US scores on the extrinsic eating subscale may also suffer from similar influences. Most of the items on the extrinsic eating subscale reflect socially undesirable eating behaviours in the US (overeating, emotional eating, environmental eating, social eating). Scores for these items may therefore be underestimated - resulting in a higher than expected extrinsic eating score.

The unexpectedly low scores for Thailand on the extrinsic eating and anti-dieting subscales may indicate higher levels of social, environmental, and restrained eating than anticipated.[38] This may suggest that for unknown reasons Thailand has moved further along in the nutrition transition than other countries, at least in terms of eating styles, than the level of economic development might predict. Unfortunately, it is difficult to evaluate this hypothesis as very little research has been done in Thailand or other Asian countries on the prevalence of different types of eating styles and eating disorders.[42]

Limitations

The research design used in this study is capable of identifying associations between variables of interest, but cannot establish cause and effect relationships. Findings are limited by the use of convenience samples that may not be representative of all college students in participating countries. Chronbach's alpha and test/retest correlations were less than optimal for some IES subscales in some countries. Hypotheses were too ambitious to be fully tested by the variables that were examined in this exploratory study. For example, the use of economic indices (e.g. GDP) to indicate progress in the nutrition transition is too blunt to reflect the many variables that influence national dietary patterns, and the number of countries surveyed was insufficient for determining clear cross-cultural trends.

Conclusion

Models for understanding and managing the nutrition transition rarely consider the relationship between culture, the pursuit of beauty, and eating styles. Instead they focus on managing the food environment,[32] or on promoting health-based strategies that target individual behaviour change.[33,43,44] By neglecting the powerful force represented by culture, beauty, and eating styles, current models of the nutrition transition may be incomplete.[12, 14]

For the Asian countries included in this study, the general hypothesis was largely supported: IES subscale scores and total IES scores tended to be higher for those countries with less economic development and with less western influence. As economic development advances, along with greater exposure to western media, advertising, and fashion, IES scores begin to decline. This finding suggests that as western definitions of beauty (i.e. thinness) are internalized by Asian populations, there may be ramifications for eating styles that gradually evolve from intuitive eating (hunger satisfaction) to progressively harmful eating styles including environmental, social, emotional, and dysfunctional eating (eating disorders).[42] The findings of this study tentatively support a model of the nutrition transition that includes culturally determined preferences for beauty that interact with various eating styles.[40] Inclusion of this cultural component will help capture the complexity of the nutrition transition and open the door for future research, theory, and public health strategies that can more effectively manage the negative aspects of the nutrition transition.[45]

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Appendix

1.	Without really trying, I naturally select the right types and amounts of food to be healthy.
2.	I generally count calories before deciding if something is OK to eat.
3.	One of my main reasons for exercising is to manage my weight.
4.	I seldom eat unless I notice that I am physically hungry.
5.	I am hopeful that I will someday find a new diet that will actually work for me.
6.	The health and strength of my body is more important to me than how much I weigh.
7.	I often turn to food when I feel sad, anxious, lonely, or stressed out.
8.	There are certain foods that I really like, but I try to avoid them so that I won't gain weight.
9.	I am often frustrated with my body size and wish that I could control it better.
10.	I consciously try to eat whatever kind of food I think will satisfy my hunger the best.
11.	I am afraid to be around some foods because I don't want to be tempted to indulge myself.
12.	I am happy with my body even if it isn't very good looking.
13.	I normally eat slowly and pay attention to how physically satisfying my food is.
14.	I am often either on a diet or seriously considering going on a diet.
15.	I usually feel like a failure when I eat more than I should.
16.	After eating, I often realize that I am fuller than I would like to be.
17.	I often feel physically weak and hungry because I am dieting to control my weight.
18.	I often put off buying clothes, participating in fun activities, or going on vacations (hoping I can get thinner first).
19.	When I feel especially good or happy, I like to celebrate by eating.
20.	*It is important to keep track of how many fat grams I eat each day.**
21.	*My main goal in choosing what I eat is to take good care of my physical body.**
22.	I often find myself looking for something to eat or making plans to eat—even when I'm not really hungry.
23.	I feel pressure from those around me to control my weight, or to watch what I eat.
24.	I worry more about how fattening a food might be, rather than how nutritious it might be.
25.	It's hard to resist eating something good if it is around me, even if I'm not very hungry.
26.	On social occasions, I feel pressure to eat the way those around me are eating—even if I'm not hungry.
27.	I honestly don't care how much I weigh—as long as I'm physically fit, healthy, and can do the things I want.
28.	*I usually eat at mealtimes, even if I'm not very hungry.**
29.	I feel safest if I have a diet plan, or diet menu, to guide my eating.
30.	I mostly exercise because of how good it makes me feel physically

* Italicised items were not used in this study due to low factor loadings during initial factor analysis.