

## Review

# Sasang types may differ in eating rate, meal size, and regular appetite: a systematic literature review

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Eating behaviours may be implicated in the increasing prevalence of obesity and metabolic disorders. The Sasang typology, a unique form of traditional Korean medicine, classifies individuals into four constitutional types that differ in a distinctive complex of external manifestations and innate natures, including eating behaviours. Our aim is to portray a picture of the distinguishing characteristics of eating behaviours across Sasang types and to provide suggestions for future studies. Six Korean and one English database were searched to acquire relevant articles. Ten peer-reviewed relevant research articles were found. The extracted data were categorised into the domains of i) food preferences; ii) eating rate; iii) eating initiation and termination; iv) meal size; v) regularity of eating; vi) regular appetite; vii) eating disorders; and viii) psychological factors. Eating rate and meal size were the issues of most concern that more frequently were different among Sasang types. The TaeEum type seemed to have obesity-linked eating behaviours, including a rapid eating rate, large meal sizes, and a strong appetite, whereas those attitudes seemed to be in contrast with those of the SoEum type. The SoYang type shared similarities with both the TaeEum and SoEum types. Future studies should be conducted with more reliable, objective, and quantitative assessment tools such as the Three Eating Factor Questionnaire or the Dutch Eating Behaviour Questionnaire.

**Key Words:** Sasang constitutional medicine, Sasang typology, eating behaviour, appetite, review

## INTRODUCTION

Over the last few decades, an increase in the prevalence of metabolic disorders related to several chronic diseases, such as obesity, diabetes, cardiovascular diseases, and cancer, has been strongly associated with food intake and food choice.<sup>1,2</sup> Excess food intake and an energy-dense food preference seem to be crucial risk factors for weight gain and obesity, which in turn cause dysfunctions of the metabolic pathways.<sup>3</sup> Studies of human eating behaviours provide information on how, why, and when individuals select certain foods and ingest certain amounts. These attitudes are influenced by various factors within the physiological, psychological, and environmental domains.<sup>4</sup>

Evidence shows that three important attitudes towards food, including cognitive restraint (a tendency to consciously restrict food intake and food mode), disinhibition (a tendency to overeat in certain circumstances, such as in emotional states or with delicious food), and hunger (a sensation that signals the need for food), have close associations with weight gain and body mass index (BMI).<sup>5-7</sup> A family study estimated the heritability of cognitive restraint, disinhibition, and hunger to be 28%, 40%, and 23%, respectively,<sup>8</sup> whereas a twin study indicated a higher heritability for those behaviours (59% for cognitive restraint, 60% for emotional eating, and 45% for uncontrolled eating).<sup>9</sup> It has also been demonstrated that other eating attitudes, such as eating rate,<sup>10</sup> sweet and fatty food preference,<sup>11</sup> and appetite,<sup>12</sup> have been linked to the risk of obesity, and that the variability in these be-

haviours is heritable. It is hard to explain why, under the same environmental risks, such as an energy-dense diet, sedentary activities, and a stressful life, one person cannot gain weight, whereas others easily become overweight and obese. People differ in eating behaviours, responsiveness to the exposed environment, and consequently, in their susceptibility to certain diseases, presumably because of their distinctive innate functional organs.

The viewpoint that the distinctive intrinsic nature of an individual determines or strongly influences his/her behaviours, temperaments, physical appearance, and responsiveness to the acquired environment is the basis of Sasang constitutional medicine (SCM), a unique form of traditional Korean medicine. According to SCM, individuals can be classified into four types: TaeYang (TY), SoYang (SY), TaeEum (TE), or SoEum (SE), differing in terms of physical features, psychological characteristics, susceptibility to certain health problem patterns, and response to certain herbs and medicines (Table 1).<sup>13,14</sup> Traditionally, SCM practitioners determine a patient's Sasang type based on a comprehensive examination, taking

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**Table 1.** General characteristics of the four SCM constitutions [adapted from Kim and Pham<sup>14</sup>].

Characteristics	Constitutions			
	TaeYang type	SoYang type	TaeEum type	SoEum type
External appearance	Developed nape of the neck Slender waist	Developed chest Small hips	Thick waist Weak nape of the neck	Developed hips Weak chest
Personality traits	Creative Positive Progressive Charismatic Heroic Rash minded	Unstable Easily bored Sacrificing Righteous Easily acceptable Hot tempered Anxious minded	Gentle Commercial Endurable Humorous Coward Fearful minded	Neat, Mild Negative Selfish Organised Jealous Persistent Nervous minded
Healthy sign	Smooth urination	Good bowel movement	Existence of perspiration	Good digestion
Unhealthy sign	Musculoskeletal weakness, emesis	Existence of constipation	Absence of perspiration	Indigestion
Vulnerability	Muscular malfunctions	Cystitis, urinary system diseases	Obesity, cardiovascular diseases, metabolic syndrome	Chronic indigestion, gastroparesis, gastrodysmotility
Representative effective herbs	Cortex Acanthopanax	Radix Rehmanniae - Glutinosae	Herba Ephedra sinica	Radix Panax Ginseng
Representative inappropriate herbs	Herba Ephedra sinica	Radix Panax Ginseng Radix Aconiti Carmichaeli - Praeparata	Gypsum Cortex Cinnamomi - Cassiae	Herba Ephedra sinica Gypsum

Effective herbs for a certain constitution refer to the herbs that have good therapeutic effectiveness without adverse effects. Inappropriate herbs for a certain constitution refer to the herbs that have no effect or that may cause adverse effects. (For more detail, see Kim and Pham.<sup>14</sup>)

into account body shape, facial features, temperament, healthy and unhealthy signs, and the history of adverse effects to certain herbs. Recently, this information has been objectified and standardised to develop more reliable diagnostic tools, such as body measurements, facial and voice analysis, and questionnaires.<sup>15</sup> Previously, we have hypothesised that the SY type is characterised by a weak capacity for waste discharge, whereas the SE type has an inherent poor digestive system. The TE type has a predominant process of storing Qi (氣) and fluid (液), which may resemble anabolic function, whereas the process of consuming inner body material, which may resemble catabolic function, is the predominant characteristic of the TY type.<sup>14</sup> In SCM theory, the TE individuals are described as big eaters who tend to overeat; the SY individuals seem to prefer cold food and have a rapid eating rate; and the SE individuals tend to eat warm food, have a preferred diet, and habitually eat slowly.<sup>13</sup>

These distinctions result in differences in the eating pattern and susceptibility to certain diseases for each Sasang type. The SE type is susceptible to digestive malfunction, such as chronic indigestion, gastroparesis, and gastrodysmotility,<sup>16,17</sup> whereas the TE type has a higher prevalence of being overweight and obese.<sup>18,19</sup> Several studies using different questionnaires have been conducted by Korean scientists to investigate the distinctive characteristics of eating habits among Sasang types.

To examine the tendency for food intake and food choice across Sasang types, we reviewed published research articles that assessed the characteristics of eating attitudes within the constitutional perspective of SCM.

We also reviewed the strengths and limitations of previous studies and provided suggestions for upcoming research in this field.

## METHODS

### *Database and search strategies*

The methods for analysis and the inclusion/exclusion criteria were specified in advance and documented in a protocol. We performed a comprehensive search of the following databases from inception up to June 2011: PubMed (<http://www.pubmed.org>), DBPIA (<http://www.dbpia.com>), Research Information Service system (RISS, <http://www.riss4u.net>), Oriental Medicine Advanced Searching Integrated System (OASIS, <http://oasis.kiom.re.kr>), Korea Studies Information Service System (KISS, <http://kiss.kstudy.com>), Korea Institute of Science and Technology Information (KISTI, <http://society.kisti.re.kr>), and KoreaMed (<http://www.koreamed.org>). Each search was performed using two keywords combined with the Boolean operator AND. The first keyword was “Sasang” or “constitution,” and the other was “eating” or “appetite,” in both English and Korean. We also conducted a search by hand in four major traditional Korean medicine journals: *Journal of Sasang Constitutional Medicine*, *Korean Journal of Oriental Medicine*, *Korean Journal of Oriental Physiology & Pathology*, and *The Journal of Korean Oriental Internal Medicine* (searched from their inception up to June 2011) to minimise publication bias. Moreover, all references cited in identified articles were reviewed to avoid omitting relevant articles. The search was performed by JCL.

### Criteria for study selection

#### Inclusion criteria

Peer-reviewed research articles that employed any type of questionnaire to investigate eating behaviours across Sasang types. The search was not limited to gender or type of population. We included only participants aged 7 (the age of children in the first year of elementary school) to 80. Language was restricted to English and Korean.

#### Exclusion criteria

Review papers that focused on translated text(s), commentary articles, hypothesis articles, clinical trials using intervention for eating behaviours, case studies, theses and dissertations were excluded.

#### Data collection process

Hard copies of all articles were obtained and read in full. Two reviewers (DDP and JCL) assessed independently the eligibility of the studies based on the titles and abstracts. Disagreements between the reviewers were resolved by consensus. Duplicate publications were verified by titles, author names, sample size, assessment and outcomes.

Data were extracted using a standardised data extraction sheet. General extracted data included the following: names of authors, time of publication, survey methods, type of questionnaire, and the validity and reliability of the questionnaire. Data pertaining to demographic characteristics consisted of the number of subjects, gender, age, type of population, and BMI. Data related to Sasang typing, such as the Sasang typing methods and the prevalence of Sasang types, were obtained to define the influence of constitutional determination on the differences in eating behaviours. Data pertaining to eating behaviours were extracted, including i) the eating pattern domains included in the study; ii) the proportion of positive responses to certain questionnaire items (for qualitative questionnaires) or scores on a rating scale for certain questionnaire items (for rating scales); and iii) significant differences in each eating behaviour across Sasang types. The data used for study quality assessment were the response rate, representativeness of responders, questionnaire pretesting, and type of questionnaire. Because the prevalence of the TY type is very small (0.03-0.1% of the whole population),<sup>13,20</sup> we focused only on the data from three Sasang types (TE, SY, and SE).

#### Data analysis

The eating pattern domains in relevant studies were assessed and categorised into certain groups relying on the view of behavioural science. We then reported the significant difference for a certain domain of the eating behaviour questionnaire that was based on the difference in the proportion of positive responses (in case of a "Yes/No" questionnaire) or the mean value of the score to a question (in the case of a rating scale). The chi square test was used to assess the difference in positive responses for a question if no statistical comparison was provided in the relevant articles. A *p*-value <0.05 was used as the basis to define significant differences. For certain items of the eating behaviour questionnaire, we

calculated the ratio between the number of studies in which the significant difference among Sasang types were found and the number of all studies that employed that item to investigate the tendency of eating attitudes across Sasang types.

## RESULTS

### Study selection

The search in PubMed and KoreaMed (two databases for English articles) produced no potential articles. Our searches identified 1812 potentially relevant articles (all in Korean with an English abstract), 1768 of which were excluded because of their non-eligible content based on the review of their titles and abstracts. Forty-three studies remained, but 29 studies were duplicates, one study enrolled the participants at the age of 5, and three studies were masters dissertations. Finally, 10 studies were included in the present review (Figure 1),<sup>21-30</sup> and their key data are summarised in Tables 2 and 3.

### Study characteristics and quality (Table 2)

#### Type of questionnaire

Six studies employed "Yes/No" questionnaires for eating behaviours, providing outcome as a percentage of positive responses,<sup>21-26</sup> whereas rating scales were used in four studies.<sup>27-30</sup>

Very few studies (3/10) employed reliable questionnaires. Of those, two studies used a self-designed questionnaire with high Cronbach's alphas,<sup>24,28</sup> and the other study used well-known questionnaires, including the Gastrointestinal Symptom Rating Scale (GSRS), the Bulimia Test Revised (BULIT-R), the Korean Version of Eating Attitude Test-26 (KEAT-26), and the Dutch Eating Behaviour Questionnaire (DEBQ).<sup>30</sup>

#### Participants

The participants in the selected studies included patients<sup>22-26,28</sup> and healthy persons.<sup>21,27,30</sup> Age was controlled in six studies: two studies enrolled elderly persons,<sup>21,25</sup> two studies included children aged 7 to 12 years old,<sup>26,27</sup> and two studies enrolled young adult participants aged 20 to 35.<sup>29,30</sup> None of the studies recruited participants randomly.

The BMI was assessed in six studies with the same trend that BMI was highest in the TE type and the lowest in the SE type.<sup>21,24,25,27,29,30</sup>

#### Response rate

Eight studies had a high response rate (100%),<sup>21-27,30</sup> whereas two studies had lower response rates (83~85%) and no non-responses to follow up.<sup>28,29</sup>

#### Sasang typing method

Sasang types were determined by various methods, including by clinical examination with experienced Sasang specialists,<sup>26,30</sup> the use of the Questionnaire for Sasang Constitution Classification version 2 (QSCC II),<sup>29</sup> herbal responses,<sup>22</sup> a combination of clinical examination and QSCCII,<sup>21,27,28</sup> a combination of herbal responses and clinical examination,<sup>23,24</sup> and a multi-method determination.<sup>25</sup>

**Table 2.** Summary data for general characteristics of the included studies

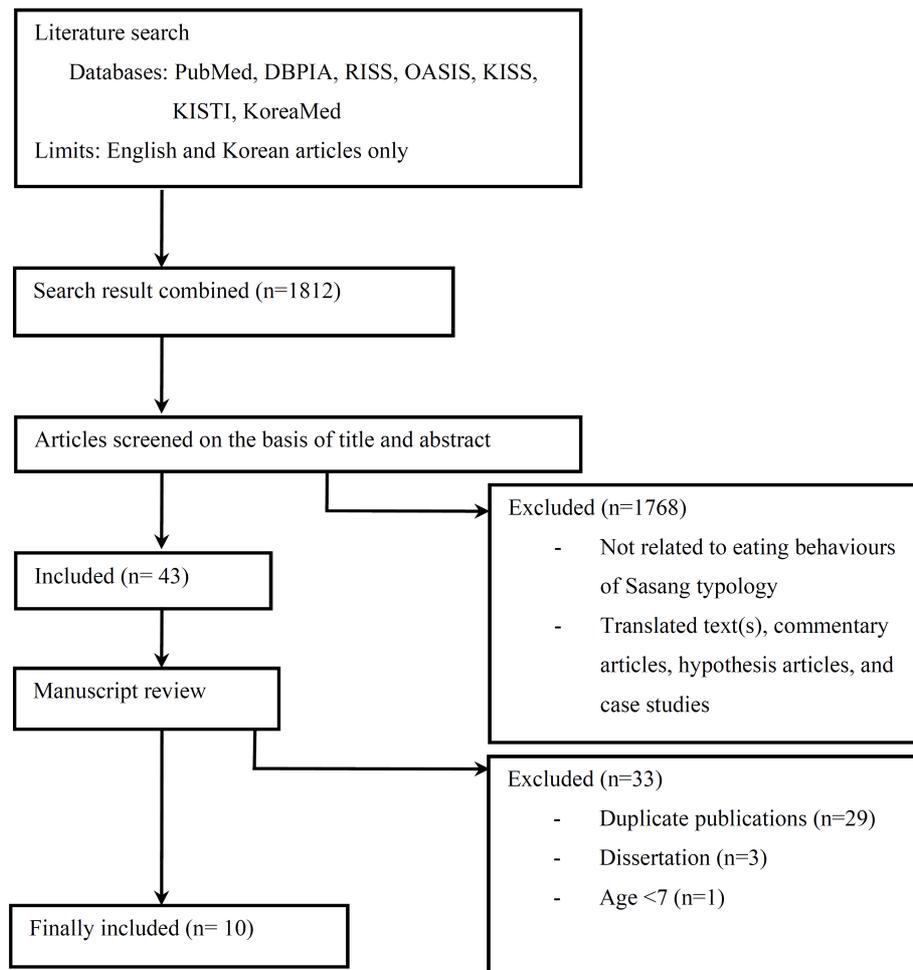
Author, Year [ref]	Sasang typing method	Survey	Demographic characteristics				
			n (M/F) Response rate	Participants	Sasang type (TE/SY/SE)	Age	BMI (TE/SY/SE)
Kim et al., 2002 <sup>21</sup>	QSCCII+ specialist	Dichotomous	84 (35/49) 100%	Elderly	41/23/19	65-80	M: 24.7(2.1)/ 22.3(2.7)/ 20.4(2.9) <sup>‡*</sup> F: 25.7(3.2)/ 22.8(2.1) <sup>¶</sup> / 22.6(3.5) <sup>‡*</sup>
Jang et al., 2007 <sup>22</sup>	Herbs	Dichotomous	418 (168/250) 100%	General patients	191/126/101	13-75	N.A.
Baek et al., 2009 <sup>23</sup>	Herbs + specialist	Dichotomous	1241 (476/765) 100%	General patients	541/389/311	10-80	N.A.
Baek et al., 2004 <sup>24</sup>	Herbs + specialist	Dichotomous <sup>†</sup>	588 (248/340) 100%	General patients	175/136/267	10-80	25.8(2.6)/ 23.0(2.6)/ 20.6(2.3) <sup>††***</sup>
Lee et al., 2007 <sup>25</sup>	QSCCII+ specialist+ PSSC+ facial analysis	Dichotomous	975 (292/682) 100%	General and obese patients	488/240/246	50-70	25.8(2.2)/ 23.4(2.1) <sup>¶</sup> / 22.0(2.0) <sup>***</sup>
Ko et al., 2007 <sup>26</sup>	Specialist	Dichotomous	146 (80/66) 100%	Paediatric patients	66/36/43	7-12	N.A.
Hong et al., 2002 <sup>27</sup>	QSCCII+ specialist	Rating scale	74 (45/29) 100%	Elementary students	33/26/15	12	19.6(0.5)/ 16.8(0.3) <sup>¶</sup> / 14.9(0.3) <sup>‡***</sup>
Jin et al., 2009 <sup>28</sup>	QSCCII+ specialist	Rating scale <sup>†</sup>	249 (30/219) 83%	General patients	66/48/114	20-51	N.A.
Park et al., 2003 <sup>29</sup>	QSCCII	Rating scale	305 (0/305) 85%	Female college students	159/99/47	20s	21.0(2.2)/ 19.2(1.3) <sup>¶</sup> / 18.2(1.2) <sup>††***</sup>
Shin et al., 2010 <sup>30</sup>	Specialist	Rating scale <sup>†</sup>	31/(31/0) 100%	Healthy males	11/10/10	20-35	22.3 (2.4)/ 21.4(2.9)/ 20.2(3.4) <sup>†† ***</sup>

†: Reliable questionnaires employed; n: number of responders; M: male; F: female; RR: response rate; TE: TeaEum type; SY: SoYang type; SE: SoEum type; Sasang typing method: QSCCII: Questionnaire for Sasang Constitution Classification 2; PSSC 2004: Phonetic system for Sasang Constitution – a voice analysis system. BMI: Body mass index; data are presented as the mean (SD); N.A.: not available; Significant outcome: \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ; Post hoc test: ‡ SE differs from TE only, § SE differs from SY only, ††: SE differs from both TE and SY, ¶: SY differs from TE

**Table 3.** Key data on eating behaviours from the included studies

Author/ Year (ref)	Food preference (TE/SY/SE)	Eating rate (TE/SY/SE)	Eating initiation (TE/SY/SE)	Meal size (TE/SY/SE)	Regularity (TE/SY/SE)	Appetite (TE/SY/SE)
Kim et al., 2002 <sup>21</sup>	N.A.	<i>Fast:</i> 34.1/39.1/26.3 <i>Slow:</i> 24.3/13.0/15.8	N.A.	N.A.	<i>Overeating:</i> 46.3/52.2/31.5 <i>Breakfast:</i> 92.7/87.0/68.4 * <i>Regularity:</i> 56.1/60.9/47.3	N.A.
Jang et al., 2007 <sup>22</sup>	N.A.	<i>Fast:</i> 60.8/46.9/41.2** <i>Slow:</i> 19.1/16.2/25.5	N.A.	<i>Big:</i> 18.6/9.2/5.9 ** <i>Small:</i> 11.9/20.0/23.5 **	N.A.	<i>Strong:</i> 26.6/19.7/13.9 * <i>Poor:</i> 6.8/12.6/14.9
Baek et al., 2009 <sup>23</sup>	N.A.	<i>Fast:</i> 60.1/46.0/37.6*** <i>Slow:</i> 12.0/15.9/24.4***	N.A.	<i>Big:</i> 17.7/10.0/5.4 *** <i>Small:</i> 12.0/17.0/23.7***	N.A.	<i>Strong:</i> 45.5/40.5/29.4 *** <i>Poor:</i> 8.0/10.1/14.5 *
Baek et al., 2004 <sup>24</sup>	N.A.	<i>Fast:</i> 53.1/51.1/35.6*** <i>Slow:</i> 11.4/14.8/16.1	N.A.	<i>Big:</i> 16.0/11.9/5.6 ** <i>Small:</i> 6.9/11.1/15.0 *	<i>Breakfast:</i> 21.1/30.4/29.6 <i>Regularity:</i> 46.3/36.3/36.7	<i>Strong:</i> 38.3/33.3/18.7*** <i>Poor:</i> 4.6/13.3/11.6 *
Lee et al., 2007 <sup>25</sup>	N.A.	<i>Fast:</i> 44.9/32.9/27.6 *** <i>Slow:</i> 6.6/10.4/17.9 ***	N.A.	<i>Big:</i> 26.8/14.2/8.1***	<i>Regularity:</i> 82.6/80.8/81.7	<i>Strong:</i> 7.8/4.6/2.8 * <i>Poor:</i> 3.9/4.2/11.0 ***
Ko et al., 2007 <sup>26</sup>	<i>Sweet:</i> 13.6/2.8/11.6 <i>Spicy:</i> 7.6/13.9/2.3 <i>Fatty:</i> 10.6/0.0/0.0 *	<i>Fast:</i> 30.3/16.7/9.3* <i>Slow:</i> 22.7/38.9/55.8 **	N.A.	<i>Big:</i> 27.3/8.3/0.0 *** <i>Small:</i> 13.6/41.7/46.5 ***	N.A.	N.A.
Hong et al., 2002 <sup>27</sup>	N.A.	65.5 (4.4) / 66.2 (5.1) /64.0 (4.9)	N.A.	52.1(4.1)/ 56.9(4.5)/66.6 (4.2)	N.A.	N.A.
Jin et al., 2009 <sup>28</sup>	<i>Sweet:</i> 2.8 (1.2) /2.6 (1.2) /2.8(1.2) <i>Spicy:</i> 3.6 (1.0) / 3.6 (0.9) /3.1 (1.1)††** <i>Fatty:</i> 2.8 (1.1)/ 3.0 (1.2)/ 2.5 (1.0) <i>Energy dense food:</i> 3.0 (1.1)/ 3.1 (1.2)/ 2.7 (1.1)	3.9 (1.3)/ 3.3 (1.1)/ 2.9 (1.2)	<i>Hunger:</i> 2.3(1.1)/ 2.9(1.4)¶/ 2.8 (1.3) ‡* <i>Pleasure:</i> 3.2(1.4)/ 2.9(1.2)/ 2.5(1.4) ‡** <i>Stress:</i> 2.5(1.0)/ 2.3(1.2)/ 2.4(1.4) <i>Habit:</i> 2.5(1.4)/2.4(1.2)/ 2.3(1.2)	<i>Big:</i> 3.6(0.9)/ 3.3(0.8)/ 3.0(1.0)‡***	<i>Overeating:</i> 3.7(1.1)/ 3.3(1.0)/ 3.1(1.1)‡*** <i>Breakfast:</i> 2.6(1.5)/ 3.4(1.5)¶/ 3.7(1.5)‡*** <i>Regularity:</i> 2.6(1.4)/ 3.0(1.3)/ 3.0(1.4)	N.A.
Park et al., 2003 <sup>29</sup>	<i>Sweet:</i> 39.6/ 33.3/ 48.9 <i>Spicy:</i> 40.3/ 50.5/ 42.6 <i>Fatty:</i> 3.2(0.7)/ 3.1(0.6)/ 3.2(0.7)	<i>Slow:</i> 2.9(0.9)/ 2.8(1.0)/ 3.4(1.0)††**	<i>Stress not initiates eating</i> 2.9(1.2)/ 3.2(1.2)/ 3.5(1.2)‡*	N.A.	<i>Not overeating:</i> 2.2(0.8)/ 2.3(0.8)/ 2.6(0.9)††* <i>Regularity:</i> N.S.	N.A.
Shin et al, 2010 <sup>30</sup>	GSRs: 5.2(12.9)/ 2.7(6.0)/ 3.2(10.9) KEAT-26: 2.0(11.7)/ 3.4(13.2)/ 4.2(12.1) DEBQ: Restraint eating: 22.2(20.8)/ 23.3(18.2)/ 17.2(16.1) Emotional eating: 24.2(27.89)/ 24.8(38.4)/ 14.6(6.4)††* External eating: 29.5(13.8)/ 30.0(27.9)/ 25.5(23.5)	BULIT-R: 44.6(20.0)/ 47.4(50.3)/ 38.0(15.0)				

TE: TeaEum type; SY: SoYang type; SE: SoEum type; GSRs: Gastrointestinal Symptom Rating Scale; BULIT-R: Bulimia Test Revised; KEAT-26: Korean Version of Eating Attitude Test-26; DEBQ: Dutch Eating Behaviour Questionnaire. Eating behaviour: Data are presented as a proportion of positive responses (for qualitative questionnaire) and mean (SD) (for rating scale); N.A.: not available; Significant outcome: \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ; †: no information on significant differences between groups; Post hoc test: ‡ SE differs from TE only, § SE differs from SY only, ††: SE differs from both TE and SY, ¶: SY differs from TE



**Figure 1.** The flow diagram of the study selection process.

### **Key data on eating behaviours (Table 3)**

We found that the eating patterns mentioned in nine relevant studies<sup>21-29</sup> could be classified into six domains: food preference, eating rate, eating initiation, meal size, and regular appetite. One study employed well-known questionnaires (Gastrointestinal Symptom Rating Scal, GSRS; Bulimia Test Revised, BULIT-R; Korean Version of Eating Attitude Test-26, KEAT-26; and Dutch Eating Behaviour Questionnaire, DEBQ) that evaluated eating disorders, restrained eating, emotional eating, and external eating behaviours.<sup>30</sup>

### **Six domains in eating behaviours**

Eating rate and meal size were the most commonly used items and were included in nine and seven studies, respectively. Among six studies that employed a qualitative questionnaire on rapid eating behaviour, five studies (5/6) showed the same trend, in which the TE type had the highest positive response rate,<sup>22-26</sup> and one study (1/6) showed no significant difference.<sup>21</sup> Six studies employed qualitative questionnaires, and one study used a rating scale for slow eating behaviour; four studies (4/7) revealed that the SE type had a habit of eating more slowly than the other Sasang types,<sup>23,25,26,29</sup> whereas two studies (3/7) showed no significant difference.<sup>21,22,24</sup> Two studies

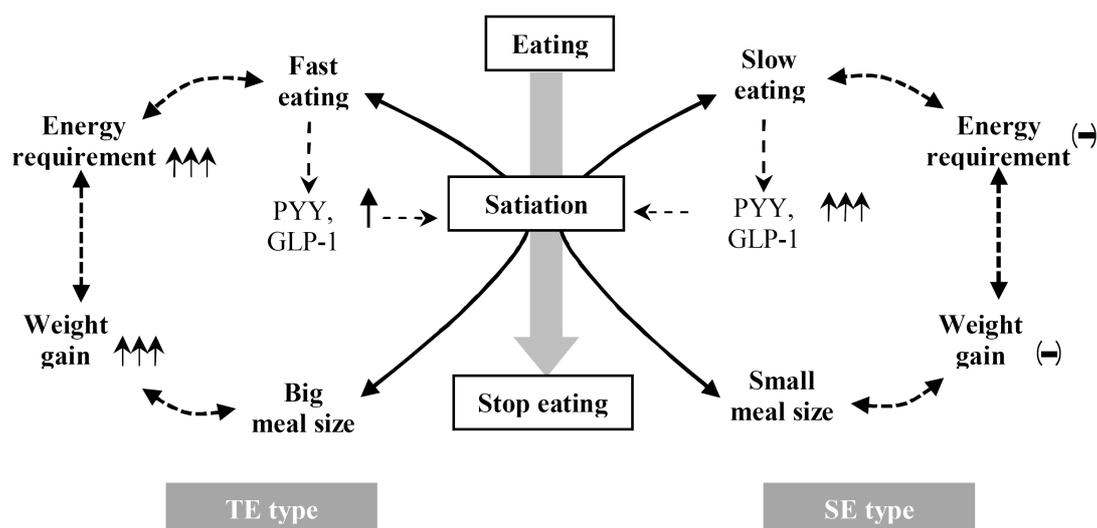
used a rating scale to assess the habit of eating speed in general and showed no significant difference.<sup>27,28</sup>

Six and four studies assessed the habit of having large and small meal sizes, respectively. The result showed the same trend; the TE type tended to consume a large amount of food in each meal,<sup>22-28</sup> whereas the SE type was prone to eat less than the other Sasang types.<sup>22-24,26</sup> One study used a rating scale for the general amount eaten and found no significant difference.<sup>27</sup>

Four studies that employed qualitative questionnaires surveyed regular appetite and found the same trend; the TE and SY types tended to have strong appetites, whereas the SE type were prone to have a poor regular appetite.<sup>22-25</sup>

The items of most concern that were used to assess food preference in the relevant studies are the questions on preferences for sweet, spicy, fatty, and energy-dense foods. Three studies included food preference items. Of those, one study reported that the TE type preferred to eat fatty foods,<sup>26</sup> and one study revealed that the TE and SY types preferred spicy foods.<sup>28</sup> No study reported a difference in the preference for sweet or energy-dense foods across Sasang types.

The reasons for the initiation of eating were assessed in the relevant studies and included hunger, pleasure, stress, and habit. One study reported that hunger tended to induce eating in the SY and SE type more than in the TE



**Figure 2.** A hypothesis to explain the role of eating behaviours in the physiological principles of the TE and SE types. PYY: peptide YY; GLP-1: Glucagon-like peptide-1; TE type: the TaEum type; SE: the SoEum type. Slow eating in the SE type enhances the secretion of PYY and GLP-1 (anorexigenic peptides), which signal satiety and lead to the cessation of eating, consequently leading to a small meal size, low level of weight gain, and a low energy intake requirement. Fast eating in the TE type causes overeating before satiety signals occur, consequently leading to a large meal size, large level of weight gain, and a higher energy intake requirement.

type, whereas eating for pleasure was more common in the TE type than in the SE type.<sup>28</sup> One study (1/2) revealed that stress was related to the initiation of eating in the TE type more than in the SE type,<sup>29</sup> whereas one study (1/2) found no relation between stress and eating across Sasang types.<sup>28</sup>

The items overeating, having breakfast regularly, and consuming meals at regular times were included in the relevant studies. Two studies (2/3) reported that the SE type tended to have less of an overeating habit than the TE and SY types,<sup>28,29</sup> whereas one study found no difference.<sup>21</sup> Three studies surveyed the habit of eating breakfast regularly and showed ambiguous outcomes.<sup>21,24,28</sup> No study claimed a difference in the regularity of meals across Sasang types.

#### Eating disorders and psychological factors

Only one study employed widely used questionnaires to investigate eating disorders (KEAT-26) and the psychological factors of eating (DEBQ).<sup>30</sup> The KEAT-26, the Korean version of the Eating Attitude Test-26, consists of 26 questions that assess eating disorders, with the clinical cut-offs for the Korean population set at 21.<sup>31</sup> The Korean version of the DEBQ composes of 33 questions that assess three psychological factors of eating, namely restrained eating, emotional eating, and external eating.<sup>32</sup> Both the KEAT-26 and the Korean version of DEBQ were reported to have high internal consistency and validity.<sup>31,32</sup> The authors also used the translated version of BULIT-R and GSRs with no report as to their reliability and validity. No difference was found across Sasang types for eating disorders as assessed by the KEAT-26 and BULIT-R or in gastrointestinal symptoms as assessed by the GSRs. The scores on the emotional eating scale for the SY type were higher than for the SE type, whereas no significant difference was found across Sasang types for restrained eating and the external eating scale.

#### DISCUSSION

Eating behaviours such as food preference, meal size, and eating rate may be implicated in the increasing prevalence of overweight and obesity.<sup>5-7</sup> Although these behaviours are influenced by various factors, an individual's physiological and psychological characteristics play an important role, and these distinctions may have genetic determinants.<sup>10-12</sup> Differences in eating attitudes among SCM types have been of great concern to SCM specialists, but the outcomes are still ambiguous.

One reason may be the heterogeneity of study quality, including the reliability and validity of questionnaires, representativeness of the subjects, response rates, and Sasang typing methods. Very few studies (three studies) used a reliable inventory to assess eating behaviour, which is a multifactor-influenced variable,<sup>24,28</sup> and the widely used questionnaires such as the KEAT-26 and DEBQ were employed in only one study with a relatively small sample size.<sup>30</sup> Two-thirds of the studies in this review used qualitative questionnaires; their findings therefore were not explicitly confirmed. Because the recruitment in all studies was not conducted randomly and patient-based recruitment might cause selection bias, the participants may not be sufficiently representative of the whole population. Different Sasang typing methods may result in different results for the Sasang type of an individual. Furthermore, several confounding factors in eating behaviour, such as age, gender, smoking, physical activities, and eating disorders, were not taken into account carefully.

Although these relevant studies remain limited, several distinctive tendencies in the eating patterns of Sasang types were found. This review showed that meal size and eating rate were the crucial points in the investigation of eating behaviour by Sasang type. In the studies that reported a significant difference in the response rate to these items, a consistent outcome was that the TE type tended to have a rapid eating habit and prefer a large meal

size, whereas the SE type was likely to have a slow eating rate and prefer a small meal size. The SY type shared similarities in meal size and eating rate with both the TE and SE types. It has been demonstrated that variations in serotonin concentration in the human hypothalamus regulates eating behaviour and particularly meal size, which in turn has an impact on food intake and, consequently, body weight.<sup>33</sup> Based on this result, it is plausible to assume that because the TE type is likely to consume a large meal, their food intake may be higher than that of other Sasang types, especially the SE type. Several studies that used a recall questionnaire supported this assumption,<sup>27,34</sup> but it is out of the scope of this review.

Previous studies indicated that the speed of eating has an impact on food intake, especially on the amount of food eaten and satiety.<sup>35</sup> An intervention to decelerate the eating rate in high-speed eaters was effective in reducing the risk of eating disorders<sup>36</sup> and was considered to be a new tool to address obesity.<sup>37</sup> Because the present evaluations of meal size and eating rate in relationship to Sasang typology were subjective, future studies in that field should be conducted objectively with a reliable apparatus, such as a Mandometer®, which is a digital scale that records the amount of food consumed and the duration of the meal.<sup>36,37</sup>

Differences in eating rate and meal size may have a mutual interaction. Eating rapidly enhances the excess intake of food before the internal signals of satiation have an effect, consequently increasing meal size and overeating, resulting in energy disequilibrium and weight gain. Overweight and obese individuals require a higher level of energy intake and need to eat a large meal quickly to meet that demand.<sup>38</sup> Because the TE type is characterised by a susceptibility towards being overweight and obese, the aforementioned pattern may be the proper explanation for the physiological principles of this Sasang type. On the contrary, eating slowly can promote the secretion of anorexigenic peptides such as peptide YY and glucagon-like peptide-1, which enhance satiation and the termination of eating and consequently reduce the meal size.<sup>39</sup> Low energy intake levels have negative effects on weight gain, and consequently, a lower energy intake level is required. This eating pattern seems to be similar to the physiological principle of the SE type (Figure 2).

Appetite sensation (AS), which composes of hunger, satiety, and satiation, is an important component of eating behaviour in terms of eating initiation and termination. Studies that used a visual analogue scale (VAS) to assess AS found that AS may be a good predictor for total energy intake.<sup>40,41</sup> Although there were few studies involving this item in the present review, these studies revealed the same trend: the TE type may have strong appetite, whereas the SE type tended to have a poor appetite, and the SY type shared similarities with both TE and SE types.<sup>22-25</sup> However, this result needs to be confirmed by rigorous studies with reliable qualitative assessments such as a VAS.

Food preference refers to the desire to consume one food item over another. A recent study noted that a strong fat taste preference was related to fewer attempts to control food intake, and a strong sweet taste preference was linked to neuroticism, a personality trait susceptible to

obesity.<sup>42</sup> In the present review, the differences in sweet, spicy, fatty, and energy-dense food preferences across Sasang types were not clearly stated.

It is already known that irregularities in eating, including overeating, regular skipping breakfast, and irregular meal times, are risk factors for eating disorders such as binge eating.<sup>43</sup> The relevant studies revealed that the SE type seemed to be less inclined to overeat than the other Sasang types, whereas other aspects of eating regularity were comparable, which may be a reason for the low prevalence of overweight and obesity in the SE type.

Two studies in this review included questions about eating initiation,<sup>28,29</sup> which are comparable with those that appear in the domain of emotional eating. Jin *et al.* showed that the SE and SY types tended to start eating when they feel hungry, whereas the TE type was likely to eat for pleasure.<sup>28</sup> The influence of stress on eating was not consistently identified.<sup>28,29</sup> Because the eating initiation domain was the least explored in the relevant studies, it should be taken into account in further studies.

Although Shin *et al.* revealed that the Sasang types may differ in emotional eating and were comparable in eating disorders, this study contained selection bias, such as a small sample size, non-randomisation, and not controlling for BMI.<sup>30</sup>

The most important finding of this review is that there may be a distinction in eating behaviours, especially in eating rate, meal size, and regular appetite, between the TE type and the SE type; the SY type shared similarities with both the TE and SE types. Because the psychological approach initiated by Chae *et al.* can only distinguish the SY and SE types,<sup>20</sup> eating behaviour may appear as a promising approach to Sasang type determination. Because the prevalence of obesity is relatively high in the TE type, accompanied with a high incidence of metabolic disorders, understanding the distinctive manifestations and innate nature of this constitutional type may provide an insight into the essence of metabolic disorder-related diseases.

This review has several limitations. Because we cannot confirm the preciseness of the data regarding the variation in quality of the reviewed articles, the conclusions may be overestimated. In addition, because there were few studies that used a reliable eating behaviour inventory, we included every type of questionnaire, which may distort the overall picture. Because the relevant studies employed various types of questionnaires, such as a “Yes/No” questionnaire and 5-point and 100-point scale ratings, a meta-analysis cannot be performed to draw an explicit and solid conclusion. Although the findings based on unreliable surveys may remain a source of bias, they at least have provided an overview on the distinctive tendency in eating patterns across Sasang types and the practical need for further studies in this field. Another limitation of this review is the location bias because all relevant studies recruited only Koreans. Thus, the finding may not be generalised to other ethnic groups.

Future studies of eating behaviours should pay more attention to potential issues such as food preference, regularity of eating, and appetite sensation, whereas other common concerns and attitudes, such as eating rate and meal size, need to be assessed by more valid and reliable

quantitative assessments.

### Conclusion

The results of this systematic review suggest that, in contrast to the SE type, the TE type has eating behavioural characteristics related to the risk of being overweight and obese, including a rapid eating rate, large meal sizes, and a strong appetite.

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### AUTHOR DISCLOSURES

None of the authors has any conflict of interest.

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## Review

# Sasang types may differ in eating rate, meal size, and regular appetite: a systematic literature review

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## 四象不同型的人在食用速度、用餐分量和食慾方面有差別：系統性回顧分析

飲食行為或許和肥胖與代謝失調的盛行率漸增有關連。四象醫學是韓國的一種傳統醫學，根據外在表徵和先天本質(包括飲食行為)將人的體質分成四類型。本篇研究目的為廓清四象不同型的人之飲食行為，並對未來相關研究提出建議。從六個韓國和一個英國數據庫中檢索相關文獻。最後找到十篇相關研究文獻。將檢索出的資料歸類為：食物的喜好、食用速度、食用開始和結束、用餐分量、飲食規律、日常食慾、飲食失調及心理因素。食用速度和用餐分量是最被關注且在四象類型中最有差異的特點。太陰型的人之飲食行為似乎與肥胖攸關，包括吃得快、吃得多和食慾好，此特點與少陰人正好相反。少陽人與太陰人或少陰人各有部分相似。未來的研究應使用更可靠、客觀和可量化的評估工具，例如：三因子飲食行為量表或荷蘭飲食行為問卷。

**關鍵字：**四象傳統醫學、四象類型、飲食行為、食慾、文獻回顧