



## Questionnaire Survey of the Methods Used in Household *Doenjang* Production in Korea

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### Abstract

This study examined the methods used in household *doenjang* (Korean soybean paste) production. Nine hundred forty-three responses were obtained using a nationwide, questionnaire-based survey (2018-2019) with non-probabilistic snowballing sampling. Consistent with previous studies, the respondents were primarily over the age of 50 years (97.1%) and female (97.9%). In addition to soybeans, the most used ingredients were red pepper (85.8%) and charcoal (85.5%), which most respondents obtained through direct farming (50.4-59.9%). Seasonal production occurred later in the higher latitude regions (Gyeonggi-do, Gangwon-do, Chungcheong-do) ( $p < 0.01$ ), which have lower average temperatures, and the fermentation period was shorter in the lower latitude regions (Jeolla-do, Gyeongsang-do, Jeju-do) ( $p < 0.01$ ), which have higher average temperatures. There were no significant regional differences in the season when *doenjang* was made, with most production occurring during January and February (81.1%). Most respondents (71.3%) made *doenjang* using homemade *meju* (soybean block used as a starter) in a traditional way to allow the microorganisms to be naturally inoculated. These results could be used as a basis for future research on topics such as starter development, standardized production, and safety of household *doenjang*.

Key Words : *Doenjang*, *meju*, method, questionnaire, survey, household

### 1. Introduction

*Doenjang* (Korean soybean paste) is a traditional Korean food made by fermenting soybeans and supplemental ingredients to create various flavors. Korea is geographically surrounded by the sea to the east, west, and south, and mountain ranges to the north, making it difficult to transport goods. Thus, long-term food storage between harvests has historically been essential to survival, leading to the development of fermented foods such as *doenjang* (Oh et al. 2014). *Doenjang* is rich in isoflavones like genistein, daidzein, glycitein-6-O-glucoside, which are well known for their anticancer effects (Ravindranath et al. 2004); *doenjang* made with a longer fermentation period also has stronger anticancer effects (Jung et al. 2006). Antioxidant, anti-obesity, antidiabetic, and anti-hypertension properties have also been reported (Kwak et al. 2007; Kwon et al. 2010; Cha et al. 2013; Kim & Kim 2014).

In the Korean food code, *doenjang* is defined as a fermented food made from the incubation of bacteria, fungi, etc. on raw ingredients, primarily soybean, rice, barley, wheat or defatted soybean. *Doenjang* and traditional *doenjang* have been uniquely defined (MFDS 2018). The

*doenjang* process is generally divided into two steps: making *meju* (soybean block), a fermentation starter, and then fermenting *doenjang* by adding soybean, brine, etc. to the *meju*. Depending on its production method, *meju* is either traditional or improved; thus, *doenjang* made with traditional *meju* is called “traditional *doenjang*” and *doenjang* made with improved *meju* is called “improved *doenjang*” (Lee et al. 2019). Traditional *meju* is influenced by the microorganisms present in the surrounding environment (e.g., air, straw). Therefore, it is also possible that toxin-producing fungi in the air (e.g., *Aspergillus flavus*, *Aspergillus ochraceus*) may produce mycotoxin contaminants such as aflatoxin and ochratoxin (Kim et al. 2015). To reduce toxin contamination, factories have recently begun using an improved method to artificially inoculate starter which does not produce toxins, such as *Aspergillus oryzae*, along with rapid fermentation and mass production, while maintaining the *doenjang*'s taste and functionality (Lee et al. 2016).

Because research on *doenjang* production forms the basis for establishing its functionality, taste, reduction of harmful substances, etc, research on its production should include various sources (e.g., factories, households, the literature).

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Previous research on production methods of *doenjang* by Park et al. (2002) assessed *doenjang* making processes described in the literature (e.g., research reports, recipes, media reports) and used in factories, to establish a standardized process. This group divided *doenjang* into traditional and improved in their investigations of *doenjang* type, fermentation periods, ingredient mixing ratios, and *meju* ingredients. Moon & Lee (2001) studied *doenjang* consumption and production among housewives in Yangsan City. Using a questionnaire, they investigated intake frequency of *doenjang*, its production season, and the type of *meju* used according to age, education, and housing type. Han & Yu (2002) studied *doenjang* consumption and production among housewives in Seoul using a questionnaire. However, in that study, only the fermentation period of *doenjang* was considered, with emphasis on consumption (e.g., frequency of use, reasons for using *doenjang*) rather than how it is made (Han & Yu 2002).

Most research on the methods for making *doenjang* was published more than 10 years ago, and insufficient research has been conducted on the conditions under which household *doenjang* is made. In addition, most research on homemade *doenjang* has been limited to a specific region, while studies assessing the entire country have not been conducted. Therefore, we sought to investigate the regional patterns of household *doenjang* production and describe changes since previous studies were conducted, using a nationwide, questionnaire-based survey.

## II. Materials and Methods

### 1. Questionnaires

A questionnaire (IRB No. 1041078-201802-HR-022-01) was used to survey household techniques for making traditional *doenjang* across the country. A total of 1076 surveys were distributed, and 943 respondents' data were collected.

#### 1) Sampling design

The study was conducted during February 2018 and November 2019. The questionnaire was distributed to households in which *doenjang* is made in six Korean provinces: Gyeonggi provinces (GG), Gangwon provinces (GW), Chungcheong provinces (CC), Jeolla-do (JL), Gyeongsang provinces (GS), and Jeju provinces (JJ). The number of questionnaires by province was assigned considering the resident population of the six provinces (31.5% in GG,

1.9% in GW, 16.9% in CC, 16.4% in JL, 31.8% in GS, and 1.5% in JJ) which were included metropolitan cities (Seoul, Sejong, Daejeon, Gwangju, Daegu, Busan, Ulsan, etc.). (KOSTAT, 2016). Before administering a survey of this type, a list of households in which *doenjang* is made should be prepared. Because such a list for the entire country was practically impossible, the snowballing (non-probabilistic) sampling method was used, in which initial respondents recruit additional respondents.

#### 2) Questionnaire design

According to Paek et al. (2016), most people who make homemade *doenjang* are aged 60 years or older. Therefore, because it was estimated that a disproportionate number of respondents would be older adults, the questionnaire was conducted by individual personal interviews, with the snowballing method. The questions were designed to be easily understood and were divided into four sections: respondent information, raw ingredients (e.g., soybeans, peppers, etc.), making *meju*, and making *doenjang* <Table 1>.

In section one, respondent information included: age (R1), gender (R2), and area of residence (R3). In section two, raw ingredients included: supplemental ingredients (I1); salt types (I2); number of washings for soybean (I3), pepper (red pepper) (I4), charcoal (I5), and jujube (red date) (I6); purchase paths for soybean (I7), pepper (I8), charcoal (I9), and jujube (I10); storage locations for soybean (I11), pepper (I12), charcoal (I13), and jujube (I14); and storage periods for soybean (I15), pepper (I16), charcoal (I17), and jujube (I18). In section three, the methods for making *meju* included: type of soybean (Me1), production season (Me2), fermentation period (Me3), and fermentation location (Me4). In section four, the methods for making *doenjang* included: whether *meju* is purchased (D1), type of *meju* purchased (D2), whether *ssi-doenjang* (the very old *doenjang* that is added to make fresh *doenjang*, and maintains the *doenjang* as if it were passed through a certain taste) is used (D3), *ssi-doenjang* fermentation period (D4), number of *meju* washings (D5), *doenjang* production season (D6), *doenjang* fermentation period (D7), and *doenjang* fermentation location (D8).

### 2. Statistical analysis

The survey results were analyzed using SPSS version 20. Frequency analysis was used to develop descriptive statistics and a chi-square test ( $\chi^2$ ) was performed to identify regional differences.

<Table 1> Survey questions investigating the production of household *doenjang* (soybean paste)

Section	Questions	Abbreviation	Scale type
Respondent information	What is your age?	R1	Nominal
	What is your gender?	R2	Nominal
	Where is your residence?	R3	Nominal
Ingredients	What other ingredients do you use?	I1 <sup>1)</sup>	Nominal
	What kind of salt do you use?	I2	Nominal
	How many times do you wash soybeans?	I3	Ratio
	How many times do you wash red pepper?	I4	Ratio
	How many times do you wash charcoal?	I5	Ratio
	How many times do you wash jujube fruit?	I6	Ratio
	Where do you buy soybeans?	I7	Nominal
	Where do you buy red pepper?	I8	Nominal
	Where do you buy charcoal?	I9	Nominal
	Where do you buy jujube fruit?	I10	Nominal
	Where do you keep the soybeans?	I11	Nominal
	Where do you keep the red pepper?	I12	Nominal
	Where do you keep the charcoal?	I13	Nominal
	Where do you keep the jujube fruit?	I14	Nominal
	How long do you store the soybeans?	I15	Nominal
How long do you store the red pepper?	I16	Nominal	
How long do you store the charcoal?	I17	Nominal	
How long do you store the jujube fruit?	I18	Nominal	
Meju	What kind of soybeans do you use?	Me1	Nominal
	When do you make <i>meju</i> ?	Me2	Nominal
	How long do you ferment <i>meju</i> ?	Me3	Ratio
	Where do you ferment <i>meju</i> ?	Me4	Nominal
Doenjang	Do you buy <i>meju</i> ?	D1	Nominal
	What kind of <i>meju</i> do you buy?	D2	Nominal
	Do you use <i>ssi-doenjang</i> <sup>2)</sup> ?	D3	Nominal
	How long is the fermenting period of the <i>ssi-doenjang</i> you use?	D4	Ratio
	How many times do you wash <i>meju</i> ?	D5	Ratio
	When do you make <i>doenjang</i> ?	D6	Nominal
	How long do you ferment <i>doenjang</i> ?	D7	Ratio
	Where do you ferment <i>doenjang</i> ?	D8	Nominal

<sup>1)</sup>Multiple choice

<sup>2)</sup>*Ssi-doenjang*: The very old *doenjang* that is added to make fresh *doenjang*, and maintains the *doenjang* as if it were passed through a certain taste.

### III. Results and Discussion

#### 1. General information

##### 1) Respondent information

Respondents' age (R1), gender (R2), and area of residence (R3) characteristics are shown in <Table 2>. Most respondents (97.1%) were over the age of 50 years, consistent with previous surveys showing that not knowing how to make *doenjang* is highest among those in the 20-50-year age group

(Kim 2012; Peak et al. 2016). Those over age 70 years made up the largest proportion of this sample (55.5%, 503/907), followed by those in their 60s (25.9%, 235/907), 50s (15.7%, 142/907), and under 50s (2.9%, 27/907). Females made up 97.9% (890/909) of the sample and 2.1% (19/909) were male. Regional representation was 19.2% (181/943), 5.8% (55/943), 6.3% (59/943), 19.7% (186/943), 47.6% (449/943), and 1.4% (13/943) from GG, GW, CC, JL, GS, and JJ, respectively.

&lt;Table 2&gt; Respondent characteristics

Survey item	Number of respondents	Percentage (%)	
Age (years)	10-19	1	0.1
	20-29	9	1.0
	30-39	4	0.4
	40-49	13	1.4
	50-59	142	15.7
	60-69	235	25.9
	70 or over	503	55.5
	Total	907	100.0
Gender	Male	19	2.1
	Female	890	97.9
	Total	909	100.0
Residence	Gyeonggi province	181	19.2
	Gangwon-do	55	5.8
	Chungcheong-do	59	6.3
	Jeolla-do	186	19.7
	Gyeongsang-do	449	47.6
	Jeju-do	13	1.4
	Total	943	100.0

<sup>1)</sup>Total response of each questions was counted except for 'no response'

## 2. Raw ingredients

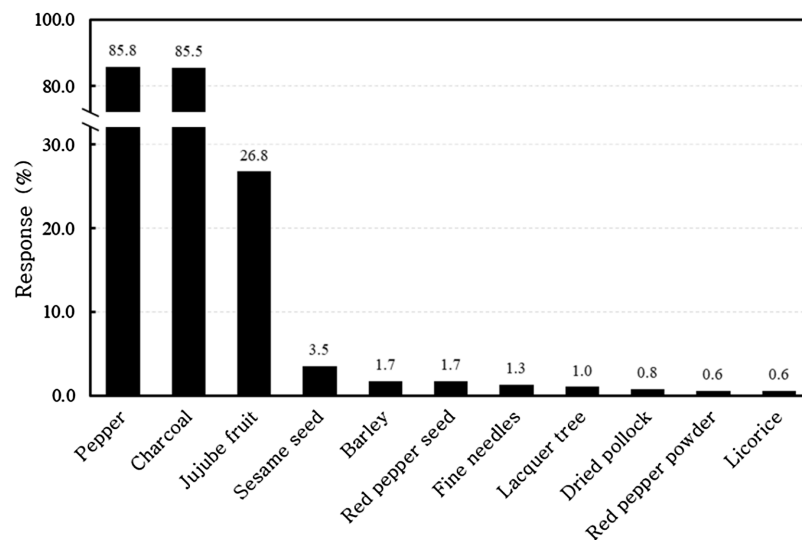
Among the supplemental ingredients (I1) (multiple choice), charcoal and red pepper were most common, with 85.8% (750/874) using "pepper" and 85.5% (747/874) using "charcoal"; 26.8% (234/874) endorsed using "jujube" and a relatively small number of respondents used "sesame seeds" (3.5%), "barley" (1.7%), "red pepper seeds" (1.7%), "pine needles" (1.3%), "lacquer tree" (1.0%), or "dried pollock" (0.8%), "red pepper powder" (0.6%), or "licorice" (0.6%)

(0.8%) (Fig. 1). That most of these participants (over 70%) used "charcoal" or "peppers" and 7-15% used jujube or sesame seeds is like a previous study of traditional *doenjang* methods (Park et al. 2002). Regarding the use of salt (I2), 97.0% (853/879) used "sun salt"; "refined salt" (2%) or "bamboo salt" (1%) were rarely used.

The number of washings of the most frequently used ingredients (I3-6) (soybean, pepper, charcoal, and jujube) was assessed. The largest proportion of respondents, 30.2% (208/688), wash soybean, the main ingredient, "4 or more than times." Supplemental ingredients pepper, charcoal, and jujube were each commonly washed "one time," 37.6% (258/687), 40.1% (264/659), and 42.6% (78/183), respectively.

Regarding the purchase path of soybean, pepper, and jujube (I7, 8, and 10), "farming" accounted for the largest portion: 58.5% (411/703), 50.4% (326/647), and 59.9% (112/187), respectively. At a "traditional market" was also endorsed: 33.3% (234/703), 37.1% (240/647), and 27.3% (51/187), respectively. Charcoal (I9) was more often purchased at a "traditional market" (41.8%) than "directly manufactured" (29.1%). About 58% of respondents make *doenjang* from directly grown soybean and about 33% purchase soybean. This finding is like a previous study showing that 50% of soybean was grown directly and about 26% was purchased (Kim et al. 2003).

Storage (I11-14) "in the storehouse" was most commonly endorsed by respondents, with 69.0% (455/659), 54.7% (346/633), 55.1% (332/603), and 46.2% (67/145) reporting this storage location for soybean, pepper, charcoal, and jujube, respectively. Soybean and charcoal, which can be stored long-term at room temperature, were also often stored



<Figure 1> Supplemental ingredients (aside from soybean) used to make *doenjang*.

&lt;Table 3&gt; Characteristics of soybean and supplemental ingredients

Survey item	Ingredients				
	Soybean	Pepper	Charcoal	Jujube fruit	
Washing times	0	22 (3.2)	95 (13.8)	154 (23.4)	30 (16.4)
	1	93 (13.5)	258 (37.6)	264 (40.1)	78 (42.6)
	2	170 (24.7)	168 (24.5)	122 (18.5)	36 (19.7)
	3	195 (28.3)	92 (13.4)	69 (10.5)	16 (8.7)
	4 or more	208 (30.2)	74 (10.8)	50 (7.6)	23 (12.6)
	Total	688 (100)	687 (100)	659 (100)	183 (100)
Purchase <sup>1)</sup>	T.M.	234 (33.3)	240 (37.1)	253 (41.8)	51 (27.3)
	S.M.	6 (0.9)	6 (0.9)	41 (6.8)	5 (2.7)
	S.S.M.	16 (2.3)	36 (5.6)	93 (15.4)	9 (4.8)
	O.M.	36 (5.1)	39 (6.0)	42 (6.9)	10 (5.3)
	Produce	411 (58.5)	326 (50.4)	176 (29.1)	112 (59.9)
	Total	703 (100)	647 (100)	605 (100)	187 (100)
Storage place	Balcony	134 (20.3)	129 (20.4)	207 (34.3)	22 (15.2)
	Refrigerator	17 (2.6)	113 (17.9)	8 (1.3)	32 (22.1)
	Storehouse	455 (69.0)	346 (54.7)	332 (55.1)	67 (46.2)
	Yard	53 (8.0)	45 (7.1)	56 (9.3)	24 (16.6)
	Total	659 (100)	633 (100)	603 (100)	145 (100)
Storage period	Immediately	107 (16.1)	129 (19.7)	238 (36.7)	26 (15.5)
	<1 week	159 (24.0)	167 (25.5)	194 (29.9)	46 (27.4)
	1–2 weeks	37 (5.6)	39 (5.9)	34 (5.2)	16 (9.5)
	2–3 weeks	43 (6.5)	27 (4.1)	24 (3.7)	2 (1.2)
	3–4 weeks	97 (14.6)	76 (11.6)	56 (8.6)	13 (7.7)
	>1 month	220 (33.2)	218 (33.2)	102 (15.7)	65 (38.7)
Total	663 (100)	656 (100)	648 (100)	168 (100)	

<sup>1)</sup>T.M.: Traditional market; S.M.: Super market; S.S.M.: Super-super market; O.M.: Organic market.

<sup>2)</sup>Total response of each questions was counted except for 'no response'

on the “balcony” rather than in “refrigerated” storage (2.6% and 1.3%, respectively). Pepper and jujube, which have the potential to rot if stored long-term at room temperature, were kept on the “balcony” (20.4, 15.2%) or “refrigerated” (17.9, 22.1%), respectively.

The storage period (I15-18) (i.e., between purchasing ingredients and making *doenjang*) was most commonly “more than one month” for soybeans, peppers, and jujubes: 33.2% (220/663), 33.2% (218/656), and 38.7% (65/168), respectively. Less common were “less than one week” (24.0, 25.5, 27.4%, respectively) and “immediate use” (16.1, 19.7, 15.5%, respectively). Because soybeans, peppers, and jujubes were usually obtained through “farming,” as described above, it is presumed that many respondents harvest and store these crops during “July-October” and then use them to make *meju* in November (i.e., more than one month later). In contrast, charcoal, (which is usually purchased in a traditional market, as described above) was “used immediately” by 36.7% (238/

648) of respondents.

### 3. *Meju* production

Next, regional differences in soybean type, production season, fermentation period, and fermentation location for making *meju* were investigated.

Among these respondents, 98.6% (634/643) reported using “Baektae” and 1.4% (9/643) used “Seoritae” to make *meju* (Me1), with no significant regional differences ( $\chi^2=5.989$ ,  $p>0.05$ ).

The most common *meju* season (Me2) was “November-December” (50.7%, 325/640), while 36.3% (232/640) made *meju* during “September-October.” This is consistent with previous studies reporting that traditional *meju* was produced from November to January (Lee et al. 1997). Significant seasonal differences were observed across regions ( $\chi^2=76.531$ ,  $p<0.01$ ). In GG, GW, and CC, which have relatively high latitudes, the reported season for making *meju* was

<Table 4> Household *meju* production in six Korean provinces

Survey item		GG	GW	CC	JL	GS	JJ	Total	$\chi^2$
Type of soybean	Baektae	120 (18.9)	50 (7.9)	49 (7.7)	159 (25.1)	247 (39.0)	9 (1.4)	634 (98.6)	5.989 <sup>n.s.</sup>
	Seoritae	4 (44.4)	0 (0.0)	1 (11.1)	3 (33.3)	1 (11.1)	0 (0.0)	9 (1.4)	
Production season	Jan.-Feb.	27 (32.5)	3 (3.6)	2 (2.4)	8 (9.6)	41 (49.4)	2 (2.4)	83 (13.0)	76.531**
	Sep.-Oct.	34 (14.7)	23 (10.3)	39 (16.8)	49 (21.1)	85 (36.6)	1 (0.4)	232 (36.3)	
	Nov.-Dec.	58 (17.8)	22 (6.8)	9 (2.8)	109 (33.5)	120 (36.9)	7 (2.2)	325 (50.7)	
Fermentation period	<1 week	2 (2.7)	0 (0.0)	0 (0.0)	33 (45.2)	38 (52.1)	0 (0.0)	73 (12.1)	123.648**
	1-2 weeks	22 (27.5)	1 (1.2)	4 (5.0)	20 (25.0)	32 (40.0)	1 (1.2)	80 (13.3)	
	2-4 weeks	21 (23.1)	3 (3.3)	12 (13.2)	14 (15.4)	36 (39.6)	5 (5.5)	91 (15.1)	
	1-3 months	51 (17.7)	24 (8.3)	25 (8.7)	88 (30.6)	96 (33.3)	4 (1.4)	288 (47.9)	
	>3 months	20 (29.0)	19 (27.5)	8 (11.6)	2 (2.9)	20 (29.0)	0 (0.0)	69 (11.5)	
Fermentation location	In the room	37 (22.8)	15 (9.3)	9 (5.6)	35 (21.6)	65 (40.1)	1 (0.6)	162 (28.5)	53.651**
	Yard	45 (15.3)	32 (10.9)	28 (9.5)	84 (28.6)	99 (33.7)	6 (2.0)	294 (51.7)	
	Balcony	29 (25.7)	1 (0.9)	4 (14.8)	4 (14.8)	18 (66.7)	0 (0.0)	113 (19.9)	

<sup>1)</sup>G, Gyeonggi-do; GW, Gangwon-do; CC, Chungcheong-do; JL, Jeolla-do; GS, Gyeongsang-do; JJ, Jeju-do

<sup>2)</sup>\*\*p<0.01; n.s. not significant

<sup>3)</sup>Total response of each questions was counted except for 'no response'

usually "September-October." In contrast, in JL and GS, which have lower latitudes, *meju* was typically made during "November-December."

The *meju* fermentation period (Me3) "1-3 months" was reported most frequently, by 47.9% (288/601); this is also like previous studies reporting a natural fermentation period of about one month (Lee et al. 1997; Park et al. 2002). This duration was followed by, "2-4 weeks" (15.1%), "1-2 weeks" (13.3%), and "less than one week" (12.1%). There was a significant regional difference in fermentation periods ( $\chi^2=123.648$ ,  $p<0.01$ ). In JL and GS, fermentation for "less than one week" was more common compared with other regions. However, because there were fewer than 10 JJ respondents, the statistical reliability of the results could not be ensured.

*Meju* fermentation usually took place (Me4) in the "yard (under the eaves)" (among 51.7%, 294/569), while "in the room" (28.5%, 162/569) and on a "balcony" (19.9%, 113/569) were less common. There was a significant regional difference in the *meju* fermentation location ( $\chi^2=53.651$ ,  $p<0.01$ ), although a significant pattern was not observed.

#### 4. *Doenjang* production

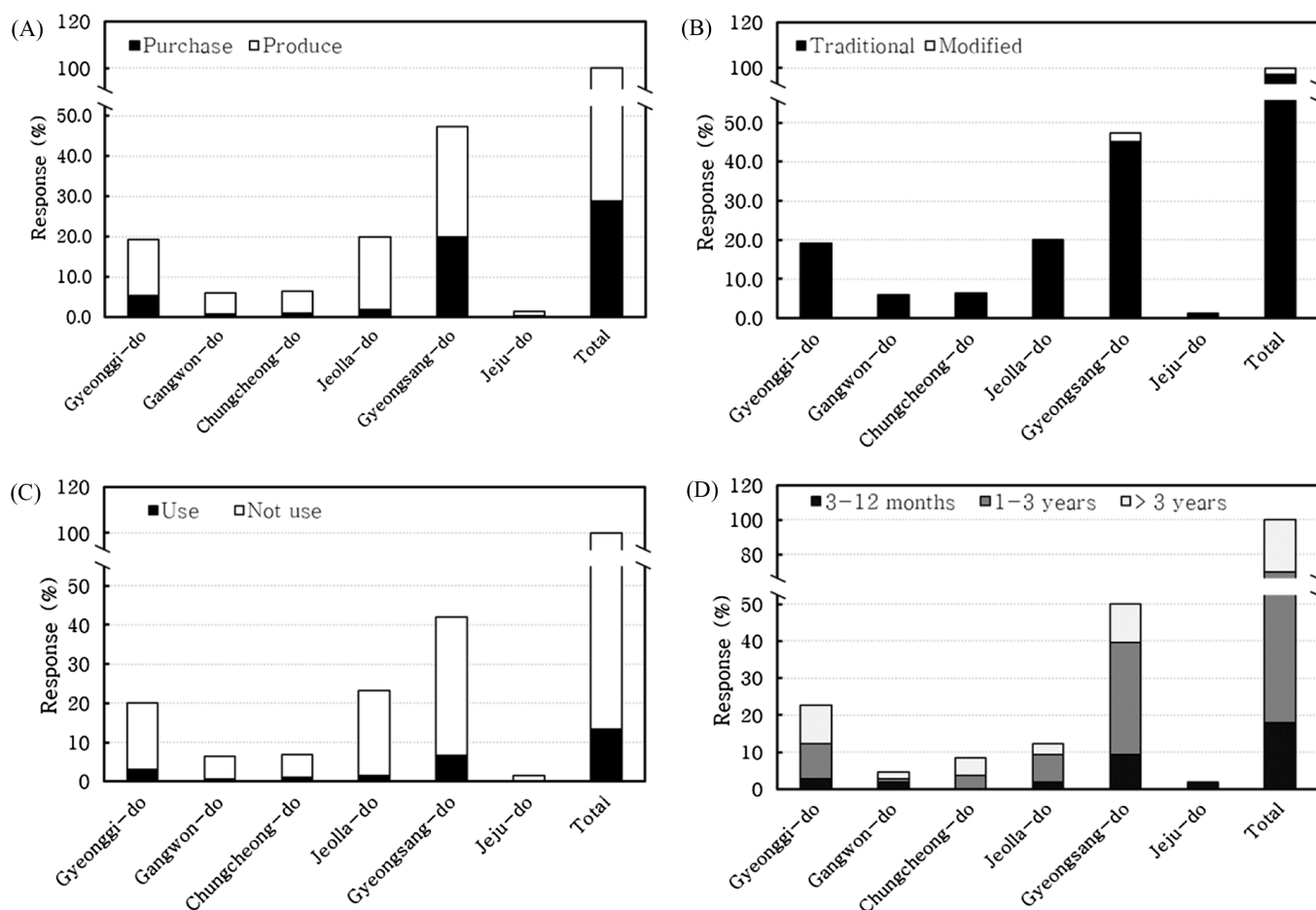
Finally, *doenjang* making methods, including whether *meju* is purchased, the type of *meju* used, whether *ssi-doenjang* is used, the *ssi-doenjang*'s degree of maturity, *meju* washings, *doenjang* season, and the fermentation period and location were explored.

Regarding whether *meju* is purchased (D1), 71.3% (650/912) of respondents reported using "homemade" *meju*, while

28.7% (262/912) indicated that it is "purchased." This is consistent with a 2001 study in which 86.8% of those surveyed use direct production and 13.2% purchase *meju* (Moon & Lee 2001), and with studies showing that the rate of purchasing *meju* is increasing (Han & Yu 2002; Peak et al. 2016). Among the types of *meju* (D2) used to make *doenjang*, 97.1% (886/912) of respondents used traditional *meju* and 2.9% (26/912) used improved *meju*. When "homemade" *meju* is used, all respondents prepared and used traditional *meju*. This replicates a previous finding: 88.9% of respondents surveyed by Moon & Lee (2001) used traditional *meju*. Thus, in the case of homemade *meju*, most households used traditional *meju* to make *doenjang*. There was a significant regional difference ( $\chi^2=12.104$ ,  $p<0.05$ ); however, because more than 25% of the items had an expected frequency 5, these data were not considered reliable.

To initiate *doenjang* production (D3), only 13% (106/796) reportedly "used *ssi-doenjang*" (i.e., the very old *doenjang* that is added to make fresh *doenjang*, and maintains the *doenjang* as if it were passed through a certain taste), while most did not. There was no significant regional difference for use of *ssi-doenjang*. Among those who use aged *ssi-doenjang* (D4), 52% reported using *doenjang* that had aged "1-3 years," 30% used *doenjang* aged "more than 3 years," and 18% used *doenjang* aged "3-12 months." There was a significant regional difference ( $\chi^2=20.930$ ,  $p<0.05$ ); however, because more than 25% of the items had an expected frequency 5, these data were not considered reliable.

*Meju* washings (D5) also varied, with 35.3% (305/863)



<Figure 2> *Meju* and *ssi-doenjang* used in household *doenjang* production. (A) Whether *meju* is purchased, (B) *Meju* type, (C) Whether *ssi-doenjang* is used, (D) Aging duration of *ssi-doenjang*

reporting washing “3 times,” followed by 29.1% (251/863) who wash “2 times.” There was significant regional variation in the number of washings ( $\chi^2=171.104$ ,  $p<0.01$ ). In GG, GW, and CC, most respondents reported that they wash “more than 4 times,” while in JL and GS, most respondents reported washing “3 times.”

Regarding seasonality (D6), 81.1% of respondents made *doenjang* during “January-February,” like previous studies reporting January production (Moon & Lee 2001; Park et al. 2002). Making *doenjang* during “March-April” (18.9%) was the second most common. There was significant regional variance in the production season ( $\chi^2=35.448$ ,  $p<0.01$ ), though no clear pattern was observed.

The most common fermentation durations (D7) were “3-12 months” (36.7%, 333/908) and “1-3 months” (33.3%, 302/908). This is like the “3 month” *doenjang* fermentation period most frequently reported in a standardization study of *doenjang* production methods (Park et al. 2002). There was a significant regional difference in fermentation periods ( $\chi^2=114.603$ ,  $p<0.01$ ). Distinctly longer compared with other

regions, respondents in JL and GW reported using a period of more than one year.

The usual fermentation sites (D8) were the “yard (under the eaves)” (65.1%, 554/851) and (26.7%, 227/851) “balcony.” There was a significant regional variation on this measure ( $\chi^2=94.880$ ,  $p<0.01$ ); however, because more than 25% of the items had an expected frequency 5, these data were not considered reliable.

#### IV. Summary and Conclusion

The methods used in household *doenjang* (Korean soybean paste) production were surveyed using a nationwide, questionnaire-based survey with non-probabilistic snowballing sampling.

Among 943 responses obtained, most household *doenjang* producers in this study were primarily over the age of 50 years (97.1%) and female (97.9%). Pepper (71.5%) and charcoal (75.7%) are the most frequently used supplemental ingredients for making *doenjang*. These respondents most commonly wash the soybean more than four times, whereas

<Table 5> Household *doenjang* production in six Korean provinces

Survey item	GG	GW	CC	JL	GS	JJ	Total	$\chi^2$	
Number of washings	1	41 (33.6)	14 (11.5)	18 (14.8)	6 (4.9)	39 (32.0)	4 (3.3)	122 (14.2)	171.102**
	2	33 (13.1)	12 (4.8)	11 (4.4)	56 (22.3)	139 (55.4)	0 (0.0)	251 (29.1)	
	3	44 (14.4)	9 (3.0)	3 (1.0)	63 (20.7)	183 (60.0)	3 (1.0)	305 (35.3)	
	4	53 (28.6)	16 (8.6)	24 (13.0)	57 (30.8)	33 (17.8)	2 (1.1)	185 (21.4)	
Production period	Jan.–Feb.	116 (16.3)	44 (6.2)	42 (5.9)	149 (21.0)	353 (49.6)	7 (1.0)	711 (77.8)	35.448**
	Mar.–Apr.	48 (28.9)	10 (6.0)	13 (7.8)	28 (16.9)	64 (38.6)	3 (1.8)	166 (18.2)	
	Other	5 (13.5)	0 (0.0)	0 (0.0)	9 (24.3)	20 (54.1)	3 (8.1)	37 (4.0)	
Fermentation period	<1 month	15 (45.5)	1 (3.0)	3 (9.1)	5 (15.2)	7 (21.2)	2 (6.1)	33 (3.6)	114.603**
	1–3 months	47 (15.6)	10 (3.3)	31 (10.3)	40 (13.2)	173 (57.3)	1 (0.3)	302 (33.3)	
	3–12 months	55 (16.5)	12 (3.6)	11 (3.3)	68 (20.4)	177 (53.2)	10 (3.0)	333 (36.7)	
	>1 year	49 (20.4)	30 (12.5)	10 (4.2)	72 (30.0)	79 (32.9)	0 (0.0)	240 (26.4)	
Fermentation location	In the room	25 (35.7)	1 (1.4)	2 (2.9)	9 (12.9)	32 (45.7)	1 (1.4)	70 (8.2)	94.88**
	Yard	100 (18.1)	45 (8.1)	41 (7.4)	146 (26.4)	215 (38.8)	7 (1.3)	554 (65.1)	
	Balcony	42 (18.5)	3 (1.3)	10 (4.4)	14 (6.2)	153 (67.4)	5 (2.2)	227 (26.7)	

<sup>1)</sup>GG, Gyeonggi-do; GW, Gangwon-do; CC, Chungcheong-do; JL, Jeolla-do; GS, Gyeongsang-do; JJ, Jeju-do

<sup>2)</sup>\*\*p<0.01

<sup>3)</sup>Total response of each questions was counted except for ‘no response’

they typically only wash supplemental ingredients (charcoal, pepper, and jujube) once. Most supplemental ingredients (excluding charcoal) are obtained through farming (50.4–59.9%). For *meju* making, soybean was usually Baektae (98%) and the production season was typically November–December (50.7%). In regions at relatively high latitudes (GG, GW, and CC), *meju* was made slightly later than in regions at lower latitudes (JL and GS) ( $\chi^2=76.531$ ,  $p<0.01$ ). The most common fermentation period lasted 1–3 months. In JL and GS, a fermentation period of less than one week was more common than in other regions. Fermentation usually occurs in the “yard (under the eaves)” (51.7%). These results indicate that because the mean temperature is lower, fermentation takes place slightly later at higher latitudes; likewise, fermentation periods at lower latitudes are shorter because mean temperatures are higher. Most respondents (71.3%) made *doenjang* using homemade *meju* (soybean block used as starter) in a traditional way to allow microorganisms to be naturally inoculated. However, the *ssi-doenjang*, the very old *doenjang* that is added to make fresh *doenjang* and maintains the *doenjang* as if it were passed through a certain taste, was not used in 86.5% of respondents. *Meju* was usually washed three times in the process of making *doenjang* (35.3%). The *doenjang* season is most often January–February (81.1%), after which it is fermented for “3–12 months” (36.7%). In GW and JL, the fermentation period is significantly longer than in other regions. Most *doenjang* fermentation occurred in the “yard (under the

eaves)” (65.1%).

These results could be used as a basis for future research on topics such as starter development, standardized production, and safety of household *doenjang*.

As a limitation of this study, since the survey targets are often elderly people, the accuracy of responses that depend on memory may be inferior, and the results of a survey conducted on Jeju were 13 cases, it is that the representativeness of the survey results may be insufficient.

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### Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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