



# Recent surge of ready meals in South Korea: can they be healthy alternatives?

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## Abstract

**Objective:** The present study analysed and compared the nutritional qualities of private brand (PB) and national brand (NB) ready meal (RM) products in South Korea.

**Design:** Data on RM products were collected via a food information database (EatSight) between February and May of 2017. A total of ninety-one PB products from a leading discount store chain in South Korea and 415 NB products were selected and divided into four main categories of 'refrigerated soups/stews', 'refrigerated noodles', 'frozen rice/noodles' and 'frozen dumplings'. Nutritional information was extracted for each product and analyses were performed to compare nutritional differences.

**Setting:** South Korea.

**Participants:** A total of 506 RM products.

**Results:** PB products explained the highest percentage of refrigerated RM products while NB products occupied the highest percentage of frozen ones. Notably, main PB and NB products showed evident nutritional problems. Among PB products, refrigerated soups/stews were significantly higher in energy, fat, Na, saturated fat and *trans*-fat. Likewise, in the case of NB products, frozen rice/noodles were significantly higher in Na and saturated fat. Particularly, overall Na contents were high. When the Korean guidance on traffic-light labelling was applied, a mere 0.2 and 5.9% of total RM products showed all four and three green lights, respectively. Meanwhile, those with no green lights accounted for 42.3%.

**Conclusions:** Although it is difficult to draw a definitive conclusion on the comparative nutritional qualities due to the lack of consistency in the results, the study suggests that there is room to improve the nutritional qualities of overall RM products.

## Keywords

Home meal replacement  
Convenience meal  
Nutritional quality  
Supermarket ready meal  
Discount store chains

According to the Korean Food Code, a 'ready meal' (RM) is a type of food that is manufactured, processed and packaged so that the consumer can eat it without or with minimal cooking<sup>(1)</sup>. It is also referred to as a 'home meal replacement (HMR)' or 'convenience meal'. Although it has only been about 10 years since the registration of RM in the Korean Food Code in 2007, the total market value produced by RM as of 2017 was about 3 trillion KRW, which is a more than threefold increase from 927.4 billion KRW in 2008<sup>(2)</sup>.

The domestic RM market in South Korea, which started in the early 1980s with an item in retort packaging called '3-Minute Curry'<sup>(2)</sup>, did not see significant growth at first

due to the prevalent local sentiment that every meal should be cooked from scratch at home. The rapid growth of RM seen today is thought to be driven by recent demographic and socio-economic changes, including increases in one-person and two-people households, female social activities, long-term economic depression and busy lifestyles<sup>(2–4)</sup>. In other words, consumers tend to pursue convenience in the food consumption process, including the planning, purchasing, preparing, cooking and cleaning up, thus increasing the demand for the quick-and-easy meals such as RM.

Discount store chains are the leading retail channel for foods including RM in South Korea. South Korean discount

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store chains have evolved dramatically since the first domestic discount store chains opened in 1993, quickly replacing the roles played by traditional market places and 'mom-and-pop' stores<sup>(5-7)</sup>. When the South Korean Government liberalized the retail market in 1996, giant foreign retailers such as Walmart and Carrefour entered South Korea<sup>(6,7)</sup>. As a result, a fierce competition market among domestic and foreign retailers was created. In 2006, the majority of foreign retailers withdrew from the market, primarily due to a failure to adjust to the tastes of South Korean consumers, who tended to use discount store chains primarily to purchase food items rather than dry goods<sup>(6,8)</sup>.

Since mid-2010, the market growth of discount store chains has been somewhat stunted due to diversification of online and offline distribution channels, governmental reinforcement of regular holidays for win-win growth with small- to medium-sized retailers, and market saturation<sup>(5-7)</sup>. Under these unfavourable market conditions, discount store chains have designated RM as a strategic solution to managerial issues and are focusing on increasing their sales<sup>(9,10)</sup>. This strategic decision was based on the fact that food items account for more than 50% of total sales of discount store chains in South Korea<sup>(11)</sup>. Furthermore, among the different types of food items, RM products are still in the early stages of development but expected to propel the future growth of food sales in discount store chains.

Currently, the Big 3 companies (Emart 30.4%, Homeplus 16.5%, Lotte Mart 15.2%) comprise 62.1% of the domestic market share of discount store chains<sup>(12)</sup> and have the highest proportion of RM sales in South Korea<sup>(13)</sup>. The RM sales share by product category, from the biggest to the smallest, is 48.8% for microwavable rice, 9.4% for soups/stews, 8.9% for porridge and 8.2% for curry<sup>(2)</sup>. In particular, the Big 3's private brand (PB) RM products are worth noting. A private brand, also referred to as a 'store brand', is manufactured and owned by a specific retailer. The 'store brand' is exclusively sold through the retailer's outlets. In contrast, a national brand (NB), also referred to as a 'manufacturer brand', is owned by a manufacturer and marketed and distributed nationally under a brand name<sup>(8,14)</sup>. Examples of local NB for RM include 'CJ Cheiljedang', 'Daesang' and 'Ottogi'. In recent years, as slower economic growth has increased consumers' price sensitivity, online retailing and convenience stores are rapidly emerging as new competitors<sup>(15,16)</sup>. To cope with this fast-changing retail environment, the Big 3 discount store chains have actively developed their PB RM products with the purpose of driving innovation, lowering prices and improving quality<sup>(17)</sup>. These have continually evolved with corresponding increases in sales. The PB sales share of the Big 3 discount store chains in South Korea is about 25%<sup>(18)</sup>, which suggests ample possibility for future growth when compared with countries with strong distribution markets, such as the UK or the USA, where PB sales share amounts to 50%<sup>(17)</sup>.

Processed foods, including RM, have become increasingly dominant in the human diet<sup>(20,21)</sup>. The biggest issue with such RM consumption is connected with nutrition-related health problems. PB products in particular have been a cause for concern, since they can affect the diet of the highly price-sensitive underprivileged because they are more cost-effective than NB products<sup>(14)</sup>. Studies on the nutritional quality of RM have so far been reported mainly in Western countries, centring around Europe and North America where the RM market developed early. These studies have consistently reported that RM products tended to be high in energy, fat, Na and sugar, and lack essential nutritional components such as vegetables<sup>(22-25)</sup>. For example, Kanzler *et al.*'s analysis of thirty-two RM main dishes concluded that they were not nutritionally balanced, containing high fat and low carbohydrate contents<sup>(22)</sup>. Another study, which analysed the nutritional contents of 166 PB RM products from British supermarkets, also showed that these products were in general high in saturated fat and Na<sup>(23)</sup>. Particularly, the amount of Na was found to be at least a third of the daily recommended intake or even exceeded it<sup>(24)</sup>. Special attention to these findings is required because obese or overweight consumers reportedly had a tendency to show a more positive attitude towards RM<sup>(26)</sup>. Furthermore, there is direct evidence of links between RM consumption and increased rates of overweight, obesity<sup>(19,27,28)</sup> and other non-communicable diseases<sup>(29-31)</sup>.

Although it is obvious that the influence of RM on our diet will only grow, there is limited research in Asian countries on the nutritional qualities of these products. Similarly, research on comparison of PB and NB products is mostly done from a marketing perspective. Hence, the current study as the first attempt in South Korea aimed to analyse and compare the nutritional qualities of PB RM products from a leading discount store chain and NB RM products in South Korea. The study results are expected to provide baseline information that can contribute to deriving points of interest for future directions in development for the RM market and to creating relevant food policies in South Korea. Furthermore, the study may also offer meaningful insight for other developing Asian countries that should prepare for similar phenomena.

## Methods

### Data collection

Data on RM products in South Korea were collected via the food information database (EatSight) of Daesang Information Technology between February and May of 2017. Daesang Information Technology is an IT service branch of Daesang Corporation, a representative Korean food corporation, which provides the total solution and

service, including data platforms, databases, middleware, applications and systems for the food and distribution industry. EatSight, a food information database by Daesang Information Technology, is the only data platform in Korea that provides basic information, ingredients and contents, nutritional facts, packaging materials and brand information for 40 000 processed food products<sup>(32)</sup>. The data of EatSight are regularly updated, managed through a thorough inspection process by data specialists in charge.

For PB RM products, data for Peacock<sup>(33)</sup>, a PB brand of the leading discount store chain (Emart), were extracted because this brand represents the number one domestic market share and is considered a reasonable proxy for current PB RM products in South Korea. Furthermore, Peacock was the only private RM brand for which full data were available in the database (EatSight). Then, all NB data of corresponding products were extracted to compare the nutritional differences. As a result, data on 601 RM products, including 105 PB and 496 NB, were collected. Basic information such as name, category, contents and brand name, as well as nutritional facts on nine nutrients (energy, carbohydrate, protein, fat, cholesterol, Na, sugar, saturated fat and *trans*-fat), was gathered for each product. All data extracted from EatSight were cross-checked by two researchers against the product packages, manufacturers' websites and online shopping channels. Products that did not provide enough information on the nine nutrients and/or lacked information on serving size were excluded. Ultimately, ninety-one PB and 415 NB products were included in the final analysis.

### Data analysis

As the collected data did not follow normal distribution, non-parametric methods were used throughout. Considering that the domestic RM market mostly comprises refrigerated or frozen processed foods<sup>(34)</sup>, the target products were categorized into four main categories of 'refrigerated soups/stews', 'refrigerated noodles', 'frozen rice/noodles' and 'frozen dumplings'. Previous studies have also shown that RM products in the four categories were most frequently purchased by Korean consumers<sup>(35,36)</sup>. In addition, both PB and NB RM products were available in the four categories, which enabled comparison of their nutritional differences. Nutritional differences between PB and NB products across the four categories were analysed using Fisher's exact test.

To enable adequate comparison, the weight of individual products written in kilograms was converted to grams. 'Amount per serving', a unit commonly used as reference in most nutrition labels of RM products in South Korea, was used to convert the values of nutritional contents. The nutritional values per serving of RM products were described using medians and interquartile ranges. Differences in median nutritional values per serving

**Table 1** Composition of national brand (NB) and private brand (PB) ready meal (RM) products, by category, in the sample of 506 RM products (PB, *n* 91; NB, *n* 415), South Korea, February–May 2017

Category	NB		PB		<i>P</i> value
	<i>n</i>	%	<i>n</i>	%	
Refrigerated products	Refrigerated soups/stews	47	11.3	48	52.7
	Refrigerated noodles	87	21.0	18	19.8
Frozen products	Frozen rice/noodles	77	18.6	10	11.0
	Frozen dumplings	204	49.2	15	16.5
Total		415	100.0	91	100.0

*P* value from Fisher's exact test; 5% level of significance was considered.

between PB and NB products in the four categories were explored using the Mann–Whitney test. In addition, median nutritional values per serving of RM products overall and within each category were compared with the current Korean guidance on traffic-light labelling; this guidance indicates ranges per serving for red/high, amber/medium and green/low contents of fat, saturated fat, sugar and Na<sup>(37)</sup>. The number of RM products rated as 'green/low' for one, two, three or all four of these target nutrients was also analysed and compared between PB and NB products. All analyses were performed using the statistical software package IBM SPSS Statistics version 23.0 and the level of significance was set at  $P < 0.05$ .

### Results

Among a total of 506 RM products, 415 were NB products (82.0%) and ninety-one were PB products (18.0%; Table 1). There was a significant difference in the proportion of PB and NB products by category ( $P < 0.001$ ). In PB products, the ratio of refrigerated to frozen products was 72.5–27.5%, while it was reversed to 32.3–67.8% in NB products. More specifically, in PB products, refrigerated soups/stews represented the highest proportion at 52.7% followed by refrigerated noodles (19.8%), frozen dumplings (16.5%) and frozen rice/noodles (11.0%). On the contrary, in NB products, the proportion of refrigerated soups/stews marked lowest at 11.3% followed by frozen rice/noodles (18.6%), refrigerated noodles (21.0%) and frozen dumplings (49.2%).

Table 2 shows the comparative nutritional contents of PB and NB products in each category. In the refrigerated soups/stews, PB products were significantly higher in energy, carbohydrate, protein, fat, Na, saturated fat and *trans*-fat than NB products; PB products were also higher in cholesterol and sugar, although the differences were not statistically significant. In the refrigerated noodles, PB products were significantly higher in cholesterol and

**Table 2** Comparison of the nutritional content, median and interquartile range (IQR), between national brand (NB) and private brand (PB) ready meal (RM) products, by category, in the sample of 506 RM products (PB, *n* 91; NB, *n* 415), South Korea, February–May 2017

Category	Nutrient	Nutritional content/serving						<i>P</i> value
		NB ( <i>n</i> 415)		PB ( <i>n</i> 91)		Total ( <i>n</i> 506)		
		Median	IQR	Median	IQR	Median	IQR	
Refrigerated soups/stews	Energy (kcal)*	95.0	55.0–155.0	142.5	96.3–241.5	120.0	75.0–192.0	0.001
	Carbohydrate (g)	5.0	2.0–10.0	11.0	7.0–18.3	9.0	4.0–14.0	<0.001
	Protein (g)	9.0	5.0–13.0	13.5	9.0–19.0	11.0	7.4–17.0	0.005
	Fat (g)	3.0	2.0–6.0	4.9	2.2–11.0	4.0	2.0–8.9	0.041
	Cholesterol (mg)	10.0	5.0–40.0	19.0	10.0–29.8	15.0	5.0–31.2	0.078
	Na (mg)	820.0	590.0–1210.0	1194.5	707.8–1615.8	980.0	632.0–1450.0	0.018
	Sugar (g)	1.0	0.0–3.0	2.0	0.0–4.0	1.0	0.0–4.0	0.062
	Saturated fat (g)	1.0	1.0–1.0	1.7	0.7–3.5	1.0	0.0–2.0	0.046
	<i>Trans</i> -fat (g)	0.0	0.0–0.0	0.0	0.0–0.0	0.0	0.0–0.0	0.024
	Refrigerated noodles	Energy (kcal)*	480.0	385.0–545.0	445.0	401.0–484.0	465.0	464.0–930.0
Carbohydrate (g)		96.0	76.0–110.0	94.5	78.3–99.0	96.0	76.5–107.5	0.449
Protein (g)		12.0	10.0–15.0	13.5	10.8–17.5	12.0	10.0–15.0	0.200
Fat (g)		4.0	2.0–8.0	4.1	1.6–6.0	4.0	2.0–7.5	0.798
Cholesterol (mg)		0.0	0.0–5.0	5.0	0.0–50.3	0.0	0.0–10.0	0.007
Na (mg)		1829.0	1180.0–2120.0	1889.0	1574.8–2460.3	1830.0	1295.0–2135.0	0.029
Sugar (g)		14.0	9.0–20.0	6.0	3.8–12.3	12.0	7.0–19.0	0.001
Saturated fat (g)		1.0	0.0–2.0	1.0	0.6–1.5	1.0	0.0–2.0	0.965
<i>Trans</i> -fat (g)		0.0	0.0–0.0	0.0	0.0–0.0	0.0	0.0–0.0	0.132
Frozen rice/noodles		Energy (kcal)*	390.0	345.0–432.5	370.0	352.5–388.8	385.0	345.0–425.0
	Carbohydrate (g)	66.0	61.0–76.0	68.0	62.8–69.8	66.0	61.0–75.0	0.684
	Protein (g)	11.0	8.0–13.0	10.0	8.0–12.5	11.0	8.0–13.0	0.789
	Fat (g)	8.0	6.0–11.0	8.0	5.8–8.3	8.0	6.0–11.0	0.181
	Cholesterol (mg)	20.0	6.5–38.5	15.0	5.0–17.5	15.0	5.0–37.0	0.389
	Na (mg)	790.0	635.0–960.0	560.0	355.0–695.0	780.0	580.0–930.0	0.004
	Sugar (g)	4.0	2.0–6.0	2.0	1.0–4.0	3.0	2.0–5.0	0.157
	Saturated fat (g)	2.0	2.0–3.0	1.1	0.8–1.1	2.0	1.1–3.0	<0.001
	<i>Trans</i> -fat (g)	0.0	0.0–0.0	0.0	0.0–0.0	0.0	0.0–0.0	0.228
	Frozen dumplings	Energy (kcal)*	280.0	250.0–310.0	275.0	219.0–705.0	280.0	250.0–310.0
Carbohydrate (g)		32.0	28.0–38.0	43.0	29.0–79.0	33.0	28.0–38.0	0.040
Protein (g)		11.0	9.0–12.0	10.0	9.0–28.0	11.0	9.0–12.0	0.871
Fat (g)		12.0	9.0–14.0	9.0	7.0–28.0	11.0	9.0–14.0	0.249
Cholesterol (mg)		10.0	6.0–15.0	10.0	10.0–50.0	10.0	7.0–15.0	0.269
Na (mg)		470.0	400.0–570.0	450.0	390.0–1115.0	470.0	400.0–570.0	0.761
Sugar (g)		3.0	2.0–4.0	6.0	3.0–10.0	3.0	2.0–4.0	0.001
Saturated fat (g)		4.0	3.0–5.0	2.7	2.0–8.0	4.0	3.0–5.0	0.079
<i>Trans</i> -fat (g)	0.0	0.0–0.0	0.0	0.0–0.0	0.0	0.0–0.0	0.025	

*P* value from Mann–Whitney test; 5% level of significance was considered.

\*To convert to kJ, multiply kcal values by 4.184.

Na than NB products. On the other hand, in the frozen rice/noodles, NB products were significantly higher in Na and saturated fat than PB products; NB products were also higher in energy, protein, cholesterol and sugar, although the differences were not statistically significant. In the frozen dumplings, NB products were significantly lower in carbohydrate and sugar compared with PB products; NB products were higher in energy, protein, fat, Na and saturated fat, but there were no statistically significant differences.

Shading in Table 3 reflects the current Korean guidance on traffic-light labelling<sup>(37)</sup>. Overall, only sugar and saturated fat for refrigerated soups/stews, and saturated fat for refrigerated noodles, were rated as green/low. In the case of Na, all categories except frozen dumplings were rated as red/high, which indicated its high content in

overall RM products. Frozen dumplings were rated as red/high for saturated fat with amber/medium for the other three nutrients.

Comparing the results between PB and NB products by category, saturated fat in refrigerated soups/stews showed green/low for NB products and red/high for PB products, while the other three nutrients were rated the same as amber/medium for fat, red/high for Na and green/low for sugar. In the case of refrigerated noodles, all four nutrients in PB and NB products showed the same coloured labelling as amber/medium for fat and sugar, red/high for Na and green/low for saturated fat. Sugar and saturated fat in frozen rice/noodles showed amber/medium for NB and green/low for PB products, while the other two nutrients were rated the same as amber/medium for fat and red/high for Na. Lastly, in the case of frozen dumplings, fat and

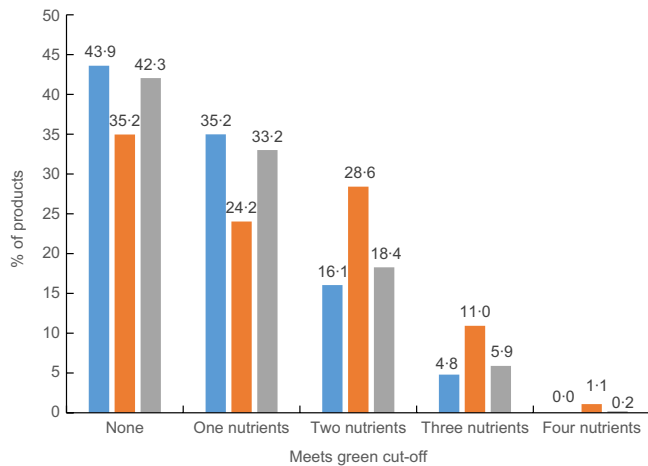


**Table 3** (colour online) Traffic-light assessment according to Korea Ministry of Food and Drug Safety (KFDA) guidelines<sup>(37)</sup> for national brand (NB) and private brand (PB) ready meal (RM) products, by category, in the sample of 506 RM products (PB, *n* 91; NB, *n* 415), South Korea, February–May 2017

Category	Nutrient	NB ( <i>n</i> 415)								PB ( <i>n</i> 91)								Total ( <i>n</i> 506)							
		Traffic light		Red		Amber		Green		Traffic light		Red		Amber		Green		Traffic light		Red		Amber		Green	
		Median	IQR	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	Median	IQR	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	Median	IQR	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Refrigerated soups/stews	Fat(g)	3.0	2.0–6.0	2	4.3	23	48.9	22	46.8	4.9	2.2–11.0	6	12.5	26	54.2	16	33.3	4.0	2.0–8.9	8	8.4	49	51.6	38	40.0
	Na (mg)	820.0	590.0–1210.0	34	72.3	12	25.5	1	2.1	1194.5	707.8–1615.8	41	85.4	6	12.5	1	2.1	980.0	632.0–1450.0	75	78.9	18	18.9	2	2.1
	Sugar (g)	1.0	0.0–3.0	0	0.0	13	27.7	34	72.3	2.0	0.0–4.0	2	4.2	19	39.6	27	56.3	1.0	0.0–4.0	2	2.1	32	33.7	61	64.2
	Saturated fat (g)	1.0	1.0–1.0	1	2.1	8	17.0	38	80.9	1.7	0.7–3.5	10	20.8	17	35.4	21	43.8	1.0	0.9–2.0	11	11.6	25	26.3	59	62.1
Refrigerated noodles	Fat (g)	4.0	2.0–8.0	7	8.0	42	48.3	38	43.7	4.1	1.6–6.0	2	11.1	9	50.0	7	38.9	4.0	2.0–7.5	9	8.6	51	48.6	45	42.9
	Na (mg)	1829.0	1180.0–2120.0	85	97.7	1	1.1	1	1.1	1889.0	1574.8–2460.3	18	100.0	0	0.0	0	0.0	1830.0	1295.0–2135.0	103	98.1	1	1.0	1	1.0
	Sugar(g)	14.0	9.0–20.0	33	37.9	53	60.9	1	1.1	6.0	3.8–12.3	1	5.6	15	83.3	2	11.1	12.0	7.0–19.0	34	32.4	68	64.8	3	2.9
	Saturated fat (g)	1.0	0.0–2.0	7	8.0	18	20.7	62	71.3	1.0	0.6–1.5	0	0.0	4	22.2	14	77.8	1.0	0.0–2.0	7	6.7	22	21.0	76	72.4
Frozen rice/noodles	Fat (g)	8.0	6.0–11.0	9	11.7	67	87.0	1	1.3	8.0	5.8–8.3	0	0.0	9	90.0	1	10.0	8.0	6.0–11.0	9	10.3	76	87.4	2	2.3
	Na (mg)	790.0	635.0–960.0	61	79.2	15	19.5	1	1.3	560.0	355.0–695.0	3	30.0	7	70.0	0	0.0	780.0	580.0–930.0	64	73.6	22	25.3	1	1.1
	Sugar (g)	4.0	2.0–6.0	0	0.0	49	63.6	28	36.4	2.0	1.0–4.0	0	0.0	4	40.0	6	60.0	3.0	2.0–5.0	0	0.0	53	60.9	34	39.1
	Saturated fat (g)	2.0	2.0–3.0	9	11.7	52	67.5	16	20.8	1.1	0.8–1.1	0	0.0	1	10.0	9	90.0	2.0	1.1–3.0	9	10.3	53	60.9	25	28.7
Frozen dumplings	Fat (g)	12.0	9.0–14.0	82	40.2	122	59.8	0	0.0	9.0	7.0–28.0	5	33.3	10	66.7	0	0.0	11.0	9.0–14.0	87	39.7	132	60.3	0	0.0
	Na (mg)	470.0	400.0–570.0	40	19.6	164	80.4	0	0.0	450.0	390.0–1115.0	4	26.7	11	73.3	0	0.0	470.0	400.0–570.0	44	20.1	175	79.9	0	0.0
	Sugar (g)	3.0	2.0–4.0	2	1.0	112	54.9	90	44.1	6.0	3.0–10.0	0	0.0	12	80.0	3	20.0	3.0	2.0–4.0	2	0.9	124	56.6	93	42.5
	Saturated fat (g)	4.0	3.0–5.0	89	43.6	109	53.4	6	2.9	2.7	2.0–8.0	4	26.7	10	66.7	1	6.7	4.0	3.0–5.0	93	42.5	119	54.3	7	3.2

IQR, interquartile range.

Shading reflects the nutritional evaluation per serving is according to current KFDA guidelines for meal replacements on front-of-pack nutrition labelling<sup>(37)</sup>; this is available only for fat, Na, sugar and saturated fat. Green traffic-light labelling refers to low, amber traffic-light labelling refers to medium and red traffic-light labelling refers high content of the nutrient. KFDA has recommended voluntary traffic-light labelling primarily on foods that children tend to prefer since 2011.



**Fig. 1** (colour online) Proportions of total (■), national brand (NB, ■) and private brand (PB, ■) ready meal (RM) products for which front-of-pack nutrients meet green traffic-light labelling cut-offs in the sample of 506 RM products (PB, *n* 91; NB, *n* 415), South Korea, February–May 2017. The nutritional evaluation per serving is according to current Korea Ministry of Food and Drug Safety guidelines on front-of-pack nutrition labelling<sup>(37)</sup>; this is available only for fat, sodium, sugar and saturated fat. Green traffic-light labelling refers to low, amber traffic-light labelling refers to medium and red traffic-light labelling refers high content of the nutrient

saturated fat were rated as red/high for NB products and amber/medium for PB products, while the other nutrients showed the same coloured labelling as amber/medium for Na and sugar.

Figure 1 describes the proportions of RM products for which front-of-pack nutrients meet green traffic-light labelling cut-offs. Products with no green lights for all four nutrients explained the highest proportions in both PB and NB products, comprising as much as 42.3% of the total RM products, 35.2% of PB products and 43.9% of NB products. In contrast, products with all four green lights accounted for only 0.2% of the total, 1.1% of PB products and 0.0% of NB products. More specifically, Table 4 shows the number of PB and NB RM products by category that were rated as green/low for one, two, three or all four target nutrients. In refrigerated soups/stews, no green lights for PB products were rated highest at 33.3%, while three green lights for NB products showed the highest percentage at 40.4%. In the case of refrigerated noodles, two green lights explained the highest proportions both for PB and NB products at 50.0 and 42.5%, respectively. In frozen rice/noodles, no green lights were rated highest at 53.2% for NB products, while two green lights showed the highest percentage at 60.0% for PB products. In the case of frozen dumplings, a total of 97.1% of NB products had no green lights (55.9%) or one green light (41.2%), and no green lights for PB products were also rated highest at 80.0%. In frozen rice/noodles and frozen dumplings, there were no PB and NB products with three or four green lights.

## Discussion

The present study analysed and compared the nutritional qualities of the PB and NB RM products in South Korea to provide baseline data for future directions in development for the RM market and to contribute to the creation of relevant policies. Although it is difficult to draw a definitive conclusion on the comparative nutritional qualities of PB and NB RM products due to the lack of consistency in the results, the current study suggests that there is room to improve the nutritional qualities of overall RM products with regard to harmful nutrients that should be limited in consumption.

Specifically, the results revealed that PB accounted for the highest percentage of refrigerated RM products while NB explained the highest percentage of frozen ones, and that their main products had more evident nutritional problems. Refrigerated soups/stews products seem to have become a leading PB RM category of discount chain stores in South Korea as they are evaluated to be competitive; a soup/stew is difficult to cook in small portions and takes time and effort to be prepared at home, although it is one of the basic elements comprising a traditional Korean meal structure. However, PB soups/stews products were significantly higher in energy, fat, Na, saturated fat and *trans*-fat than NB products. Likewise, in the case of frozen rice/noodles, NB products were significantly higher in Na and saturated fat than PB products. In particular, attention must be paid to Na, as regardless of PB and NB products, its amounts were quite high and even close to the daily recommended intake as in the case of refrigerated noodles. These nutritional problems of PB and NB RM products became more evident when Korean guidelines for traffic-light labelling were applied<sup>(37)</sup>.

The results of the present study support those of nationally representative dietary studies previously conducted in the USA<sup>(38)</sup>, Canada<sup>(39,40)</sup>, Brazil<sup>(41)</sup>, the UK<sup>(30)</sup>, France<sup>(42)</sup>, Sweden<sup>(19)</sup> and Spain<sup>(28,29)</sup>. These studies consistently showed that ultra-processed foods including RM were likely to be nutritionally imbalanced and that the increasing consumption of such foods could negatively affect dietary quality, thus impairing public health. More specifically, Monteiro *et al.*<sup>(41)</sup> showed that, in Brazil, the consumption of ultra-processed foods with generally poor nutrient profiles had been steadily replacing that of unprocessed or minimally processed foods, which could cause potential harmful effects to the overall quality of diet. Juul and Hemmingsson<sup>(19)</sup> revealed in Sweden that the consumption of ultra-processed foods of poor nutritional quality has increased markedly between 1960 and 2010. This mirrored the corresponding rise in adult obesity during the same period. Mendonça *et al.*<sup>(28)</sup>, in a prospective Spanish cohort study, suggested that the high consumption of ultra-processed foods was positively associated with a higher risk of being overweight and

**Table 4** Number of national brand (NB) and private brand (PB) ready meal (RM) products for which front-of-pack nutrients meet green traffic-light labelling cut-offs, by category, in the sample of 506 RM products (PB, *n* 91; NB, *n* 415), South Korea, February–May 2017

Category		None		One nutrient		Two nutrients		Three nutrients		Four nutrients		Total	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Refrigerated soups/stews	NB	3	6.4	11	23.4	14	29.8	19	40.4	0	0.0	47	100
	PB	16	33.3	11	22.9	10	20.8	10	20.8	1	2.1	48	100
Refrigerated noodles	NB	24	27.6	25	28.7	37	42.5	1	1.1	0	0.0	87	100
	PB	4	22.2	5	27.8	9	50.0	0	0.0	0	0.0	18	100
Frozen rice/noodles	NB	41	53.2	26	33.8	10	13.0	0	0.0	0	0.0	77	100
	PB	0	0.0	4	40.0	6	60.0	0	0.0	0	0.0	10	100
Frozen dumplings	NB	114	55.9	84	41.2	6	2.9	0	0.0	0	0.0	204	100
	PB	12	80.0	2	13.3	1	6.7	0	0.0	0	0.0	15	100

The nutritional evaluation per serving is according to current Korea Ministry of Food and Drug Safety guidelines on front-of-pack nutrition labelling<sup>(37)</sup>; this is available only for fat, Na, sugar and saturated fat. Green traffic-light labelling refers to low, amber traffic-light labelling refers to medium and red traffic-light labelling refers high content of the nutrient.

obese among middle-aged adult university graduates. Based on similar evidence, it has been proposed to make use of the proportion of ultra-processed foods in the diet, expressed as a percentage of total energy intake, as a new predictive indicator of general population diet quality<sup>(43)</sup>.

There is a strong consensus that RM products, which can provide mental and physical convenience, may no longer be a choice but rather a necessity, especially for working mothers in South Korea because the burden of household work including meal preparation is still higher for women due to the Confucian tradition. It is well understood that decreasing consumption of RM and increasing consumption of home-made meals from unprocessed or minimally processed foods would substantially improve the diet quality. However, in reality, a tired working parent who arrives home late in the evening to their hungry children may have neither the time nor the energy to prepare a meal. Therefore, despite awareness of health and nutritional problems caused by RM products, the parent may be forced to make such a choice. It is possible that the same would apply to single-person households, also comprising frequent consumers of RM in South Korea. Previous studies have also supported that consumers tend to undergo dilemmas about whether the trade-off between convenience and health benefits is worthwhile when purchasing a RM product<sup>(44,45)</sup>. Costa *et al.*<sup>(44)</sup> stated that 'ready meal consumption could be, to a large extent, dependent on the outcome of consumers' trade-offs between convenience aspects on one side and sensory- and health-related aspects on the other'. Olsen *et al.*<sup>(45)</sup> also showed that 'there were positive factors, such as satisfaction and pleasure, and negative factors, such as the feeling of moral obligation manifesting as guilt, that were concomitantly at work when making a choice to purchase a RM product'.

According to the ecological framework for conceptualizing multiple levels of food environments, food retailers belong to the physical environment where people make food choices, an environment that influences their choices<sup>(46)</sup>. A substantial part of the consumer's food

purchase experience is determined by food retailers, because the food products they decide to sell limit the choices consumers can make about what, where and how food is purchased. A review article by Hawkes<sup>(20)</sup> has also pointed out that food retailers' decisions about locations, product selections, prices, promotions and nutrition-related activities can affect consumers' food choices. In addition, that article has suggested that 'food retailers can make a more diverse diet available and accessible, but also that they can reduce the ability of marginalized populations to purchase a high-quality diet and encourage the consumption of highly-processed, energy-dense, and nutrient-poor foods'<sup>(20)</sup>. As Colls and Evans<sup>(47)</sup> have stated, retailers can make products and information available to consumers, thereafter giving them sole discretion to make the 'right choice'.

Therefore, food retailers including large discount store chains should refrain from compromising the nutritional qualities of PB RM products by focusing only on sales growth by meeting consumers' need for convenience, and shift their strategic focus from simply being 'providers of food' to being 'contributors to good health'. This is especially important in developing countries such as South Korea, where it has been suggested that the growth in large discount store chains and the processed foods they sell can lead to 'nutrition transition' to diets high in energy-dense and nutrient-poor foods<sup>(48)</sup>. In Europe, where the RM market driven by food retailers is prevalent, diverse nutrition activities (e.g. reformulating PB products to reduce harmful nutrients; developing healthier lines of PB products; promoting healthy eating; introducing easy-to-understand nutrition labels) have been implemented by retailers not as a simple commercial tactic but as a long-term health and wellness strategy<sup>(49,50)</sup>. Remnant and Adams<sup>(23)</sup> have also provided evidence that RM products could be a healthy alternative to home-made meals depending on the retailer's efforts; that is, their study revealed that it was possible to produce healthier RM and that improving the nutritional profile of RM did not



necessarily result in a retailers' cost increase which is generally passed on to consumers. Considering ample possibility for future growth of PB RM market in South Korea, it is imperative that local discount store chains make proactive efforts to utilize their PB RM products as a means for providing healthier food choices. Fortunately, as interest in health is growing rapidly in South Korea, movements to evolve the food market into a more health-conscious direction such as reduction of Na content have been reported<sup>(51)</sup>. Local discount store chains are required to take this as an opportunity to reformulate their PB RM products in a manner that considers both taste and nutritional quality, while still maintaining convenience. This would assist discount store chains to relieve negative prejudice regarding PB RM products and ensure their market competitiveness.

In addition to food retailers' voluntary efforts, relevant policy measures should be actively reviewed and undertaken. Acknowledging the need to improve public health, some countries have implemented global examples of public-private partnerships. These include the 'Food and Health Dialogue'<sup>(52)</sup> and its successor, the 'Healthy Food Partnership'<sup>(53)</sup>, in Australia; the 'Public Health Responsibility Deal'<sup>(54)</sup> in the UK; and the 'National Sodium Reduction Initiative'<sup>(55)</sup> and its expansion, the 'National Salt and Sugar Reduction Initiative'<sup>(56)</sup>, in the USA. Fundamentally, these public-private partnerships aim to work collaboratively across all levels of the food supply chain to make healthier food choices easier and more accessible, consequently improving general population diet quality. One of their common objectives is to empower food manufacturers or retailers to improve the nutritional profile of food products through reformulation, often in tandem with a front-of-pack labelling system. This reformulation using small and incremental changes to a food product is seemingly a 'health by stealth' approach. However, it can provide tremendous potential to improve the diet of a population in terms of scale and reach because, currently, a significant proportion of daily energy intake emanates from processed foods regardless of the income level of the country<sup>(21)</sup>. Previous studies have also highlighted that product reformulation, particularly when based on a government-led mandatory approach, can be an essential element in achieving population nutrient goals to prevent chronic diseases<sup>(57-60)</sup>. For example, mandatory reformulation contributed to a 3 g reduction in daily salt intake between 1979 and 2002 in Finland<sup>(61)</sup>, and to a 3.5% decrease in energy intake from saturated fats and a 5.5% increase from polyunsaturated fats in Mauritius between 1987 and 1992<sup>(62)</sup>. These changes resulted in positive public health outcomes in both cases<sup>(61,62)</sup>. The South Korean Government has also been implementing a Na reduction policy since 2012, through which public-private partnerships were built to promote product reformulation<sup>(51)</sup>. This policy was evaluated as successful thus far, leading to a 3 g reduction in

daily salt intake between 2012 and 2017<sup>(63)</sup>. However, it is limited to primarily targeting Na reduction from specific product categories, failing to include all the ranges of RM products. Therefore, it is required that the scope and reach of this policy should be further extended and strengthened, reflecting the current surge of the RM market in South Korea.

Lastly, what is more important than the efforts of retailers and the reinforcement of relevant policy measures is to strengthen food literacy among consumers and to eventually change their dietary behaviours. Food literacy is commonly defined as individuals' food-related knowledge, attitudes and skills enabling them to make informed choices about healthy food<sup>(64)</sup>. Individuals' food literacy level affects their food-related decisions, which ultimately affect their diet and health as well as the environment. Previous studies have shown that food literacy is strongly correlated with healthy eating or dietary habits, and that improving food literacy can contribute to building a virtuous circle within the food systems<sup>(65)</sup>. In addition, the need for convenience in choosing a food product is affected by lack of time, too much stress, limited food preparation skills and social norms<sup>(26,66-68)</sup>. Therefore, to improve consumers' food choices that too heavily rely on convenience, more practical guidelines that reflect these concerns are also required<sup>(67)</sup>. Therefore, future nutritional guidelines and suggestions must include not only what to eat but also how to fit those recommendations into busy daily lives, in order to induce more practical changes in consumers' dietary behaviours.

The present study is limited by the fact that it included PB RM products selected only from a leading discount store chain in South Korea. Nevertheless the chain is a market leader, representing the highest market share, and its PB RM products are evaluated as a reasonable proxy for the current RM market in South Korea. The study relied entirely on nutritional contents as stated on RM labels and did not attempt to verify their accuracy. In South Korea, nutritional contents on food labels are legally allowed to vary by 20%, considering fluctuations in the manufacturing processes<sup>(69)</sup>. Therefore, there is a possibility of errors in the nutritional values used in the current analyses. In addition, the present study was designed on a cross-sectional basis, which did not reflect time-related changes in product types and the nutritional contents of RM. Since the RM market has been growing dramatically over a relatively short period of time in South Korea, it is possible that both the product types and nutritional contents of PB and NB RM have been changed since data collection. Therefore, future studies should be conducted to include time-related changes in RM products, and to further analyse the potential impacts of these changes on dietary quality and public health in South Korea. Despite these study limitations, the current study is still expected to make a meaningful contribution because a substantial gap exists in the literature regarding





RM markets from a nutritional perspective in Asian countries, and the results can provide useful insights for other developing countries sharing similar concerns.

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