Exposure Assessment of Monosodium Glutamate in Prepared Foods with Frying, Sautéing, Grilling or Baking Process

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Abstract: Prepared foods generally contain glutamic acid which can be derived from raw materials or from the addition of monosodium glutamate (MSG) as a food additive. Consumption of prepared foods reached 650.3 g/capita/day in rural area (Bogor) and 710.8 g/capita/day in urban area (Jakarta) according to a previous study in 2014. Prepared foods can be processed by frying, sautéing, grilling, or baking with high temperatures more than 100 °C. This type of foods was consumed totally at 439.6 g/capita/day and 455.5 g/capita/day in urban and rural area, respectively, comprised 62% and 64% of total consumption of prepared food. The aim of this study was to determine MSG intake from the consumption of prepared foods processed under high temperatures. The samples were composite samples obtained from Jakarta or Bogor recently, representing 30 different menus. Prior to analysis, the samples were extracted with distilled water. The extracted glutamates were then analyzed using L-glutamic acid assay kit which then measured at 492 nm with a UV-Vis spectrophotometer Glutamic acid concentrations were converted to MSG concentrations by a factor of 169.11/147.13 because MSG in its crystal form contributed dominantly in the intake of glutamate, as informed by a previous study. By considering the Asian adult body weight of 57.7 kg as mentioned in a journal, MSG exposure in urban area (29.89 mg/kg bw/day) was higher than its exposure in rural area (21.04 mg/kg bw/day). When compared with the exposures of MSG from total prepared foods, calculated from the previous study by considering the same adult body weight and using the conversion factor, for urban 36.13 mg/kg bw/day and for rural 33.91 mg/kg bw/day, they reached 83% and 62% of the exposure. This give an insight that the high temperature-prepared foods were the main contributor to the MSG exposure from all prepared foods.

1 INTRODUCTION

Based on the Government Regulation (PP) of the Republic of Indonesia Number 28 of 2004 concerning Food Safety, Quality and Nutrition, prepared food is food and / or beverage that has been processed and ready to be served directly at the business location or outside the place of business on the basis of the order. Prepared food consumption in Bogor (rural area) was 650.33 g/capita/day or 79.63% of total consumption per person per day, while in Jakarta (urban area) was 710.75 g/capita/day or 86.29% of total consumption per person per day (Nuraida et al. 2014). The study shows that the amount of prepared food consumption in both rural and urban areas is large because respondents in both regions consumed prepared food more than 50% of total consumption per person per day. However, people in urban area tend to consume fast food more than rural communities. Among prepared foods, there are foods processed by frying, sautéing, grilling and baking. The food processing is known as the cooking process with temperatures higher than 100 ° C (Sundari et al. 2015).

People tend to like prepared food that is processed by frying, sautéing, grilling and baking. This can be inferred from the research of Nuraida et al. (2014) which shows that the people in urban and rural areas consumed more prepared foods that are processed by frying, sautéing, grilling and baking in the amount of 439.60 g/capita/day and 455.54 g/capita/day, namely 61.85% and 64.09% of total prepared food consumption. This is due to foods that are processed with the high temperatures found for frying, sautéing, grilling and baking, can undergo Maillard reaction which is important in the formation of aroma and taste components in processed foods (Nagodawithana

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1995). Maillard reaction products from peptides and sugars form strong umami and kokumi flavors in food (Liu et al. 2015).

The addition of monosodium glutamate (MSG) in crystal form to prepared food is often conducted in prepared food processing, both in rural and urban areas. This was revealed by a study on the exposure of glutamates from the consumption of seasonings and condiments. In urban area, 88.5% of the intake of free glutamate in urban area and 95.0% of the intake in rural area were come from the use of MSG in crystal form (Andarwulan et al 2011). MSG is a sodium salt of glutamic acid, which is an amino acid used as a flavor enhancer (Rodriguez et al. 2003). JECFA determined that MSG does not have a numerical ADI or it can be said that MSG has an "ADI not specified" (JECFA 2006). This is because JECFA concluded that total glutamate intake arising from its use at the level needed to achieve the desired technological effect and from an acceptable source in food did not represent a health hazard. This has been shown in a study (Walker and Lupien 2000). However, the EFSA panel has set the ADI for glutamate additives which is 30 mg/kg bw/day after re-evaluating the safety of glutamate additives (EFSA 2017).

Based on the previous study by Nuraida et al. (2014), exposure to free glutamate from prepared foods in urban area (Jakarta), 1813.96 mg/capita/day, was higher than in rural area (Bogor), 1702.37 mg/capita/day or if re-calculated as MSG by a factor of their molecular weights ratio, the exposures were 2084.95 mg/capita/day and 1956.69 mg/capita/day, respectively. These are lower than those in other studies. Research by Insawang et al. (2012) in six rural areas in Khon Kaen Province, Thailand showed a population MSG exposure of 3600 mg/capita/day. MSG exposure in China was 3800 mg/capita/day based on research in rural areas (Jiangyin, Taichang, Shuining, Jurong, Sihong, and Haimen) and urban areas in the capital cities of Nanjing and Xuzhou Prefecture in Jiangsu Province (Shi et al. 2010). Research in Hanoi, Thua Thien, and Ho Chi Minh, Vietnam shows MSG exposure in urban areas at 2300 mg/capita/day, while in rural areas at 2100 mg/capita/day (Hien et al. 2012). According to Henry-Unaeze (2017), Europe (United Kingdom) and Africa (Nigeria) data gave estimated daily MSG exposure of 600 and 560–1000 mg/capita/day, meanwhile in East and Southeast Asia, MSG exposures were 2-3 times higher than data reported in Europe; 1500–3000 mg/capita/day in Taiwan, 1100–1600 mg/capita/day in Japan and 1600–2300 mg/capita/day in South Korea.

This research was conducted to determine the contribution of prepared foods processed under high temperatures to MSG exposure from total prepared foods in the previous study (Nuraida et al. 2014). This study assumed that the amount of prepared food consumption in urban and rural populations was the same as the survey results by Nuraida et al. (2014), by considering the consumption of a specific prepared food in this current study was the same as that for a respective composite prepared food in the previous study. The concentrations of glutamate in prepared foods in this study, which were prepared by frying, sautéing, grilling and baking, were analyzed in foods from the current food sampling.

2 MATERIAL AND METHOD

2.1 Materials

The material used in this study were prepared foods and chemicals in the analytical kit for L-glutamic acid analysys (R-Biopharm, Germany). The foods were sampled from180 portions of foods bought from Bogor for rural area (90 portions) and Jakarta for urban area (90 portions), with the same 30 food menus determined for rural and urban. The food samples were composite samples. A composite sample made for each menu was a composite of foods collected from small, medium and large restaurants found in rural or urban. Food processor (Panasonic MK-5086M) was used to homogenize the composite samples. The tools used for the analysis of glutamic acid were glass wares, analytical balance (Kern&Sohn GmbH, Germany), micropipettes (20, 200, 1000 µL capacities) and tips, plastic cuvettes with 1.00 cm light path with 1.0 mL volume, and UV-Vis Shimadzu mini-1240 spectrophotometer (Shimadzu, Japan).

2.2 Prepared Food Consumption

The prepared food consumption data were secondary data obtained from a survey in urban (Jakarta) and rural (Bogor) areas conducted by Nuraida et al. (2014). The survey was performed a Food Frequency Questionnaire (FFQ) method with the number of respondents for urban and rural areas respectively 112 and 110 respondents. Prepared food in the study of Nuraida et al (2014) referred to composite food for each dish menu from three different restaurants (small, medium and large). The list of prepared foods mentioned in the study (Nuraida et al. 2014) were foods consumed by respondents purchased from outside the home or prepared by respondents at home according to the consumption survey result.

The types of prepared food consumed by respondents in rural and urban areas were basically the same, but had different amounts of per capita consumption. Respondents in the study conducted by Nuraida et al. (2014) were adult people who are in urban and rural areas with age categories from 19 years to more than 60 years old. Prepared food in the study was grouped into six categories namely fruits and vegetables, cereals and cereal products, bakery products, meat and meat products (including poultry), fish and fish products (including mollusc, crustacean, and echinoderm), as well as eggs and processed egg products. The total prepared food consumption in urban area (710.75 g/capita/day) was reported higher than in rural area (650.33 g/capita/day). However, only the last five groups were focused in this current study, due to the groups mentioned foods which were processed under high temperatures: frying, sautéing, grilling and baking. The types of food sampled and tested in this study consisted of 30 menus either for urban and rural areas, so that there were 60 composite food samples in total.

2.3 Food Sampling and Sample Preparation

Prepared foods that were selected as samples were included in the five food groups in the study conducted by Nuraida et al. (2014) with additional criteria to the purpose of the current research. Therefore, types of food processed by steaming and boiling were not sampled. There were 30 food menus from each area so that 60 composite samples were obtained. The total portions purchased were 180 portions, consisting of 90 portion for urban area and 90 portions for rural area. Portions for each menu were obtained from three different restaurants with their respective criteria, namely small, medium and large restaurants. Portions for urban area were obtained from 58 restaurants/stalls in Jakarta, and for rural area obtained from 56 restaurants/stalls in Bogor. Several samples were obtained from the same restaurant/stall so that one restaurant/stall could provide more than one menu. The sample homogenization was done by a food processor right after purchasing, or a day after purchasing if the food was stored in a freezer on the day of purchasing due to limited time for homogenization. Homogenized samples were packed in a plastic and then stored in a freezer of -20 °C prior to glutamic acid analysis.

2.4 Glutamic Acid Analysis in Food Samples

Food sample analysis consisted of sample extraction and L-glutamic acid analysis. The extraction was done for 2.0 g of sample after thawing overnight in a refrigerator, the sample weight was recorded in four decimals due to the use of an analytical balance. The weighed sample was transferred to a 150 mL beaker, then 20 mL of distilled water was added. The food sample and distilled water were mixed using a magnetic stirrer for 10 min. After that, the mixture was transferred to a 50 mL volumetric flask. The beaker used for mixing the sample and distilled water was rinsed with distilled water for 10–20 mL and transferred to the volumetric flask, then the volume in the volumetric flask was adjusted to 50 mL with distilled water. Then, the sample was filtered with Whatman filter paper no. 1 with vacuum filtration. The filtered sample solution was stored in a glass bottle in the refrigerator for 2 hours. The oil in the top layer of the solution was removed before the solution was transferred into a 2 mL vial. The tube containing the sample was covered with parafilm (3M, USA) and stored in a freezer at -20 °C. Each sample was extracted three times to get sample solutions in triplicate.

The glutamic acid analysis was done by using a L-glutamic acid assay kit (R-Biopharm) and following its procedure. The all solutions including sample solution were transferred into a cuvette using micropipettes. The procedure began from the addition of 120 µL Solution 1 (Potassium phosphate/ triethanolamine buffer, pH approximately 8.6; Triton X-100), followed by 40 µL Solution 2 (Lyophilizate, consisting of: diaphorase approximately 4 U; NAD at approximately 28 mg in 2.5 mL distilled water), 40 µL Solution 3 (Iodonitrotetrazolium chloride solution), and finally 40 µL sample or L-glutamic acid standard solution (Solution 5: 73 µg/mL of L-glutamic acid). A blank was done the same as the sample, but the sample was replaced with distilled water. Then, the mixture was added with distilled water as much as 400 µL and mixed for 2 minutes, then the absorbance was measured at a wavelength of 492 nm using a UV-Vis spectrophotometer. This absorbance is Absorbance 1 (A1). Then, 6.0 µL Solution 4 (Glutamate dehydrogenase solution at approximately 1080 U/1.2 mL) was added to the mixture and mixed for 15 minutes. This mixture was measured for absorption at a wavelength of 492 nm using a UV-Vis spectrophotometer and recorded as Absorbance 2 (A2). The measured absorbance was in the range of 0.100-0.700. Determination of the absorbance difference (A2-A1) was done for blank, standard and sample. The absorbance (ΔA) of sample or standard was calculated by subtracting (A2-A1) blank from (A2-A1) sample or (A2-A1) standard. The absorbance must be at least 0.100 absorbance units to achieve sufficiently precise result. Measurement of L-glutamic acid concentration in sample solution was carried out by calculating the ratio of ΔA sample to ΔA standard, multiplied by 73 µg/mL of L-glutamic acid. Finally, the glutamic acid concentration in the food sample was determined by multiplying the result with 50 mL of total sample solution, then dividing by the sample weight. Glutamic acid analysis in the sample was done in duplicate. For exposure assessment to MSG in food, MSG concentration in the sample was obtained by multiplying the glutamic acid concentration with a MSG to glutamic acid molecular weights ratio (169.11/147.13), assuming that glutamates were commonly found in the form of MSG in the food sample.

2.5 Exposure to MSG in Prepared Foods with High Temperature Processing

Exposure to MSG from prepared foods was conducted by deterministic method following Nuraida et al. (2014). The exposure was calculated by multiplying the consumption of each food menu with respective MSG concentration. This value was then divided by 57.7 kg according to the average body weight of an adult Asian population (Walpole et al. 2012) to report the exposure in µg/kg bw/day. Daily exposure to MSG, from the prepared foods with high temperature processing, was a sum of the exposure from each food sample.

3 RESULTS AND DISCUSSION

3.1 Prepared Food Consumption

Prepared food consumption data used in this study was obtained from the consumption data reported by Nuraida et al. (2014) under the category of dish menus. The consumption of prepared foods focused for the current study was summarized in Table 1. Prepared foods which were fried, sautéed, grilled, and baked, were the most consumed prepared foods both in urban and rural areas. This might be due to the higher preference to the types of food. People in urban area (Jakarta) consumed fried food, sautéed, grilled, and baked food at 61.85% while in rural areas

Table 1: Daily consumption of prepared foods processed by frying, sautéing, grilling and baking in urban (Jakarta) and rural (Bogor) areas (Nuraida *et al*. 2014).

Food groups	Prepared foods	Consumption (g/capita/day)	
		Urban	Rural
Cereals and their derived foods (cereals, legumes, tubers)			
Traditional snack food	Fried *pempek*	55.15	85.05
Tempe-based food	Fried tempe	40.99	39.92
Tofu-based food	Fried tofu	36.46	34.42
Fried rice	Fried rice with eggs	33.29	25.27
Legumes	Fried peanut crackers (*rempeyek*)	20.94	24.60
Noodles (wheat), fried	Fried noodles with eggs	13.94	10.10
Flour-based food	Fried *batagor* (with tapioca and wheat flour)	12.07	4.28
Oncom-based food	Fried oncom	4.12	16.35
Potato, fried	Fried potato	3.02	0.47
Sub total		**219.98**	**240.46**
Bakery			
Burger, hot dog	Beef burger	2.79	0.11
Pizza	Pizza with beef and chicken meat	1.75	0.07
Sub total		**4.54**	**0.18**
Meats and their derived foods (including chicken meat)			
Chicken, fried	Fried chicken with pre-boiling in spices,	31.21	19.47
	Fried chicken coated with flour	31.21	19.47
Chicken, grilled	Chicken satay	7.88	4.21
	Grilled chicken	7.88	4.21
	Grilled chicken steak	7.88	4.21
Fast food, beef meat derived food	Grilled beef steak	4.78	41.30
	Grilled beef meat	4.78	41.30
Chicken offal, fried	Fried chicken offal (liver, gizzard)	4.19	2.43
Beef meat, fried	Fried beef meat cooked with coconut milk (*empal*)	4.13	1.48
	Fried dry beef meat (*dendeng*)	4.13	1.48
Lamb meat, grilled	Lamb satay	2.6	0.36
Beef offal, fried	Fried beef offal (liver, lung)	2.03	0.19
Sub total		**56.82**	**69.44**

Table 1: Daily consumption of prepared foods processed by frying, sautéing, grilling and baking in urban (Jakarta) and rural (Bogor) areas (Nuraida *et al*. 2014) (cont.).

Food groups	Prepared foods	Consumption (g/capita/day)	
		Urban	Rural
Fishes and their derived foods (including mollusk, crustacean, echinoderm)			
Catched fish, non salted	Fried tuna	18.37	7.02
	Fried mackerel	18.37	7.02
Aquacultured fish	Grilled carp	17.50	8.78
	Fried carp	17.50	8.78
Crustacea, non salted	Fried shrimp	8.36	5.58
Catched fish, salted	Fried salted tuna	5.07	20.02
Sub total		**49.30**	**41.4**
Eggs and their derived foods			
Eggs, fried	Fried chicken egg	17.21	17.59
Total		**439.60**	**455.54**

at 64.09% of total prepared food consumption (Nuraida et al. 2014). The category of vegetables and fruits was not included in this study because vegetables and fruits were considered not to undergo processing with high temperatures such as frying, sautéing, grilling, and baking.

3.2 MSG Concentration in Prepared Food

The principle of glutamic acid determination in prepared food samples using the L-glutamic assay kit is by oxidative deamination of glutamic acid using nicotinamide adenine dinucleotide (NAD) to 2-oxoglutarate with the activity of the glutamic dehydrogenase enzyme (GIDH). The reaction is catalyzed by diaphorase and causes the formation of NADH to convert iodonitrotetrazolium chloride (INT) into a reddish formazan. After the reaction stops, the absorbance of the sample can be measured at a wavelength of 492 nm. The absorbance of the sample was compared to that of the glutamic acid standard (73 µg/mL).

MSG concentrations in prepared food collected from urban and rural areas can be seen in Table 2. All prepared food samples contained MSG, ranged from 152 to 14702 µg/g in urban and from 39 to 25630 µg/g

Table 2: MSG concentrations in prepared foods processed by frying, sautéing, grilling and baking which were sampled from Jakarta (urban) and Bogor (rural) in this current study.

Food groups	Prepared foods	MSG concentration* (µg/g)	
		Urban	Rural
Cereals and their derived foods (cereals, legumes, tubers)			
Traditional snack food	Fried *pempek*	4940	1499
Tempe-based food	Fried tempe	1609	39
Tofu-based food	Fried tofu	152	46
Fried rice	Fried rice with eggs	1701	7305
Legumes	Fried peanut crackers (*rempeyek*)	3889	483
Noodles (wheat), fried	Fried noodles with eggs	3735	14531
Flour-based food	Fried *batagor* (with tapioca and wheat flour)	13078	5039
Oncom-based food	Fried oncom	9230	6034
Potato, fried	Fried potato	1119	598
Mean		**4384**	**3952**
Bakery			
Burger, hot dog	Beef burger	963	140
Pizza	Pizza with beef and chicken meat	988	851
Mean		**976**	**496**
Meats and their derived foods (including chicken meat)			
Chicken, fried	Fried chicken with pre-boiling in spices,	13233	3148
	Fried chicken coated with flour	3195	8670
Chicken, grilled	Chicken satay	887	243
	Grilled chicken	282	1901
	Grilled chicken steak	1690	2088
Fast food, beef meat derived food	Grilled beef steak	3535	119
	Grilled beef meat	1173	6000
Chicken offal, fried	Fried chicken offal (liver, gizzard)	4850	9161
Beef meat, fried	Fried beef meat cooked with coconut milk (*empal*)	1230	1598
	Fried dry beef meat (*dendeng*)	7323	25630
Lamb meat, grilled	Lamb satay	667	30
Beef offal, fried	Fried beef offal (liver, lung)	2580	2495
Mean		**3387**	**5090**

Table 2: MSG concentrations in prepared foods processed by frying, sautéing, grilling and baking which were sampled from Jakarta (urban) and Bogor (rural) in this current study (cont.).

Food groups	Prepared foods	MSG concentration* (µg/g)	
		Urban	Rural
Fishes and their derived foods (including mollusk, crustacean, echinoderm)			
Catched fish, non salted	Fried tuna	3575	609
	Fried mackerel	4460	552
Aquacultured fish	Grilled carp	2412	314
	Fried carp	900	2368
Crustacea, non salted	Fried shrimp	4885	1127
Catched fish, salted	Fried salted tuna	14702	701
Mean		**5156**	**945**
Eggs and their derived foods			
Eggs, fried	Fried chicken egg	2650	218

in rural area. However, MSG concentrations in food samples from rural area tend to be lower than those in urban area, except for those of meat and derived food. The highest MSG concentrations were found in different samples, fried salted tuna from urban and fried dry beef meat from rural area. The lowest MSG concentrations were found in fried tofu from urban and fried tempe from rural area. This can affect MSG exposure in urban and rural areas.

3.3 Exposure to MSG in Prepared Foods Processed under High Temperatures

Exposure to MSG is presented in Table 3. Estimated daily exposure to MSG from prepared food processed under high temperatures for respondents in urban area was 29890 µg/kg bw/day greater than in rural area which was 21039 µg/kg bw/day. If stated per capita, they were 1724.7 and 1214.0 mg/day for urban and rural area respectively. It can be said that MSG exposure in urban area was 42% or almost 1.5 times higher than that in rural area. This is because prepared foods in urban area were to contain higher MSG levels. The level of food consumption can also affect the exposure of MSG. However, the level of consumption of prepared food in urban area was slightly lower than the level of consumption in rural area, thus it did not significantly affect the MSG exposure.

Cereals and their derived foods contributed dominantly to MSG exposure, followed by meats and their derived foods, fishes and their derived foods, eggs and and their derived foods, and finally bakery products. This is in consistent with the research conducted by Nuraida et al. (2014) that cereals and their derived foods contributed dominantly to free glutamate exposure.

When data from previous study (Nuraida et al. 2014) was calculated by taking into account an averaged adult body weight in Asia of 57.7 kg, and then calculated as MSG exposures from previously free glutamate exposures, the exposures from total prepared foods were 36134 µg/kg bw/day in urban, and 33911 µg/kg bw/day in rural. If stated per capita, they were 2084.9 and 1956.7 mg/day, respectively. The above mentioned exposures for prepared foods with processing at high temperatures, were representing 83% and 62% of the MSG exposures from total prepared foods in urban and rural areas, respectively. These percentages show that the large contribution of MSG exposure from prepared food was come from those of fried, sautéed, grilled, and baked prepared foods.

Table 3: Estimated daily exposure to MSG from prepared foods processed under high temperatures for respondents in urban and rural areas.

Food groups	Prepared foods	Exposure to MSG (µg/kg bw/day)	
		Urban	Rural
Cereals and their derived foods (cereals, legumes, tubers)			
Traditional snack food	Fried *pempek*	4721	2209
Tempe-based food	Fried tempe	1143	27
Tofu-based food	Fried tofu	96	27
Fried rice	Fried rice with eggs	981	3199
Legumes	Fried peanut crackers (*rempeyek*)	1411	206
Noodles (wheat), fried	Fried noodles with eggs	902	2544
Flour-based food	Fried *batagor* (with tapioca and wheat flour)	2736	374
Oncom-based food	Fried oncom	659	1710
Potato, fried	Fried potato	59	5
Sub total		**12709**	**10301**

Table 3: Estimated daily exposure to MSG from prepared foods processed under high temperatures for respondents in urban and rural areas (cont.).

Food groups	Prepared foods	Exposure to MSG (µg/kg bw/day)	
		Urban	Rural
Bakery			
Burger, hot dog	Beef burger	47	0
Pizza	Pizza with beef and chicken meat	30	1
Sub total		**77**	**1**
Meats and their derived foods (including chicken meat)			
Chicken, fried	Fried chicken with pre-boiling in spices,	7158	1062
	Fried chicken coated with flour	1728	2925
Chicken, grilled	Chicken satay	121	18
	Grilled chicken	39	139
	Grilled chicken steak	231	152
Fast food, beef meat derived food	Grilled beef steak	293	85
	Grilled beef meat	97	4295
Chicken offal, fried	Fried chicken offal (liver, gizzard)	352	386
Beef meat, fried	Fried beef meat cooked with coconut milk (*empal*)	88	41
	Fried dry beef meat (*dendeng*)	524	657
Lamb meat, grilled	Lamb satay	30	0
Beef offal, fried	Fried beef offal (liver, lung)	91	8
Sub total		**10752**	**9769**
Fishes and their derived foods (including mollusk, crustacean, echinoderm)			
Catched fish, non salted	Fried tuna	1138	74
	Fried mackerel	1420	67
Aquacultured fish	Grilled carp	732	48
	Fried carp	273	360
Crustacea, non salted	Fried shrimp	708	109
Catched fish, salted	Fried salted tuna	1292	243
Sub total		**5562**	**902**
Eggs and their derived foods			
Eggs, fried	Fried chicken egg	791	67
Estimated Daily Exposure		**29890**	**21039**

4 CONCLUSIONS

All prepared foods processed with high temperatures, sampled from urban and rural areas in this current study, were containing MSG reached up to 2.56% wet weight. The estimated daily exposures to MSG from the prepared foods for respondents in rural, 21039 µg/kg bw/day, lower than in urban, 29890 µg/kg bw/day. These exposures accounted more than 60% of the MSG exposures from total prepared foods, calculated from the previous study. This percentage shows the large contribution of the specific prepared foods processed under high temperatures to the exposure of MSG from total prepared foods.

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