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## **The Cause and Effect Analysis of the Melamine Incident in China**

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### **ABSTRACT**

Present study aimed at discovering the causes and effects of the melamine incident that shook the whole of China. Mainly descriptive statistics, such as average, mode, dispersion, association were used in the study. The result showed that the melamine incidence caused the reduction in the domestic production of dairy products in China and consequently surge in the import of dairy products. Export of dairy products has decreased and many dairy firms incurred financial losses. The major causes for such incidence were the low-income consumers, market failure due to asymmetric information and lack of government supervision. Present study pointed out that core of food safety problem in China lies in the demand for cheap food due to low afford ability of low-income consumers.

**Key words:** Melamine incident, inequality in dairy consumption, low-income consumers, asymmetric information, government supervision

### **INTRODUCTION**

Melamine incident occurred in 2008, China. It has brought many negative consequences in the health of infants and has instigated social unrest in China. An increased incidence of kidney stones and renal failure among infants had been publicly reported in China beginning in early September 2008.

This incident has badly affected the reputation of Chinese foods in the international market and specifically has affected the export of dairy products. Thus, it is very important to analyze the causes and effects of melamine incidence in China that would shade some lights on present situation and provides a future course of actions.

The government investigation showed that 22 manufacturers of powdered infant formula were selling melamine-contaminated products. The products of well-known companies such as Mengniu, Yili and Bright were among them. The incident first found in Sanlu group which is the biggest milk powder processing company in China. Sanlu's milk powder ranked first in the milk powder market, capturing 18% of the Chinese market share for 15 consecutive years of the company's 50 years history. Annual sales reached 10,016 million yuan in 2007. On December, 2008, Sanlu Group received a bankruptcy order from the court of Hebei province for the incident in which numerous infants suffered from kidney stones due to the consumption of melamine-contaminated milk products and formally went into bankruptcy ([http://news.xinhuanet.com/newscenter/2008-09/12/content\\_9935963.htm](http://news.xinhuanet.com/newscenter/2008-09/12/content_9935963.htm)).

Due to the impact of the melamine incident, the public trust of food containing milk was lost and concern for the food safety has risen. The event also influenced the consumption habits of people. General public shifts from milk to the soymilk. Due to the impact of the melamine incident, dairy production in China decreased although, it had expanded rapidly every year up to 2008. Dairy

production in China in 2009 was 36.5 million tons, decreasing 3.6% from the previous year (National Bureau of Statistics of China, 2008).

Consumers who refrain from purchasing domestic dairy products increased from 40 to 60% due to the event. On the other hand, imported dairy products become popular and the import of dairy products has increased greatly. The share of imported milk powder in China's domestic market rose from 70 to 85% in April, 2010 (General Administration of Customs of China, 2010).

Some of the past researcher has analyzed biomedical and chemical factors of the contaminants in dairy products. Gh. Jahed Khaniki (2007) mentioned contaminants in cow's milk and dairy products cause by accidents, carelessness and overzealous use of antibiotics. Prejit-Nanu and Latha (2007) mentioned milk was contaminated on pooling and after pasteurization process. Nasr *et al.* (2007) mentioned serious heavy metals pollution on milk in Gharbia Governorate in Egypt. Ghazi *et al.* (2010) mentioned milk was contaminated by the poor hygienic practices and health conditions of animal. Nanu *et al.* (2007) and Prejit-Nanu and Latha (2007) pointed out strict hygiene and health education, healthy animals under good hygienic conditions, hygienic practices to reduce contaminants in milk and dairy products.

However, some of the past researcher has analyzed the socio-economic factors responsible for melamine contamination. Researcher like Kongli (2009), Takarabe and Osamu (2009) mentioned that it is difficult for the dairy products processing company, dairy collection broker (milking station) and small dairy farming to perform quality control. Thus, the main reason for contamination is low supervision due to long market chain. He (2009) also indicated that the reason for the low quality was particularly due to companies objective of making high profit from the milk business. Before the melamine incident, China's dairy market was in the early stage of mass production which led to the sacrifice of quality due to the severe price competition. Apart from this, competition for the acquisition of raw milk has been intensified by many dairy companies (Kongli, 2009). The price of imported milk powder has been soaring since 2007. Thus, most of the milk manufacturers began to scramble for the domestic raw milk due to low price. Because the raw milk supply did not surpass increasing demand, the low quality of raw milk was overlooked Cheng-qing *et al.* (2009). Similarly, Tao and Chang (2010), Cheng-qing *et al.* (2009), Liu and Wang (2010) and Chen (2010) pointed out that there were existing problems on the law and regulation system, government supervision mechanism, detection capability and quality standard system. However, the past studies have not focused on the other probable factors like afford ability of consumers, poverty and income inequality in China, information system that could be the root cause for such incidence. In this context, this study was carried out to analyze the effect and causes of melamine incidence in China.

## **MATERIALS AND METHODS**

An exploratory survey of different concerned stakeholders was carried out in 2009. Present study has used the data from different sources, as there are no independent statistics for this incidence. For the national level data, this study utilized a secondary data published by government which includes year books published by different government offices like China Food Association, 2008; China Dairy Industry Association, 2009; National Bureau of Statistics of China, 2009a. Information on income, annual production and population were taken from the online database of National Bureau of Statistics of China, 2008. Similarly, the export figure was taken from the General Administration of Customs of China, 2010. Information on the list of companies, in which melamine contamination was discovered, was referenced from the General Administration

of Quality Supervision Inspection and Quarantine of China 2008. Data of dairy firms were from the Ministry of Industry and Information Technology of China, 2008. Information on the deaths and patients of infants was from the Ministry of Health of China, 2008. As there were no direct statistics on each province, articles published on government website were also used. For the data of private companies, this study utilized the data from the company website and annual reports.

**Statistical analysis:** In this study mainly descriptive statistics, such as average, mode, dispersion and association were used. A common Microsoft excel was used for this purpose. To analyze the effect, three issues were considered namely effect on consumption, effect on domestic dairy firms and effects on export of dairy products. A general descriptive statistics and graphical methods were used to see the effect on these three aspects. Similarly, to analyze the cause of the incidence, descriptive statistics with a graphical method was used.

## RESULTS AND DISCUSSION

**The melamine incident:** To reduce cost, intermediaries diluted milk with water but the numerical value of the protein content did not pass quality inspections. In China, commonly used methods of protein analysis do not distinguish whether nitrogen is from protein or non-protein sources. Melamine is industrial waste. The addition of melamine can cause a misleadingly high protein reading. Because of companies and individuals who are driven by economic interests, melamine came to be sold to food companies instead of being treated as industrial waste. In the melamine incident, investigations showed that melamine had been deliberately added to the diluted raw milk to boost its apparent protein content. Table 1 presents the details that show how the incident occurred in China. As the incident was first occurred in Sanlu group, the detail events are focused on Sanlu group.

### Effect of melamine incident

**Effect on dairy firms:** After the incident, the Chinese dairy firms were in financial trouble. At the end of 2008, 128 of 638 dairy firms were unable to maintain production due to the melamine incident (Ministry of Industry and Information Technology of China, 2008). As seen in Table 2, in the third quarter of 2008, Yili milk, Bright Daily and VV Group suffered significant losses from year to year.

**Effect on export of chinese dairy products:** Figure 1 presents the export scenario of dairy products. The result showed that the export of Chinese dairy products decreased continually since the incident. Chinese dairy products were completely lost the overseas market due to the melamine incident.

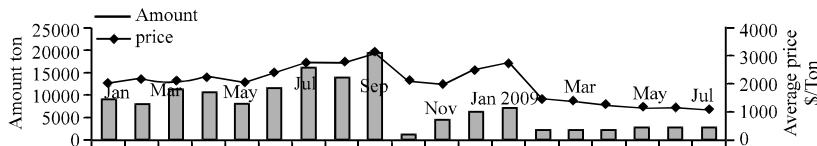


Fig. 1: Monthly Amount and Average Price of Dairy Products of China (Jan. 2008~Jul. 2009)  
Source: General Administration of Customs of China, 2010 A quarter of the rapid growth of imports of dairy products industry faces a double crisis of concern: Import and export monitoring and early warning project

Table 1: Detail events of investigations

Date	Events
2004	Sanlu was blacklisted due to the Fungus poison milk powder event but was able to use positive public relations to overcome any negative outcomes caused by the event
December 2007	Sanlu Customer Service sections received complaints from consumers
May 17, 2008	Sanlu Customer Service sections reported complaints from consumers to the manager
June, 2008	Complaints about Sanlu's milk powders appeared the General Administration of Quality Supervision, Inspection and Quarantine of China (AQSIQ) website
June, 2008	Sanlu commodities were inspected in the official inspection section. Because the milk powders assumed to be the problem were produced in October 2007, all commodities produced up to December, 2007 are recalled
July 16, 2008	The Gansu Health Administration started investigating the cause of the infant kidney stones complaints
July 20, 2008	Sanlu began to doubt the melamine pollution of the milk powder and the inspection is executed in the official inspection section
July 26, 2008	Melamine addition was found in the sample sent to the official inspection section
August 01, 2008	Sanlu's leaders reported that melamine was detected in 15 batches of items of 16 lots. Although, a meeting was held, there are neither information disclosures nor a commodity recall.
August 04, 2008	The concealment of the problem was sanctioned by the Sanlu conference
August 13, 2008	The Sanlu conference instructed that the milk powder with the high melamine levels be substituted with the milk powder that contains less than 15 mg kg <sup>-1</sup> of melamine
September 9, 2008	Lanzhou Morning News reported that infants who suffered from kidney stones consumed the same brand of milk powder
September 9, 2008	AQSIQ became aware of the news article and begins the sampling inspection
September 11, 2008	Doubts about the "Sanlu brand" are publicized by the Oriental Morning Post
September 11, 2008	Sanlu group announced "The product of Sanlu group is inspected by official departments and applies to domestic standard. There is no evidence to prove the relationship between kidney stones and Sanlu' milk powder"
September 11, 2008	There was a report that 59 infants develop kidney stones and one dies in Gansu province throughout the course of September (Xinhua)
September 11, 2008	The Sanlu group admitted that 700 tons' of milk powder had been polluted by the melamine and issued a recall of the baby milk powder
September 12, 2008	The government orders Sanlu to stop production and sale

Source: all, except those noted, are from China Food Association, 2008

Table 2: Loss of each company in the third quarter 2008

Company	Operating profit Unit: million yuan		Net income Unit: million yuan	
	The third quarter 2008	The third quarter 2007	The third quarter 2008	The third quarter 2007
Yili	-27298	4488	-23237	-491
Bright	-32977	5063	-27419	3843
VV	881	2759	826	1586

Source: 2008 third quarter reports of each company

**The cause of melamine incident:** Par researcher like Kongli (2009), Takarabe and Osamu (2009) mentioned that difficulty in performing the quality control due to a long market chain is the main reason for this incidence. Similarly, Kongli (2009), Cheng-qing *et al.* (2009) and He (2009) mentioned that a rapid expansion of dairy companies that led to the intense competition to acquire the raw milk due to inability to meet the demand is the main reason for the contamination by the companies. These reviews are in support to present study. Present study has indicated followings as the major causes of melamine incident.

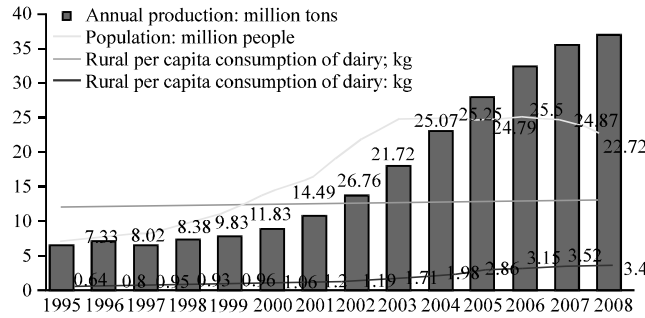


Fig. 2: Changes in consumption and production of dairy products from 1995 to 2008 in China  
 Source: Database of Bureau of Statistics of China, China Dairy Industry Association, 2009, National Bureau of Statistics of China, 2009a

Table 3: Per capita income, food consumption expenditure, dairy consumption expenditure of urban and rural areas unit: yuan

Year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Income of urban	1510	4283	6280	6860	7703	8472	9422	10493	11759	13786	15781
Income of rural	686	1578	2253	2366	2476	2622	2936	3255	3587	4140	4761
Food expenditure of urban	694	1772	1971	2014	2272	2417	2710	2914	3112	3628	4260
Food expenditure of rural	344	768	821	831	848	886	1032	1162	1217	1389	1599
Dairy expenditure of urban			69	80	105	125	132	139	150	161	190

Source: National Bureau of Statistics of China

**Inequality in dairy consumption:** The root cause of melamine incidence lies at the socio-economic structure of China. There is a big gap between urban and rural dwellers in terms of per capita income and consequently the afford ability of quality products. The demand for the cheap dairy products from the poor section of the rural society led companies to produce low quality milk. Following section elaborates the structure of dairy consumption and production in China that has led to this incidence.

**Dairy consumption and production of China:** The population and per capita consumption drive the consumption of dairy products. In Fig. 2, the population of China maintains a growth rate of less than 1% since 1995 when the population was 1.3 billion. Per capita dairy consumption has been increasing every year because of the increase in income. Driven by these two factors, dairy consumption in China has grown rapidly. The production of dairy products has increased at the rate of 15% annually since 1995 and has reached 37,814,500 tons in 2008. However, milk consumption per person in China has remained below the international consumption rates. Based on Milk Equivalent (ME), in 2008, average per capita global milk consumption amounted to about 104 kg of milk/year; however, the average per capita milk consumption in China is only around 31 kg/year. Although, China's dairy industry has achieved rapid growth, milk consumption in China is still below the global average.

**Domestic milk consumption structure:** Dairy consumption in China has inequities. First, there is a gap both in the amount and expenditure on dairy consumption between urban and rural populations. Per capita dairy consumption in rural areas is not even 20% of that of urban areas, though both have increased (Fig. 2). In Table 3, with the inequity of per capita income, there is also inequity of food consumption expenditure between urban and rural areas. The per capita food consumption expenditure of rural areas was about 49.5% that of urban areas in 1990 and dropped

Table 4: Ranking of the top four provinces which were most affected by the melamine incident and each province's average net income

Top provinces by number of patients	Number of infants with kidney stones	Net income of rural residents (yuan)	Disposable income of city residents (yuan)
Gansu Province	1695	2724	10969
Hebei Province	1499	4795	13441
Henan Province	633	4454	13231
Xinjiang Uygur Autonomous Region	201	3175	11432
The national average income		4761	15781

Source: Numbers of infants with kidney stones on September 17 are taken from articles on the central government (Patient numbers are based on data provided on September 17, 2008 when the patients' numbers of most provinces were provided). Income data was taken from the National Bureau of Statistics of China

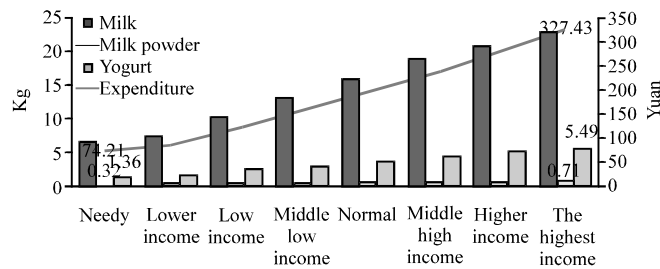


Fig. 3: The expenditure (yuan) and amount (kg) of dairy consumption by income group in urban areas Source: National Bureau of Statistics of China, 2009b

to only 37.5% in 2008. Although, there are no statistics concerning the dairy consumer expenditure of urban areas, the lower per capita dairy consumption in urban areas can be estimated through food expenditure and the amount of milk consumption.

Second, even within urban and rural areas, there is a marked difference in consumption of dairy products. In 2008, in rural areas, expenditure on food of the lowest income consumers was only 30% of that of the highest income consumers (645.14 yuan vs. 2082.32 yuan) (National Bureau of Statistics of China, 2009a). Note that in Fig. 3, in urban areas in 2008, the expenditure on dairy consumption for the lowest income consumers is only 23% of that of the highest income consumers. The quantity of consumption of milk, milk powder and yogurt was 3.4, 2.2 and 4.0 times greater in the highest income consumers than in the lowest income consumers, respectively.

For the high-income consumers, the health and safety of the product is valued more than its price. According to the investigation conducted by the Japanese Finance Corporation (a public corporation wholly owned by the Japanese government) of Chinese (Beijing Shanghai) high-income groups in July, 2008, when buying food in daily life; 91.1% of consumers choose food based on the health factors, 85.2% of consumers choose food based on safety factors and only 33.5% choose food based on “economic orientation” (Japan Finance Corporation, 2009). The price of imported milk powder ranges from 135 to 280 yuan per container (900 g). The high-income consumers mainly consume expensive imported milk powder.

On the other hand, the low-income consumers focus on price. Sanlu's milk powders were sold at a low price of 25-30 yuan per container (400 g) according to the advertising department of Sanlu and had expanded quickly in the rural market. Table 4 shows the ranking of the top four provinces which were most affected by the melamine incident. Each region's income is below the national average. Disposable incomes of urban residents in the four provinces are all below the national

average and the net incomes of rural residents in three provinces are below the national average. In Gansu Province which has the largest number of melamine incident patients, the disposable income of urban residents and net income of rural residents are both among the lowest in the country. Xinjiang is the fourth most affected region and it is where the disposable income of urban residents is the second lowest in the country. The Gansu health agency announced that the patients in Gansu province were mainly rural children and that farmers in the low-income region consumed melamine-contaminated powdered milk concentrate. From the 29.4 million infants who showed an abnormality, it is evident that the cheap, polluted milk powder had a large market share.

Because of the demand for cheap milk powder of low-income consumers in the above-mentioned, companies are forced to adjust prices to maintain the stability of the domestic market. To produce low-priced products, costs were reduced, milk inspection and quality control standards were loosened, causing the melamine incident. In another word, inequality in dairy consumption especially the low afford ability of low-income consumers is the structural cause of the melamine incident.

**Market failure due to asymmetric information:** People cannot always take the appropriate actions because only incomplete information is provided about the quality of the product which is the essence of the quality issue (Nakasima, 2004). Information on health hazards associated with contaminated raw milk should be extended to the public, so that consumption of untreated/ improperly treated raw milk could be avoided (Prejit-Nanu and Latha, 2007). Consumers can only obtain information from the media but China is still not equipped with a developed media network or a strong government leader. On September 2, 2007, information about Sanlu's milk powder production was broadcasted for the first time as part of the "China manufacturing" series of programs "Quality report every week" on China central television, whose audience is the largest in China. In this program, Sanlu reported that the inspection of its raw milk was particularly strict and that Sanlu milk powder had a rigorous examination procedure, testing their products more than 1100 times. Consumers who were not aware of the discrepancy between the quality of the product and its brand image, continued to buy it because they trusted it as an established brand, exacerbated the effects of the incident.

As mentioned above, the government-led public agency should have inspected the products to ensure quality and offered information about its findings to the consumer but it did not and the inequity of information increased.

**The lack of government supervision and government failure:** Difficulty in the execution of Chinese regulation and the incompleteness of the inspection of products are two factors that contributed to occurrence of the incident. Some of the past researcher like Tao and Chang (2010), Liu and Wang (2010) Chen (2010) have also pointed out that there were problems on the law and regulation system, government supervision mechanism, detection capability and quality standard system. These reviews are in support to this study. On June 1, 2007, the Chinese Ministry of Agriculture published "Notice that strengthened the supervisor to safe mass of fodder" and "Notice that forbade the malfeasance of illegal product" and 'Protein energy' use, the use of melamine is strictly prohibited. Nevertheless, investigations revealed that 22 manufacturers were selling melamine-contaminated products in 2008. Despite strict controls after the incident, in



Table 5: List of 22 melamine-contaminated milk powder products that were detected on September 14, 2008

The order of melamine value	Company name	Brand name	Melamine value (mg kg <sup>-1</sup> )	Whether the product is exempt from inspection
1	Sanlu Group Co., Ltd	Sanlu infant formula	2563.00	Exempt
2	Shanghai Panda dairy company	Panda infant formula	619.00	Exempt
3	Qingtao shengyuan dairy company	Shengyuan infant formula	150.00	Exempt
4	Shanxi gucheng dairy group	Gucheng infant formula	141.60	Exempt
5	Jiangxi hero dairy company	Hero infant formula	98.60	Exempt
6	Baoji huimin dairy Group Co., Ltd	huimin infant formula	79.17	Exempt
7	Inner Mongolia mengniu dairy Group Co., Ltd	mengniu infant formula	68.20	Exempt
8	MAM Tianjin Co., Ltd	Kocci infant formula	67.94	Not exempt
9	Guangdong Yashili Group Co., Ltd	Yashili infant formula	53.40	Exempt
10	Hunan beiyi dairy company	Nanshan beiyi infant formula	32.00	Exempt
12	Shanxi yashili dairy company	Yashili infant formula	26.30	Exempt
14	Scinet _iguangzhou_jin infant food company	Scinet infant formula	17.00	Exempt
16	Inner Mongolia yili dairy Group Co., Ltd	Yili infant formula	12.00	Exempt

Source: General Administration of Quality Supervision Inspection and Quarantine of China, 2008 Inspection and Quarantine of China (AQSIQ), "a list of companies in which melamine contamination was discovered"

December 2009, it was discovered that the Shanxi Jinqiao dairy company camouflaged 5.25 tons of melamine-contaminated milk powder and 5 tons of uninspected milk powder and sold the melamine-contaminated milk in the Guangxi Province. Also, Shanghai panda milk Co., Ltd. which was the second in the list of companies that contained the most melamine-contaminated powdered milk, re-used the melamine-contaminated milk. Recurrence of these incidents shows the difficulty in the execution of laws in China. In addition, the fact that it was the local news article and not an official agency that first recognized the issues concerning melamine suggests there is a lack of government supervision.

Moreover, the quality inspection exemption system is considered a government failure. As shown in Table 5, nine of the top 10 milk powder products that are exempt from inspection contain melamine. The top 4 milk powder producing companies which contain melamine at, more than 100 mg kg<sup>-1</sup> are all well-known enterprises. For the largest company, Sanlu products, melamine levels were reported to be as high as 2,563 mg kg<sup>-1</sup>. That this product was able to enter the market at all is thought to be a result of the quality inspection exemption system.

To encourage efficiency improvements and excellent product, the Chinese government carried out the quality inspection exemption system on December 5, 1999. According to this system, no official inspection organization had the right to inspect the quality of an exempted product for three years. In the situation where there is no external supervision, there is a high chance of moral hazard.

## CONCLUSIONS AND RECOMMENDATION

The Melamine incidence has seriously jeopardized the flourishing dairy business in China. It has further affected the reputation of Chinese goods in the international markets. The demand for low-price milk powder, market failures due to asymmetric information, lack of government supervision and government failure were the causes of the melamine incident.

The melamine incident has had a large impact on government supervision, consumer's safety awareness and enterprise profit. These effects create a large incentive for enterprises to improve quality control which will improve the safety of Chinese food in future. After the melamine incident,

the Chinese government strengthened its policies and tightened regulation of the dairy industry. First, in October 9, 2008, to strengthen the quality control on the process of purchasing and selling raw milk material and the process of producing and selling dairy products, “dairy quality and safety supervision and management regulation” was promulgated. Second, the Ministry of Health of China promulgated a new “dairy products quality safety national standard”, which contained 66 standards on April 22, 2010. It led to the abolition of the inspection exemption system and the enactment and execution of the “Food Safety Law of the PRC”.

However, the core of food safety problem in China lies in the demand for cheap food due to low afford ability of low-income consumers. So, the policy should be developed and enacted in a broader framework not specific to strengthen of government supervision but also to reduce the inequality. The government has to give emphasis on reducing the economic inequality in China. Apart from this, to avoid the asymmetric information, a display system on food is also required in China.

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