American Journal of Public Health Research, 2026, Vol. 14, No. 3, 52-57
Available online at http://pubs.sciepub.com/ajphr/14/3/1
Published by Science and Education Publishing
DOI:10.12691/ajphr-14-3-1

Iodine and Moisture Content of Salt Sold in the Diffun Community Market: Responding to Iodine Deficiency

Angela Mae S. Tomas[1,2,*], Kenneth John Babaran[1], Madeilyn B. Estacio[1]

[1]Graduate School, University of La Salette, Inc., Santiago City, Philippines
[2]College of Health Sciences, Quirino State University, Diffun, Quirino, Philippines
*Corresponding author: angela.mae@qsu.edu.ph

Received April 01, 2026; Revised May 01, 2026; Accepted May 08, 2026

Abstract Iodine deficiency disorder (IDD) remains a persistent public health concern in developing countries despite the implementation of universal salt iodization programs including policies such as the Philippine ASIN Law (RA 8172). Variations in salt processing, packaging, and storage may affect iodine stability and compromise program effectiveness. This study assessed the iodine and moisture content of salt sold in the Diffun Community Market, Quirino Province, Philippines, and evaluated their compliance with national iodization standards. A cross-sectional descriptive-analytical design was employed using total enumeration sampling, including 40 salt samples collected from 30 retail vendors. Samples were classified according to texture (refined or rock salt), packaging status (repacked or manufacturer-sealed), and storage conditions (dry/dark or moist/open). Iodine content was determined using WYD iodine testing kit, while moisture content was measured using a digital moisture analyzer. Data were analyzed using descriptive and inferential statistics including t-test, chi-square tests, and Pearson correlation at 0.05 level significance. Result showed a mean iodine content of 44.29 ± 28.41 mg/kg, indicating general compliance with ASIN Law standards. However, 22.5% of samples were iodine deficient. Most samples met acceptable moisture limits. Refined salt showed significantly higher iodine content and lower moisture level compared to rock salt ($p < 0.05$). Packaging and storage conditions showed no significant differences, although trends suggested reduced iodine retention in repacked and poorly stored samples. Iodine content was significantly associated with texture ($r = -0.483$, $p = 0.002$) and packaging ($r = 0.384$, $p = 0.014$). These findings indicate that while compliance is generally achieved, inconsistencies in iodization and handling persist. Strengthening monitoring, improving packaging practices, and enhancing vendor awareness are recommended to ensure consistent iodine intake.

Keywords: *iodine deficiency, iodized salt, moisture content, ASIN Law, salt quality, Philippines*

Cite This Article: Angela Mae S. Tomas, Kenneth John Babaran, and Madeilyn B. Estacio, "Iodine and Moisture Content of Salt Sold in the Diffun Community Market: Responding to Iodine Deficiency." *American Journal of Public Health Research*, vol. 14, no. 3 (2026): 52-57. doi: 10.12691/ajphr-14-3-1.

1. Introduction

Iodine is an essential micronutrient required for the production of thyroid hormones. These hormones regulate key bodily functions like metabolism, growth, and development. Dietary sources of iodine include seafood, dairy, and eggs; however, iodine deficiency continues to be a serious public health problem worldwide including the Philippines. This deficiency can cause Iodine Deficiency Disorders (IDD) such as goiter, poor cognitive function, reduced productivity, and developmental delays in children as well as in severe cases cretinism [1]. To address this issue, the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) advocates universal salt iodization (USI) as the most cost-effective and sustainable strategy to IDD prevention [2].

In the Philippines, this global recommendation was put into law through Republic Act No. 8172, known as the "ASIN Law", which mandates that all salt for human and animal consumption be iodized [3]. Despite this legislation, monitoring studies indicate persistent non-compliance and variable iodine content at the community retail level [4]. Problems compounded by factors such as improper packaging, storage, and high moisture content can affect the iodine content in salt. Iodine is a volatile element that can degrade when exposed to heat, light, air, and humidity, potentially reducing its effectiveness in preventing IDD [4]. These issues highlight the need for continuous monitoring of iodized salt quality at the retail level to ensure compliance with national standards. Furthermore, recent policy developments such as the Republic Act No. 11985, known as the "Salt Industry Revitalization Act," promote local and artisanal salt production [5]. While this brings economic benefits, the law also introduces challenges in maintaining consistent iodization practices and regulatory compliance. This highlights the need for continued surveillance of iodized salt quality at the community level. This study therefore aimed to assess the iodine and moisture content of salt sold in the Diffun Community Market, Quirino Province,

Philippines, and to evaluate their compliance of packaging type and storage conditions on iodine stability to provide evidence for strengthening salt iodization policy implantation.

2. Methodology

2.1. Study Design and Setting

This study employed a cross-sectional descriptive-analytical design to assess the iodine content and moisture content of salt products sold in the Diffun Community Market, Quirino Province, Philippines.

2.2. Sampling Technique and Sample Size

A total enumeration sampling technique was employed. All available salt products sold by retail vendors during data collection were included in the study, yielding a total of 40 samples.

2.3. Sample Collection and Handling

Salt samples were collected from retail outlets and immediately placed into small, sealable polyethene bags. Each sample was labeled according to stall code, salt type, packaging condition and date of collection. A structured tracking sheet was used for proper identification and traceability. Samples were stored in clean, air-tight containers and transported to the laboratory under controlled conditions. Care was taken to prevent additional exposure to moisture, light, and heat during handling.

2.4. Laboratory Analysis

Iodine concentration was measured using a WYD iodine testing kit based on iodometric principles. The procedure involved dissolving salt samples in a reagent solution and iodine content were determined via colorimetric comparison using a digital readout. Results were expressed in milligrams per kilogram (mg/kg). The method was conducted following manufacturer's instructions and aligned with WHO and Department of Health (DOH) standards for iodized salt testing.

Moisture content was analyzed using a calibrated digital moisture analyzer. Approximately 1 gram of each sample was subjected to controlled heating to determine water loss, and result were expressed as percentage moisture content (%).

All analyses were performed following standardized laboratory procedures. Instruments were calibrated prior to testing, and measurements were conducted in duplicate to ensure accuracy and reliability.

2.5. Data Analysis

Data were analyzed using descriptive and inferential statistics. Frequency and percentage were used to describe sample characteristics and categorical iodine and moisture classifications. One sample t-test was used to compare measured iodine and moisture content against ASIN Law standards. Independent samples t-test was used to compare differences in iodine and moisture content across salt type, packaging condition, and storage environment. Pearson product-moment correlation coefficient was used to determine relationships among iodine content, moisture content, and selected variables. Statistical significance was set at $p < 0.05$.

2.6. Ethical Considerations

Ethical clearance was obtained from the local government of Diffun prior to data collection. No human participants were involved in the study. All samples were anonymized using coded identifiers to ensure confidentiality. Data was solely for academic purposes. Results were reported objectively without manipulation or bias, and raw data were securely stored and accessible only to research team.

3. Results

This section presents the results from the study based on the data collected and analyzed in relation to the research objectives and hypotheses.

3.1. Physical Characteristic of Salt Samples in terms of Texture, Packaging Status, and Storage Area Description

The study analyzed 40 samples collected from Diffun Community Market. Most samples were refined salt.

Table 1. Distribution of Salt Sample in terms of Texture

Texture	**n**	**%**
refined	24	60.0
rock	16	40.0
Total	**40**	**100.0**

Refined salt accounted for 60.0% (n=24) of samples, while 40.0% (n=16) were rock salt, indicating higher availability of refined salt in Diffun Community Market.

Table 2. Distribution of Salt Sample in terms of Packaging Status and Texture

Packaging Status	Texture		Total (n)	%
	Refined (n)	Rock (n)		
Repacked form	18	16	34	85.0
Manufacturer-sealed packaging	6	0	6	15.0
Total	24	16	40	100.0

In terms of packaging status, most samples (85.0%, n=34) were repacked, whereas only 15.0% (n=6) were sold in manufacturer-sealed packaging. All sealed samples were refined salt.

In terms of storage area description, majority of the salt samples 87.5% (n=35), were stored in dry and dark areas, while 12.5% (n=5) were exposed to moist and open conditions.

Table 3. Distribution of Salt Sample in terms of Storage Area Description and Texture

Storage Area Description	Texture		Total(n)	%
	Refined (n)	Rock (n)		
Dry/ dark area	21	14	35	87.5
Moist/ Open area	3	2	5	12.5
Total	**24**	**16**	**40**	**100.0**

3.2. Classification of Salt Samples by Iodine Content

Table 4. Results of Iodine Content level of Salt Samples

Iodine Content Level (mg/kg)	Refined(n)	Rock (n)	Total (n)	%
< 10	0	9	9	22.5
> 10 to 40	8	3	11	27.5
41 to 100	14	4	18	45.0
>100	2	0	2	5.0
Total	**24**	**16**	**40**	**100**

Results show that 45.0% of samples had adequate levels (41-100 mg/kg), while 22.5% were iodine-deficient (<10mg/kg).

3.3. Moisture Content Classification of Salt Samples

Table 5. Moisture Content Classification Salt Samples

Moisture Content (%)	Refined(n)	Rock(n)	Total (n)	%
0-4	24	15	39	97.5
4-7 above but below 7%	0	1	1	2.5
Total	24	16	40	100

Most samples (97.55, n=39) had moisture content within acceptable limits (0-4), indicating generally proper storage conditions.

3.4. Comparison with Standard Levels Recommended by ASIN Law

Table 6. One-Sample t-Test Comparing Measured Values to ASIN Law Standard

One-Sample Statistics	Mean	SD	t-value	df	p-value	Interpretation
Iodine Level (mg/kg)	44.2925	28.41	0.96	39	0.345	Not significantly different
Moisture Content (%)	1.9703	0.94	-13.53	39	<0.0001	Significantly lower

The iodine content did not significantly differ from the standard (t (39) =0.96, p=0.345), while moisture content was significantly lower than the allowable maximum= -13.53, p=<0.001).

3.5. Comparison of Iodine Content and Moisture Content of the Salts by Texture, Packaging Status, and Storage Area

The result showed that texture significantly influenced both moisture and iodine content. Refined salt had significantly lower moisture (M= 1.73%) than rock salt (M=2.34%; p= 0.043) and significantly higher iodine content (M=55.36 mg/kg vs. 27.69 mg/kg; p= 0.002), indicating more controlled processing in iodization. In contrast, no significant differences were observed in moisture or iodine content when grouped by packaging status or storage area (p > 0.05), suggesting that these factors did not significantly affect salt quality in this study.

Table 7. Independent Samples t-Test (Group Differences)

Variable	Group 1	Mean	Group 2	Mean	p-value	Decision
Texture						
Moisture Content (%)	refined	1.7271	rock	2.3350	0.043	Significant difference
Iodine Content (mg/kg)	refined	55.3583	rock	27.6937	0.002	Significant difference
Packaging Status						
Moisture Content	repacked	2.06	Manufacturer-sealed packaging	1.35	0.619	Not significant
Iodine Content	repacked	43.04	Manufacturer-sealed packaging	90.25	0.389	Not significant
Storage Area						
Moisture Content	dry/dark	1.9409	moist/open	2.1760	.606	Not significant
Iodine Content	dry/dark	46.9400	moist/open	25.7600	.120	Not significant

The result showed that texture significantly influenced both moisture and iodine content. Refined salt had significantly lower moisture (M= 1.73%) than rock salt (M=2.34%; p= 0.043) and significantly higher iodine content (M=55.36 mg/kg vs. 27.69 mg/kg; p= 0.002), indicating more controlled processing in iodization. In contrast, no significant differences were observed in moisture or iodine content when grouped by packaging status or storage area (p > 0.05), suggesting that these factors did not significantly affect salt quality in this study.

3.6. Correlation between Variables

Table 8. Result of Pearson and Chi-square Correlation between and among the Selected Variables

Variables	r-value	p-value	Interpretation
Iodine vs Texture	-0.483	0.002	Significant (negative)
Iodine vs Packaging	0.384	0.014	Significant (positive)
Iodine vs Moisture	-0.082	0.613	Not significant
Iodine vs Storage	-0.250	0.120	Not significant
Moisture vs Texture	0.322	0.043	Significant (positive)

Iodine content showed a significant negative correlation with texture (r = -0.483, p = 0.002) and a positive correlation with packaging (r= 0.384, p = 0.014).

4. Discussion

This study assessed the iodine and moisture content of salt sold in the Diffun Community Market and evaluated compliance with the Philippine ASIN Law (RA 8172). The findings highlight important patterns in salt quality, processing practices, and potential public health implications.

4.1. Physical Characteristics and Market Practices

Most of the samples were refined salt accounting for 60.0% and repacked products indicate that iodized salt is widely available in the market; however, informal repacking remains highly prevalent. While repackaging improves affordability for low-income consumers, it introduces potential risks related to iodine stability and product integrity.

Similar concerns have been documented in salt iodization programs in low and middle-income countries, where repackaging practices are associated with reduced quality assurance and increased variability in iodine retention [6]. The use of polyethylene packaging may partially mitigate iodine loss, however, improper sealing and prolonged storage under ambient conditions can still lead to degradation of iodine content [6,7,8,9].

The high proportion of repacked salt observed in this study reflects common retail practices aimed at improving affordability. Presence of both manufacturer-sealed and repacked salts highlights disparities in quality control, with sealed products likely offering more stable iodine retention due to controlled production and packaging environments.

4.2. Iodine Content and Compliance with ASIN Law

The results show that the mean iodine content was statistically comparable to ASIN Law minimum requirement, indicating general compliance at the market level. However, the wide variability observed suggests inconsistent iodization across products.

A substantial proportion of samples remained below adequate iodine levels, particularly rock salt, which reinforces the known limitation of minimally processed salt in maintaining consistent iodization. These findings are consistent with global evidence showing that iodine losses commonly occur during storage, transport, and repacking, especially under humid or unregulated market conditions [10,11].

4.3. Moisture Content and Salt Quality

The moisture content findings demonstrate strong overall compliance with regulatory standards, with most samples falling within acceptable limits. This suggests that many retailers maintain appropriate storage conditions, such as dry and dark environments, which support product stability.

Moisture content plays a critical role in iodine retention, as higher moisture levels accelerate iodine volatilization and oxidation [1,11]. The generally low moisture levels observed in this study suggest favorable conditions for iodine preservation in most samples.

However, the presence of at least one sample exceeding recommended moisture levels highlights occasional lapses in storage or drying practices, which could contribute to reduced shelf stability and product quality.

4.4. Influence of Texture, Packaging and Storage Conditions

Significant differences in iodine and moisture content were observed between refined and rock salt, indicating that processing level is a key determinant of salt quality. Refined salt consistently demonstrated higher iodine content and lower moisture levels, reflecting better fortification and drying process.

In contrast, rock salt exhibited lower iodine levels and higher moisture content, suggesting minimal processing and inconsistent iodization. These findings align with established literature indicating that refinement improves both chemical stability and nutrient retention in iodized salt [14,15,16,17,18,19].

Packaging status showed no statistically significant effect on iodine or moisture content in this study. This suggests that while sealed packaging is theoretically protective, its effectiveness may be reduced by repackaging practices, extended storage duration, or improper handling after opening [7,13].

Similarly, storage conditions did not show significant statistical differences, although trends [14,15,16,20] indicated lower iodine levels in salts stored in moist or open environments. This supports evidence that environmental exposure gradually contributes to iodine degradation even when immediate differences are not statistically detectable.

4.5. Correlation between Variables

Correlation analysis revealed that iodine content is significantly associated with texture and packaging, but not with moisture content or storage conditions. This suggests that structural product characteristics (processing and packaging) play a stronger role in iodine retention than environmental factors alone.

The negative association between texture and iodine content confirms that refined salt is more consistently iodized than rock salt. Meanwhile, the positive association between packaging and iodine content highlights the protective role of proper sealing in preserving iodine levels.

Moisture content was positively associated with texture, indicating that rock salt retains higher moisture levels. However, the lack of significant correlation between moisture and iodine suggests that other factors, such as production and fortification practices, may have a stronger influence on iodine stability than moisture alone within this dataset.

4.6. Public Health Implications

The findings underscore the importance of strengthening salt iodization programs at retail level. Although overall compliance with ASIN Law is moderately achieved, variability in iodine content poses a risk to sustained iodine sufficiency in the population. Iodine deficiency remains a preventable public health issue associated with impaired cognitive development, thyroid dysfunction, and reduced productivity [1,9]. The

persistence of inadequately iodized salt highlights the need for improved regulatory enforcement, vendor training, and consumer awareness programs [2,7]. The dominance of repacked salt also emphasizes the need for stricter monitoring of informal distribution systems where quality control is often weak [8,11].

4.7. Theoretical Implications

The findings support Public Health Nutrition Theory, which emphasizes that policy effectiveness depends on both availability and actual nutrient intake in populations. Although refined salt was more widely available, variations in iodine content indicate that availability alone does not guarantee adequate iodine consumption, highlighting the gap between access and nutritional benefit. The result also reinforces Food Quality Assurance Theory, as difference in iodine levels and moisture content suggest that physical factors such as packaging, storage conditions, and processing methods influence nutrient stability. Samples with inadequate iodine levels may reflect lapses in quality control during production and distribution [7,17]. Finally, the findings reflect Policy Implementation Theory, as observed inconsistencies between measured iodine content and the standards set by the ASIN Law (RA 8172) demonstrate a gap between policy and practice. This underscores the need for continuous monitoring, stricter enforcement, and improved regulatory mechanism to ensure compliance in real-world settings.

5. Conclusion

This study evaluated the iodine and moisture content of salt sold in the Diffun Community Market in relation to the Philippine ASIN Law (RA 8172). The findings indicate that iodized salt is generally available in the local market, with most samples meeting the minimum iodine requirement for retail-level consumption. However, substantial variability in iodine content was observed, particularly among rock salt and repacked products, suggesting inconsistencies in iodization practices and post-production handling.

Refined salt demonstrated significantly higher iodine content and lower moisture levels compared to rock salt, indicating that processing and refinement play a critical role in ensuring product quality and iodine stability. Moisture content across most samples remained within acceptable limits, suggesting generally adequate storage conditions in the market. Nevertheless, isolated cases of substandard moisture and iodine levels highlight weaknesses in handling, repackaging, and monitoring practices.

Statistical analyses further confirmed that texture and packaging significantly influence iodine retention, while storage conditions did not reach statistical significance in this study but suggested a concerning trend. The result collectively suggests that while the ASIN Law is partially effective in ensuring iodized salt availability, enforcement gaps at the retail level continue to affect uniform compliance.

Overall, the study underscores that compliance with iodization standards is not solely dependent on legislation but also influenced by processing quality, packaging integrity, and retail handling practices.

6. Recommendations

Based on the findings of this study, the following recommendations are proposed:

6.1. Strengthen Regulatory Monitoring

Regular and systematic monitoring of iodized salt at the retail level should be intensified by relevant regulatory agencies to ensure consistent compliance with ASIN Law standards.

6.2. Improvement of Repacking Practices

Since repacked salt constitutes a major portion of market products, guidelines and training programs should be implemented for vendors to ensure proper sealing, labeling, and hygienic handling to minimize iodine loss.

6.3. Packaging Standardization

The use of moisture-resistant and iodine stable packaging materials should be promoted, particularly low-permeability containers that reduce exposure to air and humidity.

6.4. Vendor Education and Training

Capacity-building programs should be conducted for salt retailers focusing on proper storage conditions, iodine preservation, and the public health importance in iodized salt.

6.5. Consumer Awareness Campaigns

Public health education should be strengthened to encourage consumers to prioritize properly labeled and manufacturer-sealed iodized salt.

6.6. Expanded Future Research

Future studies may include:

6.6.1. Longitudinal monitoring of iodine stability over storage time

6.6.2. Multi-site comparisons across provinces

6.6.3. Experimental assessment of packaging materials and iodine retention

6.6.4. Evaluation of household-level iodine intake to link market quality with nutritional outcomes

6.7. Policy Enhancement Studies

Further research is recommended to assess the implementation gap between RA 8172 and RA 11985, particularly in balancing salt industry revitalization and iodine fortification compliance.

References

[1] World Health Organization, *Guideline on fortification of food-grade salt with iodine for the prevention and control of iodine deficiency disorders*, WHO, Geneva, 2014. [Online]. Available: https://www.who.int/publications/i/item/9789240065089. [Accessed April 10, 2025].

[2] United Nations Children's Fund. *Universal Salt Iodization: Global Progress Report, 2019*. [Online]. Available: https:// data.unicef.org/ resources/ universal- salt-iodization-global-progress-report-2019/. [Accessed February 23, 2025].

[3] Republic of the Philippines. *Republic Act No. 8172: An Act Promoting Salt Iodization Nationwide (ASIN) and for Related Purposes*, Philippines, 1996. [Online]. Available: https:// www.fda.gov.ph/wp-content/uploads/2021/05/Republic-Act-No.-8172.pdf. [Accessed January 27, 2025].

[4] Perlas, L., Ulanday, J., Marcos, J., Serafico, M., Desnacido, J., Alibayan, M., Duante, C., Capanzana, M., "Iodine Deficiency Disorder Among Filipino School Children, Pregnant and Lactating Women and the Elderly 20 Years After the Act for Salt Iodization Nationwide Law," *Journal of Endocrinology and Metabolism*, North America, 7, Jun. 2017. [Online] Available: <https:// jofem.org/index.php/jofem/article/view/414>. [Accessed January 27, 2026].

[5] Republic of the Philippines, *Republic Act No. 11985*: *An act Strengthening and Revitalizing the Salt Industry in the Philippines, 2024.* [Online]. Available: https:// legacy.senate.gov.ph/ republic_acts/ra%2011985.pdf. [Accessed January 27, 2025].

[6] Diosady LL, Alberti JO, Ramcharan K, Mannar MGV. "Iodine stability in salt double-fortified with iron and iodine," *Food and Nutrition Bulletin*, 23(2):196-207. 2002.

[7] Chauhan, S. A., Bhatt, A. M., Bhatt, M. P., & Majeethia, K. M., "Stability of iodine in iodized salt used for correction of iodine-deficiency disorders II," *Food and Nutrition Bulletin*, 19(Suppl), S98–S103.1998.

[8] Choudhary, S., Sharma, P., & Gupta, R., "Stability of iodine in fortified salt under different storage and packaging conditions," *Journal of Food Science and Technology*, *60*(4), 1123–1132. 2023.

[9] Asare, G. A., Asare-Anane, H., Amegatcher, A. G., & Osei, J. Y., "Quality of iodized salt in Ghana: Retail-level variations and implications for iodine deficiency prevention," *BMC Public Health*, 22(1), 1452, 2022.

[10] Maramag, C. C., Ranchez, J. A., & Ranchez, A. G., "Stability of iodine in salt sold under Philippine market conditions," *Asia Pacific Journal of Public Health*, 19(2), 42–48. 2007.

[11] Abughoush, M., et at., "Quantitative determination of iodine content in iodized table salt marketed in Jordan as an indicator of compliance with national salt iodization standards: A cross-sectional study," *Italian Journal of Food Science*, 36(4), 73, 2024.

[12] Mirete, E. M., Befkadu, D. M., & Hamda, M. G., "Investigation of the effects of heat and light on iodine content of packaged and open salt brands available in Jimma Town, Ethiopia," *Heliyon*, 2023.

[13] Habib, M. A., Chowdhury, A. I., Alam, M. R., & Rahman, T., "Commercially available iodized salts in Bangladesh: iodine content, stability, and consumer satisfaction," *Food Control*, 145, Article 109532, 2023.

[14] Ekott, E. J., & Etukudo, U. I., "Impact of storage on iodine stability of commercial salt brands," *International Journal of Scientific Research and Engineering Development*, 8(1), 124–129, 2019.

[15] Nyamari, D., Muriuki, J., & Mwangi, M., "Factors affecting iodine concentration in household salt: A case of moisture and packaging," *African Journal of Food, Agriculture, Nutrition and Development*, 20(6), 16546–16559, 2020.

[16] Hassan, H., "Physio-chemical characterization of food-grade natural spring salt: moisture, mineral composition, and quality parameters," *Journal of Food Composition and Analysis*, 105, 2024.

[17] Halal Health Journal, "Quality assessment of refined table salts and locally processed salts: moisture content and compliance with standards," *Journal of Halal Health Hygiene & Management, 2024.* [Online]. Available: https:// jhhhm.halal.ac.ir/ article_186037. [Accessed January 27, 2025].

[18] Number Analytics, *Moisture control in salt: a guide*. 2025. [Online]. ttps:// www.numberanalytics. com/ ultimate-guide-moisture-control-salt-food-safety. [Accessed, July 30, 2025]

[19] Fallah, S. H., Khalilpour, A., Amouei, A., Rezapour, M., & Tabarinia, H., "Stability of iodine in iodized salt against heat, light, and humidity," *Journal of Health Research and Technology*, 6(1), e100098. 2020.