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Knowledge, Practice, And Consumption Pattern Of Dietary Salt Among Adolescent Females - A Cross-Sectional Survey

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ABSTRACT

The human body requires iodine for normal growth and function. Over the years, iodine intake has been continuously low, causing iodine deficiency disorders (IDD) in developing countries like India. The World Health Organization (WHO) introduced the Universal Salt Iodization (USI) program to combat IDD. Our study aimed to assess the knowledge, practices and consumption patterns of salt among adolescent females in Chennai, Tamil Nadu. In this survey, we included 200 participants, 100 from school and 100 from college. The data was collected through a face-to-face interview using a random sampling method. A Chi-square test was employed to compare the responses of the two student groups. The results showed that less than one-fourth of the participants were aware of the RDA of salt (21.5%) and IDD (18%). More than half of the participants were familiar with the health risks associated with increased salt consumption (66%). More than half of the total participants (52%) used iodized table salt, and their reason for salt consumption was mainly its taste-enhancing property (68%). A significant proportion of the participants (67%) preferred to store salt in plastic containers and reported adding salt in between cooking (69%). This survey has revealed the inadequate knowledge of the respondents about the RDA of salt and IDD. The reason for salt intake, storage method, and time of salt added to food exposed their poor practice and consumption patterns. Implementing educational programs in schools and colleges is highly recommended to impart proper knowledge on salt handling and consumption patterns.

Keywords: Salt, adolescent females, IDD, knowledge, practice, and consumption pattern.

1. INTRODUCTION

Iodine (I) is an essential micronutrient required for the synthesis of thyroid hormones. Normal healthy adults contain 15 to 20 mg of iodine, of which 70%-80% exist in the thyroid gland. (Chung 2014). Inadequate iodine intake causes IDD, which includes a spectrum of health consequences such as goiter, hypothyroidism, and increased susceptibility to nuclear radiation for people of all age groups. It is marked with impaired mental function, delayed physical development, and iodine-induced hyperthyroidism in children and adolescents (WHO 2007). The probability of complications during the gestation period such as stillbirth, congenital anomalies, perinatal mortality, and spontaneous abortion of the fetus increases in case of iodine deficiency (WHO/UNICEF/ICCIDD 2001). To meet the daily requirement of iodine, the World Health Organization (WHO) has recommended a daily iodine intake of 90 μg for infants (up to 59 months), 120 μg for children (6-12 years), 150 μg for adolescents, and adults, 250 μg for pregnant and lactating women (WHO 2007).

Studies conducted in the 20th century revealed that the entire world was suffering from IDD, with regions such as Southeast Asia, Africa, and Latin America being the worst affected. Even today, the whole Indian population is at risk of IDD because the soil of the subcontinent is naturally deficient in iodine (Pandav et al., 2013). Universal Salt Iodization (USI) was adopted in 1986 to ensure adequate intake of iodine for individuals all over the globe, and subsequent legislation prohibits the sale of non-iodized salt

for human consumption (Rah et al., 2013). Likewise, a massive worldwide effort of salt iodization dramatically raised the proportion of people consuming iodized salt, from less than 20% in the early 1990s to about 70% by 2000. Thirty-four countries have achieved the USI goal. (UNICEF 2008).

According to India iodine survey 2018-19 reports, 76.3% of salt was adequately iodized (≥ 15 ppm), with Jammu and Kashmir having the highest iodized salt coverage (99.8%) and Tamil Nadu having the least coverage (61.9%). The reason for the least coverage in Tamil Nadu could be attributed to the decreased awareness among the public. Researchers have conducted surveys to study IDD prevalence, the public's knowledge of IDD & salt iodization, and monitor salt practices in recent years. Bali et al. (2018) organized a cross-sectional study among school children in the Damoh district of Madhya Pradesh to assess the prevalence of IDD & iodine toxicity. Anusha et al. (2018) executed another cross-sectional study among rural school children in Kancheepuram, Tamil Nadu, India, to monitor goiter prevalence. Vasudevan et al., (2019) conducted a cross-sectional community-based survey to assess knowledge, attitude & practice on IDD and Iodine levels in salt in retail & vendors among the rural population. Datta et al., (2018) undertook a community-based survey among rural women in Tripura to assess their knowledge, attitudes & practices towards iodized salt.

Among the studies performed in Tamil Nadu, no surveys were conducted in Chennai in recent years. Also, surveys focusing on adolescent females and women of reproductive age are very few. Having these in observance, we have executed this survey to assess the knowledge, practices, and consumption patterns of salt among adolescent females in Chennai, Tamil Nadu. The study population consisted of adolescent females as they are the most vulnerable group & are also knowledge carriers for coming generations.

2. MATERIALS AND METHODS

A cross-sectional survey was employed to assess the knowledge, practices, and consumption patterns of adolescent females regarding salt. This study was confined to school and college students from different localities in Chennai, Tamil Nadu, and was conducted between November 2019 and January 2020. A total of 200 adolescent females (100 school students and 100 college students) aged between 13 and 19 years were selected, and the date and time of the survey were fixed according to their convenience. Figure 1 represents the outline of the study.

A pre-designed questionnaire containing a total of 30 questions was used to collect the data. A detailed explanation regarding the study was dictated, and obtained consent before delivering the questionnaire. Chi-Square test was performed using Statistical analysis software (SAS). Chi-Square test compared the knowledge, practice, and consumption patterns related to salt among the school and college students. P-value ≤ 0.05 was considered statistically significant.

3. RESULTS

Knowledge of the participants about salt intake related information:

RDA and health risks associated with high salt intake:

Our survey data revealed that only a small proportion of both school (15%) and college (28%) students were aware of the RDA of salt and only 12% of school and 20% of college students reported the consumption of the right amount of salt. 45% of participants had no idea about the quantity of salt they consume. The current study disclosed that 54% of school and 78% of college students were aware of the severe health risks associated with increased salt consumption. 63% and 72% of school and college students agreed that excess dietary sodium (salt) increases blood pressure. Table 1 illustrates the responses of the participants, which assessed their knowledge related to RDA, salt intake, health risks, salt iodization, and IDD.

Salt iodization and IDD:

50% of school students and 60% of college students had proper knowledge of salt iodization, whereas the rest were unaware. Our study also disclosed that only 13% of school and 23% of college students had the proper knowledge of IDD. 87% and 77% of school and college students were unaware of IDD.

Mineral composition of salt:

Among the total survey population, 82% of school students were best introduced to the mineral composition of salt, but unexpectedly, only 32% of the college participants had proper knowledge. 18% and 68% of school and college students were unaware of the minerals present in salt. Of the 200 participants, only 45% of school and 27% of college students recognized sodium

as the chief mineral present in all types of salt. More than half of the total survey participants (52%) believed that iodized salt had the highest mineral content. Only less than one-fourth of the participants (19.5%) knew that Himalayan pink salt was naturally packed with a wide variety of minerals. Table 2 depicts the responses of the participants to the questions that assessed their knowledge related to minerals and additives present in salt.

Additives present in refined salt:

In the current study, only 36 % of the survey participants had sufficient knowledge about the additives present in refined salt. Among them, 38% were school students, and 33% were college students. 62% and 67% of school and college students were clueless about the additives present in refined salt. Our study showed that 42 % of the participants were aware of the cancer-causing properties of additives present in refined salt if it exceeded the permissible limit, which indicates that they were familiar with the dark side of using processed salt regularly.

Practice and consumption pattern of salt among the participants:

Choice of salt type:

Among the survey participants, 46% of school students and 58% of college students reported the use of iodized table salt. 10% of school and 12% of college students reported sea salt. Only 5% of school and 2% of college students stated using Himalayan pink salt. 28% of school and 23% of college students reported using both sea salt and table salt. The remaining 11% of school and 4% of college students were using a combination of different types of salts like sea salt, table salt, Himalayan pink salt, and black salt. The present study also showed that 74% of the total survey population reported the use of more than one type of salt.

Choice of the salt brand:

Regarding the brands of salts used, 74% of school students and 73% of college students reported the use of TATA salt, and the remaining 18% of school and 18% of college students used a combination of different brands like Aashirvad, Annapurana, and VVD priyam. The remaining participants used salt purchased from local vendors.

Recognition of iodized salt:

Among the total survey participants, only a negligible proportion (2%) recognized iodized salt by the smiling sun symbol printed on the packet. Our study revealed that 52% of school and 40% of college students identified iodized salt from printed iodine levels.

Containers used for salt storage:

The survey results regarding the types of containers used for salt storage disclosed that 66% of school and 68% of college students, 15% of school and 21% of college students reported using plastic airtight and glass containers, respectively. Less than 10% of the participants reported stainless steel, mud pot, and a combination of different types of containers. Table 3 displays the responses given by the participants related to the practice and consumption pattern of salt.

Time of addition of salt while cooking:

15% of school and 17% of college students reported adding salt at the beginning of cooking in their house. 68% and 70% said the addition of salt in the middle. Only 9% and 8% reported adding salt at the end of cooking in their house, respectively. Few participants reported that salt was added randomly at any time while cooking.

Consumption pattern of salt:

Data obtained from the current study reflects that 60% of school and 76% of college students consumed salt because it enhances the taste of the food, and 21% and 14% of school and college students consumed salt because of its health benefits. The rest of the participants (68%) stated that they consume salt as it adds taste and has health benefits.

4. DISCUSSION

Knowledge of the participants about salt intake related information:

In the present study, out of 200 participants (school and college), unexpectedly, only 21.5% knew the RDA, and 16% consumed the correct amount of salt. According to WHO, adults must consume less than 5 g (just under a teaspoon) of salt per day (<2 g sodium/day), and the recommended maximum intake of salts for adults should be adjusted downward for children aged 2-15 years based on the energy requirements (WHO 2012). A study conducted among 426 women participants in north India Aparna et al.,

(2019) revealed that only nine knew the exact RDA of salt. However, 80% of the participants reported consuming the correct amount of salt. Similarly, Garg et al., (2019) revealed that only 14% of participants knew the RDA of salt, but 67% of participants consumed the right amount of salt. Another study (Johnson et al., 2017) showed that 73% of participants consumed the right amount of salt. In contrast, Ghimire et al., (2019) disclosed that 81.6% of their subjects consumed higher salt levels than the WHO recommended. Knowledge of the RDA of salt is essential to regulate its intake. The poor level of awareness observed in the present study disclosed an unfavourable attitude towards salt reduction. Hence, there is a need to create awareness among students about the RDA of salt.

Salt is the major source of sodium, and increased sodium consumption is associated with adverse health outcomes, including high blood pressure, increased risk of heart disease, and stroke. Excessive dietary sodium can induce target organ damage. It may directly impact the brain, heart, kidney, and vasculature (Farquhar et al., 2015). Ismail et al., (2019) reported that 70.3% of their survey populace could relate high salt intake with hypertension. More than three-fourths of the survey participants agreed that reducing salt intake would help maintain the overall health and blood pressure. Similarly, Aparna et al. (2019) reported that 80% of the survey participants were aware of the harmful effects of high salt intake, and 45% knew that increased salt intake could cause high blood pressure.

A study on systemic analysis for the global burden of diseases revealed that high sodium intake is a prominent dietary risk factor for deaths and disability-adjusted life years (DALY's) globally and in many countries (Afshin et al., 2019). Our study showed that 66% of the total participants were aware of health risks associated with high salt intake, and 67% knew that high salt intake might lead to hypertension. Hence, educating the school, college students, and children to reduce salt intake and limit the consumption of salty snacks/processed foods could be an effective way to promote healthy eating habits.

The utilization of adequately iodized salt is one of the essential requisites to prevent IDD. A survey conducted by Roy et al., (2016) with 253 participants revealed that 71.1% had good knowledge about salt iodization. A similar study by Datta et al., (2018)showed that out of 260 participants, only 92 (35%) were aware of salt iodization, which was lesser than our results. Andersson et al., (2008) reported that iodine deficiencies are major public health problems in India, and only 51% of Indian families are using adequately iodized salt. Creating awareness regarding salt iodization would encourage people to use adequately iodized salt to achieve optimal iodine nutrition.

A study by Roy et al. (2016) showed that 54.1% of households were aware of the role of iodine in the cure of goiter for growth and development, and about 15% of them believed that it was essential for remaining healthy. Another study among the rural households of low iodized salt coverage states in India showed that 58.7% of households were aware of iodized salt. Only 35.4% of their respondents knew that iodine deficiency causes "less mental development and diminished intelligence" (Iodized salt coverage study, 2010). A study conducted by Nwadiaro & Beshel (2019) among women of reproductive age, revealed that 68% had poor knowledge of IDD. The present findings indicate that the knowledge and awareness of the school and college students about salt iodization and IDD were unsatisfactory, and this reflects the necessity to educate adolescent females about the spectrum of diseases caused by iodine deficiency and its prevention.

A notable proportion of school and college students believed iodine as the leading mineral present in all kinds of salt. Advertisements regarding iodized salt on television, radio, and other media networks have made our participants believe iodine as a chief mineral. Hence, they could not identify sodium as the chief mineral present in all varieties of salt. Proper knowledge regarding the mineral content of repetitive dietary ingredients such as salt would result in balanced mineral consumption. As in this case, the populace who believed iodized salt as the highest mineral holding component would only have good access to iodine as iodized salt is inferior in terms of various other minerals.

Health-hazardous anti-caking agents like sodium and potassium ferrocyanide are added to table salt during the refining process to prevent clumping. It has been reported that the premium brands of refined and iodized salts sold in India contain alarming levels of carcinogenic and harmful chemicals as additives. More than half of the respondents were not aware of the health risks accompanied by the consistent use of refined salt

augmented with additives for a more extended period. Many opined that additives are used to maintain the texture and to stabilize the natural components of salt. Hence, it is essential to educate the student community, create awareness, and caution people to make healthy salt preferences.

Practice and consumption pattern of salt among the participants:

Himalayan pink salt contains many minerals compared to iodized table salt as it undergoes an advanced refining process which aid in the loss of its mineral content. To properly check sodium intake and maintain it below the recommended levels (<2 g/day), we can use any variety of salt that satisfies our taste buds. In the present study, only half of the participants (52%) have reported the use of iodized salt in their house, which is relatively higher than that of the results indicated by Datta et al. (2018), where 11.9% of their survey participants reported the consumption of iodized salt. Another study conducted among households in the rural area of Uttar Pradesh (Roy et al., 2016) showed that 54% of them were using iodized salt. Using different kinds of salt ensures that all the benefits are acquired since each salt type has a higher concentration of some minerals than others. The normal population needs to consume a balanced diet; in that case, a regular shift between different salt types would provide the individual with all the essential minerals and thus may prevent them from corresponding deficiencies.

A recent study on brands of salt used by the consumers indicated that the preferences of salt were in order of TATA (28%), Aashirvad (20%), Patanjali (14%), Everest (22%), and other company salts (16%) (Nithya. 2019). While purchasing salt, it is essential to understand that the primary source (natural raw material) should be hygienic; if processed, it is wiser to select the least processed one.

The Government of India promoted the smiling sun symbol to easily recognize an iodized salt packet (Cariappa and Singh., 2002). A survey by Datta et al. (2018) demonstrated that 54 % of their survey participants did not recognize iodized salt packets, only 10% recognized from the smiling sun logo, and 17.8% identified from the iodine level printed on the pack. A survey by Cariappa and Singh., (2002) in Chennai disclosed that only 12.2% of their survey participants were aware of the smiling sun symbol printed on the salt packet. Another study showed that only 4% of participants recognized the smiling sun symbol (Kumar et al., 2013) . All these studies disclosed that the knowledge of the participants in this aspect was not satisfactory. Hence imparting knowledge through health education campaigns is recommended.

A survey by Singh & Raghuvanshi (2014) regarding the household storage practices of iodized salt indicated that 47% of respondents used glass containers for storage, which was relatively higher than our results. A similar study by Goris et al., (2018) revealed that 54% of the survey participants used plastic containers. Plastic containers are permeable to gases which might contribute to mild loss of iodine; Glass is the suitable material to make salt containers because of their impermeable nature (Goddard and Palling, 1980). Storage of iodized salt in airtight containers kept in cool, dry, and dark conditions is vital to acquire adequate iodine.

Iodized salt contains fortified iodine, which is a volatile mineral and evaporates during cooking. The time of addition of salt while cooking is of great importance in preserving the iodine content. A study held among adolescent girls testified that 39.9% of their families added iodized salt to the food at the beginning of the cooking process, 25.1% added salt at the end of cooking, and only 18.8% used it at the table (Heidari et al., 2019). In a study conducted (Datta et al., 2018) among 260 participants, 61.9% of them reported the addition of salt in the middle of cooking, 1.5% at the end, and 36.5% at the beginning of cooking. These two studies have reported similar results as our survey.

To effectively utilize the iodine present in iodized salt, it must be added to food at the end of cooking. It is evident that only a few participants in the present study and other studies reported adding salt at the end, which reveals the alarming need to create awareness on the proper utilization of iodized salt among the general public. Initial steps would focus on the most affected groups like women of reproductive age and adolescent females.

In the current study, more than half of the school and college students reported the consumption of salt for its taste. Datta et al. (2018) showed that 36.9% of their participants consumed salt because of its taste and 45.4% consumed salt because it is essential for maintaining good health. Another study disclosed that 48.5% of respondents used salt for an added sense of taste, and only 18.9% consumed salt because of its health benefits (Karmakar et al., 2019) . It is essential to spread awareness amongst the general population about

the health benefits of salt to prevent misconceptions. Consuming salt for taste leads to overindulgence, which leads to excess food consumption, depending on the individual taste preference rather than the actual requirement.

According to the India Iodine survey (2019), Tamil Nadu has an iodized salt coverage of 61.9%. A few more steps are needed to reach the USI goal (70% iodized salt coverage). To achieve the goal, frequent awareness programs and continuous monitoring of the production and supply of iodized salt are crucial.

The responses given by the school and college students were compared using the chi-square test. The findings showed a significant difference between the knowledge of the two student groups in some areas. College students were more likely to identify the correct RDA of salt, health problems associated with increased salt consumption, and the reason for using additives in salt. School students were comparatively familiar with the mineral composition of salt and the chief mineral present in all types of salt. A significant difference was observed in some practices and consumption patterns of the two student groups.

Compared to school students, most of the college students stated the use of more than one type of salt in their house. Significant variation was noted between the reasons for salt consumption of the two student groups. The majority of college students consumed salt solely for its taste without considering its health benefits. Irrespective of the level of education, the other questions assessing the knowledge, practices, and consumption patterns of salt among the school and college students were similar. Awareness programs at the school and college level to educate the student community concerning salt intake and appropriate handling practices would encourage healthy salt consumption.

5. CONCLUSION

The present study provides the level of knowledge, practices adopted, and consumption patterns related to salt among adolescent females in Chennai. Most of our participants were unaware of the RDA of salt, IDD, and additives in processed salt. Many respondents were not able to identify sodium as a chief mineral present in all types of salt. On the other hand, many participants were aware that excessive salt consumption might increase blood pressure and other health issues. Many students reported storage of salt in plastic containers and its addition in between the cooking process. Almost no one knew about the iodized salt logo, the smiling sun symbol. The present survey imposes the urgent need to create awareness on salt and its intake levels, IDD, and effective handling practices. Proper guidance is necessary to avoid discretionary and inappropriate salt consumption practices among the vulnerable groups and the general public. Regular health checks by government physicians in schools & colleges are essential to identify the adolescents affected by IDD. Frequent awareness campaigns that impart sufficient knowledge related to dietary sodium (salt), iodized salt, and IDD are the need of the moment.

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Strengths and Limitations

The present study was successfully carried out with 100% response rate. The heart-warming outcome of our survey was that all the participants agreed to spread awareness among their family and friends, thus benefiting society. The main limitation of the study is the lack of iodine assessment in salts used by the respondents. A larger number of student participation would have assessed the knowledge, practices, and consumption patterns on a broader scale.

Recommendations

A detailed survey among a diverse population with a greater number of participants is required. Estimation of the iodine content of salt at households and determining urinary iodine concentration is recommended to prevent/overcome IDD.

Conflict of Interest

The authors declare that there are no potential conflicts of interest

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Figure 1: Outline of the survey

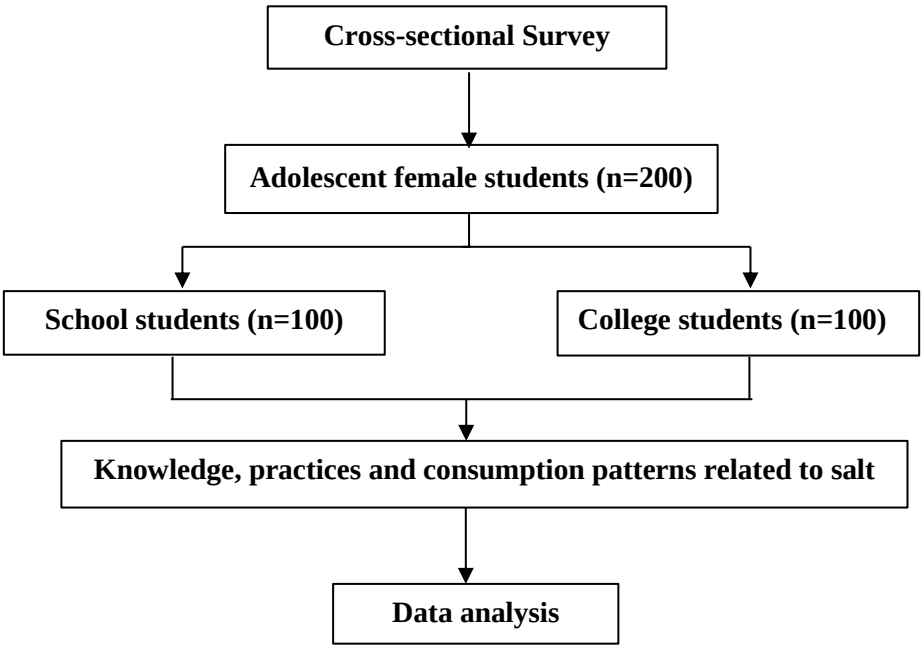

Table 1: Responses of the survey participants to the questions that revealed their knowledge of RDA, salt intake, health risks, salt iodization, and IDD

S. No.	Question	Response	School Students (n=100) %	College Students (n=100) %	Chi Square (X^2)	P Value
1	RDA of salt	Aware	15	28	5.006	**0.02**
		Not Aware	85	72		
2	How much salt do you think you consume?	Too much	32	25	3.07	0.38
		Right amount	12	20		
		Too little	11	9		
		Not aware	45	46		
3	Health problems caused by increased salt consumption	Aware	54	78	12.83	**0.0003**
		Not aware	46	22		
4	Dietary sodium (salt) increases blood pressure	Aware	63	72	1.84	0.17
		Not aware	37	28		
5	Salt iodization	Aware	50	60	2.02	0.15
		Not aware	50	40		

6	Iodine deficiency disorders	Aware	13	23	3.38	0.06
		Not aware	87	77		

*Bold values indicate statistical significance at P ≤ 0.05 level

Table 2: Responses of the survey participants to the questions that revealed their knowledge related to minerals and additives present in salt

S. No.	Question	Response	School Students (n=100) %	College Students (n=100) %	Chi Square (X^2)	P Value
1	Mineral composition of salt	Aware	82	32	50.99	< **0.00001**
		Not aware	18	68		
2	Chief mineral present in all types of salt	Sodium	45	27	7.24	**0.02**
		Iodine	41	57		
		Calcium	14	16		
3	Salt containing the highest mineral composition	Sea salt	34	25	2.20	0.33
		Iodised salt	50	54		
		Himalayan pink salt	16	21		
4	Additives present in salt.	Aware	38	33	0.54	0.45
		Not aware	62	67		
5	Health risks associated with the intake of additives in salt	Allergy	35	32	0.64	0.88
		Asthma	9	9		
		Hyperactivity	14	18		
		Cancer	42	41		
6	Reason for usage of additives in salt	Texture	21	32	9.74	**0.02**
		To alter the chemical composition	9	9		
		To stabilize the natural components	29	12		
		Texture & to stabilize the natural components	41	47		

*Bold values indicate statistical significance at P ≤ 0.05 level

Table 3: Responses of the survey participants to the questions that revealed their practice and consumption patterns of salt

S. No.	Question	Response	School Students (n=100) %	College Students (n=100) %	Chi Square (X^2)	P Value
1	Type of salts used for cooking	Sea salt	10	12	5.59	0.23
		Iodised table salt	46	58		
		Himalayan pink salt	5	2		
		Sea salt and table salt	28	23		
		Other type of salts	11	4		
2	Do you use more than one type of salt in your home	Yes	65	83	8.42	**0.003**
		No	35	17		
3	Brand of table salt used	TATA salt	74	73	0.28	0.99
		Aashirvaad salt	9	9		
		Annapurana salt	4	5		
		VVD Priyam salt	5	4		
		Local Vendor	8	9		
4	Recognition of iodized salt from its packet	Smiling sun logo	1	1	2.92	0.23
		Iodine level printed	52	40		
		Not aware	47	59		
5	Preferable storage method	Plastic airtight container	66	68	4.29	0.36
		Glass container	15	21		
		Ceramic container	6	4		
		Mud pot	7	2		
		Stainless steel container	6	5		
6	Time of addition of salt during cooking	Beginning	15	17	0.90	0.82
		In between	68	70		
		End	9	8		
		At any time	8	5		
7	Reason for salt	Taste	60	76	6.07	**0.047**

consumption	Health benefits	21	14
	Both taste and health benefits	19	10

*Bold values indicate statistical significance at $P \leq 0.05$ level