

# Effect of Spicy Diet on Health: A Comprehensive Study

## Research Article

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### Abstract

Spices have been an integral part of cooking since ancient times and are widely used as flavouring and colouring agents around the world. The active component that gives spicy food its hot tangy flavour is capsaicin.

Capsaicin provides many health benefits and therefore, is now also introduced in medical, cosmetic and perfume industry. Asians consume more spicy food compared to western countries. Some people frequently savour spicy food while others try and avoid it, because a lot of people believe that frequent consumption of spicy food causes common health effects such as acidity, loss of appetite, excessive sweating, skin reaction and burning sensation while urinating. The purpose of this study was to investigate the relationship between frequent consumption of spicy food and health effects. A survey-based study was conducted to determine the frequency of spicy food intake, preferences and other general characteristics. Based on the data collected, chi-square and correlation tests were performed on the selected health ailments. Maximum population (47%) preferred moderate level of spiciness and only 4.7% preferred extreme level of spiciness. No correlation was found between level of spiciness and health effects. These findings suggest that consuming spicy food is not the sole reason for health effects.

**Keywords:** Spicy diet; Capsaicin; Health effects; Statistical analysis; Chi-square test; Correlation test

## Introduction

Spice is a crushed powder of fruit, bark, root, or seed of specific plants and is used since long time as a flavoring and coloring agent. Other components commonly used as flavoring agents are herbs. Spices can be distinguished from herbs, as herbs are extracted from leaves, flowers or stems of plants. Spices have been used as color and flavoring agents, for preservation, and medical purpose in many ancient cultures around the world [1]. Now-a-days, perfume, cosmetic and pharmaceutical industries have also started including spices in their products.

On an average, Asian people consume 2.5-8 g chili per day, versus ~ 0.1-0.5 g per day by Europeans and Americans [2]. This indicates the high amount of spice used in Asian cuisines as compared to western countries. The active component in spicy food that provide its tangy

flavour is capsaicin. There are various health benefits of spicy foods. The component capsaicin is believed to keep the weight in check of an individual [3]. It is believed that consuming spicy food increases longevity and body metabolism of an individual, reduces digestive issues, relieves diarrhoea and eases health issues related to heart [4-6].

Spices can relieve arthritic and neurotic pain of an individual and may also be used as an analgesic.[7] Spicy food is seen as a source of endorphin for the people suffering from depression.[8]

Although consumption of spicy food has various health benefits, still there is a common myth among people that frequent consumption of spicy food causes common health ailments such as acidity, excessive sweating, skin reactions, loss of appetite, burning sensation on urinating, etc. Dietary recommendations for the consumption of spicy foods and its effect on health are debatable.

Spicy foods have been consumed by humans for centuries, although the heat present in most plants is an adaptation meant to be a consumption deterrent [9]. Many researchers have explored the psychological and physiological reasons behind different preferences towards spicy foods. When spicy food likers and spicy foods non-likers consumed spiked jelly with equal amount of capsaicin, non-likers rated the jelly to be more intense and less pleasant than likers. The results of this study propose that genetic factors may also help explain differences in pungency [10]. A finding mentioned in Jay M. Lillywhite, 2013 suggests that exposure can develop likeness towards spicy food [9], while other findings show no difference between “non-likers” and “likers” in their exposure to spicy foods [10]. Cultural influences (e.g., role models, early introduction) may also affect frequency of consumption of spicy foods [2].

Certain individuals develop preference for spicy foods, while others reject them, this holds substantial merit in public health which is explained and understood by improved potential mechanism. One mechanism that may account for difference in spicy food preference is that, experience may alter the sensory responses elicited by spicy foods, leading to more favourable evaluations and increased consumption frequency of spicy intake [2]. It is conceivable that adaptations induced due to regular, repeated exposure, however initiated, may allow individuals to more easily tolerate the pungency of spicy foods and suffer less health effects [2].

Hedonic responses towards spicy foods are varied extraordinarily, ranging from high desirability to aversions [2]. The frequency of consumption of spicy food and customary concentration are equally diverse, suggesting that sensation seekers require greater stimulation from foods with respect to taste (flavour) and texture [2].

Earlier works from the 1970s and 1980 reported positive correlations between sensation seeking behaviour and the consumption of spicy foods [2]. The beneficial effects attributed to chili peppers in extreme climates represent dynamic culture impact on food choice [2]. The sweating induced by chili peppers is viewed as a cooling mechanism in hot weather [2], whereas for some it is considered as side effect of spicy food.

In humans, it is well established that repeated experience and exposure with unfamiliar foods increases both liking and preference [2] for those foods. The frequency of spicy food intake plays potential role in likeness and preference towards it. Some people frequently savour spicy food while others try and avoid it, because a lot of people believe that frequent consumption of spicy foods cause health effects. Therefore, a survey was conducted to evaluate the frequency of spicy food consumption and its effect on health. The objective was to statistically check whether the common health effects faced by large population, like acidity, excessive sweating, skin reactions, loss of appetite, burning sensation while urinating, etc are linked to excessive spicy food consumption and put forward the facts related to it.

## Materials and Methods

### Subject study

The frequency of intake of spicy foods was estimated using a

validated dietary habit questionnaire. The participants were chosen from an urban demographic area. A survey was conducted and 406 responses of urban population were collected from different age groups. The information collected was kept anonymous and clear objectives were provided to the participants of the survey with regard to the purpose of the study.

### Hedonic assessment of preferences

The questionnaire for the survey was prepared using ‘Google forms’ to determine general characteristic, spice habits of people and their health status. The questionnaire was divided into three parts, general information like age, weight, gender and physical activity was included in the first part. In the second part, questions regarding their use of spicy food, reasons for their preference, likeness towards spicy food and frequency of spicy food intake were asked. In third part, data related to medical history, their health status and health effects experienced by consumption of spicy foods were collected.

### Statistical analysis

The primary data obtained from the 406 responses was maintained in Microsoft Excel (2018). The chi square test was applied to examine the association between frequency of consumption of spicy food and various health effects considering the standard alpha value to be 0.05. Correlation test was performed to evaluate the relation between level of spiciness and health effects. The studied health effects were supported with relevant graphs and distribution curves.

## Results and Discussion

### Chi square test

Chi square test was performed for the comparative study of the parameters like frequency of consumption of spicy food, common health effects observed after consumption of spicy food, and the frequency of occurrence of health effects. The null hypothesis and the alternate hypothesis are as follows:

Ho = The frequent consumption of spicy food does not cause health effects.

H1 = Frequent consumption of spicy food causes health effects.

The standard alpha value for the test was considered to be 0.05

The chi square test was performed for the health effects Acidity, Skin reactions, Excessive sweating, Loss of appetite, Burning sensation while urinating.

This large cross-sectional study explored the association between spicy food consumption with health effects. The dataset obtained from the responses of 406 candidates was examined and suitable statistical tests were performed to extract valuable insights from the data.

Figure 2 shows the individual analysis of the frequency of occurrence of each of the health ailments studied, which is also in agreement with the results obtained from chi square test, since graph of each of the respective health ailments depict the bar for the response ‘rarely’, more than any other option mentioned.

The fondness of spicy food and level of spicy food that population prefers is represented in (Figure 3). According to this data, the

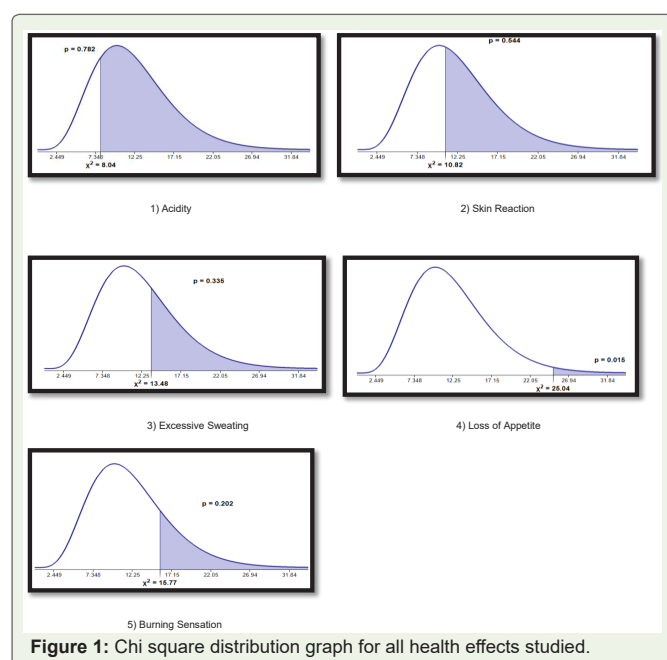


Figure 1: Chi square distribution graph for all health effects studied.

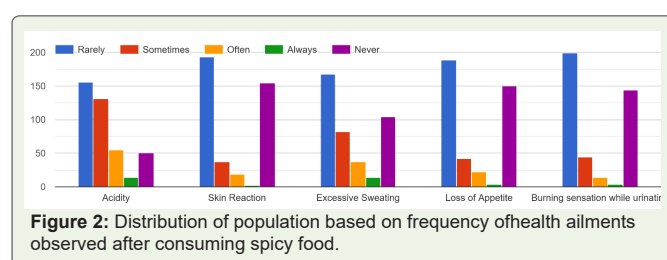


Figure 2: Distribution of population based on frequency of health ailments observed after consuming spicy food.

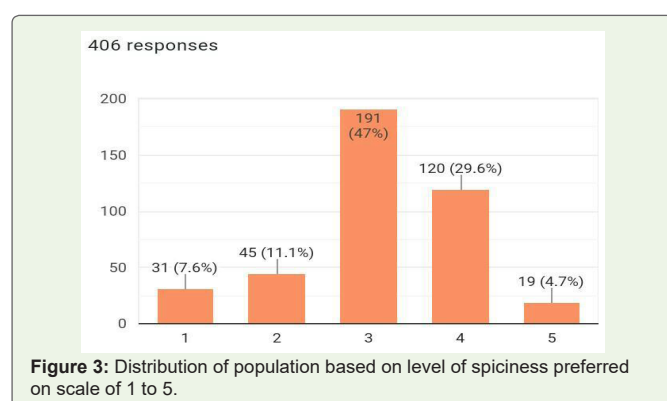


Figure 3: Distribution of population based on level of spiciness preferred on scale of 1 to 5.

extreme level of spiciness is preferred by very less population (4.7%). Maximum population (47%) reported that they prefer medium level of spiciness in their food and 7.6% of population reported very low level of spiciness. In agreement with previous studies, this may be due to difference in their sensory perception and experience with spicy food or due to different stimuli of oral lingual trigeminal innervation. [2] Level of spiciness was correlated with health effects and the results shown in table 2 which indicate that level of spiciness consumed have no relation with health effects. The “r” and “r<sup>2</sup>” values come close

to zero for all the health effects studied thus indicating their low dependency on spicy food consumption.

According to the data represented in table 1 for acidity, individuals that consumed spicy food 1-2 days (15.2%) or 3-5 days (15.5%) experienced acidity rarely. Whereas, only 3.4% individuals suffered from acidity every time they consumed spicy food. Maximum population (38.4%) rarely suffered from acidity irrespective of frequency of consumption of spicy food. This shows that experiencing acidity is independent of frequency of spicy food consumption. Most previous population-based studies showed similar results. In a study conducted in 2019, by S. Rajaie the frequency or severity of heartburn was not significantly associated with spicy food consumption among women [11]. Similar results were obtained in a population based Australian study [12].

The data in table 1 illustrates the results for loss of appetite. As much as 20.9% of the population consuming spicy food 1-2 days have rarely experienced loss of appetite after consumption of spicy food. Among total population, 48.7% rarely experience loss of appetite, 0.9% have always experienced and 36.9% have never experienced loss of appetite irrespective of frequency of consumption of spicy food. The chi square test suggests that frequent consumption of spicy food causes loss of appetite as  $p < 0.05$ . Therefore, null hypothesis is accepted. In earlier study conducted in 2012 by S. Whiting, it was observed that regular consumption of spicy food significantly reduced adipose tissue level and showed reduction in appetite as well as energy intake [13]. Consumption of spicy food has been shown to cause an increase in gut derived hormone, which may be affecting hunger [13]. It may be that the release of catecholamine's caused by capsaicin, is influencing appetite [13]. It was also observed that there was less of an effect on appetite amongst those that were consuming capsaicin prior to the trial [13]. It is possible that Capsaicin have synergistic effect with bioactive ingredients [13]. For example: the combined effect of Capsaicin and green tea supplement reduced appetite and energy uptake [13]. However, spicy food could play a role in reduced appetite but is not the sole reason for loss of appetite.

The distribution of participants in terms of frequency of consumption of spicy food and skin reaction is shown in table 1. Maximum population i.e., 47.5% have experienced skin reaction rarely, whereas 38.1% have never experienced it. This suggests that there is no correlation between spicy food intake and skin reaction. But in an article published by marquee medicalin 2017 they had referred an outcome from Eastern Mediterranean Health Journal, 2006 which concluded that acidic content in spicy food alters skin pH levels that triggers inflammatory reactions causing irritation and breakouts on your skin [14]. Spicy foods are not stimulating for everyone. Some people are sensitive to such foods because they cause inflammatory chemicals in their bodies to dilate, allowing the blood vessels in their skin to flush and turn red [15]. This could be the reason why only 0.4% of the population has experienced skin reaction every time they consumed spicy food.

The statistical data analysis for excessive sweating in table 1 shows that, 82.6% of population consuming spicy food for 1-2 days has never experienced excessive sweating. As much as 56.5% of individual

**Table 1:** Evaluation of frequency of consumption of spicy foods and health effects (chi square test)

Frequency of consumption of spicy food	1-2 days		3-5 days		Daily		Never		Total		P (alpha value = 0.05)	Test statistics	Critical value
	n	%	n	%	n	%	n	%	n	%			
Acidity													
Rarely	62	15.2	63	15.5	23	5.6	8	1.9	156	38.4	0.7 (p>0.05)	8.0358	21.026
Sometimes	56	13.7	46	11.3	20	4.9	9	2.2	131	32.2			
Often	23	5.6	17	4.1	10	2.4	5	1.2	55	13.5			
Always	6	1.4	3	0.73	3	0.73	2	0.5	14	3.4			
Never	16	3.9	21	5.1	11	2.7	2	0.5	51	12.5			
Excessive sweating													
Rarely	75	18.4	57	14	26	56.5	11	2.7	169	41.6	0.33 (p>0.05)	13.476	21.026
Sometimes	37	9.1	27	6.6	10	2.4	7	1.7	81	19.9			
Often	11	2.7	17	36.9	9	2.2	1	2.1	38	9.3			
Always	2	0.4	7	1.7	3	0.7	2	0.4	14	3.4			
Never	38	82.6	42	10.3	19	4.6	5	1.2	104	25.6			
Loss of appetite													
Rarely	85	20.9	65	16	27	6.6	11	2.7	188	48.7	0.015 (p<0.05)	25.038	21.026
Sometimes	15	3.6	17	4.1	7	1.7	3	0.7	42	10.3			
Often	10	2.4	9	2.2	1	0.2	2	0.4	22	5.4			
Always	0	0	0	0	2	0.4	2	0.4	4	0.9			
Never	53	13.0	59	14.5	30	7.3	8	1.9	150	36.9			
Skin reaction													
Rarely	83	20.4	74	18.2	23	5.6	13	3.2	193	47.5	0.54 (p>0.05)	10.813	21.026
Sometimes	8	1.9	8	1.9	3	0.7	0	0	19	4.6			
Often	16	3.9	10	2.4	8	1.9	3	0.7	37	9.1			
Always	0	0	1	0.2	1	0.2	0	0	2	0.4			
Never	56	13.7	57	14	32	7.8	10	2.4	155	38.1			
Burning sensation while urinating													
Rarely	90	22.1	70	17.2	29	7.1	10	2.4	199	49	0.2 (p>0.05)	15.752	21.026
Sometimes	17	4.1	12	2.9	10	2.4	6	1.4	45	11			
Often	8	1.9	5	1.2	1	0.2	0	0	14	3.4			
Always	1	0.2	1	0.2	1	0.2	1	0.2	4	0.9			
Never	56	13.7	51	12.5	27	6.6	10	2.4	144	35.4			

From the P values calculated from chi square test it can be concluded that,

P values > Alpha value ( for acidity, skin reaction, excessive sweating, burning sensation while urinating)

P value< Alpha value( for loss of appetite)

Thus, null hypothesis ( $H_0$ ) is accepted, i.e., the frequent consumption of spicy food does not cause health effects except for loss of appetite where null hypothesis( $H_0$ ) is rejected suggesting that frequent consumption of spicy food leads to loss of appetite.

**Table 2:** Correlation Test between level of spiciness and health effects.

	Level of Spiciness (r)	r <sup>2</sup>
Level of Spiciness	1	
Acidity	-0.104769551	0.010976659
Skin Reaction	-0.037511701	0.001407128
Excessive Sweating	-0.033046082	0.001092044
Loss of Appetite	-0.097528073	0.009511725
Burning sensation	-0.113915276	0.01297669

Correlation test was performed between level of spiciness and health effects.

The r and r<sup>2</sup> values are close to 0 therefore, the level of spiciness does not correlate with the health effects.

population have rarely experienced excessive sweating even though they consumed spicy foods daily, whereas, population consuming spicy food for 3-5 days (36.9%) have experienced it often. Among the sample population, 22.1% of people consuming spicy foods for 1-2 days rarely experienced burning sensation while urinating, while 4.1% experienced it sometimes. Whereas, 6.6% of population have never experienced it even though they consume spicy food daily. These

results suggest that experiencing sweating and burning sensation while urinating has no relation with spicy food intake. No previous trials or studies were found that investigated the association between spicy food consumption, excessive sweating and burning sensation. Further investigation in this area would provide useful insights which would help in drawing solid conclusions. Also, the chi square distribution graphs shown in fig (a) obtained from statsdistribution.com are in sync with the chi square test results.

Overall, it was seen that there is no significant statistical association between frequency of consumption of spicy food and health effects except for loss of appetite where association was observed between consumption of spicy food and reduced appetite.

In earlier studies, conducted by Qiaorui Wenet al in year 2020, it was found that metrics of spicy food consumption including frequency and pungency degree, have been grouped with diverse factors, including tea/alcohol consumption, tobacco, smoking and different dietary habits. In addition, details of lifestyle vary across frequency of consumption of spicy food and pungency degree which

affect health outcome in different ways [5]. These earlier results propose that the changing potency of other dietary habits, tea/alcohol consumption and smoking as well as the patterns of these behaviours must be taken into consideration while assessing the health effects of spicy food consumption. Besides, our study didn't take into account the amount of spicy food intake and way of cooking. This would have made the study more complete.

## Conclusion

The present findings suggest that maximum population prefer medium level of spiciness in their food and there is no correlation between level of spiciness consumed and health effects. No statically significant relation was found between frequency of spicy food intake and health effects except for loss of appetite. Although there is no direct relation between them but there are chances that if combined with other dietary habits, smoking, tea/alcohol consumption, spicy food can cause adverse health effects.

Further, the study can be conducted in specific demographic groups by considering various other factors such as age, gender, health, diet, amount of physical activity, etc along-with amount of spicy food intake and way of cooking while assessing health effects along with frequency in order to conclusively say that spicy food alone is not directly responsible for health effects.

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