Exploring the Relationship Between Garlic Intake and the Risk of Getting Different Types of Cancer

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Abstract. Whether the correlation exists between the risk of getting cancer and garlic intake is a mystery. On one hand, the media advertise that garlic could lower the opportunity of getting cancer, but on the other hand, no serious proof or studies are given. In order to quantitatively demonstrate the authenticity, a meta-analysis is applied grounded upon previous works for exploring the relationship between garlic and cancer. Five different types of cancers are considered in this work, including gastric, colon, prostate, breast, and lung cancer. The collected dataset is analyzed by the linear probing model for evaluating the previous results measured by risk ratio (RR) or odds ratio (OR). Then the averaged correlations between garlic intake and cancer of different types are calculated and further visualized for comparison. The results show that no major correlation is identified between garlic intake and the opportunities of suffering from all kinds of cancer. Moreover, the degree of correlation between different types of cancer can have a discrepancy to some extent.

Keywords: Garlic intake; cancer; linear regression; multiple types of cancer.

1. Introduction

Some people in China believe that eating raw garlic will kill the bacteria and viruses in the human body and thus reduce the risk of getting cancer. The anecdote is being propagated by the media and there are some people who believe in such unverified information. In the media reporting, they use the word about the research report vaguely and they also like to exaggerate some cases to get more attraction from the general public. This is the typical action of the media. They like to take some extreme cases and use that particular result and tout it to the general public. For example, they would say something like based on research, people eating garlic will decrease the risk of getting cancer by 50%.

However, most people will not dig deeper into the research results they exaggerate because they are busy with their lives and basically nobody really cares about it. This situation causes some of the general public easily believes the result and thus spread the false results to other people for secondary promotion. This is especially common in regions where garlic takes up a relatively large portion of the daily diet. In some regions of China, for example, He Nan, people believe the report sensationalism and believes that taking garlic as their diet will kill the bacteria thus reducing the risk of getting cancer.

In order to correct this thought, several data analyses were applied to the research results of studying garlic intake and the correlation between different types of cancers. The research involves 5 different types of cancer studies conducted in 8 different countries. The result reveals no clear indication of a correlation exists between having garlic and reducing the opportunity of getting cancer.

2. Method

2.1 Experimental Material

The research data is extracted from several pieces of research conducted in different counties and in different time periods. The data is collected from ‘American Journal of Clinical Nutrition’ by Ji Yeon Kim and Oran Kwon in January 2009 [1].

The five different cancer the studies contained are gastric cancer, colon cancer, prostate cancer, breast cancer, and lung cancer. In the rest part of this section, each cancer's details will be sequentially elaborated.

2.1.1 Gastric cancer data

Gastric cancer, also known as stomach cance, is curable during the early stage. This type of cancer can happen in any part of the stomach. Here, 4 previous studies are evaluated. The first is conducted by scientists from China in 2006 which is an intervention study that involves 3411 subjects. This study leverages a randomized double-blind factorial trial. This method is proposed to lower the prevalence of gastric cancer[2]. The second one is a case-cohort study in the Netherlands which involves 152 subjects and 3340 case-control subjects[3]. The third one is a case-control study in Sweden which involves 338 subjects and 669 case-control subjects[4]. The last one is a case-control study which involves 136 subjects and 136 case-control subjects[5].

2.1.2 Colon cancer data

Colon cancer is one of the most typical cancer types. 9 studies are being extracted about this type of cancer. The first study is conducted by Tanaka in 2004, it is an intervention study in Japan that involves 37 subjects [6]. The second one is by Steinmetz in 1994 which is a case-cohort study in the US that involves 212 subjects and 41837 case-control subjects [7]. The Third is by Giovannucci in 1994, which is a case-cohort study in the US that involves 205 subjects and 47949 case-control subjects [8]. Fourth is by Dorant in 1996 which is a case-cohort study in the Netherlands that involves 443 subjects and 3123 case-control subjects [9]. The fifth is by Levi in 1999 and implemented in Switzerland. This research is a case-control study that involves 223 subjects and 491 case-control subjects [10]. The sixth is by Galeone in 2006, in Italy which involves 2280 subjects and 4765 case-control subjects [11]. Seventh is by Witte in 1996, a case-control study in the US that involves 448 subjects and 448 case-control subjects [12]. Eighth is by Le Marchand in 1997, a case-control study in the US that involves 1192 subjects and 1192 case-control subjects [13]. The last one is by Franceschi in 1998 conducted in Italy which involves 1953 subjects and 5155 case-control subjects [14].

2.1.3 Prostate cancer data

The Prostate is the position that is below the bladder in males. For this type of cancer, 4 studies are being extracted. The first study is conducted by Galeone in 2006, a case-control study in Italy that involves 1294 subjects and 1451 case-control subjects [11]. The second one is by Kirsh in 2007, a case-cohort study in the US that involves 1338 subjects and 29361 case-control subjects [15]. The third is by Hsing in 2002, conducted in China that involves 238 subjects and 471 case-control subjects [16]. Fourth is by Key in UK in 1997 that involves 328 subjects and 328 case-control subjects [17].

2.1.4 Breast cancer data

Breast cancer is also a typical type of cancer; it develops from the breast tissues and grows out of control. The typical sign of breast cancer is a lump in the breast. For this type of cancer, 3 studies are included in the analysis. The first one is by Dorant in 1995, a case-cohort study in the Netherlands that involves 469 subjects and 1713 case-control subjects [18]. The second one is by Galeone in 2006 in Italy. It is a case-control study that involves 2900 subjects and 3122 case-control subjects [11]. The last one is by Franceschi in 1998 that involves 2569 subjects and 5155 case-control subjects [14].

2.1.5 Lung cancer data

Lung cancer is also a typical type of cancer; it develops from the lung tissues which grow out of control. The typical sign of lung cancer is serious coughing and pain in the chest. For this type of cancer, 2 studies are included in the analysis. The first one is by Linseisen in 2007, a cohort study in Europe that involves 1126 subjects and 478590 case-control subjects [19]. The last one is by Dorant in 1994, a case-cohort study in the Netherlands that involves 549 subjects and 3340 case-control subjects [20].

2.2 Method and Evaluation

To analyze the data, the general model applied is a simple linear regression model which is y = constant ± Mean square error(mse). The mse equals to mean of the sum of the square of the difference between the mean and each sample.

The y axis is being flipped from the (0.3,1.2) to (1.2,0.3), the intention is to make the smaller value in the high position since the smaller value of the risk ratio or odds ratio indicates a higher likelihood of correlation, and thus the plots are now better and easier for readers to visualize and compare.

For each research, the degree of relationship is presented as the risk ratio (RR) or odds ratio (OR). RR and OR compare the risk or odds of getting cancer among one group of people who takes garlic with the risk or odds of another group that doesn't take garlic.

$$\text{OR} = \frac{\textit{odds of getting cancer while taking the garlic}}{\textit{odds of getting cancer without taking any garlic}} \tag{1}$$

$$\text{RR} = \frac{\textit{risk of getting cancer while taking garlic}}{\textit{risk of getting cancer wtihout taking any galic}} \tag{2}$$

The OR and RR are approximate to each other for rare diseases, in this case, cancer.

When the risk ratio or odds ratio is really close to 1, it indicates there is no correlation between intake and reducing cancer risk. When the OR or RR gets smaller, the possibility of a negative correlation between the garlic and getting cancer grows larger.

3. Results and Analysis

In order to reveal the correlation, the RR or OR are divided into 6 categories. When RR or OR is in between 0.95 and 1.05, there is no correlation between; When RR or OR is in between 0.85 and 0.95, there is almost no correlation; When RR or OR is in between 0.75 and 1.85, there is a minor correlation; When RR or OR is in between 0.65 and 0.75, there is a moderate correlation; When RR or OR is in between 0.55 and 0.65, there is some correlation; When RR or OR is in between 0.45 and 0.55, there is a major correlation.

This section will analyze the correlation between garlic and its effectiveness in reducing the opportunity of getting different types of cancer. In section 3.6, The analysis of comparison of the relationship between garlic and 5 different cancers is presented. Then in section 3.7, the correlation between the amount of garlic intake and its effectiveness in decreasing the probability of holistic cancer is evaluated.

3.1 Gastric Cancer Risk Analysis

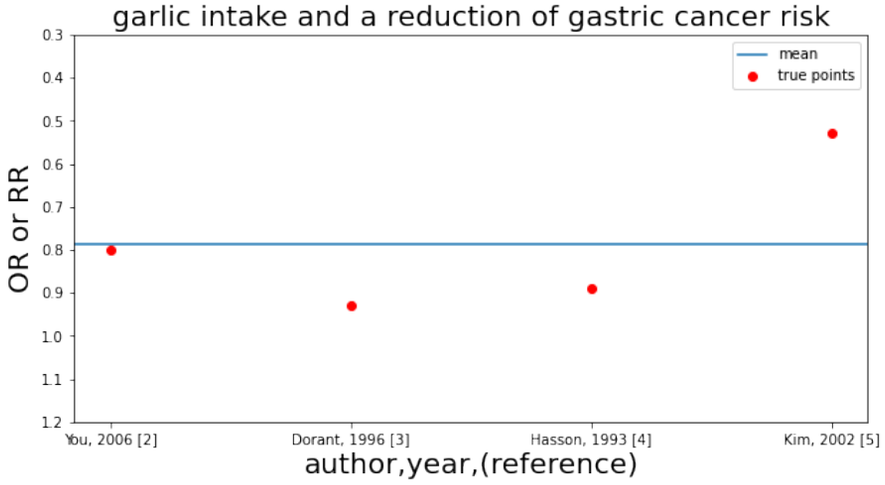

Fig. 1 Correlation between gastric cancer risk and garlic. Averaged risk ratio is 0.788 ±0.024.

According to Figure 1, the mean value for the risk ratio is about 0.79, which is close to 0.8. However, 0.8 means there is only a minor opportunity that consuming garlic could decrease the possibility of getting gastric cancer. Thus having garlic has a nearly minor correlation with getting gastric cancer.

The study that contains the most number of subjects is from You(2006)[2] which involves 3411 subjects and Dorant(1996)[3] which involves 3492 subjects. The result of these 2 studies is relatively more convincing, and they indicate minor correlations which correspond to the primary analysis.

Based on the equation the flipping of the mean defined as {mean-mse : mean+mse} is {0.764 : 0.812}. Based on this, mse does not influence the analysis.

3.2 Colon cancer risk analysis

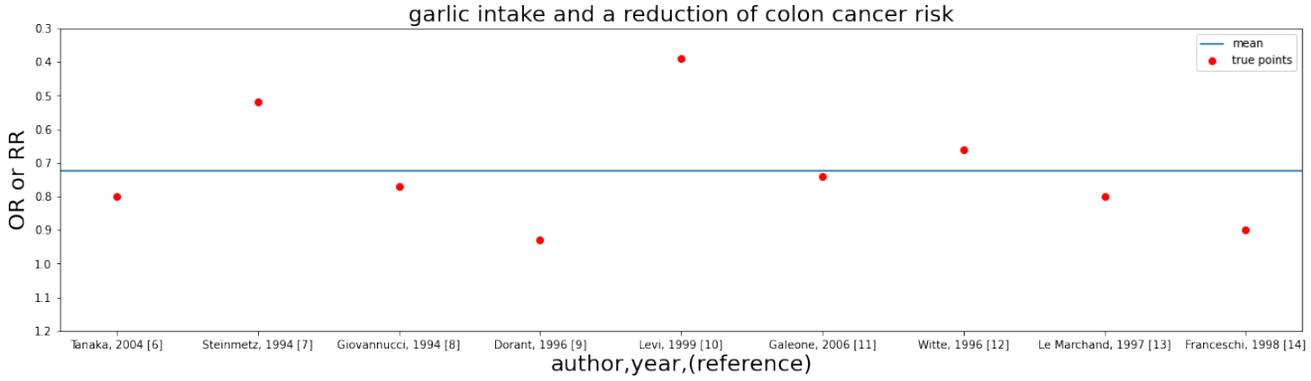

Fig. 2 Correlation between colon cancer risk and garlic. Averaged risk ratio is 0.723 ± 0.027.

According to Figure 2, colon cancer's mean value for the risk ratio is about 0.72, which is close to 0.7. A risk ratio of 0.7 means there is still some moderate but better than minor correlation. Thus, having garlic has a nearly moderate correlation with getting colon cancer.

The study that contains the greatest number of subjects is by Steinmetz (1994) [7], Giovannucci (1994) [8], Dorant (1996) [9], Galeone (2006) [11], and Franceschi (1998) [14] which involve over 3000 subjects. The result of these 5 studies is relatively more convincing, their mean for the RR or OR is 0.772. Which still indicates a moderate to minor correlation as discussed in the primary analysis.

Based on the equation the flipping of the mean defined as {mean-mse : mean+mse} is {0.696 : 0.75}. Based on this, mse does not influence the analysis.

3.3 Prostate cancer risk analysis

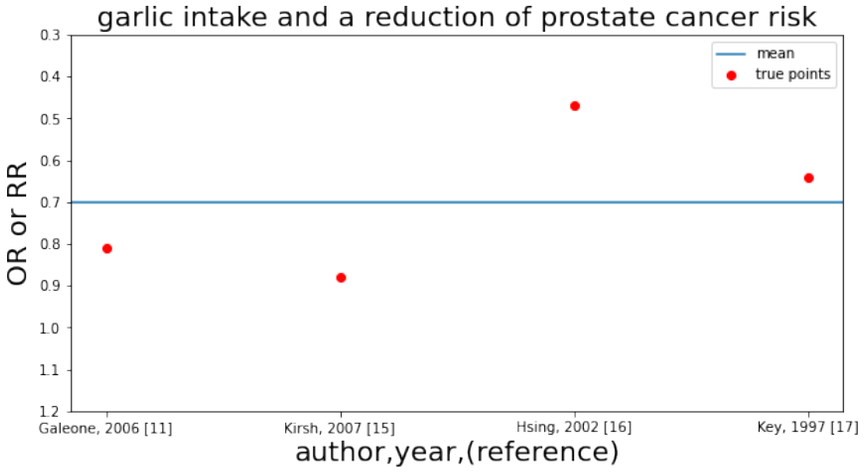

Fig. 3 Correlation between prostate cancer risk and garlic. Averaged risk ratio is 0.700 ± 0.025.

According to Figure 3, colon cancer's mean value for the risk ratio is about 0.7. A risk ratio of 0.7 means there is still a moderate but better than minor correlation. Thus, having garlic has a moderate correlation with getting prostate cancer.

The 2 researches which involve higher than or near 3000 subjects are Galeone [11] and Kirsh [15]. Their mean for the RR or OR is 0.845. There is a large difference between this value compared to the primary analysis, as 0.845 indicates minor to no correlation whereas 0.7 implies moderate correlation.

Based on the equation the flipping of the mean defined as {mean-mse : mean+mse} is {0.675 : 0.725}. Based on this, mse does not influence the analysis.

3.4 Breast cancer risk analysis

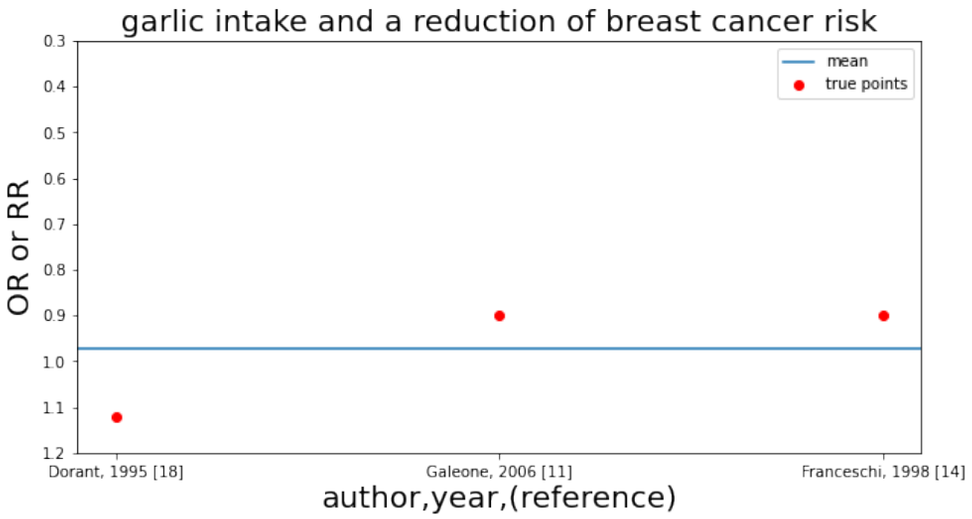

Fig. 4 Correlation between prostate cancer risk and garlic. Averaged risk ratio is 0.973 ± 0.011.

According to Figure 4, breast cancer's mean value for the risk ratio is about 0.97, which is really close to 1. A risk ratio of 1 means there is no correlation occurs. Thus, having garlic has no correlation with getting breast cancer.

The 2 convincing researches which involve over 3000 subjects are Galeone [11] and Franceschi [14]. They both have a RR or OR of 0.9. Which indicates no correlation. This result corresponds to the primary analysis.

Based on the equation the flipping of the mean defined as {mean-mse : mean+mse} is {0.962 : 0.984}. Based on this, mse does not influence the analysis.

3.5 Lung cancer risk analysis

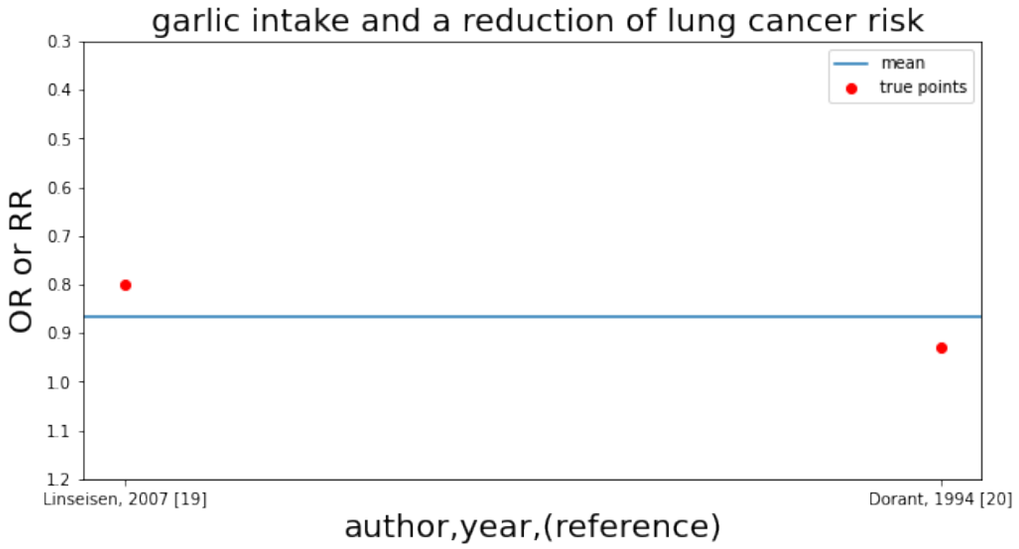

Fig. 5 Correlation between prostate cancer risk and garlic. Averaged risk ratio is 0.865 ± 0.004.

According to Figure 5, lung cancer's mean value for the risk ratio is about 0.86, which is really close to 0.9. A risk ratio of 0.9 means there is almost no probability that consuming garlic could lower the risk of colon cancer. Thus, having garlic has almost no correlation with getting lung cancer.

These 2 analyses here involve more than 3000 subjects so they are both convincing.

Based on the equation the flipping of the mean defined as {mean-mse : mean+mse} is {0.861 : 0.869}. Based on this, mse does not influence the analysis.

3.6 Summary of five cancer risk analysis

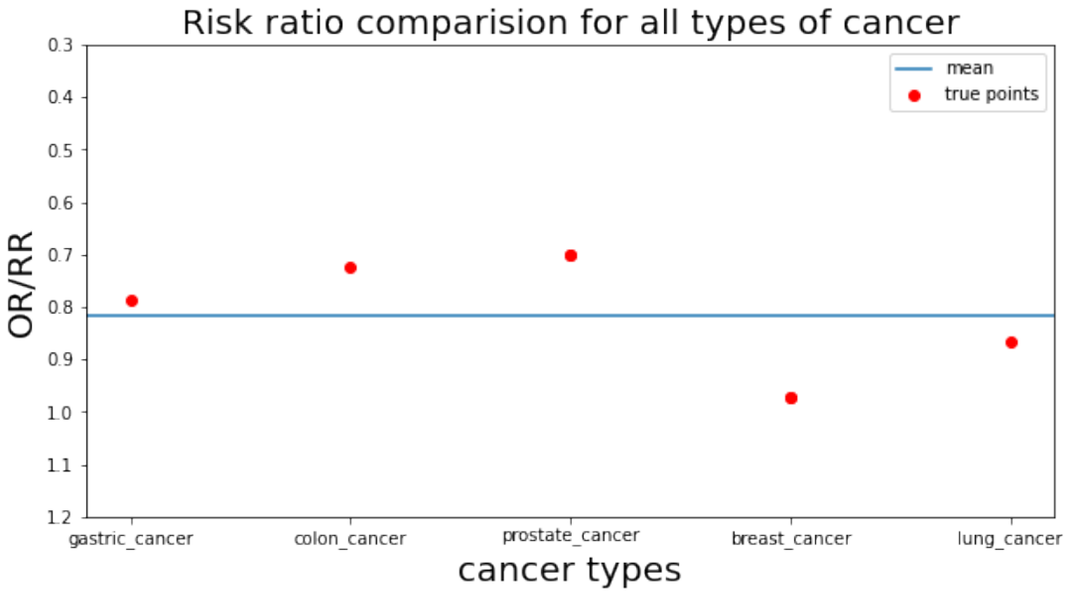

Fig. 6 Correlation between cancer risk and garlic. Averaged risk ratio is 0.810±0.010.

According to fig 6, the cross-sectional comparison of the means of the 5 different types of cancer has a mean value of almost 0.81. This indicates in general, there is only a minor correlation between eating garlic and reducing the chances of getting cancer. According to comparison, the likelihood of

correlation goes from high to low: Colon cancer (0.7), Prostate cancer (0.73), Gastric cancer (0.78), Lung cancer (0.86), Breast cancer (0.97)

Based on the equation the flipping of the mean defined as {mean-mse : mean+mse} is approximately {0.800 : 0.820}. Based on this, mse does not influence the analysis.

3.7 Holistic analysis

By observations in Figure 7, there exist high differences between the risk ratio of getting cancer after eating garlic and the opportunity of getting cancer risk after intermediate intake of garlic. So the absolute value of differences for each research is displayed. Figure 8 is the final result. According to Figure 8, the mean difference in risk ratio is almost about 0.3, which is a high amount. However, according to fig 7, the mean risk ratio after a high intake of garlic only goes to around 0.6. It still indicates only some correlation.

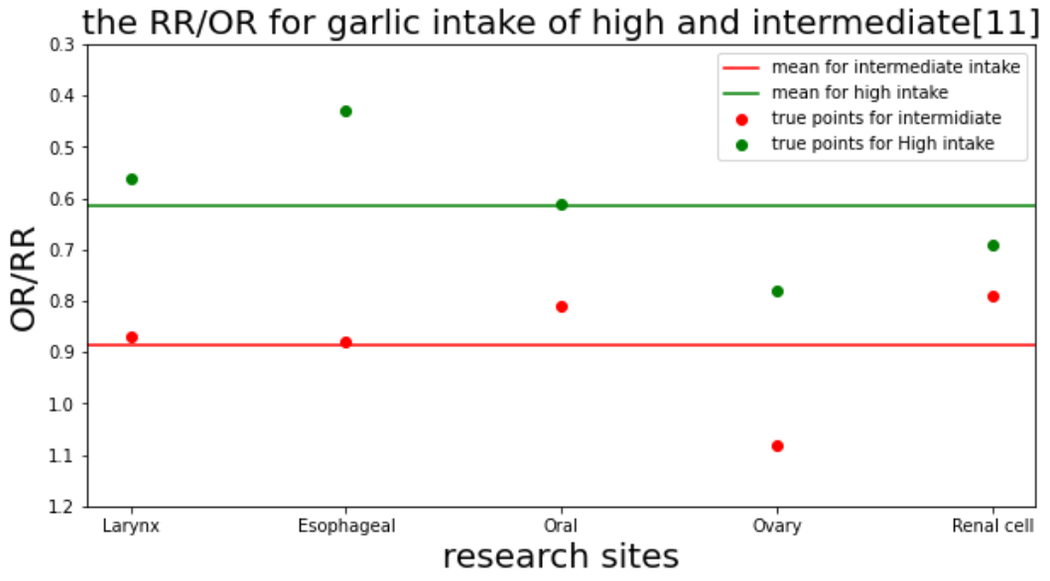

Fig. 7 Averaged cancer risk ration of intermediate garlic intake 0.886±0.014 and high garlic intake 0.614±0.011.

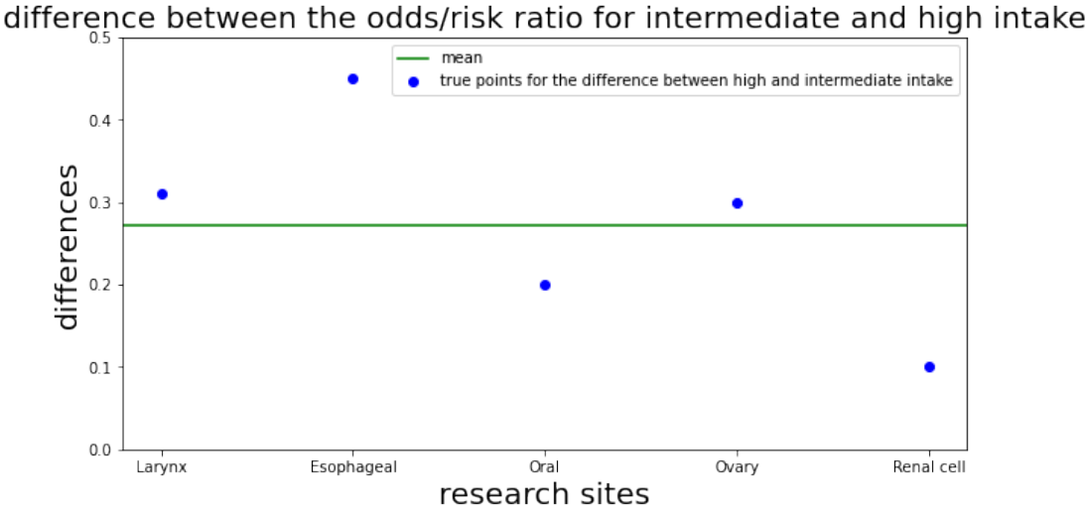

Fig. 8 Difference between the risk ration of intermediate garlic intake and high garlic intake. Averaged risk ratio is 0.272±0.014

The only research which involves more than 3000 subjects is conducted in Ovary [11]. This more convincing research indicates a gap in the correlation between the high intake of garlic and the intermediate intake is 0.3 which corresponds to the primary analysis. However, this research reveals a high difference between its RR or OR and the mean of RR or OR with its cross-sectional analysis. According to Fig 8, this research's OR or RR is around 0.2 increase in their corresponding mean of 2 pieces of research. Which indicates there is still a minor correlation.

Based on the equation the flipping of the mean is defined as {mean-mse : mean+mse}. The flipping of the mean for the intermediate intake is approximately{0.872 : 0.900}; The flipping of the mean for the high intake is approximately{0.603 : 0.625}; The flipping of the mean for the difference of RR or OR for intermediate and high intake is approximately{0.258 : 0.286}; Based on this, mse does not influence the analysis.

3.8 Limitations

First, The region of the research being conducted does not take into consideration. Some of the research data may be influenced by the eating habit of local people as some subjects in specific region eats garlic in their daily diet.

Besides this, the type of garlic being served to the subjects is unclear based on current studies. Some of the research uses cooked garlic and some use raw garlic. Some of the studies only say "garlic supplement". Which is vague as they did not indicate whether it is being cooked. Whether the garlic is being cooked may also flip the result.

Finally, the amount of garlic intake also may influence the risk ratio by a large amount. However, in the studies, they describe the dose in a really vague term. Some say "high intake", but there is no clear indication about the quantitative value of garlic intake amount which will be counted as the "high" intake. Therefore the dosage(quantitative value) of garlic intake can be another significant fact that may flip the conclusion.

4. Conclusion

In this study, the linear regression model is being applied to evaluate the OR and RR for the previous studies exploring garlic consumption and suffering from various types of cancer. The cancer types being explored in this study are gastric cancer, colon cancer, prostate cancer, breast cancer, and lung cancer. The correlation between the number of garlic taking and the extent of decrease in OR or RR of general cancer is also evaluated and discussed.

Based on the study of the mean value of the RR and OR, there is only a minor correlation between having garlic and decreasing the probability on getting any cancer. In shit study, according to the research of the gap of decreasing in OR and RR for garlic intake between median intake and high intake, taking more garlic may help decrease the risk of getting general cancers, however, the risk ratio after declining is still moderate and reveals no major correlation. Based on the parallel comparison in decreasing in OR and RR after taking garlic, colon cancer and prostate cancer seems more affected by having garlic. The flaws of the study are not taking the region, the amount, and the types of garlic intake into account. This can be improved by the evaluation of the custom for the study region and specifying the amount taken for the garlic and controlling the type of garlic being served for each subject in the study.

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