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Meta Analysis

Factors Influencing the Lung Cancer Incidence in China: A Meta-Analysis

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Abstract

AIM: The aim of the study was to systematically evaluate the main factors associated with lung cancer incidence in China and provide reference for developing successful lung cancer interventions and accelerating progress against cancer.

METHODS: All publications related to the influencing factors of lung cancer incidence were retrieved from four databases from their date of inception through September 2022. Eight Medical Subject Headings and corresponding keywords were utilized to identify eligible trials in China National Knowledge Infrastructure (CNKI), Wanfang Database, Chinese Scientific Journals Database (VIP), and China Biology Medicine Database (CBM). The heterogeneity test and meta-analysis were conducted using Review Manager (RevMan, version 5.4) software. This study was designed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols.

RESULTS: Fourteen studies, published from 2000 to 2019, have been chosen and incorporated in a meta-analysis. The mean total quality score across the included studies was 7, with a range of 6–8. The findings of the meta-analysis demonstrated that smoking (odds ratio = 2.46, 95% confidence interval: 1.94–3.11), passive smoking (odds ratio = 2.44, 95% confidence interval: 2.13–2.80), lung/respiratory disease (odds ratio = 2.66, 95% confidence interval: 1.82–3.89), family history of tumor (odds ratio = 2.79, 95% confidence interval: 1.80–4.32), oil fume (odds ratio = 1.91, 95% confidence interval: 1.50–2.43), and psychological factor (odds ratio = 2.27, 95% confidence interval: 1.89–2.73) were risk factors for lung cancer, while more fruits and vegetables (odds ratio = 0.51, 95% confidence interval: 0.35–0.75), exercise (odds ratio = 0.55, 95% confidence interval: 0.43–0.72), and tea drinking (odds ratio = 0.52, 95% confidence interval: 0.32–0.83) were protective factors for lung cancer. Funnel plot analysis demonstrated the absence of any apparent publication bias.

CONCLUSION: The risk and protective factors influencing the lung cancer incidence are diverse. Considering the research limitations, we should have more research projects to explore the factors that affect lung cancer incidence and explain the research results.

Keywords: Influencing factor, lung cancer, meta-analysis, review, risk factor

Introduction

Cancer is a critical public health issue worldwide. The International Agency for Research on Cancer (IARC) estimated that approximately 19.3 million individuals received a new cancer diagnosis, and 10.0 million cancer-related deaths occurred globally in 2020 (Sung et al., 2021). Among all malignancies, lung cancer ranks high in incidence and mortality (Ferlay et al., 2019), with around 2.2 million new cases and 1.8 million deaths worldwide in 2020, accounting for 11.4% of total cancer incidence and 18.0% of all cancer fatalities (Sung et al., 2021). In the USA, 238 340 new cases of lung/bronchus cancer and 127 070 deaths from lung/bronchus cancer were projected to occur in 2023 (Siegel et al., 2023). In Japan, an estimated 125 424 new cases of lung cancer arose in 2016 with 74 328 resulting in death in 2018, comprising 12.6% of all detected cases of cancer and 19.9% of all cancer-related deaths (Cancer Information Service, National Cancer Center, Japan, 2022). In China, lung cancer accounted for 17.9% of all cancer cases and 23.8% of all cancer deaths (Liu et al., 2020). Although the incidence and mortality of lung cancer vary across regions/countries, the five-year survival rate for patients with lung cancer worldwide is only 10–20%, and lung cancer remains the leading cause of cancer-associated mortality (IARC, 2020). Therefore, timely prevention, diagnosis, and treatment are crucial for lung cancer patients to ensure their better prognosis and survival (Ansar et al., 2023; Leiro-Fernández et al., 2019).

Evidence suggests that despite the exploration and implementation of multiple treatment measures to combat cancer, the success or failure of tertiary prevention and new diagnosis and

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treatment methods for lung cancer, to some extent, depends on the study of its epidemiological characteristics and related risk factors (Yao & Liu, 2014). Hence, numerous studies have measured the factors influencing the incidence of lung cancer. The research on pathogenic factors of lung cancer has been started since the early 1950s, and the earliest manuscript was published in 1954 (Wynder, 1954). Since 1984, the number of manuscripts published has increased, and there is a rapid upward trend from 2006 to 2020. The first study examined the correlation between smoking and lung cancer, and the findings demonstrated that the mortality of lung cancer patients increased with the increase of smokers (Wynder, 1954). Recently, numerous studies have found that unfavorable environmental factors, behavioral factors, and genetic susceptibility play a role in the onset and advancement of lung cancer. For example, Kanwal et al. (2017) confirmed that the primary causes of lung cancer were smoking and air pollution, with an increased risk for those with a family history of lung cancer. Yang et al. (2018) found that in the East Asian population, two single-nucleotide polymorphisms of *CLPTM1L* could affect susceptibility to lung cancer by regulating the expression of *TERT*.

It is expected that by 2030, 75% of global cancer deaths will be in low and middle-income countries/regions (Shah et al., 2019). As a developing country, China has an extremely high incidence of lung cancer (Cao et al., 2022). The earliest research on the factors of lung cancer in China was conducted in 1987 (Jiang & Liao, 1987). Yao and Liu (2014) found that smoking, genetic factors, environmental pollution, occupational exposure, and unhealthy eating habits were risk factors affecting the lung cancer incidence. Shen et al. (2021) demonstrated that a higher socio-economic status was related to a lower risk of lung cancer. Ding et al.'s (2021) study showed that the changes in smoking behavior might be the most practical and direct measure to reduce the risk of lung cancer, and this behavior can be influenced by other risk factors, particularly obesity. Although these studies filled the gap in the association and causation between lung cancer and common factors in China, these results still show some differences and further exploration should be conducted. For example, there has been disagreement on whether dietary intake or chronic obstructive pulmonary disease had a causal relationship with lung cancer. Therefore, our study aims to synthetically explore factors associated with lung cancer incidence in China by using the meta-analysis method. The following questions have been raised to address the aim.

Research Questions

1. What commonly reported factors were related to the occurrence of cancer among patients with lung cancer?
2. What were the common protective factors for preventing lung cancer?

Methods

Study Design

This study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) for designing and reporting (Moher et al., 2015).

Search Strategy

A reasonable search strategy was formulated according to PICOS principle (Joanna Briggs Institute [JBI], 2014). The PICOS in this study was described as follows:

P (population): The target population in this study was patients with lung cancer.

I (intervention): This study emphasized the evaluation of the relation between various factors and increased lung cancer incidence.

C (comparison): The identified studies were compared in terms of evaluating the impact of various factors on lung cancer incidence.

O (outcome): The outcome studied in this study was the increase in lung cancer incidence.

S (study design): Studies that used a case-control trial design were integrated into the meta-analysis.

To identify correlative publications, we searched a range of databases from their date of inception through September 2022, which included China National Knowledge Infrastructure (CNKI), Wanfang Database, Chinese Scientific Journals Database (VIP), and China Biology Medicine Database (CBM). Eight Medical Subject Headings (MeSH), and corresponding keywords, such as "lung cancer," "lung neoplasms," "influencing factor," and "risk factor," were used to identify potential publications. Titles and abstracts of the retrieved publications were downloaded and screened, and only studies that met the inclusion and exclusion criteria were selected.

Inclusion and Exclusion Criteria

The following inclusion criteria were applied: i) participants: patients with definite diagnosis of lung cancer; ii) form of outcome: lung cancer incidence; iii) influencing factors: smoking, passive smoking, lung/respiratory disease, and family history of tumor, etc.; iv) research design: a case-control study; v) literature type: published periodical literature; and v) language category: Chinese. Studies were excluded if they i) had partial data; ii) were conference announcements; and iii) duplicates.

Study Selection, Data Extraction, and Analysis

The information extracted from the retrieved publications using Microsoft Office Excel 2019 included study ID, region, sample size, and factors. The quality of each selected study was assessed using the Newcastle–Ottawa Scale (NOS), which evaluated the following issues: selection, comparability, and exposure (Ottawa Hospital Research Institute, 2021; Stang, 2010). The overall score for NOS varied between 0 and 9 points. Studies with a score of ≥ 6 points were included in the meta-analysis.

Statistical Analysis and Synthesis

Review Manager (RevMan, version 5.4) software was employed to conduct a meta-analysis. The odds ratio (*OR*) was used as the effect index for two categorical variables. The pooled *OR* value and a 95% confidence interval (*CI*) were then calculated. The heterogeneity test was conducted by I^2 values. Depending on

the values obtained, a fixed-effect model was used for meta-analysis when $p > .10$ or $I^2 \leq 50\%$, indicating low heterogeneity among study results. Otherwise, the source of heterogeneity was analyzed, and a random effects model was used. Sensitivity analysis was performed using the transformed data effect model, so as to test the stability of meta-analysis results. If the change of the pooled *OR* value and 95% *CI* obtained after transforming the effect model was not obvious, we considered the sensitivity to be low and the meta-analysis results were robust and reliable. The possible publication bias of the study was tested by funnel plots. The level of significance for meta-analysis was set at $\alpha = 0.05$.

Results

Literature Search Results

Initially, 548 records were retrieved, and 534 studies were excluded due to following causes: duplicates (286 studies), title or abstract was not related to the research topic (208 studies), conference announcements (18 studies), full text was not reached (11 studies), and low quality (11 studies). Fourteen studies were finally included for the meta-analysis (Fang et al., 2019; Han et al., 2005; 2008; Huang & Liu, 2006; Liang et al., 2009; Lin et al., 2010; Liu et al., 2000; Lu et al., 2004; Ma et al., 2012; Su et al., 2013; Xu & Cai, 2013; Xu et al., 2015; Zhang et al., 2008; Zhao et al., 2013). Figure 1 depicts the process and results of literature screening.

Characteristics of the Included Studies

The 14 studies included in this meta-analysis were published in Chinese journals from 2000 to 2019. The studies estimated the effect of smoking, passive smoking, lung/respiratory disease, family history of tumors, oil fume, psychological factor, pollution near the residence, more fruits and vegetables, exercise, and tea drinking. The sample size varied from 262 to 2459 participants, with a pooled sample size of 13399. See Table 1 for details on the included studies.

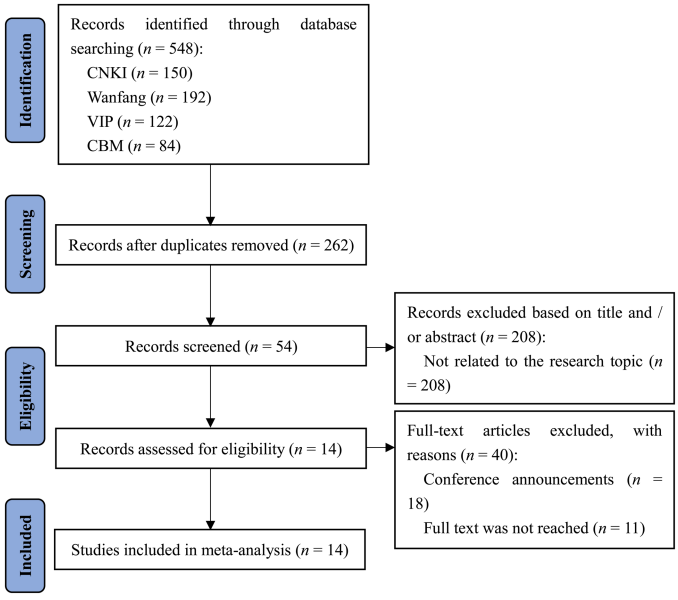

Figure 1.
Preferred Reporting Items for Systematic Reviews and Meta-Analyses Flowchart.

Quality Evaluation of the Included Studies

The total quality scores ranged from 6 to 8, with a mean of 7. Among the three evaluation indicators, the highest (selection) and lowest (exposure) average scores were 3.2 and 1.7 respectively. Table 2 displays the quality evaluation of the studies.

Meta-Analysis Results

Smoking

Twelve studies (Fang et al., 2019; Han et al., 2005, 2008; Huang & Liu, 2006; Liang et al., 2009; Liu et al., 2000; Lu et al., 2004; Su et al., 2013; Xu & Cai, 2013; Xu et al., 2015; Zhang et al., 2008; Zhao et al., 2013) with a combined total of 12,583 participants were analyzed to investigate the effect of smoking on

Table 1.
Characteristics of the Included Studies

Study ID	Region	Sample Size (CG^1/CG^2)	Factors
Fang et al. (2019)	Shaoxing, China	1061 (461/600)	(1) (3) (4) (6) (8)
Han et al. (2005)	Xi'an, China	511 (248/263)	(1) (3) (4) (5) (6)
Han et al. (2008)	Jiangsu, China	2447 (523/1924)	(1) (4) (5) (8) (10)
Huang and Liu (2006)	Shanghai, China	542 (271/271)	(1) (5) (6) (8)
Liang et al. (2009)	Zhuhai, China	262 (131/131)	(1) (3) (4) (5) (8)
Lin et al. (2010)	Fujian, China	416 (208/208)	(2) (4) (5) (8) (9) (10)
Liu et al. (2000)	Shanghai, China	700 (350/350)	(1) (3) (5) (6) (8)
Lu et al. (2004)	Foshan, China	240 (120/120)	(1) (3) (4) (5) (6) (7) (8) (9)
Ma et al. (2012)	Dalian, China	400 (200/200)	(4) (9)
Su et al. (2013)	Taiyuan, China	861 (396/465)	(1) (5) (10)
Xu and Cai (2013)	Fujian, China	2459 (1225/1234)	(1) (2) (3) (4) (7) (10)
Xu et al. (2015)	Yangzhou, China	850 (425/425)	(1) (3) (6) (8)
Zhang et al. (2008)	Changzhou, China	1034 (505/529)	(1) (3) (4) (6) (8)
Zhao et al. (2013)	Guangzhou, China	1616 (808/808)	(1) (2) (3) (4) (8)

Note: (1) Smoking; (2) Passive smoking; (3) Lung/respiratory disease; (4) Family history of tumor; (5) Oil fume; (6) Psychological factor; (7) Pollution near the residence; (8) More fruits and vegetables; (9) Exercise; (10) Tea drinking.
CG1 = Case group; CG2 = Control group.

Table 2.
Quality Evaluation of the Included Studies

Study ID	Selection	Comparability	Exposure	Total Score
Fang et al. (2019)	3	2	2	7
Han et al. (2005)	3	2	1	6
Han et al. (2008)	4	2	2	8
Huang and Liu (2006)	3	2	1	6
Liang et al. (2009)	3	2	2	7
Lin et al. (2010)	3	2	2	7
Liu et al. (2000)	4	2	2	8
Lu et al. (2004)	3	2	1	6
Ma et al. (2012)	3	2	2	7
Su et al. (2013)	3	2	2	7
Xu and Cai (2013)	3	2	2	7
Xu et al. (2015)	3	2	1	6
Zhang et al. (2008)	4	2	2	8
Zhao et al. (2013)	3	2	2	7

lung cancer incidence. A random effects model was employed for meta-analysis as the 12 studies showed a high level of heterogeneity ($I^2 = 89\%$, $p < .001$). The pooled effect size indicated smoking as a risk factor for lung cancer (OR = 2.46, 95% CI: 1.94–3.11).

Passive Smoking

Three studies (Lin et al., 2010; Xu & Cai, 2013; Zhao et al., 2013), including 4,491 participants, investigated the effect of passive smoking on lung cancer incidence. A minimal degree of heterogeneity was noted among the three studies ($I^2 = 0\%$, $p = .86$), and thus, a fixed-effect model was chosen for meta-analysis. The analysis revealed that exposure to passive smoking increased the risk of developing lung cancer (OR = 2.44, 95% CI: 2.13–2.80).

Lung/Respiratory Disease

Nine studies (Fang et al., 2019; Han et al., 2005; Liang et al., 2009; Liu et al., 2000; Lu et al., 2004; Xu & Cai, 2013; Xu et al., 2015; Zhang et al., 2008; Zhao et al., 2013), involving 8733 participants, investigated the effect of lung/respiratory disease on lung cancer. Remarkable heterogeneity was found among the studies ($I^2 = 86\%$, $p < .001$), which led to the utilization of a random-effect model for meta-analysis. The results showed that lung/respiratory disease significantly associated with an increased risk of lung cancer (OR = 2.66, 95% CI: 1.82–3.89).

Family History of Tumor

Ten studies (Fang et al., 2019; Han et al., 2005, 2008; Liang et al., 2009; Lin et al., 2010; Lu et al., 2004; Ma et al., 2012; Xu & Cai, 2013; Zhang et al., 2008; Zhao et al., 2013), involving 10 446 participants, investigated the effect of family history of tumor on lung cancer. The studies displayed a significant amount of heterogeneity ($I^2 = 90\%$, $p < .001$), leading to the adoption of a random-effect model for meta-analysis. The results indicated that family history of tumor was a risk factor for lung cancer (OR = 2.79, 95% CI: 1.80–4.32).

Oil Fume

Eight studies (Han et al., 2005, 2008; Huang & Liu, 2006; Liang et al., 2009; Lin et al., 2010; Liu et al., 2000; Lu et al., 2004; Su et al., 2013), including 5979 participants, investigated the effect of oil fume on lung cancer. A significant level of heterogeneity existed among the eight studies ($I^2 = 70\%$, $p = .001$), and thus, a random-effect model was applied. The findings showed that exposure to oil fume was a risk factor for lung cancer (OR = 1.91, 95% CI: 1.50–2.43).

Psychological Factor

Seven studies (Fang et al., 2019; Han et al., 2005; Huang & Liu, 2006; Liu et al., 2000; Lu et al., 2004; Xu et al., 2015; Zhang et al., 2008), including 4949 participants, examined the influence of psychological factors on lung cancer. The studies showed low heterogeneity ($I^2 = 28\%$, $p = .22$); thus, a fixed-effect model was selected. The results indicated that psychological factors increased the risk of developing lung cancer (OR = 2.27, 95% CI: 1.89–2.73). The results are shown in Figure 2.

More Fruits and Vegetables

Ten studies (Fang et al., 2019; Han et al., 2008; Huang & Liu, 2006; Liang et al., 2009; Lin et al., 2010; Liu et al., 2000; Lu et al., 2004; Xu et al., 2015; Zhang et al., 2008; Zhao et al., 2013), including 7232 participants, investigated the effect of more fruits and vegetables on lung cancer. A high degree of heterogeneity was observed among studies ($I^2 = 92\%$, $p < .001$), leading to the selection of a random effect model. The results showed that a higher intake of fruits and vegetables might be protective against lung cancer (OR = 0.51, 95% CI: 0.35–0.75).

Exercise

Three studies (Lin et al., 2010; Lu et al., 2004; Ma et al., 2012) with 1056 participants investigated the effect of exercise on lung cancer. A low level of heterogeneity was observed across studies ($I^2 = 0\%$, $p = .53$), leading to the selection of a fixed-effect model. The results indicated that exercise served as a protective factor against lung cancer (OR = 0.55, 95% CI: 0.43–0.72).

Tea Drinking

Tea drinking was investigated in a total of four studies (Han et al., 2008; Lin et al., 2010; Su et al., 2013; Xu & Cai., 2013), comprising 6183 participants, to determine its effect on lung cancer. There was significant heterogeneity between studies ($I^2 = 91\%$, $p < .001$), and thus, a random-effect model was chosen. The findings indicated that tea drinking was a protective factor for lung cancer (OR = 0.52, 95% CI: 0.32–0.83). The results are shown in Figure 3.

Sensitivity Analysis and Risk of Bias of the Included Studies

After transforming the effect model, we acquired pooled OR values and 95% CIs under two effect models, as displayed in Table 3. The analysis showed a minimal shift in the results for nine factors, suggesting that the results were relatively robust and reliable. Funnel plot analysis was conducted on three

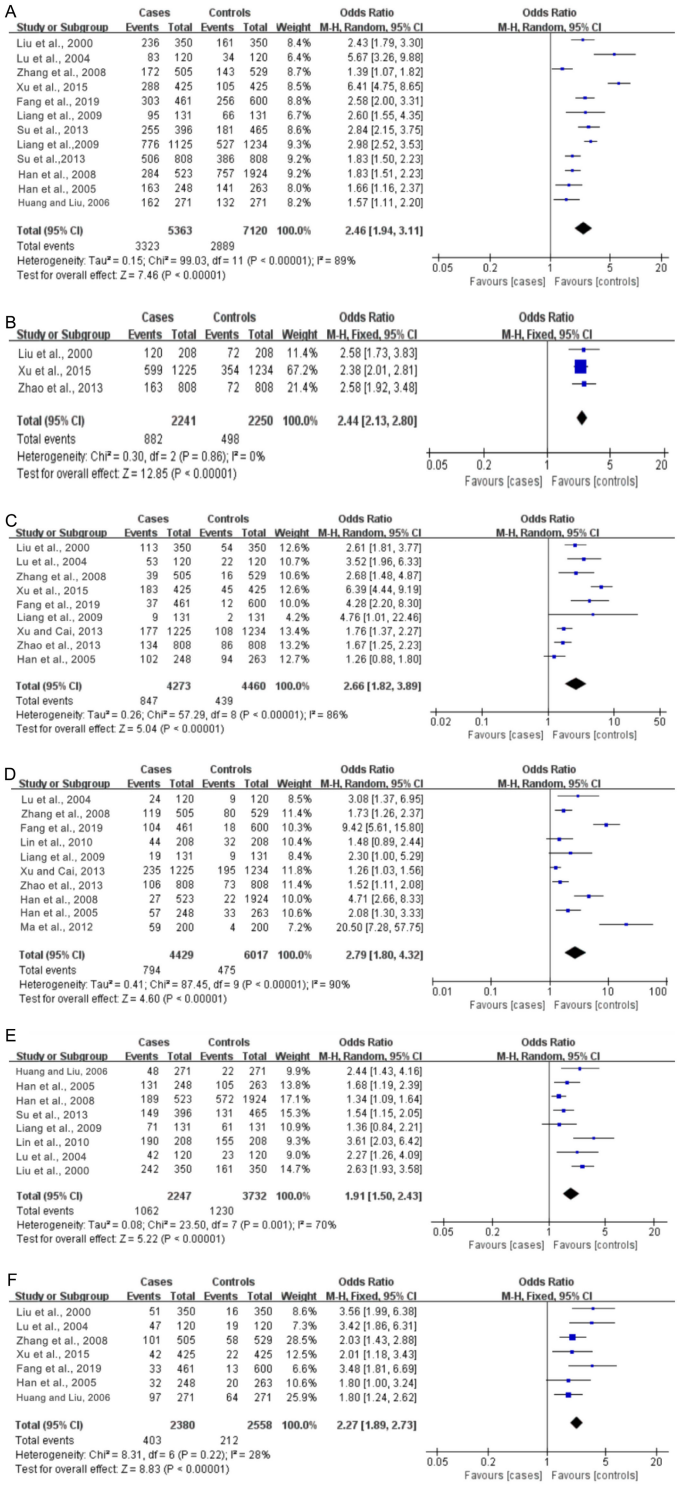

Figure 2.
Forest Plot of Comparison: Risk Factors Affecting the Incidence of Lung Cancer.

factors (≥ 10 studies). The shapes of the funnel plot for the primary "smoking" and "more fruits and vegetables" outcomes were approximately symmetrical, indicating that there was no obvious publication bias. Funnel plots are shown in Figure 4.

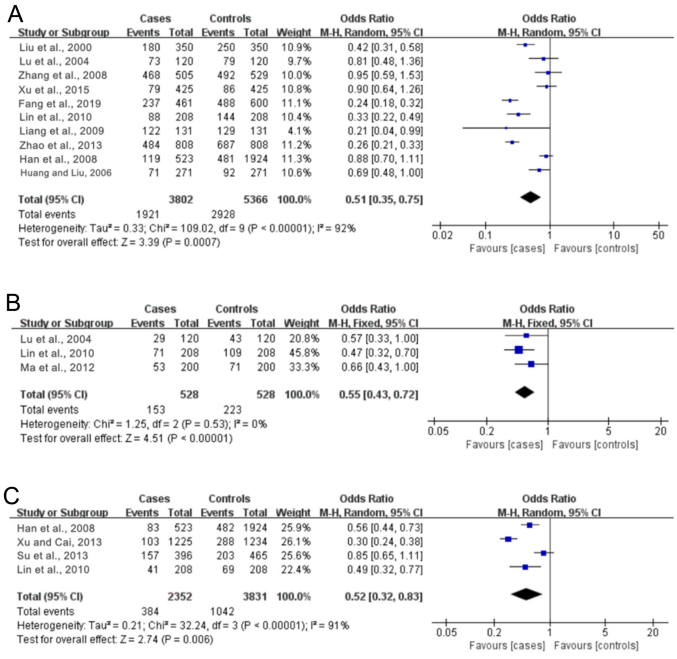

Figure 3.
Forest Plot of Comparison: Protective Factors Affecting the Incidence of Lung ancer.

Discussion

Risk Factors Influencing the Lung Cancer Incidence

The results of meta-analysis showed that smoking, passive smoking, lung/respiratory disease, family history of tumors, oil fume, and psychological factors were risk factors for lung cancer. Firstl, as is well known, tobacco smoking is the leading risk factor for the development of lung cancer. Worldwide, China's cigarette production and tobacco consumption are both high. In 2017, the mortality rate of lung cancer related to smoking was reported to be 41.94/100,000 for males and 5.14/100,000 for females in China (Liu et al., 2020). The main cause of lung

Table 3.
Sensitivity Analysis of the Included Studies

Factors	OR (95% CI) Under FE	OR (95% CI) Under RE
Smoking	2.36 (2.19, 2.55)	2.46 (1.94, 3.11)
Passive smoking	2.44 (2.13, 2.80)	2.44 (2.13, 2.80)
Lung/respiratory disease	2.33 (2.05, 2.65)	2.66 (1.82, 3.89)
Family history of tumor	2.01 (1.78, 2.27)	2.79 (1.80, 4.32)
Oil fume	1.74 (1.54, 1.96)	1.91 (1.50, 2.43)
Psychological factor	2.27 (1.89, 2.73)	2.31 (1.85, 2.89)
More fruits and vegetables	0.48 (0.44, 0.54)	0.51 (0.35, 0.75)
Exercise	0.55 (0.43, 0.72)	0.55 (0.43, 0.72)
Tea drinking	0.50 (0.43, 0.57)	0.52 (0.32, 0.83)

Note: CI = Confidence interval; FE = Fixed-effect model; OR = Odds ratio; RE = Random effect model.

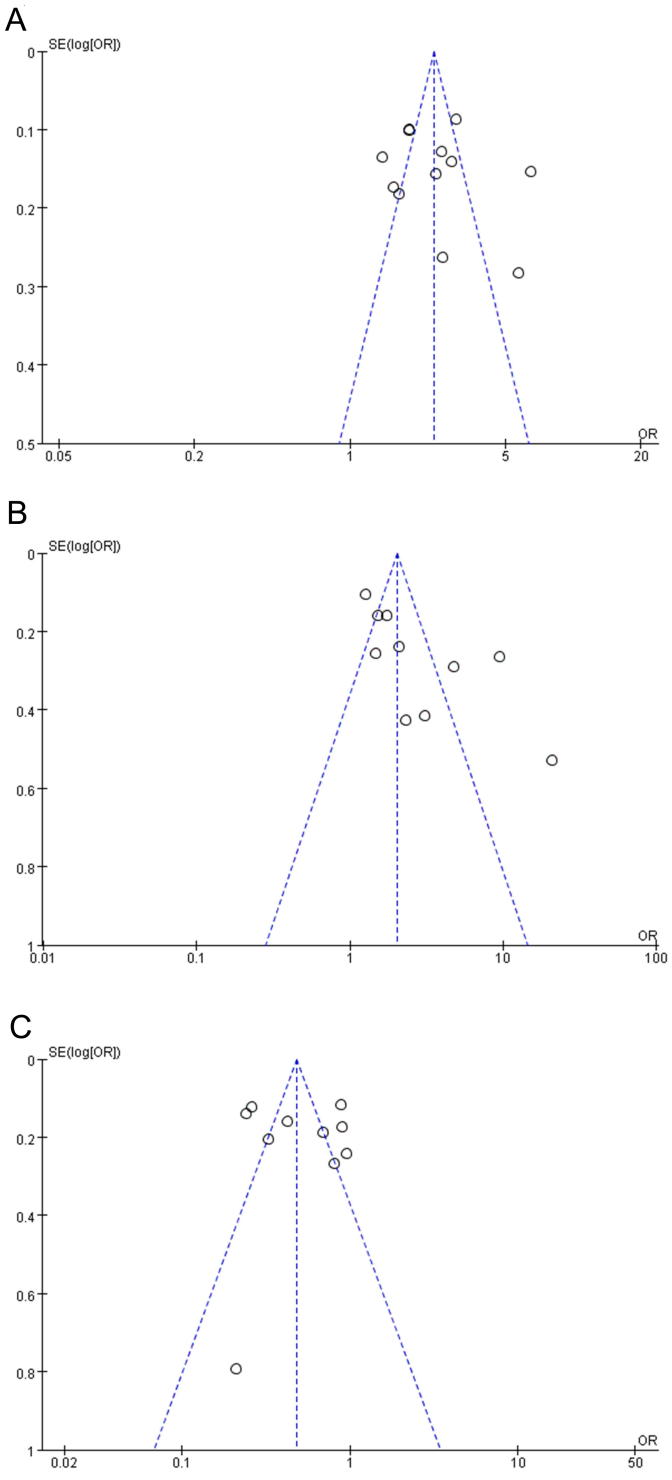

Figure 4.
Funnel Plot of Comparisons: Factors Affecting the Incidence of Lung Cancer.

cancer caused by smoking is that tobacco can produce tar and some carcinogens, such as nitrite, during the combustion process, which will cause lung lesions after long-term exposure to lung tissue (Du, 2019). Therefore, it is highly recommended to stop smoking. Second, in the Chinese population, frequent or high cumulative exposure to cigarette smoke is significantly associated with lung cancer (Tse et al., 2011). Passive smoking, which refers to the unintentional inhalation of cigarette smoke by people living and working near smokers, is the main source of this exposure (Peterson & Hecht, 2017). Previous studies showed that the main source of passive smoking mostly was family members, and spouse smoking was closely related to female lung cancer (Du, 2019). Additionally, the association between passive smoking and lung cancer appeared to be stronger than smoking, which is almost consistent with the synergistic effect between smoking and high cumulative cigarette smoke exposure in the living environment on lung cancer risk (Kurmi, 2022). Third, as proposed by Fang et al. (2019) and Han et al. (2005), smoking can easily induce chronic inflammation response in lungs and airways. Meanwhile, studies have shown that pulmonary chronic inflammation may enhance the interaction between hydroxyl radicals and DNA, thereby increasing the likelihood of mutations occurring during DNA replication (Schottenfeld & Beebe-Dimmer, 2006). Previous studies revealed that emphysema increased the relative risk of lung cancer by 2.44 times, chronic bronchitis by 1.47 times, tuberculosis by 1.48 times, and pneumonia by 1.57 times (Li & Yao, 2016). Fourth, it is undeniable that an individual's risk of developing lung cancer is mediated by a series of factors, and there is strong evidence to support the familial genetic composition of lung cancer. We can learn from biology that various carcinogenic factors may cause chromosome variation, which may be passed down to the next generation, thereby increasing the risk of lung cancer (Hua, 2010). Fifth, oil fume generates sulfur dioxide, nitrogen dioxide, acrolein, benzene, formaldehyde, and other volatile organic compounds (Lin et al., 2022). Many of these have been proved or suspected to be human carcinogens related to lung cancer (IARC, 2006). Previous studies of oil fume and lung cancer were based mainly on females. Due to the toxic smoke produced by high-temperature oil fumes that stimulate the eyes and throat for a long time and damage the cells and tissues of the respiratory system, and women have more daily exposure to oil fume than men, it has almost become a major risk factor for women to suffer from lung cancer (Lin et al., 2010). Finally, the World Health Organization indicates that "there is no health without mental health" (WHO, 2018), emphasizing the relationship between psychological and physical health. Many studies have found that psychological factors, such as depression, grief, and anxiety, are associated with the risk of lung cancer (Huang & Liu, 2006; Xu et al., 2015; Zhang et al., 2008), and this risk is related to physiological alterations in multiple systems, such as immune, neuroendocrine, and cardiovascular (Bomyea et al., 2012).

Protective Factors Influencing the Lung Cancer Incidence

The meta-analysis results revealed that more fruits and vegetables, exercise, and tea drinking were protective factors for lung cancer. There is evidence to suggest that factors, such as diet, nutrition, and physical activity, have a significant impact on cancer risk, so positive behavioral changes can to some extent reduce cancer burden (Gonzalez et al., 2010). Firstly, it is reported that consuming fruits and vegetables can protect against lung cancer (Ubago-Guisado et al., 2021). Studies have shown that intake of fresh vegetables and fruits can

supplement multiple nutrients, especially heme iron, vitamin C, vitamin K2, and antioxidants, which are related to a lower risk of lung cancer (Ubago-Guisado et al., 2021). The World Cancer Research Fund/American Institute of Cancer Research report stated that consuming fruits and vegetables containing a certain amount of retinol or carotenoids may lower the chance of developing lung cancer (WCRF / AICR, 2018). Second, Su et al.'s (2022) study found that in the Chinese population, a high level of physical activity was negatively correlated with some subtypes of cancer. However, globally, the lack of physical activity is very common, with approximately 31% of residents in China and worldwide not reaching the recommended exercise levels (Hallal et al., 2012). Finally, tea is one of the most widely consumed drinks and has long been claimed to have multiple beneficial health benefits, but its relationship with cancer risk remains controversial. This meta-analysis found that drinking tea can effectively reduce lung cancer risk. Although tea components vary with various factors such as planting technology, tea variety, and climate, the most important component is tea polyphenols. An animal experiment revealed that tea polyphenols can reduce the risk of tumor formation and tumor size (Cabrera et al., 2003).

Study Limitations

Several possible limitations of this study ought to be recognized. First, the publications included meta-analysis only adopted the case-control study design, so potential publication bias cannot be ruled out. Second, some important confounding factors (such as age, gender, etc.) could not be controlled, and the interaction between these factors could not be analyzed. Third, the sample size of certain studies was limited, and additional investigation is necessary to scrutinize the outcomes of the meta-analysis.

Conclusion and Recommendations

In conclusion, several risk factors for lung cancer were identified, including smoking, passive smoking, lung/respiratory disease, family history of tumors, oil fume, and psychological factors. Furthermore, certain protective factors were identified, such as consuming more fruits and vegetables, exercise, and drinking tea. Findings from our study can provide a scientific reference for doctors, nurses, or community health managers to optimize lung cancer prevention and management decision-making. Due to the limitations, further studies are needed to support our findings.

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Declaration of Interests: The authors have no conflict of interest to declare.

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