

1. Summary

The aim of the study was to comprehensively assess the association between dietary patterns, adherence to recommendations regarding lung cancer prevention, and the risk of lung cancer in men.

This case-control study was conducted in 439 men aged 45-80 years from north-eastern Poland. The clinical sample consisted of 187 men with newly diagnosed lung cancer, and the control sample consisted of 252 men without lung cancer. Data was collected from 2013 to 2017.

Dietary data on the consumption of 62 food groups was collected using a validated food frequency questionnaire FFQ-6[®] during individual face-to-face interviews. Two approaches were used to identify dietary patterns (DPs) – data-driven and hypothesis-driven (predefined). Data-driven dietary patterns were identified using the Principal Components Analysis (PCA-DP). Two types of predefined dietary patterns were used: (i) Mediterranean diet (MED) score in the Polish adaptation ('Polish-aMED[®]'), developed by Krusinska et al. [1], (ii) dietary adherence to WCRF/AICR cancer prevention recommendations ('WCRF/AICR Score'), adapted to the recommendation of lung cancer prevention ('Ad-LC WCRF/AICR Score'), developed for the aim of this study.

The PCA-DPs were identified by including data on the frequency of consumption of 62 food groups after being combined into 23 food groups. These patterns were named adequately to the most frequently consumed food groups, which were most correlated with each dietary pattern. Three dietary patterns were identified: 'Prudent', 'Westernized Traditional' and 'Sweet Dairy'. For each of PCA-DPs adherence to the pattern was determined separately based on the tertile distribution; with the bottom tertile representing low adherence to the pattern and the upper tertile representing high adherence to the pattern.

The Mediterranean diet score included the characteristics of the traditional Mediterranean diet - positively correlated with fruits, vegetables, wholegrain cereal products, fish, legumes, nuts and grains, the ratio of the frequency of consumption of vegetable fats to animal fats, and negatively correlated with red meat and meat products, abuse of alcohol. The Polish adaptation regarding replacing olive oil with vegetable oils when calculating the quotient of the frequency of consumption of vegetable fats to animal fats to reflect the specificity of the Polish diet and adopting a different system for determining cut-off thresholds (based on the median), respecting the idea and construction principles of the original score. The 'Polish-aMED[®]' score was calculated as a sum of points. The original 'WCRF/AICR Score' consisted of eight components expressing recommendations. It was adapted by removing recommendations regarding women, adding a recommendation regarding smoking (expressed in pack-years), and changing all criteria and/or the scoring system of eight components, respecting the idea and construction principles of the original score. 'Ad-LC WCRF/AICR Score' was calculated as a sum of points. In both component's scores, after their adaptation, the range of points did not change ('Polish-aMED[®]' range: 0-9 points; 'Ad-LC WCRF/AICR' range: 0-8 points) defining the degree of adherence to the diet to the score (predefined DP). The results were interpreted as follows: the higher the score indicates the better adherence of the diet to the predefined DP.

In the statistical analysis, logistic regression analysis (with and without adjustment for confounding factors) was used to estimate the odds ratio (OR) and the 95% confidence interval (95% CI) of lung cancer risk, depending on the degree of the adherence of men's diet to dietary patterns. The analysis included smoking, which was the basis for grouping men into: never smokers (0 pack-years), moderate smokers and heavy smokers (>11 pack-years).

Men with a high dietary adherence to the 'Prudent' pattern were shown to have a 28% lower risk of lung cancer (adjusted OR=0.72; 95%CI 0.53–0.96) compared to men with a low dietary adherence to the 'Prudent' pattern. Moderate smokers with a high 'Prudent' dietary adherence had a 41% lower risk of lung cancer (adjusted OR=0.59; 95%CI 0.39–0.90) compared to non-smokers and a low adherence to this pattern. The 'Western-Traditional' and 'Sweet-dairy' patterns were not significantly associated with the risk of lung cancer in moderate smokers and men overall (without taking into account smoking status). In heavy smokers, none of the three PCA-DPs were significantly associated with lung cancer risk. The risk of lung cancer was lower by 66% (adjusted OR=0.34; 95%CI 0.15–0.76) in moderate smokers with a high adherence of the diet to 'Polish-aMED[®]' (7-9 points), and lower by 65% (adjusted OR=0.35; 95%CI 0.18–0.65) in moderate smokers with moderate dietary adherence to 'Polish-aMED[®]' (4-6 points) compared to non-smokers with low dietary adherence (0-3 points). In heavy smokers, none of the levels of adherence of their diet to 'Polish-aMED[®]' was significantly associated with the risk of lung cancer.

The risk of lung cancer in the full model, taking into account all recommendations included in the 'Ad-LC WCRF/AICR Score', was lower by 47% (adjusted OR=0.53; 95%CI 0.32-0.88) in men with higher compliance with recommendations compared to people with lower compliance with recommendations. Each 1-point increase in the 'Ad-LC WCRF/AICR Score' reduced the risk of lung cancer in men by 34% (OR=0.66; 95%CI 0.45-0.95).

The recommendation 'limit smoking' of the as one of components 'Ad-LC WCRF/AICR Score' was independently associated with a lower risk of lung cancer in men, regardless of the set of confounding factors used for adjustment. The risk of lung cancer was by 87% lower in men who never smoked (adjusted OR=0.13; 95%CI 0.04–0.37) and by 45% lower in men who were moderate smokers (adjusted OR=0.55; 95% CI 0.33–0.91) compared to heavy smokers. An analysis of the association between the risk of lung cancer and various combinations of several single recommendations of the 'Ad-LC WCRF/AICR Score' showed that greater adherence to a combination of three or more recommendations reduced the risk of lung cancer by from 39% to 66% in men with higher (6-8 points) compliance to the recommendations compared to men with lower (0-2 points) compliance to the recommendations.

Studies have shown that healthy dietary patterns, including the Polish Mediterranean diet, may help reduce the risk of lung cancer in men, including moderate smokers, although this has not been confirmed in heavy smokers. Previous evidence has been confirmed that reducing smoking reduces the risk of lung cancer in men, and new evidence has been provided that smoking is an independent risk factor for lung cancer and also interacts with diet, with moderate levels of smoking being protected by a healthy diet. For the first time, the importance of adhering to multiple recommendations has been demonstrated in reducing the risk of lung cancer in men. There is strong evidence that adhering to at least three lung cancer prevention recommendations related to diet, lifestyle or body fat can prevent lung cancer in men despite the presence of other unhealthy behaviors.

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