

Letter to the Editor

Inaccurate data in meta-analysis; ‘A posteriori dietary patterns and metabolic syndrome in adults: a systematic review and meta-analysis of observational studies’

Madam

We read with interest the meta-analysis by Shab-Bidar *et al.*⁽¹⁾ on the association of a *a posteriori* dietary patterns (DP) and metabolic syndrome. We noticed several inaccuracies regarding the inclusion of data that need to be clarified. The authors declare that the meta-analysis was conducted with articles published up to July 2015, but many articles^(2–6) meeting the inclusion criteria were not selected and included in the study. We found that the food composition of the DP included in the meta-analysis not always reflected the frequency of consumed foods characterizing the categories ‘Unhealthy/Western’ and ‘Healthy/Prudent’ investigated by the authors. They classified and analysed together as ‘Healthy/Prudent’, DP whose composition differed considerably, as described in the studies by Suliga *et al.*⁽⁷⁾, Akter *et al.*⁽⁸⁾, Hong *et al.*⁽⁹⁾, Kim and Jo⁽¹⁰⁾ and DiBello *et al.*⁽¹¹⁾. Similarly, for the analysis of the ‘Unhealthy/Western’ pattern, they combined different DP described in the studies by Gadgil *et al.*⁽¹²⁾, Hong *et al.*⁽⁹⁾, Kim and Jo⁽¹⁰⁾, DiBello *et al.*⁽¹¹⁾, Noel *et al.*⁽¹³⁾

and Esmailzadeh *et al.*⁽¹⁴⁾. Therefore, the combination of these risk estimations seems methodologically incorrect. We summarize the misclassified DP included in the ‘Unhealthy/Western’ and ‘Healthy/Prudent’ patterns in Table 1.

In addition, we noticed some inconsistencies regarding the risk data included in the meta-analysis. The most evident inaccuracies in the risk data for the ‘Unhealthy/Western’ pattern are the following: (i) study by Gadgil *et al.*⁽¹²⁾, ‘Animal protein’ DP, OR = 0.69 (95 % CI 0.65, 1.10) instead of OR = 0.69 (95 % CI 0.43, 1.10); and (ii) study by Suliga *et al.*⁽⁷⁾, ‘Fat, meat and alcohol’ DP, OR = 1.22 (95 % CI 0.97, 1.53) instead of the risk estimate of the adjusted model OR = 1.04 (95 % CI 0.82, 1.33). The inaccuracies in the risk data for ‘Healthy/Prudent’ pattern regard the following risk estimations: (i) study by Gadgil *et al.*⁽¹²⁾, ‘Fruits, vegetables, nuts, and legumes’ DP, OR = 0.80 (95 % CI 0.62, 1.51) instead of OR = 0.65 (95 % CI 0.38, 1.11); (ii) study by Suliga *et al.*⁽⁷⁾, ‘Healthy’ DP, OR = 0.68 (95 % CI 0.53, 0.92) instead of the adjusted model OR = 0.87 (95 % CI 0.68, 1.13); (iii) study by Naja *et al.*⁽¹⁵⁾, ‘Traditional Lebanese’ DP, OR = 1.96 (95 % CI 0.85, 4.51) instead of OR = 1.96 (95 % CI 0.82, 4.34); and (iv) study by Cho *et al.*⁽¹⁶⁾, ‘Healthy’ DP, OR = 0.58 (95 % CI 0.43, 0.78) instead of OR = 0.58 (95 % CI 0.50, 0.91).

Table 1 Summary and composition of the misclassified dietary patterns (DP) included in the meta-analysis

Authors, year, reference	Description of DP included in the ‘Western/Unhealthy’ DP	Description of DP included in the ‘Healthy/Prudent’ DP	DP excluded from the meta-analysis	Notes
Gadgil <i>et al.</i> , 2015 ⁽¹²⁾	<ol style="list-style-type: none"> ‘Animal protein’: poultry, red meat, eggs, fish ‘Fried snacks, sweets, and high-fat dairy’: butter/ghee, fried snacks, high-fat dairy, potatoes, sweets 	<ol style="list-style-type: none"> ‘Fruits, vegetables, nuts, and legumes’: fruit, legumes, nuts, vegetables, vegetables oil 	–	The ‘Fried snacks, sweets, and high-fat dairy’ DP should be excluded from the meta-analysis
Suliga <i>et al.</i> , 2015 ⁽⁷⁾	<ol style="list-style-type: none"> ‘Fat, meat and alcohol’: lard, red meat, cold cured meat, eggs, fried dishes, vegetable oils, mayonnaise and alcoholic drinks 	<ol style="list-style-type: none"> ‘Healthy’: fruit and vegetables, low-fat milk and dairy products, whole grain foods ‘Prudent’: fish and whole grain products 	<ol style="list-style-type: none"> ‘Coca cola, hard cheese and French fries’: coca cola, hard cheese and French fries 	The ‘Prudent’ DP should be excluded from the meta-analysis
Akter <i>et al.</i> , 2013 ⁽⁸⁾	<ol style="list-style-type: none"> ‘Animal food’: fish and shellfish, meat, processed meat, mayonnaise and egg 	<ol style="list-style-type: none"> ‘Healthy Japanese’: vegetables, fruits, soya products, mushrooms, green tea ‘Westernized breakfast’: bread, confectioneries, milk and yoghurt, mayonnaise and egg 	–	The ‘Westernized breakfast’ DP should be excluded from the meta-analysis

Table 1 *Continued*

Authors, year, reference	Description of DP included in the 'Western/Unhealthy' DP	Description of DP included in the 'Healthy/Prudent' DP	DP excluded from the meta-analysis	Notes
Hong <i>et al.</i> , 2012 ⁽⁹⁾	<ol style="list-style-type: none"> 'Alcohol and meat': processed meats, eggs, fish paste, animal fat and alcohol 'Sweets and fast foods': fruit juices, chocolate, ice cream, pizza and hamburgers 	<ol style="list-style-type: none"> 'Korean traditional': refined and whole grains, Korean seasonings, onions and garlic, vegetable oil, soya products, starch syrup and sugar 'Fruit and dairy': fruits and dairy products, rice cakes and nuts 	–	The 'Korean traditional' and 'Sweets and fast foods' DP should be excluded from the meta-analysis
Kim and Jo, 2011 ⁽¹⁰⁾	<ol style="list-style-type: none"> 'Meat and alcohol': noodles and dumplings, meat and its products, alcohol 'High fat, sweets, and coffee': sugar and sweets, eggs, oils, coffee 	<ol style="list-style-type: none"> 'White rice and kimchi': white rice, kimchi, vegetables 'Grains, vegetables, and fish': grains, nuts, vegetables, fish and shellfish, seasonings 	–	The 'White rice and kimchi' and 'High fat, sweets, and coffee' DP should be excluded from the meta-analysis
DiBello <i>et al.</i> , 2009 ⁽¹¹⁾	<p>American Samoan</p> <ol style="list-style-type: none"> 'Factor 2': meat and coconut products such as coconut cream dishes and lamb 'Factor 3': meat and coconut products such as coconut cream dishes and lamb 	<p>American Samoan</p> <ol style="list-style-type: none"> 'Neo-traditional': crab and lobster, fish, coconut cream dishes, papaya soup, coconut milk, papaya and taro 'Modern': sausage, eggs, milk, cheese, coconut cream, rice, instant noodle soup, bread, pancakes, cereal, butter/margarine, cake and potato chips <p>Samoan</p> <ol style="list-style-type: none"> 'Neo-traditional': crab and lobster, ripe coconut, coconut cream and coconut cream dishes, and papaya soup 'Modern': sausage, eggs, rice, instant noodle soup, pancakes, cereal, papaya, cake, potato chips, ripe coconut, chop suey, rice dishes, crackers, and soup with vegetables 	–	The composition of the DP described in the article by DiBello <i>et al.</i> differs consistently from the composition of the DP described in the other published articles. The combination of the risk estimates referring to these DP seems inappropriate
Noel <i>et al.</i> , 2009 ⁽¹³⁾	<ol style="list-style-type: none"> 'Meat and French fries': meat, processed meat, French fries, pizza and Mexican foods, eggs, alcohol, and other grains and pasta 'Traditional': beans and legumes, rice, oil, vegetables 	<ol style="list-style-type: none"> 'Sweets': candy, sugar and chocolate candy, soft drinks, sugary beverages, sweet baked goods, dairy desserts and salty snacks 	–	The 'Traditional' dietary pattern should be considered as 'Healthy/Prudent' dietary pattern The 'Sweets' dietary pattern should be excluded from the meta-analysis
Esmailzadeh <i>et al.</i> , 2007 ⁽¹⁴⁾	<ol style="list-style-type: none"> 'Western': refined grains, red meat, butter, processed meat, high-fat dairy products, sweets and desserts, pizza, potatoes, eggs, hydrogenated fats and soft drinks 'Traditional': refined grains, potatoes, tea, whole grains, hydrogenated fats, legumes and broth 	<ol style="list-style-type: none"> 'Healthy': fruits, tomatoes, poultry, legumes, cruciferous and green leafy vegetables, other vegetables, tea, fruit juices and whole grains 	–	The 'Traditional' dietary pattern should be excluded from the meta-analysis

In summary, since the dietary patterns represent a complex variable reflecting specific combination of different foods which varies consistently among the studies, we

believe that pooling dietary patterns on the basis of factor loadings and combining risk data referring to similar dietary patterns are essential to obtain consistent and solid



evidence on the association between diet and health-related outcomes as expected in a meta-analysis.

Acknowledgements

Acknowledgements: The work was completed at the University of Perugia, Italy. The authors thank their home institution for financial support. **Financial support:** This study was supported by Perugia University, Perugia, Italy. Perugia University had no role in the design, analysis or writing of this article. **Conflict of interest:** The authors declared no personal or financial conflicts of interest. **Authorship:** R.F., G.N. and M.C. contributed to the manuscript drafting. **Ethics of human subject participation:** Not applicable.

Roberto Fabiani¹, Giulia Naldini² and Manuela Chiavarini³

¹Department of Chemistry, Biology and Biotechnology
University of Perugia
Via del Giochetto, 06126 Perugia, Italy
Email: roberto.fabiani@unipg.it

²School of Specialization in Hygiene and
Preventive Medicine
University of Perugia
Perugia, Italy

³Department of Experimental Medicine
Section of Public Health
University of Perugia
Perugia, Italy

References

- Shab-Bidar S, Golzarand M, Hajimohammadi M *et al.* (2018) *A posteriori* dietary patterns and metabolic syndrome in adults: a systematic review and meta-analysis of observational studies. *Public Health Nutr* **21**, 1681–1692.
- He DH, Yang M, Zhang RH *et al.* (2015) Dietary patterns associated metabolic syndrome in Chinese adults. *Biomed Environ Sci* **28**, 370–373.
- Aekplakorn W, Satheanoppakao W, Putwatana P *et al.* (2015) Dietary pattern and metabolic syndrome in Thai adults. *J Nutr Metab* **2015**, 468759.
- Baik I, Lee M, Jun N-R *et al.* (2013) A healthy dietary pattern consisting of a variety of food choices is inversely associated with the development of metabolic syndrome. *Nutr Res Pract* **7**, 233–241.
- Bian S, Gao Y, Zhang M *et al.* (2013) Dietary nutrient intake and metabolic syndrome risk in Chinese adults: a case-control study. *Nutr J* **12**, 106.
- Panagiotakos DB, Pitsavos C, Skoumas Y *et al.* (2007) The association between food patterns and the metabolic syndrome using principal components analysis: the ATTICA study. *J Am Diet Assoc* **107**, 979–987.
- Suliga E, Kozielec D, Cieśla E *et al.* (2015) Association between dietary patterns and metabolic syndrome in individuals with normal weight: a cross-sectional study. *Nutr J* **14**, 55.
- Akter S, Nanri A, Pham NM *et al.* (2013) Dietary patterns and metabolic syndrome in a Japanese working population. *Nutr Metab (Lond)* **10**, 30.
- Hong S, Song Y, Lee KH *et al.* (2012) A fruit and dairy dietary pattern is associated with a reduced risk of metabolic syndrome. *Metabolism* **61**, 883–890.
- Kim J & Jo I (2011) Grains, vegetables, and fish dietary pattern is inversely associated with the risk of metabolic syndrome in South Korean adults. *J Am Diet Assoc* **111**, 1141–1149.
- DiBello JR, McGarvey ST, Kraft P *et al.* (2009) Dietary patterns are associated with metabolic syndrome in adult Samoans. *J Nutr* **139**, 1933–1943.
- Gadgil MD, Anderson CAM, Kandula NR *et al.* (2015) Dietary patterns are associated with metabolic risk factors in South Asians living in the United States. *J Nutr* **145**, 1211–1217.
- Noel SE, Newby PK, Ordovas JM *et al.* (2009) A traditional rice and beans pattern is associated with metabolic syndrome in Puerto Rican older adults. *J Nutr* **139**, 1360–1367.
- Esmailzadeh A, Kimiagar M, Mehrabi Y *et al.* (2007) Dietary patterns, insulin resistance, and prevalence of the metabolic syndrome in women. *Am J Clin Nutr* **85**, 910–918.
- Naja F, Nasreddine L, Itani L *et al.* (2013) Association between dietary patterns and the risk of metabolic syndrome among Lebanese adults. *Eur J Nutr* **52**, 97–105.
- Cho YA, Kim J, Cho ER *et al.* (2011) Dietary patterns and the prevalence of metabolic syndrome in Korean women. *Nutr Metab Cardiovasc Dis* **21**, 893–900.