

Association between consumption of fruit or processed fruit and chronic diseases and their risk factors: a systematic review of meta-analyses

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Context: The degree of fruit processing is rarely considered in epidemiological studies of fruit consumption. **Objective:** Pooled analyses and meta-analyses of cohort studies and randomized controlled trials that linked fruit consumption with the risk of chronic disease and metabolic deregulation were reviewed systematically to examine the effects of fruit processing. **Data Sources:** The Web of Science and Cochrane Library databases were searched until June 2018. Search terms, querying the article title only, were based on multiple combinations and included the following: type of publication, fruit products, and chronic diseases and their risk factors. **Study Selection:** The selection of studies and the systematic review were carried out in accordance with the PRISMA statement. **Data Extraction:** The literature search identified 189 pooled analyses and meta-analyses, 10 of which met the inclusion criteria. **Results:** The results showed that the degree of processing influences the health effects of fruit-based products. Fresh and dried fruits appeared to have a neutral or protective effect on health, 100% fruit juices had intermediary effects, and high consumption of canned fruit and sweetened fruit juice was positively associated with the risk of all-cause mortality and type 2 diabetes, respectively. **Conclusions:** The results support the need to consider the degree of food processing in future epidemiological studies and randomized controlled trials in order to adjust official recommendations for fruit consumption.

INTRODUCTION

Fruit consumption has been generally associated with either protective or neutral effects against chronic diseases (including mental illnesses),^{1,2} especially cardiovascular diseases,^{3–5} hypertension,^{6,7} type 2 diabetes,^{8–11} cancers,^{4,12–17} asthma and wheezing,¹⁸ cataracts,¹⁹ cognitive impairment,²⁰ depression,² Barrett esophagus,²¹ and bone fracture.²² In some epidemiological studies, the term *fruits* or *total fruits* may refer to both raw fresh fruits and various fruit products that result from

different degrees of processing, such as dried fruits, canned fruits, and fruit juices with or without added sugars.

The degree of processing, however, is rarely considered in epidemiological studies, even though it appears to be important for defining the health potential of food, as recently emphasized by the use of the international NOVA classification.^{23–25} The NOVA system classifies foods into 4 groups: unprocessed or minimally processed foods, culinary ingredients, processed foods, and ultraprocessed foods.²⁶ Other studies not using the

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