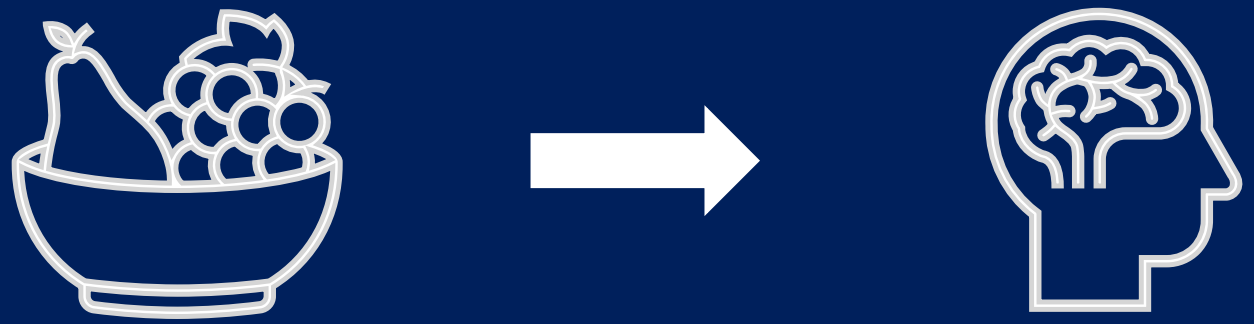
Freitag, 22. November 2024
11:00 bis 13:00 Uhr
JW Marriott Hotel Berlin

JPSI FACHFORUM BERLIN

Polyphenole: Effekte auf die zerebrale Leistungsfähigkeit und Gesundheit

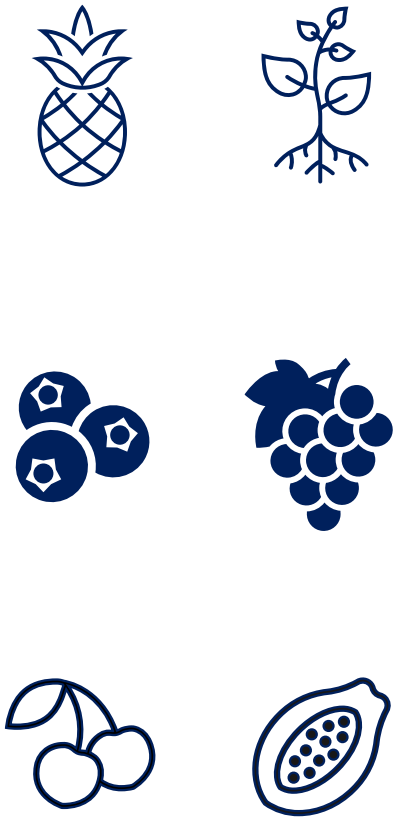
TOBIAS ZIEGLER MSc



Juice Plus+
Science Institute
Advancing plant-based nutrition

Pflanzenbasierte Ernährung

Pflanzenbasierte Ernährung versorgt uns mit:

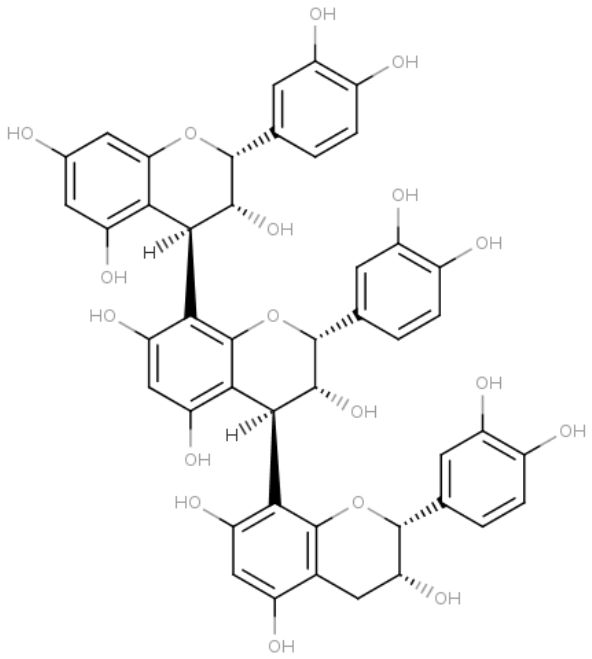


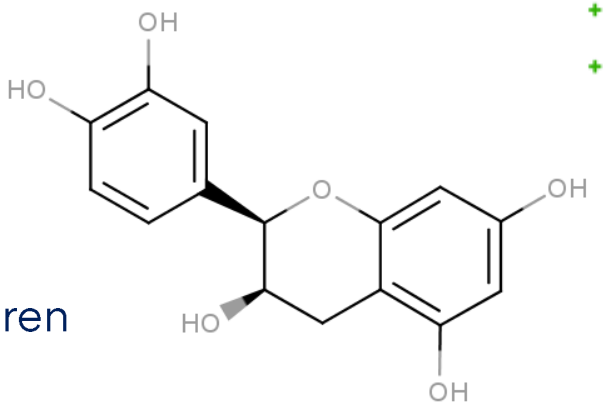
- Kohlenhydraten, Fett, Protein
- Vitaminen, Mineralstoffen
- Ballaststoffen
- **Sekundäre Pflanzenstoffe → Polyphenole**

Juice Plus+ Science Institute
Advancing plant-based nutrition

Polyphenole…

- …sind sekundäre Pflanzenstoffe
- …sind definiert als Moleküle mit mehreren (mindestens 2) Hydroxyl-Gruppen an aromatischen Ringen
- …lassen sich in die Hauptgruppen unterteilen:
  - Flavonoide
  - Lignane
  - Phenolsäuren
  - Stilbene
  - Andere Polyphenole
- …sind hauptsächlich in Obst & Gemüse enthalten
- …tragen zur Farbe bei → Anthocyanine in dunklen Beeren





Source: www.phenol-explorer.eu

Juice Plus+ Science Institute
Advancing plant-based nutrition

Polyphenole und ihre positiven Effekte

- Polyphenole fungieren als Antioxidantien → neutralisieren freier Radikale

- Polyphenole haben eine anti-entzündliche Wirkung →
  beeinflussen entzündliche Signalwege wie z.B. NF-κB

- Diese Eigenschaften machen Polyphenole interessant in der Prävention von:
  - Entzündlichen Erkrankungen
  - Herz-Kreislauf-Erkrankungen
  - Altersbedingte Erkrankungen
  - Neurodegenerative Erkrankungen
  - Und mehr...

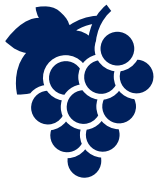
Juice Plus+
Science Institute
Advancing plant-based nutrition

Polyphenole → Nahrungsmittel/Quellen

- Beeren
- Kakao & dunkle Schokolade
- Gewürze (z.B. Curcuma)
- Nüsse & Samen
- Rotwein
- Oliven & Olivenöl
- Gemüse
- Bohnen
- Soja

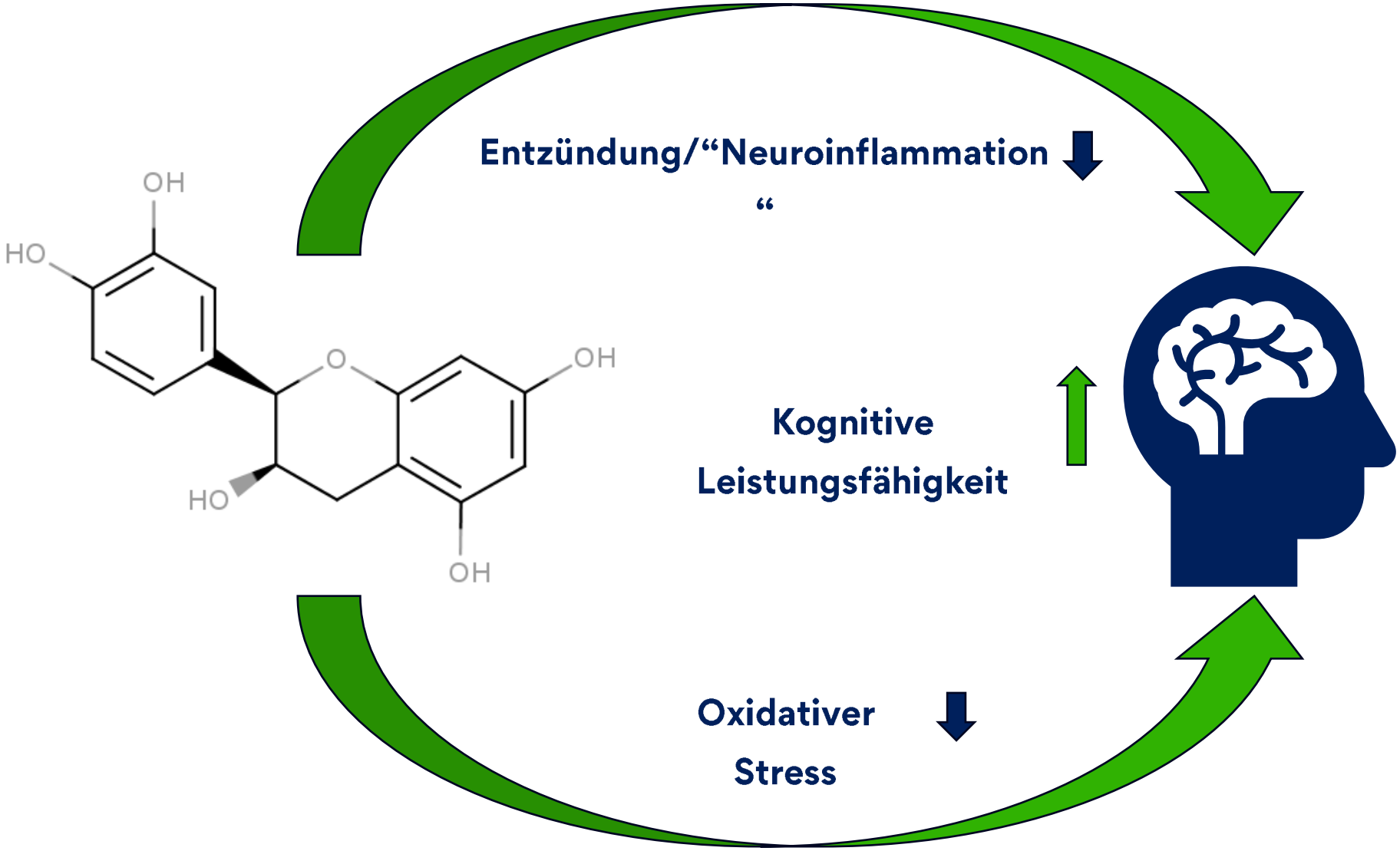





Juice Plus+
Science Institute
Advancing plant-based nutrition

Verbindung zwischen Polyphenolen und kognitiver Funktion



Juice Plus+
Science Institute
Advancing plant-based nutrition

JPSI → "Review-Article"

- **Zielsetzung:**

  die Auswirkungen von Polyphenol-Interventionen auf Biomarker der Gehirnalterung zu bewerten

  - **Brain-Derived Neurotrophic Factor (BDNF)**
  - **amyloid beta peptides (Aβ)**
  - **Nerve Growth Factor (NGF)**
  - **Tau Proteine**

  Biomarker, die im Blut oder mittels Positronen-Emissions-Tomographie (PET) und Magnetresonanztomographie (MRT) gemessen werden, bei gesunden, mittelalten bis älteren Personen

nutrients MDPI

Review

Polyphenols' Impact on Selected Biomarkers of Brain Aging in Healthy Middle-Aged and Elderly Subjects: A Review of Clinical Trials

Tobias Ziegler [1,2], Melina Tsiountsioura [1,2], Lisa Meixner-Goetz [2], Gerhard Cvirn [1] and Manfred Lamprecht [2,3,*]

[1] Division of Medicinal Chemistry, Otto Loewi Research Center, Medical University of Graz, 8010 Graz, Austria; tobias.ziegler@jpsi.info (T.Z.); melina.tsiountsioura@jpsi.info (M.T.); gerhard.cvirn@medunigraz.at (G.C.)
[2] Juice Plus+ Science Institute, Memphis, TN 38017, USA; lisa.meixner-goetz@jpsi.info
[3] Green Beat Institute of Nutrient Research, 8010 Graz, Austria
* Correspondence: dr.lamprecht@jpsi.info

Abstract: With a constantly growing elderly population, incidences of neurodegenerative diseases are also rising and are expected to further increase over the next years, while costing health systems across the world trillions of dollars. Therefore, biomarkers to detect manifestations of brain aging early and interventions to slow down its pace are of great interest. In the last years, the importance of the neurotrophins brain-derived neurotrophic factor (BDNF) and nerve growth factor (NGF) in the context of cognitive function and the aging brain has increased, besides the already well-established amyloid-beta (Aβ) and tau plaques. Due to their wide range of beneficial health effects as well as their antioxidant and anti-inflammatory properties, a class of secondary plant-metabolites, the so-called polyphenols, gained increasing attention. In this review, we discuss the roles of BDNF, Aβ, NGF, and tau proteins as biomarkers of brain aging and the effect of dietary polyphenol interventions on these biomarkers, assessed via blood analysis, magnetic resonance imaging (MRI), and positron emission tomography (PET).

Keywords: polyphenols; brain aging; BDNF; amyloid-beta; Aβ; NGF; tau; flavonoids; curcumin; resveratrol

check for updates

Citation: Ziegler, T.; Tsiountsioura, M.; Meixner-Goetz, L.; Cvirn, G.; Lamprecht, M. Polyphenols' Impact on Selected Biomarkers of Brain Aging in Healthy Middle-Aged and Elderly Subjects: A Review of Clinical Trials. *Nutrients* **2023**, *15*, 3770. https://doi.org/10.3390/nu15173770

Academic Editor: Donald K. Ingram

Received: 20 July 2023
Revised: 25 August 2023
Accepted: 25 August 2023
Published: 29 August 2023

1. Introduction

During the process of aging, the human body undergoes several physiological changes, and the same holds true for the brain. In the aging brain, certain molecules, cells, vasculature, and morphology are seen to be altered, which in turn can increase susceptibility to developing diseases. For example, incidences of stroke and white matter lesions rise with age and can be accompanied by changes in levels of neurotransmitters or hormones [1]. The loss of brain volume and weight can also be a concomitant manifestation, starting at the age of 40 and accelerating further beyond the age of 70 years [2,3]. Certainly, these physical, physiological, or neurotransmitter/hormone-related changes can in turn affect cognitive function. Generally, cognitive function is assessed by investigating its subdomains such as memory, the most widely observed subdomain to be affected by aging [1]. Additionally, executive function, which is a complex construct reflecting many higher-order cognitive processes such as planning future actions, inhibiting the processing of irrelevant information, and adjusting behavior to changes, can be negatively impacted by age. The decline in these so-called executive functions has recently been stated as a characteristic of cognitive aging [4]. However, all these undesirable changes must have underlying molecular triggers, which appear to become more pronounced over the course of the aging process. Among these triggers, which ultimately have been referred to as "hallmarks of brain aging", mitochondrial dysfunction, oxidative stress, and neuroinflammation particularly stand out [5].

JPSI → “Review-Article”

Schlussfolgerungen:

- Begrenzte Evidenz zu den Auswirkungen von Polyphenolen BDNF-, Aβ-, NGF- und Tau-Werte mit inkonsistenten Ergebnissen
- Die Standardisierung der Messungen dieser Marker ist entscheidend für genaue Vergleiche
- Aktuelle Biomarker erfassen möglicherweise nicht die Komplexität der Gehirnalterung vollständig
- Trotz vielversprechender Ergebnisse bleibt die Beziehung zwischen Polyphenol-Konsum und Biomarkern der Gehirnalterung unklar.

nutrients MDPI

Review

Polyphenols' Impact on Selected Biomarkers of Brain Aging in Healthy Middle-Aged and Elderly Subjects: A Review of Clinical Trials

Tobias Ziegler [1,2], Melina Tsiountsioura [1,2], Lisa Meixner-Goetz [2], Gerhard Cvirn [1] and Manfred Lamprecht [2,3,*]

[1] Division of Medicinal Chemistry, Otto Loewi Research Center, Medical University of Graz, 8010 Graz, Austria; tobias.ziegler@jpsi.info (T.Z.); melina.tsiountsioura@jpsi.info (M.T.); gerhard.cvirn@medunigraz.at (G.C.)
[2] Juice Plus+ Science Institute, Memphis, TN 38017, USA; lisa.meixner-goetz@jpsi.info
[3] Green Beat Institute of Nutrient Research, 8010 Graz, Austria
* Correspondence: dr.lamprecht@jpsi.info

Abstract: With a constantly growing elderly population, incidences of neurodegenerative diseases are also rising and are expected to further increase over the next years, while costing health systems across the world trillions of dollars. Therefore, biomarkers to detect manifestations of brain aging early and interventions to slow down its pace are of great interest. In the last years, the importance of the neurotrophins brain-derived neurotrophic factor (BDNF) and nerve growth factor (NGF) in the context of cognitive function and the aging brain has increased, besides the already well-established amyloid-beta (Aβ) and tau plaques. Due to their wide range of beneficial health effects as well as their antioxidant and anti-inflammatory properties, a class of secondary plant-metabolites, the so-called polyphenols, gained increasing attention. In this review, we discuss the roles of BDNF, Aβ, NGF, and tau proteins as biomarkers of brain aging and the effect of dietary polyphenol interventions on these biomarkers, assessed via blood analysis, magnetic resonance imaging (MRI), and positron emission tomography (PET).

Keywords: polyphenols; brain aging; BDNF; amyloid-beta; Aβ; NGF; tau; flavonoids; curcumin; resveratrol

check for updates

Citation: Ziegler, T.; Tsiountsioura, M.; Meixner-Goetz, L.; Cvirn, G.; Lamprecht, M. Polyphenols' Impact on Selected Biomarkers of Brain Aging in Healthy Middle-Aged and Elderly Subjects: A Review of Clinical Trials. *Nutrients* **2023**, *15*, 3770. https://doi.org/10.3390/nu15173770

Academic Editor: Donald K. Ingram

Received: 20 July 2023
Revised: 25 August 2023
Accepted: 25 August 2023
Published: 29 August 2023

1. Introduction

During the process of aging, the human body undergoes several physiological changes, and the same holds true for the brain. In the aging brain, certain molecules, cells, vasculature, and morphology are seen to be altered, which in turn can increase susceptibility to developing diseases. For example, incidences of stroke and white matter lesions rise with age and can be accompanied by changes in levels of neurotransmitters or hormones [1]. The loss of brain volume and weight can also be a concomitant manifestation, starting at the age of 40 and accelerating further beyond the age of 70 years [2,3]. Certainly, these physical, physiological, or neurotransmitter/hormone-related changes can in turn affect cognitive function. Generally, cognitive function is assessed by investigating its subdomains such as memory, the most widely observed subdomain to be affected by aging [1]. Additionally, executive function, which is a complex construct reflecting many higher-order cognitive processes such as planning future actions, inhibiting the processing of irrelevant information, and adjusting behavior to changes, can be negatively impacted by age. The decline in these so-called executive functions has recently been stated as a characteristic of cognitive aging [4]. However, all these undesirable changes must have underlying molecular triggers, which appear to become more pronounced over the course of the aging process. Among these triggers, which ultimately have been referred to as “hallmarks of brain aging”, mitochondrial dysfunction, oxidative stress, and neuroinflammation particularly stand out [5].

Flavonoide und Gehirnleistung → Meta-Analyse

- **Zielsetzung:**

  Ein besseres Verständnis für das Ausmaß der Wirkung von Flavonoiden auf die kognitive Funktion zu gewinnen

- **Methoden:**
  - Hauptziel: Auswirkungen von flavonoid haltiger Ernährung auf kognitive Ergebnisse

  - Sekundäre Ziele: Identifikation des Einflusses von Studiendesign, Bevölkerungsmerkmalen, kognitiven Domänen und verschiedenen Interventionen

RESEARCH ARTICLE

Molecular Nutrition & Food Research
www.mnf-journal.com

Dietary Flavonoids and Human Cognition: A Meta-Analysis

*Nancy Cheng, Lynne Bell, Daniel J. Lamport, and Claire M. Williams**

Improving cognition is important in all age groups, from performance in school examinations to prevention of cognitive decline in later life. Dietary polyphenols, in particular flavonoids, have been examined for their benefits to cognitive outcomes. This meta-analysis evaluates the effects of dietary flavonoids on cognition across the lifespan. In January 2020 databases were searched for randomized controlled trials investigating flavonoid effects on human cognition. Eighty studies, comprising 5519 participants, were included in the final meta-analysis. The global analysis indicates dietary flavonoids induced significant benefit to cognitive performance ($g = 0.148$, $p < 0.001$), with subgroup analyses revealing that cocoa ($g = 0.224$, $p = 0.036$), ginkgo ($g = 0.187$, $p \leq 0.001$), and berries ($g = 0.149$, $p = 0.009$) yielded the most notable improvements. Significant benefits were observed from chronic studies, in middle-aged and older adults, and with low and medium doses. The domains of long-term memory, processing speed, and mood showed sensitivity to flavonoid intervention. This meta-analysis provides evidence for the positive effects of flavonoids on cognition and highlights several moderating factors. Flavonoid-based dietary interventions therefore potentially offer a highly accessible, safe, and cost-effective treatment to help tackle the burden of cognitive decline.

1. Introduction

There is increasing consensus that mental health and physical health are interlinked and given that cognitive function is a key contributor to the development and maintenance of good mental health, it will play an important role in overall well-being. Particular interest has been paid to the impact of diets on cognitive health. Age-related neurodegenerative disorders such as Alzheimer's disease (AD) and vascular dementia place a significant burden on healthcare provision in an aging population, however epidemiological studies show that diets rich in fruit and vegetables reduce the risk of such disorders and help to improve or maintain cognitive function as we age.[1–3] Polyphenols are a group of phytonutrients found in fruits and vegetables that have shown promise as facilitators of cognitive enhancement or neuroprotection. In particular, the polyphenolic subclass of the flavonoids have been extensively studied for their ability to influence cognition and to delay cognitive aging due to their known bioactivity and their high concentrations found in certain food-types. The biochemistry of flavonoids and proposed mechanisms through which they exhibit their effects on cognition, including activation of neuronal signaling pathways, reduction of neuroinflammation, improvements to vascular function, and interactions with the gut microbiome and neurotransmitter systems, have already been described in detail elsewhere.[4–7] Differences in the molecular structure between flavonoid subclasses means that evidence of mechanistic variations are emerging. For example, isoflavones are thought to exert their cognitive effects through their particular affinity for estrogen receptors,[8] the degree of hydroxylation around the aromatic rings impacts on the antibacterial properties of flavonoids,[9] and there are differential effects on glucose metabolism.[10]

A number of published studies have investigated the cognitive benefits of the flavonoid family of polyphenols, following supplementation with flavonoid-rich whole foods or supplements, including berries, cocoa, citrus fruits, tea, soya products, and ginkgo biloba. While the cognitive effects observed following ingestion of any given food cannot necessarily be attributed to a specific polyphenol subclass or subclasses in isolation, flavonoids are the most abundant polyphenol subclass found in foods and beverages and are likely to be present across the interventions investigated in cognitive studies. In contrast, the presence of nonflavonoid polyphenols varies substantially between foods and when characterized, are generally found at lower concentrations than flavonoids.[11] The flavonoid content of investigated polyphenol-rich foods is therefore likely to be responsible for observed neurocognitive responses. Reported effects of flavonoids on cognition have been mixed and suggest that cognitive outcomes may be dependent on several experimental factors which warrant examination. The flavonoid source may be a particularly influential factor, for example Whyte et al.[12] found a mixed berries intervention improved measures of executive function whereas Decroix et al.[13] found acute cocoa supplementation failed to elicit an effect when also

N. Cheng, L. Bell, D. J. Lamport, C. M. Williams
School of Psychology and Clinical Language Sciences
University of Reading, Reading
UK
E-mail: claire.williams@reading.ac.uk

DOI: 10.1002/mnfr.202100976

Juice Plus+ Science Institute
Advancing plant-based nutrition

Flavonoide und Gehirnleistung → Meta-Analyse

Hauptergebnisse:

- Flavonoid-Supplementierung hat einen signifikant positiven Effekt auf die Messwerte der kognitiven Leistung
- Die größten Effekte wurden bei Kakao festgestellt, gefolgt von Ginkgo und Beeren
- Die Supplementierungsperiode sollte mindestens 6 Wochen dauern
- Es gibt einen signifikanten Nutzen für die kognitive Funktion bei Erwachsenen mittleren und höheren Alters
- Bei Kindern und jungen Erwachsenen wurden keine signifikanten Effekte festgestellt

RESEARCH ARTICLE

Molecular Nutrition & Food Research
www.mnf-journal.com

Dietary Flavonoids and Human Cognition: A Meta-Analysis

*Nancy Cheng, Lynne Bell, Daniel J. Lamport, and Claire M. Williams**

Improving cognition is important in all age groups, from performance in school examinations to prevention of cognitive decline in later life. Dietary polyphenols, in particular flavonoids, have been examined for their benefits to cognitive outcomes. This meta-analysis evaluates the effects of dietary flavonoids on cognition across the lifespan. In January 2020 databases were searched for randomized controlled trials investigating flavonoid effects on human cognition. Eighty studies, comprising 5519 participants, were included in the final meta-analysis. The global analysis indicates dietary flavonoids induced significant benefit to cognitive performance ($g = 0.148$, $p < 0.001$), with subgroup analyses revealing that cocoa ($g = 0.224$, $p = 0.036$), ginkgo ($g = 0.187$, $p \leq 0.001$), and berries ($g = 0.149$, $p = 0.009$) yielded the most notable improvements. Significant benefits were observed from chronic studies, in middle-aged and older adults, and with low and medium doses. The domains of long-term memory, processing speed, and mood showed sensitivity to flavonoid intervention. This meta-analysis provides evidence for the positive effects of flavonoids on cognition and highlights several moderating factors. Flavonoid-based dietary interventions therefore potentially offer a highly accessible, safe, and cost-effective treatment to help tackle the burden of cognitive decline.

1. Introduction

N. Cheng, L. Bell, D. J. Lamport, C. M. Williams
School of Psychology and Clinical Language Sciences
University of Reading, Reading
UK
E-mail: claire.williams@reading.ac.uk

DOI: 10.1002/mnfr.202100976

Juice Plus+ Science Institute
Advancing plant-based nutrition

Flavonoide und Gehirnleistung → Meta-Analyse

Hauptergebnisse:

- Signifikante Vorteile für die Kognition bei kognitiv gesunden und ungesunden Probanden
- Größere Effektstärken wurden bei kognitiv ungesunden Teilnehmern beobachtet
- Signifikante Effekte auf die Kognition wurden bei niedrigen und mittleren Dosen von Flavonoiden festgestellt, jedoch nicht bei hohen Dosen
- Signifikante Effekte der Flavonoide auf das Langzeitgedächtnis und die Verarbeitungsgeschwindigkeit

	Dose range [mg]		
Flavonoid source	Low	Medium	High
Cocoa	0–349	350–699	700+
Citrus	0–74	75–149	150+
Tea	0–424	425–849	850+
Ginkgo	0–39	40–79	80+
Berry	0–349	350–699	700+
Soya	0–69	70–139	140+
Pine bark	0–249	250–499	500+
Other	N/A	N/A	N/A

Juice Plus+ Science Institute
Advancing plant-based nutrition

Flavonoide und Gehirnleistung → Meta-Analyse

Schlussfolgerung:

„Diese Meta-Analyse liefert Beweise für die positiven Effekte von Flavonoiden auf die kognitive Funktion und hebt mehrere Faktoren hervor. Flavonoid-basierte Ernährungsinterventionen bieten daher möglicherweise eine sehr zugängliche, sichere und kostengünstige Option, um der Belastung durch kognitiven Abbau entgegenzuwirken.“

RESEARCH ARTICLE

Molecular Nutrition & Food Research
www.mnf-journal.com

Dietary Flavonoids and Human Cognition: A Meta-Analysis

*Nancy Cheng, Lynne Bell, Daniel J. Lamport, and Claire M. Williams**

Improving cognition is important in all age groups, from performance in school examinations to prevention of cognitive decline in later life. Dietary polyphenols, in particular flavonoids, have been examined for their benefits to cognitive outcomes. This meta-analysis evaluates the effects of dietary flavonoids on cognition across the lifespan. In January 2020 databases were searched for randomized controlled trials investigating flavonoid effects on human cognition. Eighty studies, comprising 5519 participants, were included in the final meta-analysis. The global analysis indicates dietary flavonoids induced significant benefit to cognitive performance ($g = 0.148$, $p < 0.001$), with subgroup analyses revealing that cocoa ($g = 0.224$, $p = 0.036$), ginkgo ($g = 0.187$, $p \leq 0.001$), and berries ($g = 0.149$, $p = 0.009$) yielded the most notable improvements. Significant benefits were observed from chronic studies, in middle-aged and older adults, and with low and medium doses. The domains of long-term memory, processing speed, and mood showed sensitivity to flavonoid intervention. This meta-analysis provides evidence for the positive effects of flavonoids on cognition and highlights several moderating factors. Flavonoid-based dietary interventions therefore potentially offer a highly accessible, safe, and cost-effective treatment to help tackle the burden of cognitive decline.

improve or maintain cognitive function as we age.[1–3] Polyphenols are a group of phytonutrients found in fruits and vegetables that have shown promise as facilitators of cognitive enhancement or neuroprotection. In particular, the polyphenolic subclass of the flavonoids have been extensively studied for their ability to influence cognition and to delay cognitive aging due to their known bioactivity and their high concentrations found in certain food-types. The biochemistry of flavonoids and proposed mechanisms through which they exhibit their effects on cognition, including activation of neuronal signaling pathways, reduction of neuroinflammation, improvements to vascular function, and interactions with the gut microbiome and neurotransmitter systems, have already been described in detail elsewhere.[4–7] Differences in the molecular structure between flavonoid subclasses means that evidence of mechanistic variations are emerging. For example, isoflavones are thought to exert their cognitive effects through their particular affinity for estrogen receptors,[8] the degree of hydroxylation around the aromatic rings impacts on the antibacterial properties of flavonoids,[9] and there are differential effects on glucose metabolism.[10]

A number of published studies have investigated the cognitive benefits of the flavonoid family of polyphenols, following supplementation with flavonoid-rich whole foods or supplements, including berries, cocoa, citrus fruits, tea, soya products, and ginkgo biloba. While the cognitive effects observed following ingestion of any given food cannot necessarily be attributed to a specific polyphenol subclass or subclasses in isolation, flavonoids are the most abundant polyphenol subclass found in foods and beverages and are likely to be present across the interventions investigated in cognitive studies. In contrast, the presence of nonflavonoid polyphenols varies substantially between foods and when characterized, are generally found at lower concentrations than flavonoids.[11] The flavonoid content of investigated polyphenol-rich foods is therefore likely to be responsible for observed neurocognitive responses. Reported effects of flavonoids on cognition have been mixed and suggest that cognitive outcomes may be dependent on several experimental factors which warrant examination. The flavonoid source may be a particularly influential factor, for example Whyte et al.[12] found a mixed berries intervention improved measures of executive function whereas Decroix et al.[13] found acute cocoa supplementation failed to elicit an effect when also

1. Introduction

There is increasing consensus that mental health and physical health are interlinked and given that cognitive function is a key contributor to the development and maintenance of good mental health, it will play an important role in overall well-being. Particular interest has been paid to the impact of diets on cognitive health. Age-related neurodegenerative disorders such as Alzheimer's disease (AD) and vascular dementia place a significant burden on healthcare provision in an aging population, however epidemiological studies show that diets rich in fruit and vegetables reduce the risk of such disorders and help to

N. Cheng, L. Bell, D. J. Lamport, C. M. Williams
School of Psychology and Clinical Language Sciences
University of Reading, Reading
UK
E-mail: claire.williams@reading.ac.uk

The ORCID identification number(s) for the author(s) of this article can be found under https://doi.org/10.1002/mnfr.202100976

DOI: 10.1002/mnfr.202100976

Juice Plus+ Science Institute
Advancing plant-based nutrition

Polyphenole in Juice Plus+

- **Zielsetzung:**

  Charakterisierung der (Poly)phenole in JP+ Fruit-, Veg- und Berry mittels Massenspektrometrie

Contents lists available at ScienceDirect

PharmaNutrition

journal homepage: www.elsevier.com/locate/phanu

(Poly)phenolic characterization of three food supplements containing 36 different fruits, vegetables and berries

Letizia Bresciani [a], Luca Calani [a], Marta Cossu [a], Pedro Mena [a], Marietta Sayegh [b], Sumantra Ray [b,**], Daniele Del Rio [a,b,*]

ARTICLE INFO

ABSTRACT

1. Introduction

High consumption of plant based foods is recommended in dietary guidelines worldwide [1]. Their high daily intake promotes human health, playing an important role in prevention of chronic diseases [2]. The consumption of 5 portions or at least 400 g of fruits and vegetables daily is the ideal target for many national nutrition societies and public policies [1,3]. The amount of daily plant based food has been associated with a reduction in all-cause mortality [4], a reduction in hypertension, coronary heart disease and stroke risk [2], and a decrease in overall cancer risk [5], with specific effects on colorectal [6], esophageal and gastric cancer [7]. In addition, the consumption of fruits and vegetables has been proven to reduce the risk of certain eye diseases, dementia, osteoporosis, and metabolic diseases like type II diabetes [8,9].

The nutritional relevance of fruits, vegetables and their derived products seems to be linked to a range of micronutrients and non-nutrient bioactive compounds, including phytochemicals such as (poly)phenolic compounds and carotenoids, vitamins (mainly vitamin C, folate, and provitamin A), minerals as potassium, calcium, and magnesium, and dietary fibre [10,11]. Among them, (poly)phenolic compounds are maybe the most investigated components in plant foods. They are principally represented by phenolic acids, flavonoids, and tannins [11] and their dietary intake has been related to beneficial health effects, including reduction of inflammation, hypertension, and risk of cardiovascular diseases, neurodegenerative diseases and cancer [12,13]. This fact turns likely this wide class of plant compounds into the best candidates to justify the benefits associated with plant-based diets.

Consumers are becoming more aware of the importance of consuming a healthy diet due to health promotion and are inclined to buy products rich in bioactive compounds [14]. Among other reasons, lifestyle changes and consumer health demands have boosted the market of plant-based nutraceuticals and food supplements in recent years. These products represent new ways

Juice Plus+ Science Institute
Advancing plant-based nutrition

Polyphenole in Juice Plus+

Ergebnisse (Polyphenolgehalt):

- Die Berry Blend zeigt den höchsten Gehalt mit 176 mg/g → 75 identifizierte Verbindungen
- Die Fruit Blend beinhaltet 128 mg/g → 25 identifizierte Verbindungen
- Die Veg Blend hat 50 mg/g → 28 identifizierte Verbindungen
- Insgesamt wurden 119 polyphenolische Verbindungen identifiziert
- Zwei Kapseln jeder Blend liefern ca. 600 mg Polyphenole

Contents lists available at ScienceDirect

PharmaNutrition

journal homepage: www.elsevier.com/locate/pharma

(Poly)phenolic characterization of three food supplements containing 36 different fruits, vegetables and berries

Letizia Bresciani [a], Luca Calani [a], Marta Cossu [a], Pedro Mena [a], Marietta Sayegh [b], Sumantra Ray [b,**], Daniele Del Rio [a,b,*]

ARTICLE INFO

ABSTRACT

1. Introduction

Juice Plus+ Science Institute
Advancing plant-based nutrition

Bioverfügbarkeit der Juice Plus+ Polyphenole

+ Zielsetzung:

Untersuchung des Absorptionsprofils der (Poly)phenole, die in JP+ Fruit-, Veg- und Berry enthalten sind

+ Methoden:

20 Probanden konsumierten die Nahrungsergänzungsmittel, und Blutproben wurden zu folgenden Zeitpunkten entnommen: vor der Einnahme (Baseline) sowie 1, 2, 5 und 10 Stunden nach der Einnahme

nutrients

MDPI

Article

Absorption Profile of (Poly)Phenolic Compounds after Consumption of Three Food Supplements Containing 36 Different Fruits, Vegetables, and Berries

Letizia Bresciani [1], Daniela Martini [1], Pedro Mena [1], Michele Tassotti [1], Luca Calani [2], Giacomo Brigati [1], Furio Brighenti [1], Sandra Holasek [3], Daniela-Eugenia Malliga [4], Manfred Lamprecht [5,6] and Daniele Del Rio [1,7,*]

1 The Laboratory of Phytochemicals in Physiology, Human Nutrition Unit, Department of Food & Drug, University of Parma, 43125 Parma, Italy; letizia.bresciani@unipr.it (L.B.); daniela.martini@unipr.it (D.M.); pedromiguel.menaparreno@unipr.it (P.M.); michele.tassotti@studenti.unipr.it (M.T.); giacomo.brigati@studenti.unipr.it (G.B.); furio.brighenti@unipr.it (F.B.)
2 Department of Food & Drug, University of Parma, 43124 Parma, Italy; luca.calani@unipr.it
3 Institute of Pathophysiology and Immunology, Medical University of Graz, A-8010 Graz, Austria; sandra.holasek@medunigraz.at
4 Division of Cardiac Surgery, Department of Surgery, Medical University of Graz, A-8010 Graz, Austria; daniela-eugenia.martin@medunigraz.at
5 Institute of Physiological Chemistry, Medical University of Graz, A-8010 Graz, Austria; manfred.lamprecht@medunigraz.at
6 Green Beat—Institute of Nutrient Research and Sport Nutrition, 8042 Graz, Austria
7 The Need for Nutrition Education/Innovation Programme (NNEdPro), Global Centre for Nutrition and Health, St John's Innovation Centre, Cambridge CB4 0WS, UK
* Correspondence: daniele.delrio@unipr.it; Tel.: +39-0521-903-830

Received: 30 January 2017; Accepted: 23 February 2017; Published: 26 February 2017

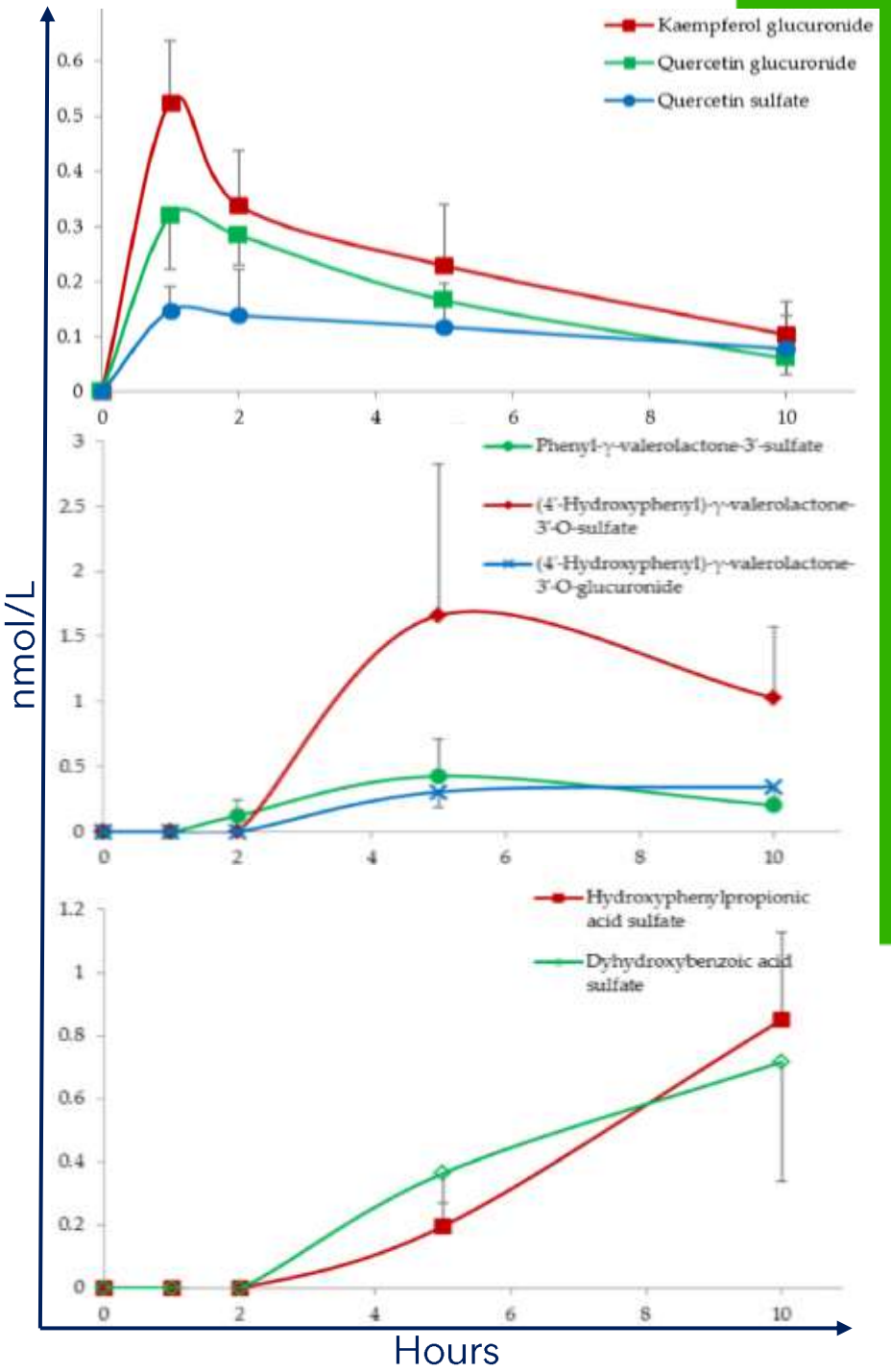
Abstract: The market of plant-based nutraceuticals and food supplements is continuously growing due to the increased consumer demand. The introduction of new products with relevant nutritional characteristics represents a new way of providing bioactive compounds and (poly)phenols to consumers, becoming a strategy to ideally guarantee the health benefits attributed to plant foodstuffs and allowing the increase of daily bioactive compound intake. A paramount step in the study of nutraceuticals is the evaluation of the bioavailability and metabolism of their putatively active components. Therefore, the aim of the present study was to investigate the absorption profile of the (poly)phenolic compounds contained in three different plant-based food supplements, made of 36 different plant matrices, which were consumed by 20 subjects in an open one-arm study design. Blood samples were collected at baseline and 1, 2, 5, and 10 h after capsule intake. Twenty quantifiable metabolites deriving from different (poly)phenolic compounds were identified. Results showed that the consumption of the three capsules allowed the effective absorption of several (poly)phenolic compounds and metabolites appearing at different times in plasma, thereby indicating different absorption profiles. The capsules thus ensured potential health-promoting molecules to be potentially available to target tissues and organs.

J P S I Juice Plus+ Science Institute
Advancing plant-based nutrition

Bioverfügbarkeit der Juice Plus+ Polyphenole

+ Ergebnisse:

- 20 quantifizierbare Metaboliten aus verschiedenen Polyphenolen wurden im Plasma identifiziert
- Der Konsum der Kapseln ermöglichte die Aufnahme mehrerer Polyphenole
- Plasmaspitzen zu unterschiedlichen Zeitpunkten weisen auf unterschiedliche Absorptionsprofile hin



JP+ und kognitive Funktion

University of Murcia, Spanien

+ **Zielsetzung:**

  Das Ziel dieser Studie war es, die Auswirkungen eines verkapselten Frucht-, Gemüse- und Beeren-Saftpulver-Konzentrats auf die kognitiven Funktionen bei gesunden Erwachsenen zu bewerten

antioxidants

MDPI

Article

Effects of Fruit and Vegetable-Based Nutraceutical on Cognitive Function in a Healthy Population: Placebo-Controlled, Double-Blind, and Randomized Clinical Trial

Juan Ángel Carrillo, Raúl Arcusa, María Pilar Zafrilla * and Javier Marhuenda

Faculty of Health Sciences, Universidad Católica de San Antonio, 30107 Murcia, Spain; jacarrillo4@alu.ucam.edu (J.Á.C.); rarcusa@ucam.edu (R.A.); jmarhuenda@ucam.edu (J.M.)
* Correspondence: mpzafrilla@ucam.edu; Tel.: +34-968-27-86-18

Abstract: There is scientific evidence of the positive effect of polyphenols from plant foods on cognition, but not enough is known about the synergistic effect when multiple polyphenols are consumed and even less in a healthy non-elderly population. The aim of the present study is to investigate the possible effects of improvements in cognitive function in healthy people as a preparation based on micronized fruit and vegetables consumed. One hundred and eight subjects were selected, stratified by sex in the control intervention group (n = 53) and placebo (n = 55). Volunteers completed the study after two 16-week periods of consumption with a 4-week wash period between each phase. At the beginning and the end of each phase, volunteers performed the Stroop, TESEN, and RIST tests for the measurement of different cognitive function patterns. The results revealed statistically significant differences in all the variables of the tests carried out, especially compared with the placebo. Specially, the results obtained in the Stroop and TESEN test, in addition to the processing speed even with semantic interferences, were markedly better after the treatment with the product under study. Moreover, the consumption of the product under study clearly improves short-term memory, verbal and non-verbal, according to the results obtained in the RIST test. The results showed an improvement in executive function in terms of short-term memory, working memory, selective and sustained attention, and speed of processing.

Keywords: cognition; polyphenols; executive function; memory; attention; Stroop; TESEN; RIST

check for updates

Citation: Carrillo, J.Á.; Arcusa, R.; Zafrilla, M.P.; Marhuenda, J. Effects of Fruit and Vegetable-Based Nutraceutical on Cognitive Function in a Healthy Population: Placebo-Controlled, Double-Blind, and Randomized Clinical Trial. *Antioxidants* **2021**, *10*, 116. https://doi.org/10.3390/antiox10010116

Received: 10 December 2020
Accepted: 12 January 2021
Published: 15 January 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

1. Introduction

Polyphenols, including phenolic acids, flavonoids, such as anthocyanins or flavonols and tannins, vary depending on the fruits or vegetables where they are present: berries, onions, apples, parsley, celery, broccoli... [1,2]. They have a considerable capacity to neutralize free radicals and exert anti-inflammatory and neuroprotective effects [3,4] and are considered important in cognitive function. Although the mechanisms of action have not yet been clarified, these compounds are known to modulate cerebral blood flow, inducing changes in memory processing [5,6], improving neuronal connectivity and neuronal growth in the hippocampus [7], and synaptic plasticity [8] related to variations in nitric oxide (NO) levels [9].

The effect of bioactive compounds also depends on consumption and frequency levels [10,11] since there is evidence of the effects in acute consumption [12], but not so much in prolonged consumption over time. The brain is especially sensitive and prone to oxidative damage and the accumulation of reactive oxygen species (ROS) due to increases in oxygen consumption [13]. Polyphenol supplementation decreases the vulnerability of elderly people who present higher risk factors to oxidative stress, improving neuronal communicability [14,15].

There are authors who have investigated the synergistic effects of various plant compounds [16,17], but their effects have not been clearly demonstrated and more randomized

Juice Plus+ Science Institute
Advancing plant-based nutrition

JP+ und kognitive Funktion

+ Studien Design:

- Randomisierte, Placebo-kontrollierte, doppelblind Studie mit Crossover-Design
- 4 Studienbesuche: Beginn der Studie, 16 Wochen (nach der 16. Woche: 4 Wochen Wash-out), 20 Wochen und 36 Wochen

+ Intervention:

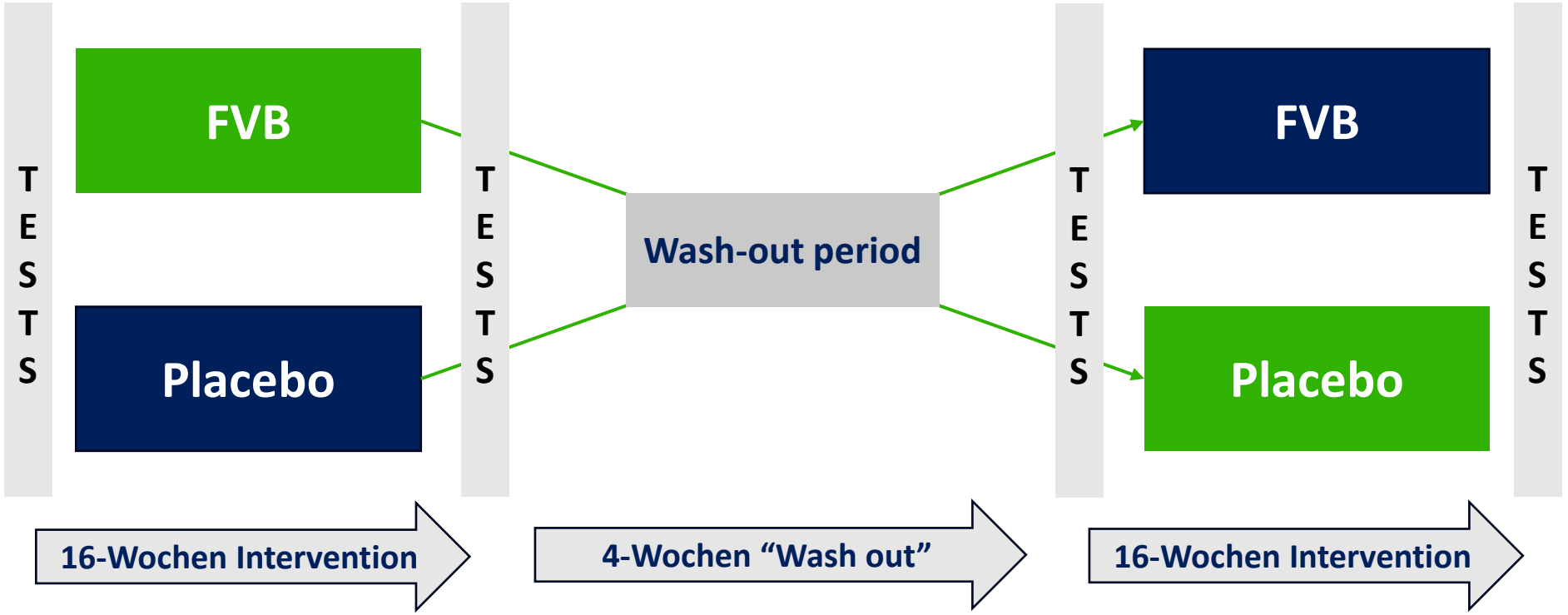
- 6 Kapseln/Tag Juice Plus+ Obst-, Gemüse- und Beeren Kapseln oder Placebo

+ Probanden

- 94 allgemein gesunde Probanden im Alter von 18 bis 65 Jahren beendeten die Studie
- BMI ≥ 18.5 ≤ 35 kg/m2
- Verzehr von ≤ 3 Portionen Obst oder Gemüse pro Tag

Juice Plus+
Science Institute
Advancing plant-based nutrition

JP+ und kognitive Funktion



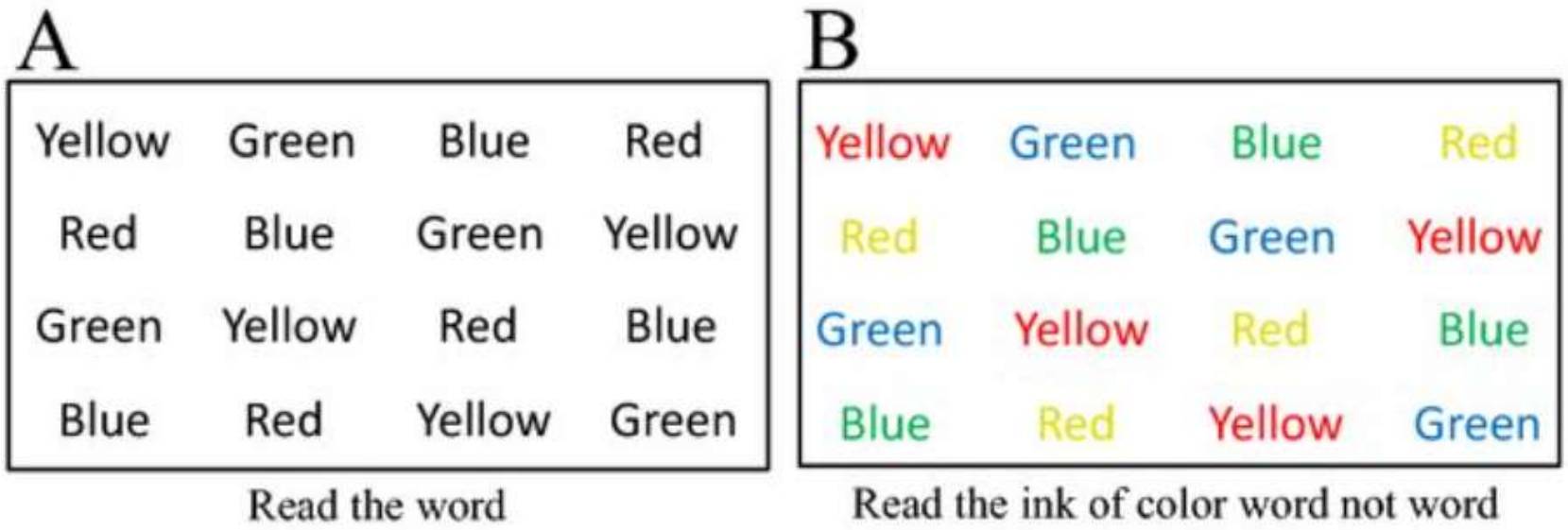
Juice Plus+
Science Institute
Advancing plant-based nutrition

JP+ und kognitive Funktion

Verwendete Tests:

- Stroop Test → Selektive Aufmerksamkeit
- TESEN Test (Basierend auf dem Trail-Making-Test) → Exekutive Funktionen und Arbeitsgedächtnis
- RIST Test (Reynolds Intellectual Screening Test) → Gedächtnis

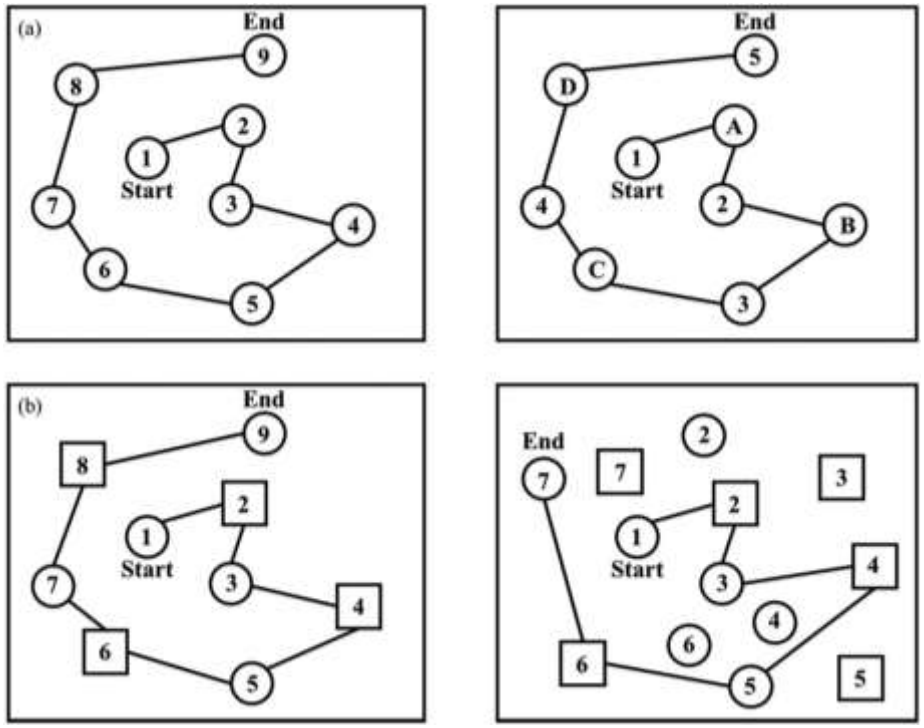
Stroop Test



Juice Plus+ Science Institute
Advancing plant-based nutrition

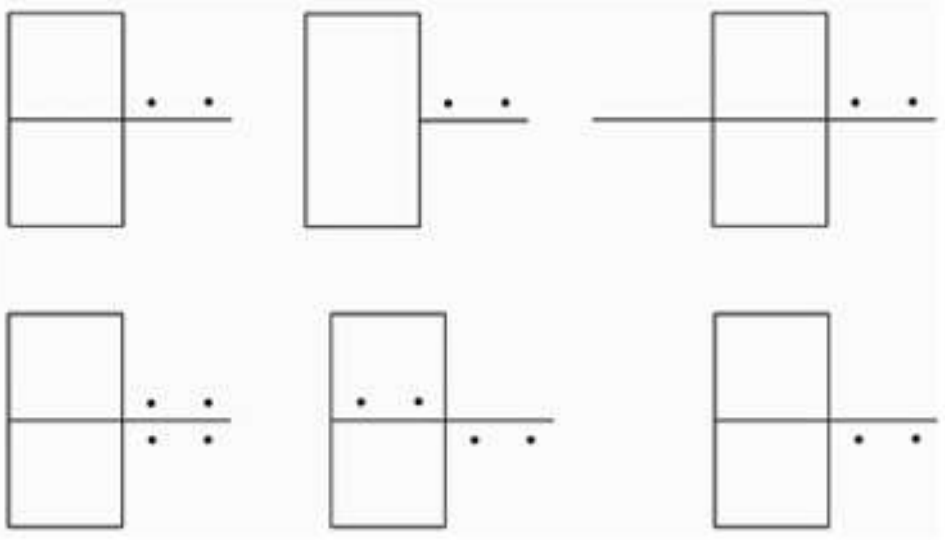
JP+ und kognitive Funktion

TESEN Test (Trail Making



Simfukwe et al. 2021

RIST Test



Reynolds Intellectual Assessment Scale – Reynolds & Kamphaus

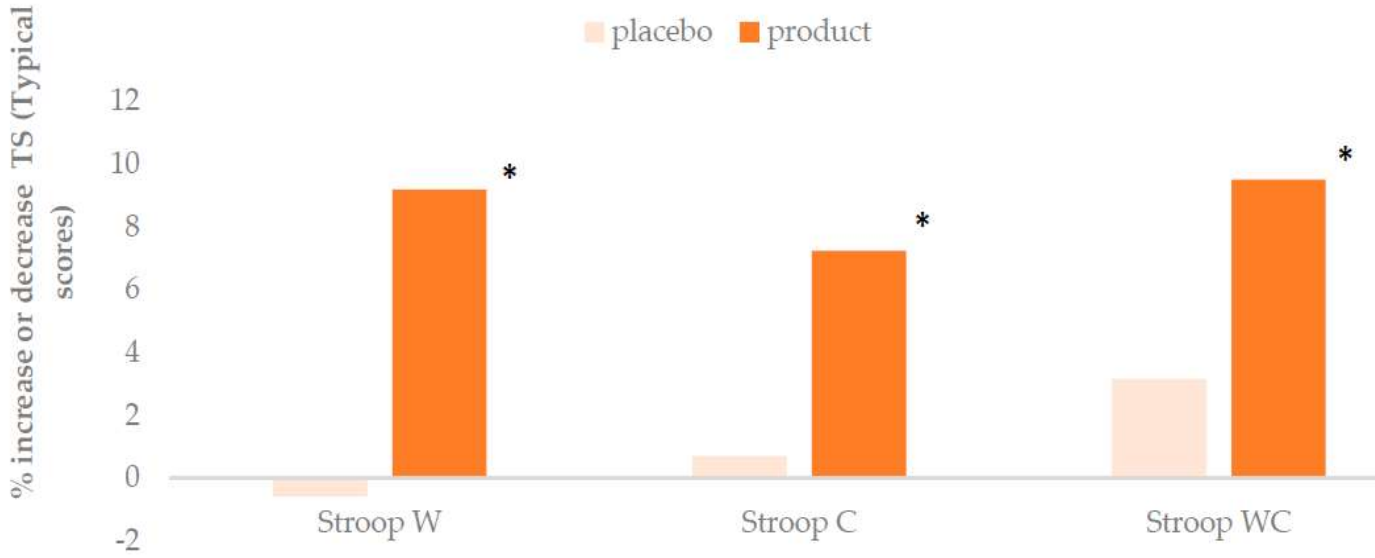
Juice Plus+ Science Institute
Advancing plant-based nutrition

JP+ und kognitive Funktion

+ Ergebnisse Stroop Test:

- Im Vergleich zu Placebo führte die Supplementierung zu signifikanten Verbesserungen in allen 3 Variablen des Stroop-Tests (W, C, WC)

- Die Einnahme des Placebos zeigte keine statistische Verbesserung in einer der Variablen des Tests.



Entwicklung der Ergebnisse in den verschiedenen Variablen des Stroop-Tests in prozentualer Zunahme oder Abnahme. *Signifikante Unterschiede angeben ($p < 0,05$)

Juice Plus+ Science Institute
Advancing plant-based nutrition

JP+ und kognitive Funktion

Ergebnisse TESEN Test:

- Im Vergleich zur Ausgangsbasis führte die Supplementierung zu signifikanten Verbesserungen in der Ausführungsgeschwindigkeit (S), der Präzision (P) sowie Geschwindigkeit und Präzision (E)

- Im Vergleich zu Placebo zeigte die Supplementierung einen signifikanten Anstieg der Geschwindigkeit (S) und eine signifikante Verbesserung der Ausführung (E)

Entwicklung der Ergebnisse in den verschiedenen Variablen des TESEN-Tests in prozentualer Zunahme oder Abnahme. *Signifikante Unterschiede angeben ($p < 0,05$)

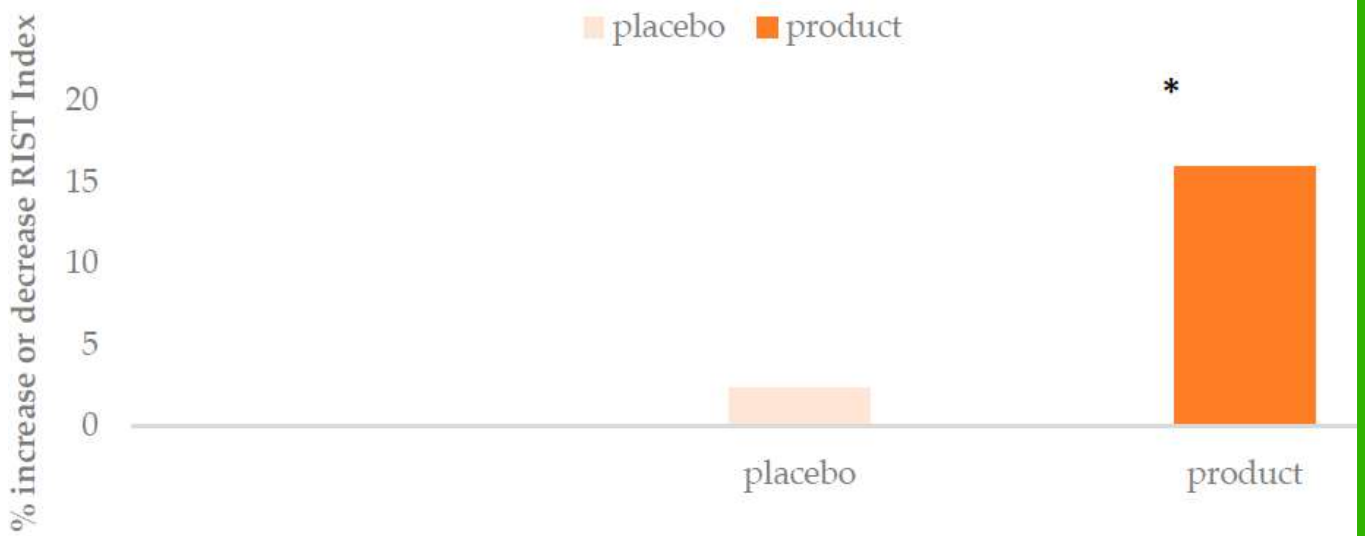
Juice Plus+ Science Institute
Advancing plant-based nutrition

JP+ und kognitive Funktion

Ergebnisse des RIST Test:

- Im Vergleich zur Ausgangsbasis führte die Supplementierung zu einer signifikanten Verbesserung des Arbeitsgedächtnisses, gemäß dem RIST-Index

- Im Vergleich zu Placebo führte die Supplementierung zu einem signifikanten Anstieg des RIST-Index



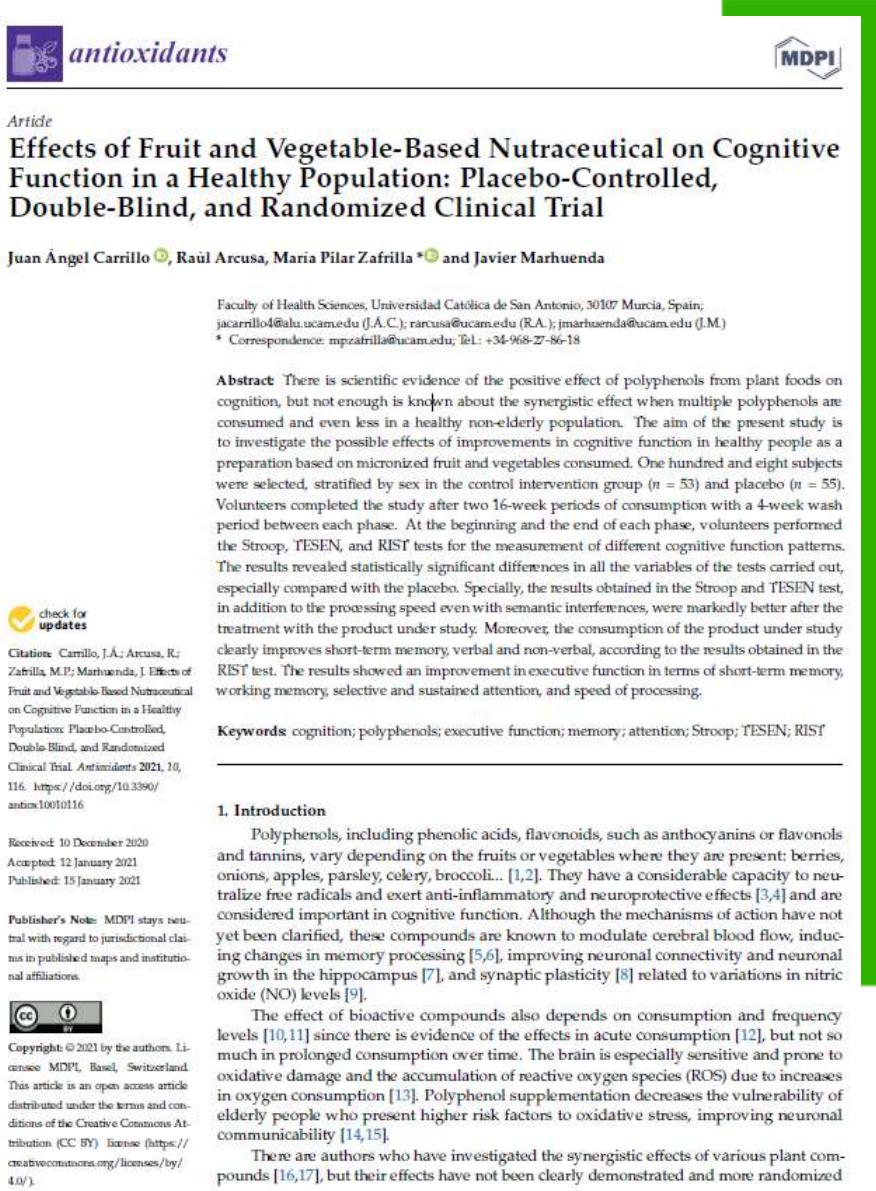
Entwicklung der Ergebnisse in den verschiedenen Variablen des RIST-Tests zwischen der Placebo- und der Produktgruppe in prozentualer Zunahme oder Abnahme. *Signifikante Unterschiede angeben ($p < 0,05$)

Juice Plus+ Science Institute
Advancing plant-based nutrition

JP+ und kognitive Funktion

Schlussfolgerung

Die Supplementierung mit einem konzentrierten Pulver aus Obst-, Gemüse- und Beeren-Saftkonzentrat, das reich an Polyphenolen ist, führte zu einer Verbesserung der exekutiven Funktionen, des Arbeitsgedächtnisses, der selektiven und nachhaltigen Aufmerksamkeit sowie der Verarbeitungsgeschwindigkeit.



antioxidants

MDPI

Article

Effects of Fruit and Vegetable-Based Nutraceutical on Cognitive Function in a Healthy Population: Placebo-Controlled, Double-Blind, and Randomized Clinical Trial

Juan Ángel Carrillo, Raúl Arcusa, Maria Pilar Zafrilla * and Javier Marhuenda

Faculty of Health Sciences, Universidad Católica de San Antonio, 30107 Murcia, Spain; jacarrillo4@alu.ucam.edu (J.Á.C.); rarcusa@ucam.edu (R.A.); jmarhuenda@ucam.edu (J.M.)
* Correspondence: mpzafrilla@ucam.edu; Tel.: +34-968-27-86-18

Abstract: There is scientific evidence of the positive effect of polyphenols from plant foods on cognition, but not enough is known about the synergistic effect when multiple polyphenols are consumed and even less in a healthy non-elderly population. The aim of the present study is to investigate the possible effects of improvements in cognitive function in healthy people as a preparation based on micronized fruit and vegetables consumed. One hundred and eight subjects were selected, stratified by sex in the control intervention group (n = 53) and placebo (n = 55). Volunteers completed the study after two 16-week periods of consumption with a 4-week wash period between each phase. At the beginning and the end of each phase, volunteers performed the Stroop, TESEN, and RIST tests for the measurement of different cognitive function patterns. The results revealed statistically significant differences in all the variables of the tests carried out, especially compared with the placebo. Specially, the results obtained in the Stroop and TESEN test, in addition to the processing speed even with semantic interferences, were markedly better after the treatment with the product under study. Moreover, the consumption of the product under study clearly improves short-term memory, verbal and non-verbal, according to the results obtained in the RIST test. The results showed an improvement in executive function in terms of short-term memory, working memory, selective and sustained attention, and speed of processing.

Keywords: cognition; polyphenols; executive function; memory; attention; Stroop; TESEN; RIST

check for updates

Citation: Carrillo, J.Á.; Arcusa, R.; Zafrilla, M.P.; Marhuenda, J. Effects of Fruit and Vegetable-Based Nutraceutical on Cognitive Function in a Healthy Population: Placebo-Controlled, Double-Blind, and Randomized Clinical Trial. *Antioxidants* **2021**, *10*, 116. https://doi.org/10.3390/antiox10010116

Received: 10 December 2020
Accepted: 12 January 2021
Published: 15 January 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

1. Introduction

Polyphenols, including phenolic acids, flavonoids, such as anthocyanins or flavonols and tannins, vary depending on the fruits or vegetables where they are present: berries, onions, apples, parsley, celery, broccoli... [1,2]. They have a considerable capacity to neutralize free radicals and exert anti-inflammatory and neuroprotective effects [3,4] and are considered important in cognitive function. Although the mechanisms of action have not yet been clarified, these compounds are known to modulate cerebral blood flow, inducing changes in memory processing [5,6], improving neuronal connectivity and neuronal growth in the hippocampus [7], and synaptic plasticity [8] related to variations in nitric oxide (NO) levels [9].

The effect of bioactive compounds also depends on consumption and frequency levels [10,11] since there is evidence of the effects in acute consumption [12], but not so much in prolonged consumption over time. The brain is especially sensitive and prone to oxidative damage and the accumulation of reactive oxygen species (ROS) due to increases in oxygen consumption [13]. Polyphenol supplementation decreases the vulnerability of elderly people who present higher risk factors to oxidative stress, improving neuronal communicability [14,15].

There are authors who have investigated the synergistic effects of various plant compounds [16,17], but their effects have not been clearly demonstrated and more randomized

Juice Plus+ Science Institute
Advancing plant-based nutrition

Freitag, 22. November 2024
11:00 bis 13:00 Uhr
JW Marriott Hotel Berlin

JPSI FACHFORUM BERLIN

Aktuelles aus der Juice Plus+ Forschung

Manfred LAMPRECHT

THE JUICE PLUS+ SCIENCE INSTITUTE

Juice Plus+
Science Institute
Advancing plant-based nutrition

+ 2 weitere peer-reviewed Publikationen der Murcia-Studie

molecules

MDPI

Article

Effects of a Fruit and Vegetable-Based Nutraceutical on Biomarkers of Inflammation and Oxidative Status in the Plasma of a Healthy Population: A Placebo-Controlled, Double-Blind, and Randomized Clinical Trial

Raúl Arcusa, Juan Ángel Carrillo, Raquel Xandri-Martínez, Begoña Cerdá, Débora Villaño, Javier Marhuenda * and María Pilar Zafrilla

Faculty of Health Sciences, Universidad Católica de San Antonio, 30107 Murcia, Spain; rarcusa@ucam.edu (R.A.); jacarrillo4@alu.ucam.edu (J.Á.C.); rxandri@ucam.edu (R.X.-M.); bcerda@ucam.edu (B.C.); dvillano@ucam.edu (D.V.); mpzafrilla@ucam.edu (M.P.Z.)
* Correspondence: jmarhuenda@ucam.edu; Tel.: +34-600-72-82-42

antioxidants

MDPI

Article

Anti-Inflammatory and Antioxidant Capacity of a Fruit and Vegetable-Based Nutraceutical Measured by Urinary Oxylipin Concentration in a Healthy Population: A Randomized, Double-Blind, Placebo-Controlled Clinical Trial

Raúl Arcusa [1], Juan Ángel Carrillo [1], Begoña Cerdá [1], Thierry Durand [2], Ángel Gil-Izquierdo [3], Sonia Medina [3], Jean-Marie Galano [2], Débora Villaño Valencia [1], Javier Marhuenda [1,*] and Pilar Zafrilla [1]

1 Faculty of Health Sciences, Universidad Católica de San Antonio, 30107 Murcia, Spain; rarcusa@ucam.edu (R.A.); jacarrillo4@alu.ucam.edu (J.Á.C.); bcerda@ucam.edu (B.C.); dvillano@ucam.edu (D.V.V.); mpzafrilla@ucam.edu (P.Z.)
2 Institut des Biomolécules Max Mousseron (IBMM), Pôle Chimie Balard Recherche, UMR 5247, National School of Chemistry Montpellier, Université de Montpellier, Centre National de la Recherche Scientifique, 1919 Route de Mende, CEDEX 05, 34293 Montpellier, France; thierry.durand@umontpellier.fr (T.D.); jgalano@univ-montp1.fr (J.-M.G.)
3 Research Group on Quality Safety and Bioactivity of Plant Foods, Food Science and Technology Department, CEBAS-CSIC, 30100 Murcia, Spain; angelgil@cebas.csic.es (Á.G.-I.); soniamedes@gmail.com (S.M.)
* Correspondence: jmarhuenda@ucam.edu; Tel.: +34-600-72-82-42

JP+: kognitive Funktion, oxidativer Stress und Entzündung

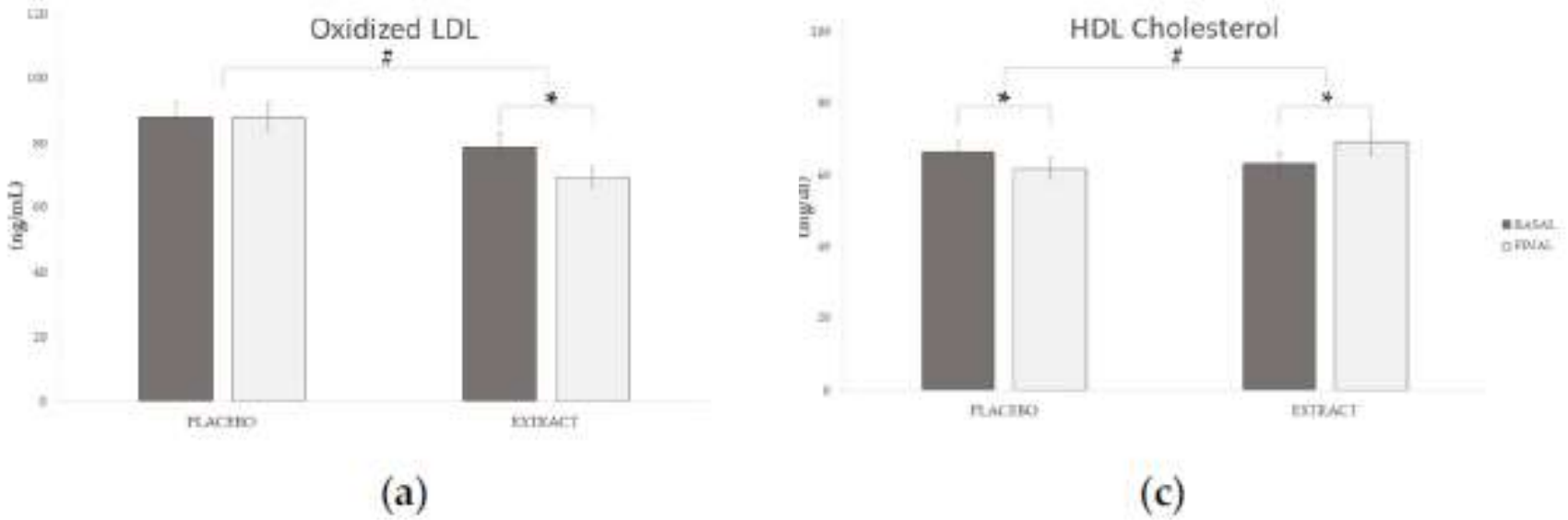


Figure 2. Evolution of (a) oxidized low-density lipoprotein (OxLDL), (c) high-density lipoprotein (HDL) during the study. *Means significant statistical differences when comparing the evolution between the baseline and final ($p<0.05$). # Means significant statistical differences when comparing the evolution between groups ($p<0.001$)

Arcusa et al, Molecules 2021

Juice Plus+ Science Institute
Advancing plant-based nutrition

JP+: kognitive Funktion und Neurotransmitter

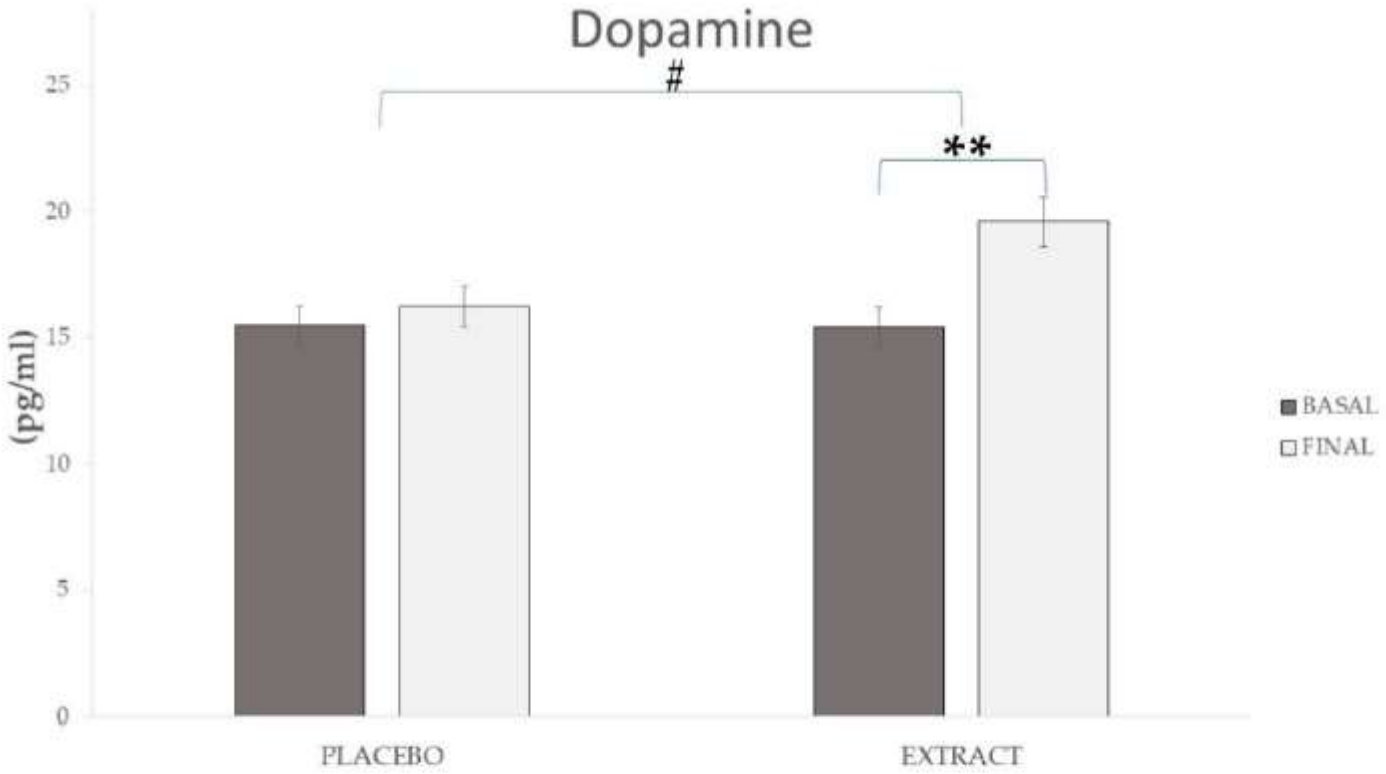


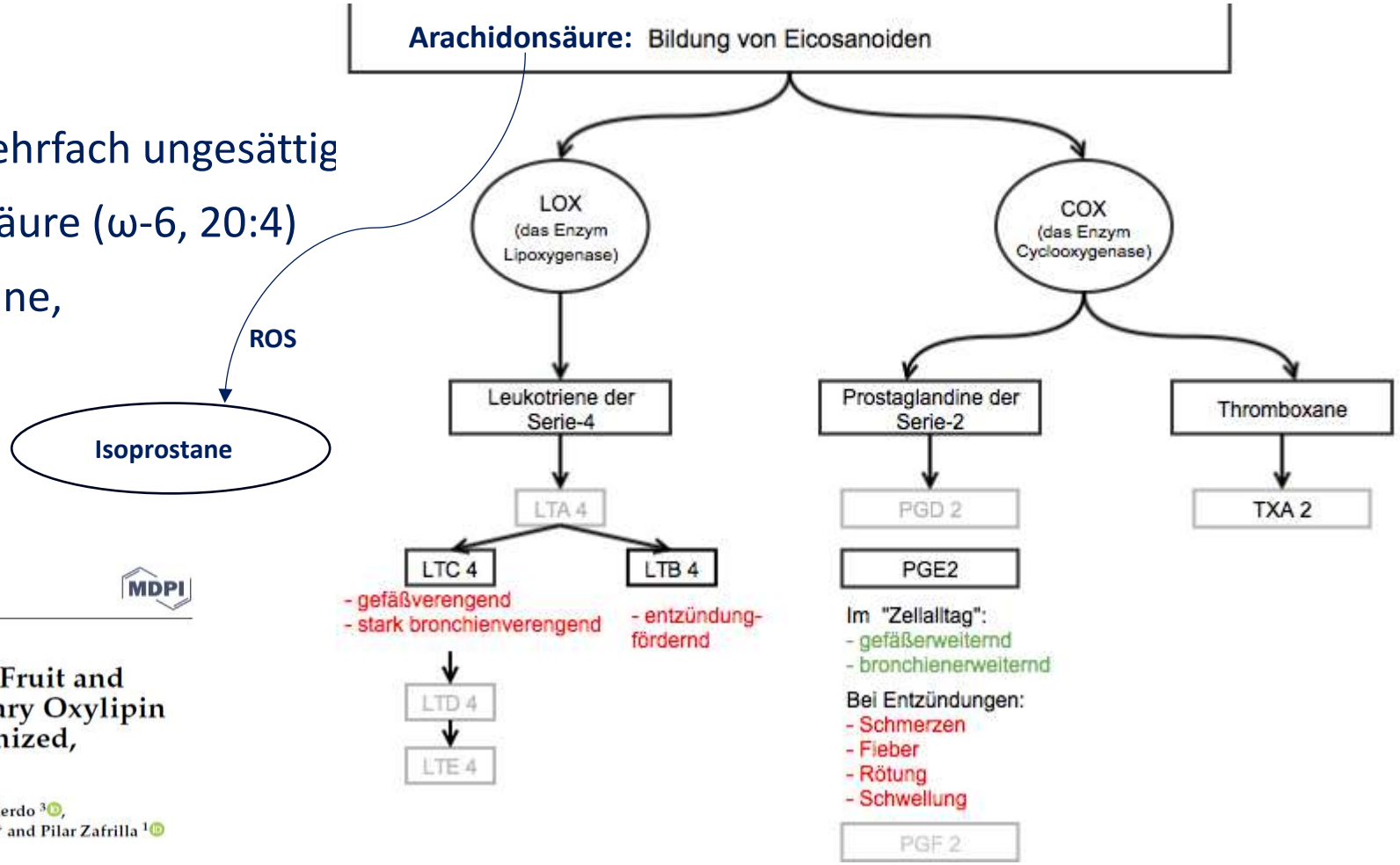
Figure 3. Evolution of dopamine during the study. ** Means significant statistical differences comparing the evolution between baseline and final ($p < 0.001$). # Means significant statistical differences comparing the evolution between groups ($p < 0.001$).

Arcusa et al, Molecules 2021

Juice Plus+ Science Institute
Advancing plant-based nutrition

Oxylipine

- Oxidationsprodukte von mehrfach ungesättig Fettsäuren, v.a. Arachidonsäure (ω-6, 20:4)
- Prostaglandine, Thromboxane, Leukotriene, Isoprostane



antioxidants

MDPI

Article

Anti-Inflammatory and Antioxidant Capacity of a Fruit and Vegetable-Based Nutraceutical Measured by Urinary Oxylipin Concentration in a Healthy Population: A Randomized, Double-Blind, Placebo-Controlled Clinical Trial

Raúl Arcusa [1], Juan Ángel Carrillo [1], Begoña Cerdá [1], Thierry Durand [2], Ángel Gil-Izquierdo [3], Sonia Medina [3], Jean-Marie Galano [2], Débora Villaño Valencia [1], Javier Marhuenda [1,*] and Pilar Zafrilla [1]

[1] Faculty of Health Sciences, Universidad Católica de San Antonio, 30107 Murcia, Spain; rarcusa@ucam.edu (R.A.); jacarrillo4@alu.ucam.edu (J.Á.C.); bcerda@ucam.edu (B.C.); dvillano@ucam.edu (D.V.V.); mpzafrilla@ucam.edu (P.Z.)
[2] Institut des Biomolécules Max Mousseron (IBMM), Pôle Chimie Balard Recherche, UMR 5247, National School of Chemistry Montpellier, Université de Montpellier, Centre National de la Recherche Scientifique, 1919 Route de Mende, CEDEX 05, 34293 Montpellier, France; thierry.durand@umontpellier.fr (T.D.); jgalano@univ-montp1.fr (J.-M.G.)
[3] Research Group on Quality Safety and Bioactivity of Plant Foods, Food Science and Technology Department, CEBAS-CSIC, 30100 Murcia, Spain; angelgil@cebas.csic.es (Á.G.-I.); soniamedes@gmail.com (S.M.)
* Correspondence: jmarhuenda@ucam.edu; Tel.: +34-600-72-82-42

Juice Plus+ Science Institute
Advancing plant-based nutrition

JP+: kognitive Funktion, oxidativer Stress und Entzündung

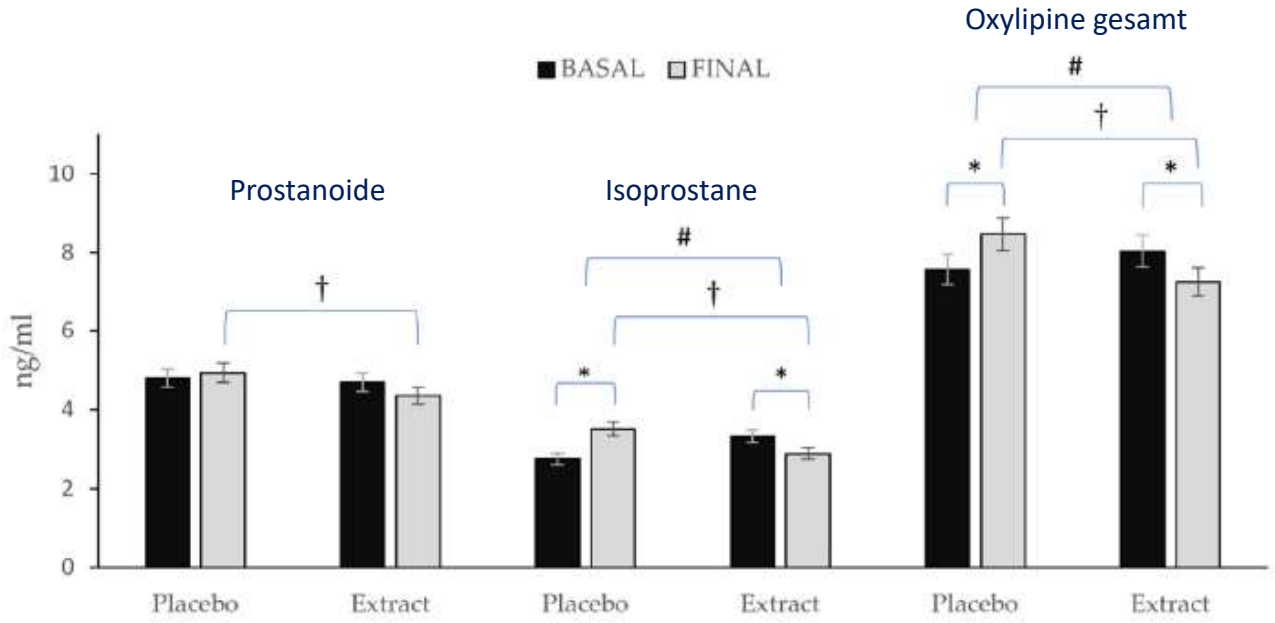


Figure 4. Variation in total prostanoids, total IsoPs, and total oxylipins in each group during the intervention. * Means significant statistical differences comparing the evolution between baseline and final intragroup ($p < 0.05$). † Means significant statistical differences comparing final moment between groups at the end of the intervention ($p < 0.001$). # Means significant statistical differences comparing evolution between groups during the intervention ($p < 0.05$).

Arcusa et al, Antioxidants 2022

Juice Plus+ Science Institute
Advancing plant-based nutrition

Aktuelles aus der Juice Plus+ Forschung

Aktuelle Forschungsprojekte

Juice Plus+
Science Institute
Advancing plant-based nutrition

Aktuelle Studien / Projekte

- University of Newcastle: “Muskelfunktion / Mobilität in einer älteren Population” (RCT mit Juice Plus+ COMPLETE)
- Texas A&M University und Texas Extension Education Foundation: „Wirkmechanismen von Juice Plus+ auf verschiedene Faktoren des Metabolischen Syndroms“ (In-vitro-Studie mit FVB, OMEGA)
- University of Reading: „Steigerung von Lernfähigkeit und Gedächtnis nach Supplementation mit Juice Plus+ Omega in Jugendlichen” (RCT mit Omega Blend)
- Medizinische Universität Graz: „Auswirkungen des langfristigen Konsums von zwei pflanzlichen Nahrungsergänzungsmitteln auf die kardiovaskuläre Gesundheit und niedrig-gradige Entzündungen bei älteren Menschen” (RCT mit Juice Plus+ FVB, OMEGA)
- University of California Los Angeles und University of Ulster, NIH-Studie: “Polyphenole, Mikrobiom, kognitive Funktionen und Prävention von Alzheimer‘s” (RCT mit Juice Plus+ Berry Blend)

Juice Plus+ Science Institute
Advancing plant-based nutrition

Aktuelle Studien / Projekte

Thema: **Muskelfunktion und Mobilität in einer älteren Population**

Studienort:
Hunter Medical Research Institute,
University of Newcastle, Australia

Design: Randomisierte, kontrollierte Studie, 2 parallele Gruppen, Männer und Frauen 65+ Jahre

Intervention: Juice Plus+ Complete, 2x/Tag, für 12 Wochen im Vergleich zu Kontrollgruppe, selbes Übungsprogramm in beiden Gruppen

Outcomes: Muskelkraft & Funktion, Körperzusammensetzung, Knochendichte, niedrig-gradige Entzündung, Genexpression inflammatorischer Proteine

Aktueller Status: Experimente abgeschlossen, warten auf Publikation

Juice Plus+
Science Institute
Advancing plant-based nutrition

Aktuelle Studien / Projekte

Thema: Metabolisches Syndrom

Studienort:
Department of Horticultural Science,
Texas A&M University, USA

Design: In-vitro Untersuchung in verschiedenen Zell-Linien, die mit Übergewicht, Entzündung und Insulinresistenz assoziiert sind

Intervention: Obst-, Gemüse-, Beeren Kapseln und Omega Blend

Outcomes: Präbiotische Effekte von Juice Plus+ auf Zellen des Mikrobioms von normalen und übergewichtigen Personen, Charakterisierung der Wirkmechanismen auf das metabolische Syndrom

Aktueller Status: Experimente abgeschlossen, warten auf Publikation

Juice Plus+
Science Institute
Advancing plant-based nutrition

Aktuelle Studien / Projekte

Thema: Lernfähigkeit und Gedächtnis

Studienort:
School of Psychology and Clinical Language Sciences,
University of Reading, Reading, UK

Design: Randomisierte, Placebo-kontrollierte, doppelblind, parallel gruppierte Studie in Jugendlichen (männlich und weiblich, 13-14 Jahre)

Intervention: Juice Plus+ Omega Blend für 16 Wochen im Vergleich zu Placebo

Outcomes: Kognitive Leistungsfähigkeit, Omega-3 Index, EEG spektrale Aktivität und ereignisbezogene Potenziale

Aktueller Status: Experimente abgeschlossen, warten auf Publikation

Juice Plus+
Science Institute
Advancing plant-based nutrition

Aktuelle Studien / Projekte

Thema: Kardiovaskuläre Gesundheit, niedrig-gradige Entzündung, biologisches Alter

Cardiovascular & InflammAging Study, "CIA Study"

Studienort:
Institut für Medizinische Chemie / Zentrum für Medizinische Forschung (ZMF)
Medizinische Universität, Graz, Österreich

Design: Randomisierte, kontrollierte, parallel gruppierte Studie, Männer und Frauen, 55 – 80 Jahre.

Intervention: Obst-, Gemüse-, Beeren Kapseln, Omega Blend, über 1 Jahr verglichen mit Kontrollgruppe

Outcomes: Kardiovaskuläre Gesundheit, oxidativer Stress, niedrig-gradige Entzündung, biologisches Alter, kognitive Funktion, Bioverfügbarkeit, Knochengesundheit

Aktueller Status: Rekrutierung, Experimente laufen (Publikationen ab 2026)

J P S I Juice Plus+ Science Institute
Advancing plant-based nutrition

Aktuelle Studien / Projekte

Themen: Polyphenole, Mikrobiom, kognitive Funktionen, Alzheimer‘s

“MAEVE-Study: Microbial-mediated flAvonoid mEtabolites for cognitiVe hEalth”

Studienorte:
University of California Los Angeles, USA, und University of Ulster, Nordirland

NIH finanzierte Studie!!!

NIH National Institutes of Health
Turning Discovery Into Health

Projektfördersumme: 10 000 000 USD, J+ - Anteil: 250 000 USD (2,5 %)

(Surrogat-)Endpunkte/Outcomes (u.a.):
kognitive Funktionen, Herz-Kreislauf-Parameter Mikrobiom, Anthropometrie,

J P S I Juice Plus+ Science Institute
Advancing plant-based nutrition

The National Institutes of Health (NIH)

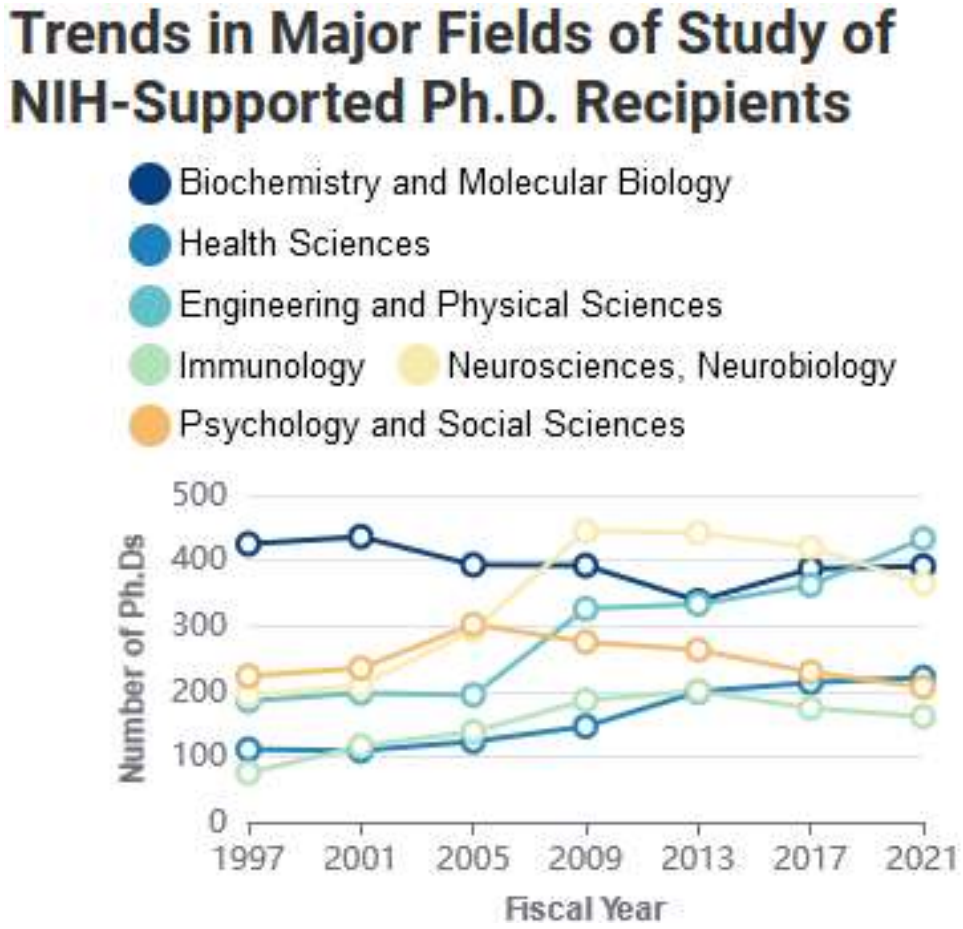
- Das National Institutes of Health (NIH) ist der größte öffentliche Fördergeber für Biomedizinische Forschung auf der Welt (ca. 50 Milliarden USD/Jahr);

- Das NIH gehört zum Amerikanischen Gesundheitsministerium und repräsentiert die nationale medizinwissenschaftliche Forschungseinrichtung;

- NIH-geförderte Forschung führte zu bedeutenden Erkenntnissen in den medizinischen Wissenschaften um Menschen ein gesünderes und längeres Leben zu gewähren oder bessere Behandlungsmethoden/Therapien anzubieten.

The National Institutes of Health (NIH)

Kategorien der biomedizinischen Forschung:

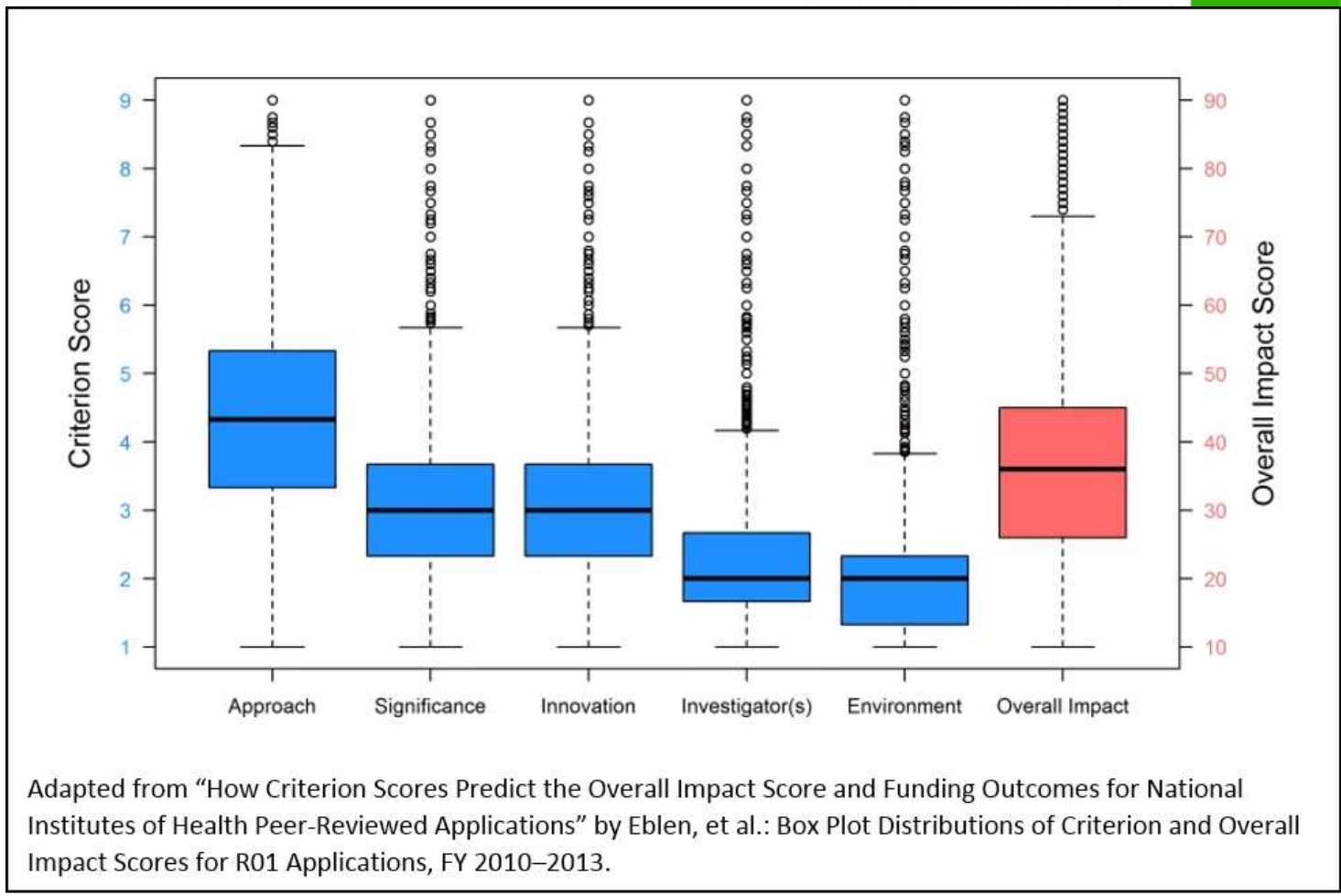


Juice Plus+ Science Institute
Advancing plant-based nutrition

The National Institutes of Health (NIH)

5 Hauptkriterien/Förderbedingungen:

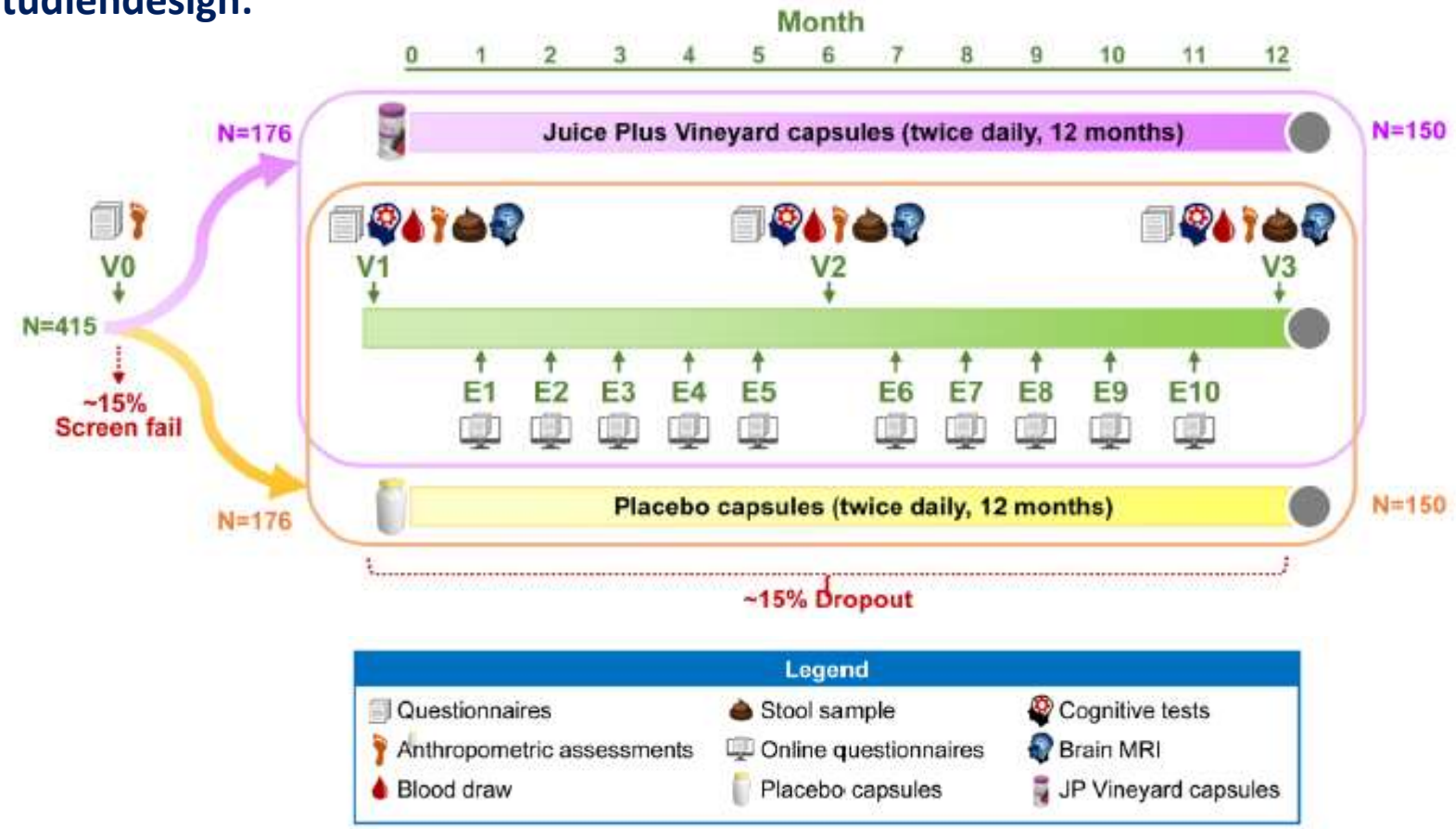
- Wissenschaftliche Ansatz/Zugang
- Signifikanz d. Outcomes
- Neuheit/Aktualität
- Reputation der ForscherInnen
- Forschungsinstitution u. –umfeld



Adapted from "How Criterion Scores Predict the Overall Impact Score and Funding Outcomes for National Institutes of Health Peer-Reviewed Applications" by Eblen, et al.: Box Plot Distributions of Criterion and Overall Impact Scores for R01 Applications, FY 2010–2013.

NIH Studie mit J+ Beerenkapseln

Studiendesign:



Juice Plus+
Science Institute
Advancing plant-based nutrition

NIH Studie mit J+ Beerenkapseln

Themen: Polyphenole, Mikrobiom, kognitive Funktionen, Alzheimer´s

“MAEVE-Study: Microbial-mediated flAvonoid mEtabolites for cognitiVe hEalth”

Outcomes:
Kardiovaskuläre Gesundheit, oxidativer Stress, niedrig-gradige Entzündung, Alterungsprozess, kognitive Funktionen, Gehirn-MRI, PSS, HADS, Metabolomics (LC-MS), Mikrobiom-Zusammenstellung, Bioverfügbarkeit, Sicherheit (Leber, Niere), QoL, BIA, Ernährungstagebuch, Bewegungsprofile....

Aktueller Stand:
Projektvorbereitungen, Produkt- u. Placebo-Produktion etc. (Publikationen ab 2027)

J P S I Juice Plus+ Science Institute
Advancing plant-based nutrition

NIH Studie mit J+ Beerenkapseln

StudienleiterInnen:

UCLA:

- Prof. Emeran Mayer (https://emeranmayer.com/about/)
- Prof. Arpana Church, „Annie“ (maiden name „Gupta“), participated in „Hack Your Health: The Secrets of your Gut“ (Netflix documentary)

University of Ulster:

- Prof. Chris Gill (https://www.ulster.ac.uk/staff/c-gill)

Juice Plus+ Science Institute
Advancing plant-based nutrition

Zusammenfassung der gesamten J+ Forschung (1995 – 2024): Einzigartiger Forschungshintergrund bei Obst, Gemüse & Beeren Kapseln:

- 48 wissenschaftliche Artikel („peer-reviewed“)
- Veröffentlicht in > 30 different wissenschaftlichen
- 33 klinische Studien auf 4 Kontinenten
- 23 „Gold Standard“ klinische Studien
- > 2.500 untersuchte Probanden
- Knapp 50 Universitäten und Kliniken
- Gesamter Impact Score: >225 !

Topics: Bioverfügbarkeit, kardiovaskuläre Gesundheit, Phytonährstoffe und Polyphenol, Nutrigenomics, Gehirn- Gesundheit, Immunsystem, Haut-Gesundheit, Zahn-Gesundheit, oxidativer Stress, Entzündung etc.

J P S I
Juice Plus+ Science Institute
Advancing plant-based nutrition

KONTAKTE

www.jpsi.info

Webseite mit allen Studien zu J+, Studien zu pflanzlich basierter Ernährung, Videos, pp-Präsentationen..

research@jpsi.info

Für Forschungskooperationen und Studien

Juice Plus+ Science Institute
Advancing plant-based nutrition

Freitag, 22. November 2024
11:00 bis 13:00 Uhr
JW Marriott Hotel Berlin

JPSI FACHFORUM BERLIN

DIE JPSI WEBSITE

Alle Funktionalitäten im Überblick

Lisa Meixner-Götz, BSc MPH

Juice Plus+
Science Institute
Advancing plant-based nutrition

We know the power and potential of plant-based nutrition

JPSI WEBSITE

“OPEN AREA”

“GATED AREA”

Juice Plus+
Science Institute
Advancing plant-based nutrition

PUBLISHED RESEARCH TAB

OPEN ACCESS - KATEGORIEN

1. Bioavailability
2. Brain health and psychology
3. Cardiovascular health
4. Gut health
5. Inflammation
6. Public health nutrition
7. Redox biology and antioxidant research
8. Sports and muscle function

GATED ACCESS - KATEGORIEN

1. Juice Plus research
2. Bioavailability
3. Brain health and psychology
4. Cardiovascular health
5. Gum and teeth health
6. Gut health
7. Immunity
8. Inflammation
9. Lung health and allergies
10. Nutrition and genes
11. Public health nutrition
12. Redox biology and antioxidant research
13. Skin health
14. Sports and muscle function

MEDIA TAB

OPEN ACESS - KATEGORIEN

1. Videos on plant-based nutrition research
2. Summaries on plant-based nutrition research
3. Bioavailability
4. Brain health and psychology
5. Cardiovascular health
6. Immunity
7. Inflammation
8. Redox biology and antioxidant research
9. Sports and muscle function

GATED ACESS - KATEGORIEN

1. Videos on Juice Plus+ research
2. Summaries on Juice Plus+ research
3. Videos on plant-based nutrition research
4. Summaries on plant-based nutrition research
5. Meetings and Presentations
6. Bioavailability
7. Brain health and psychology
8. Cardiovascular health
9. Gum and teeth health
10. Gut health
11. Immunity
12. Inflammation
13. Lung health and allergies
14. Nutrition and genes
15. Redox biology and antioxidant research
16. Sports and muscle function

SIGN-UP / ANMELDUNG

Sign Up

First name

Last name

Academic Qualification

Country

State

Occupation

Sector

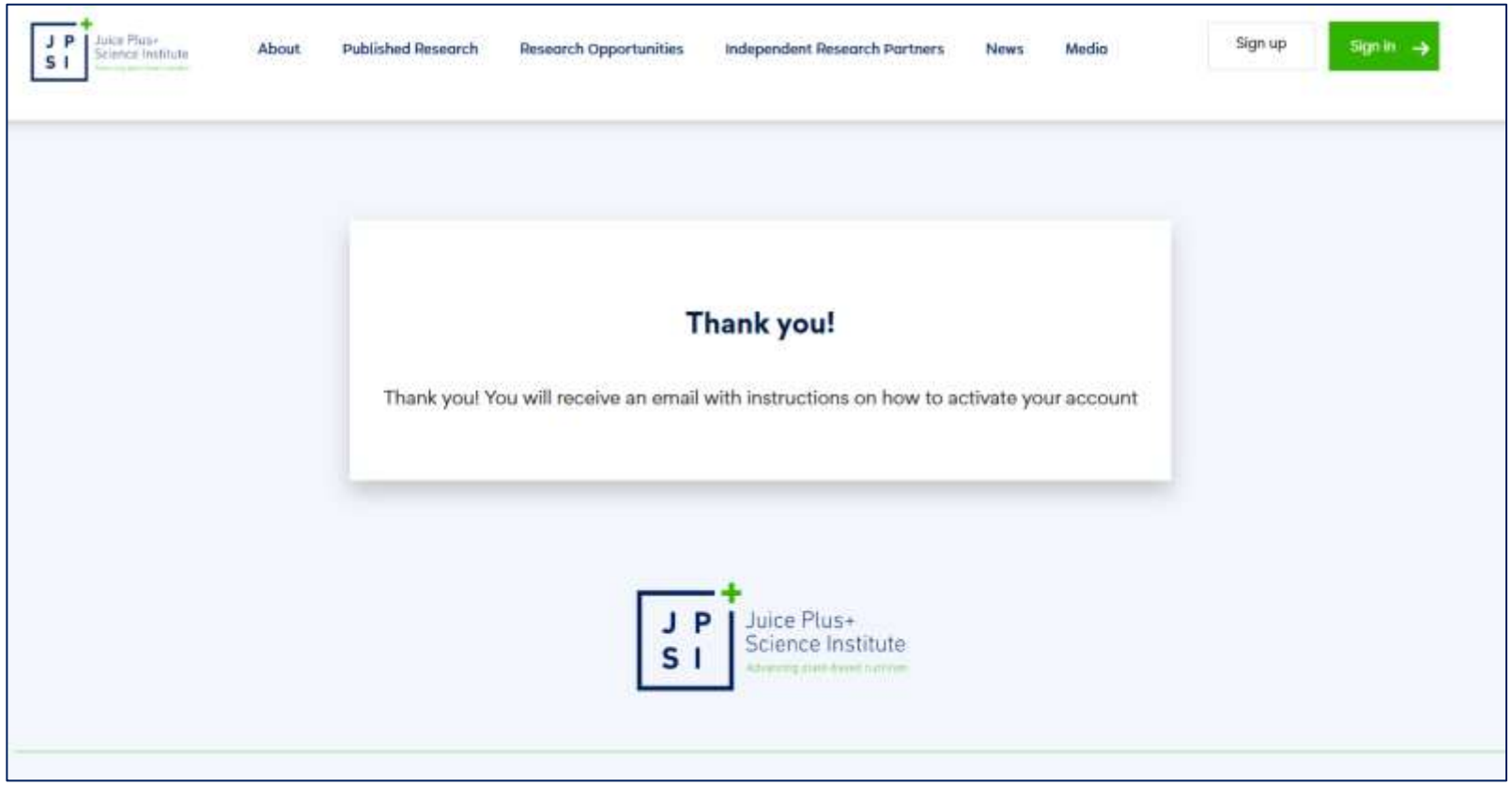
Professional Webpage

How did you hear about us ?

EMAIL

PASSWORD

☐ I CONFIRM I AM A HEALTHCARE PROFESSIONAL



E-Mail-Adresse bestätigen!

Juice Plus+
Science Institute
Advancing plant-based nutrition

Freitag, 22. November 2024
11:00 bis 13:00 Uhr
JW Marriott Hotel Berlin

JPSI FACHFORUM BERLIN

Effekte einer Herz-Kreislauf einer pflanzen-basierten Ernährung Auf das Herz-Kreislaufsystem

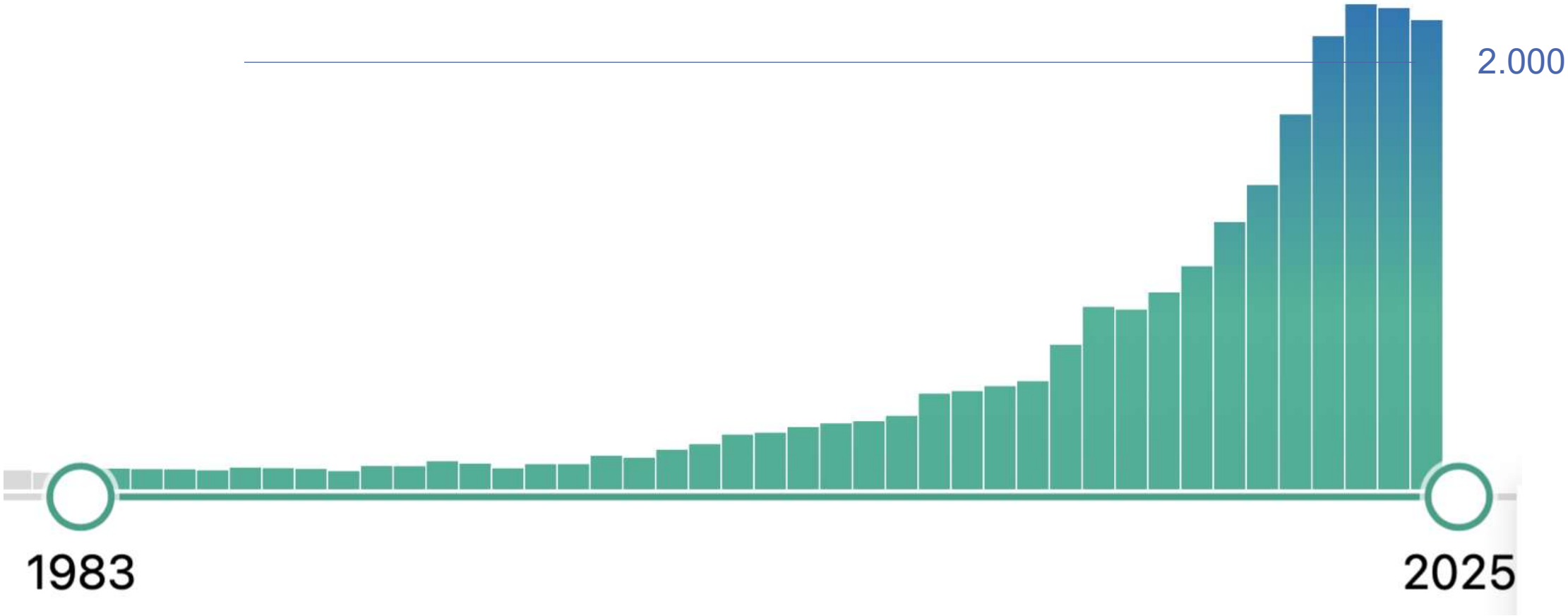
Univ.Prof. Dr. Gerald Tulzer

Vorstand: Klinik für Kinderkardiologie
Kepler-Uniklinikum Linz

Juice Plus+
Science Institute
Advancing plant-based nutrition

PubMed search: „Plant based nutrition“

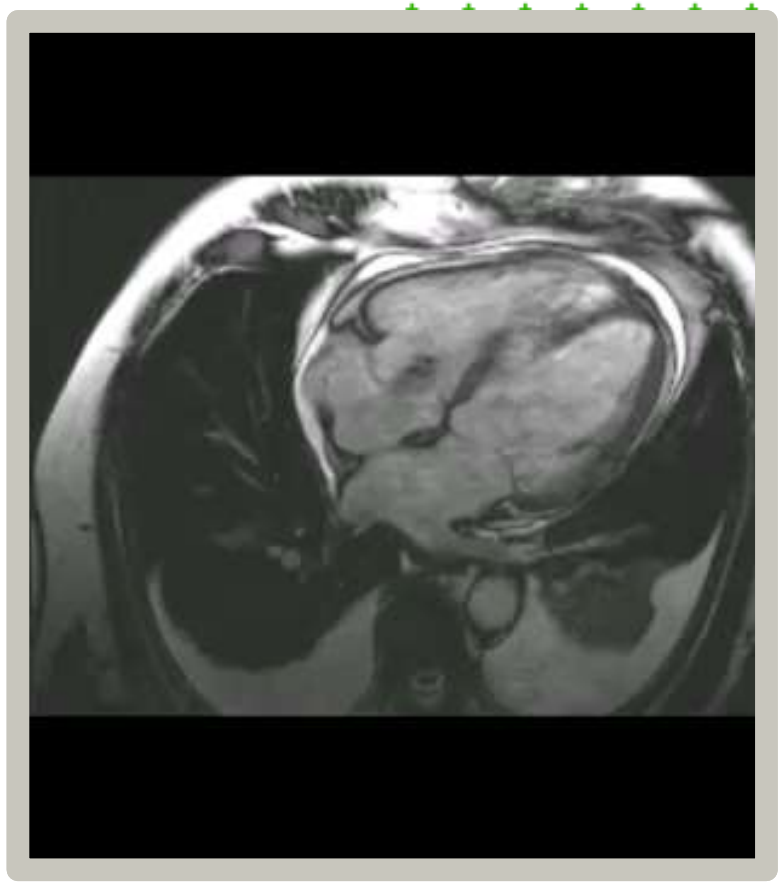
N= 20.889



Pflanzenbasierte Ernährung und Herz-Kreislauf Erkrankungen

- Wichtigkeit der Herz-Kreislauf Gesundheit
- Was wissen wir über Prävention
- Schwangerschaft
- Bedeutung für die Herzfehler Entwicklung
- Fetale Programmierung des Herz-Kreislaufsystems
- Bedeutung von Nahrungsergänzung

100.000 mal pro Tag



Juice Plus+
Science Institute
Advancing plant-based nutrition

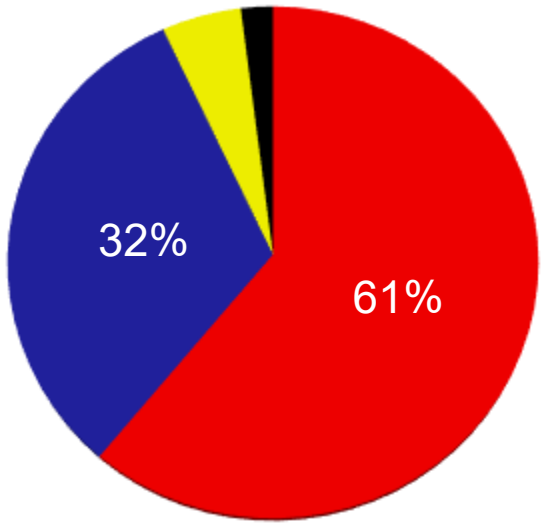
Bedeutung der Herz-Kreislauf Gesundheit

- Häufigste Ursache für Mortalität
- Ernährung hat hier eine kritisch wichtige Rolle
  - Blutdruck
  - Cholesterin
  - Blutzuckerstoffwechsel

Juice Plus+ Science Institute
Advancing plant-based nutrition

Verlorene gesunde Lebensjahre

41% aufgrund von Fehlernährung!



- *Cardiovascular system*
- *Cancer*
- *Diabetes*
- *Others*

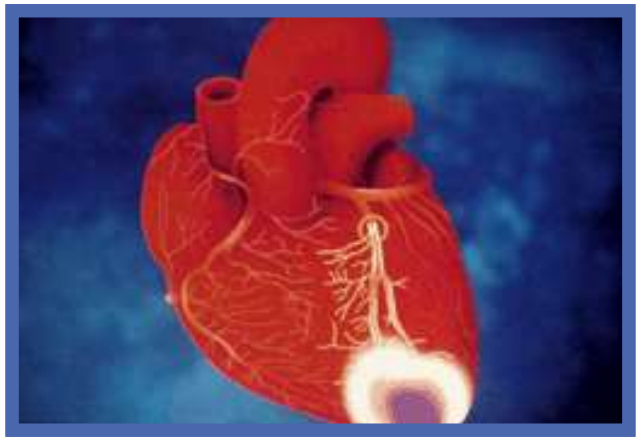
WHO/FAO. Diet, nutrition and the prevention of chronic diseases.
World Health Organ Tech Rep Ser 2003; 916: i- viii, 1-149.

Juice Plus+ Science Institute
Advancing plant-based nutrition

Bedeutung der Herz-Kreislauf Gesundheit

- Deutschland:
  - 300.000 Herzinfarkte pro Jahr
  - 270.000 Schlaganfälle pro Jahr

  Hohe Behandlungskosten, verlorene gesunde Lebensjahre
- Belastung = jährliche Steuer von 10,8%



GBE 2015, Cardio News 8/2021

Juice Plus+ Science Institute
Advancing plant-based nutrition

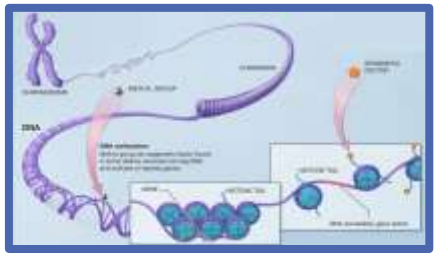
Was wissen wir über Prävention?

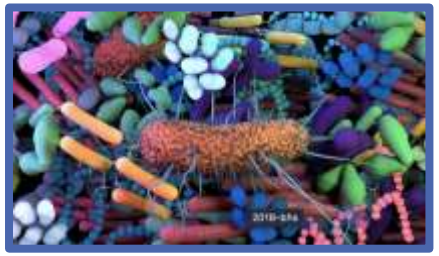
- Die **Framingham Heart Study** feierte seinen 75. Geburtstag 2023
- Identifizierung der wichtigsten Risikofakoren für HK Erkrankungen seit 1948
  - > 15.000 Teilnehmer
  - 3 Generationen
  - > 3600 Studien wurde mit den Daten dieser Studie bisher publiziert.
- Rauchen, Bluthochdruck, Fettstoffwechselstörungen, Übergewicht, Bewegungsmangel, Menopause, Diabetes …,

Juice Plus+ Science Institute
Advancing plant-based nutrition

Was wissen wir über Prävention?

- Für Kinder: **The Bogalusa Heart Study**
  - Initiiert durch das National Heart, Lung and Blood Institute (NHLBI) 1972
  - HK Risikofaktore bei Kindern und Jugendlichen
  - Atherosklerose beginnt lange vor dem Erwachsenenalter
  - 2016: Epigenetik
  - 2018: Mikrobiom





Juice Plus+ Science Institute
Advancing plant-based nutrition

Was wissen wir über Prävention?

Institute of Preventive Pediatrics
TUM School of Medicine and Health
Technical University of Munich

Example Overweight and Obesity

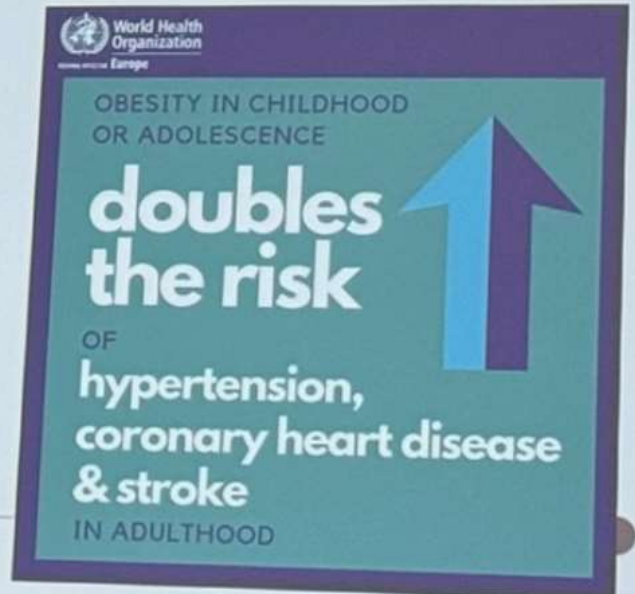
Overweight (Children 7-9 Years) (Data: Childhood Obesity Surveillance Initiative COSI 2018-2020)

- Overall prevalence: 29% (including obesity)
- Boys (31%) > girls (28%)
- Regions with highest prevalence: Cyprus, Greece, Spain and Italy.
- Regions with lowest prevalence: Tajikistan, Denmark, Israel and Kazakhstan.

Tenfold increase in childhood and adolescent obesity in four decades: new study by Imperial College London and WHO

11 October 2017 | News release | LONDON |Reading time: 5 min (1409 words)

World will have more obese children and adolescents than underweight by 2022



Ernährung in der Schwangerschaft

- Weitreichende Effekte auf die fetale Entwicklung
- Einfluss aufs fetale und postnatale HK System
- Beeinflusst das Risiko für Herzfehler
- Mütterliche Ernährung ist schon vor der Empfängnis wichtig

*Liu, Ruiqi, et al. "Maternal diet and lifestyle, and the risk of congenital heart defects: A review." *Birth Defects Research* 109, no. 20 (2017): 1574-1582.*

Juice Plus+ Science Institute
Advancing plant-based nutrition

Folsäure & Neuralrohrdefekte

- Prevention of the first occurrence of neural-tube defects by periconceptional vitamin supplementation.
  - ***N Engl J Med 1992; 327:1832-5***.

- MRC Vitamin Study Research Group. Prevention of neural tube defects: results of the Medical Research Council Vitamin Study.
  - ***Lancet 1991; 338:131-7. 33***.

Juice Plus+
Science Institute
Advancing plant-based nutrition

Folsäure & Neuralrohrdefekte

Gesunde Frauen ohne erkennbares Defizit

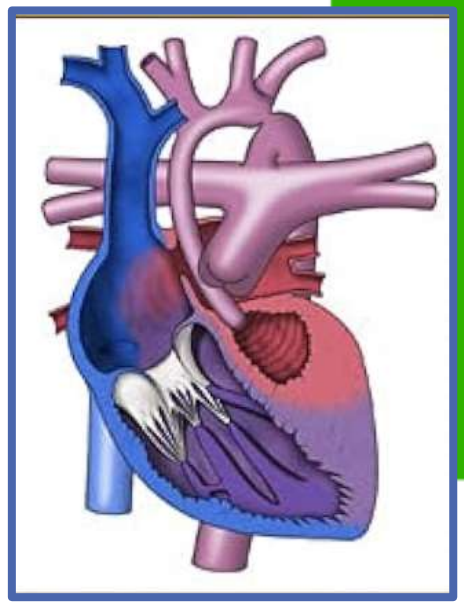
Empfehlung:

Mindestens 400 yg Folsäure pro Tag

Juice Plus+
Science Institute
Advancing plant-based nutrition

Ernährung und Herzfehler

- Mütterliches Übergewicht erhöht das Risiko für Herzfehler beim Kind
- Folsäure ist wichtig für eine normale Herzentwicklung
- Erhöhte Homocystein Spiegel können zu Herzfehlern führen
- Genetik: MTHFR Mutation (10%): erhöhtes Risiko für Herzfehler beim Kind
- Folsäure Supplementierung hebt dieses Risiko auf!



Folsäure und angeborenes Herzfehler

- Preconceptional folate intake and malformations of the cardiac outflow tract. Baltimore-Washington Infant Study Group.
  - *Epidemiology 1998;1:95-8*

- Homocysteine induces congenital defects of the heart and neural tube: effect of folic acid.
  - *Proc Natl Acad Sci USA 1996;93(26):15227-3*

Homocysteine induces congenital defects of the heart and neural tube: effect of folic acid. Proc Natl Acad Sci USA 1996;93(26):15227-3

Juice Plus+ Science Institute
Advancing plant-based nutrition

Schwangerschaft und Ernährung

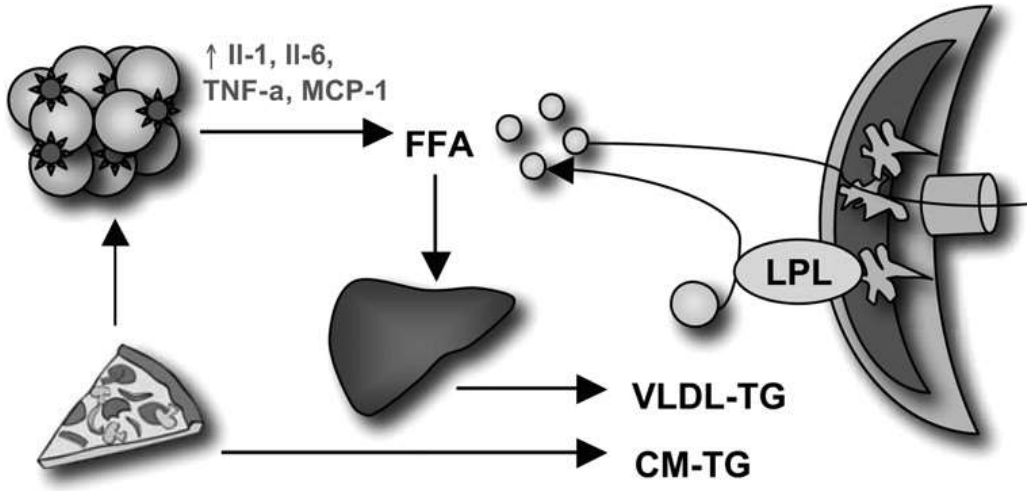
aps® American Physiological Society

AMERICAN JOURNAL of PHYSIOLOGY
Regulatory, Integrative and Comparative Physiology®

MATERNAL OBESITY, OVERNUTRITION → **FETAL LIPID EXPOSURE** → **CHILDHOOD DISEASE**

↑ INFLAMMATION
↑ INSULIN RESISTANCE

↑ LYPOLYSIS
↑ VLDL SECRETION



REPROGRAMMING OF METABOLIC GENE TARGETS:

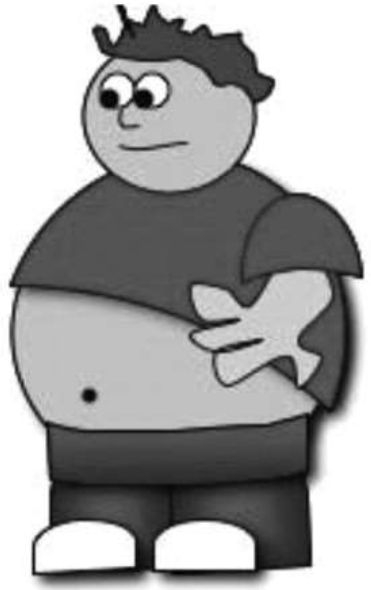
↑ FETAL INFLAMMATION?

↑ HEPATIC LIPIDS

- SKELETAL MUSCLE
- ADIPOSE TISSUE
- BRAIN
- PANCREAS

↑RISK:

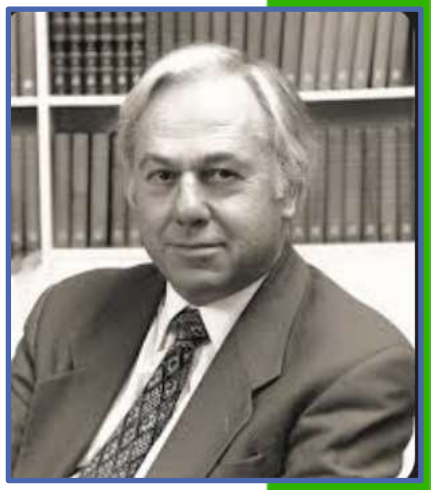
- NAFLD
- INSULIN-RESISTANCE
- OBESITY
- HYPERPHAGIA
- DIABETES



Juice Plus+ Science Institute
Advancing plant-based nutrition

“Barker Hypothesis”

Fetale Ursachen für HK Erkrankungen bei Erwachsenen



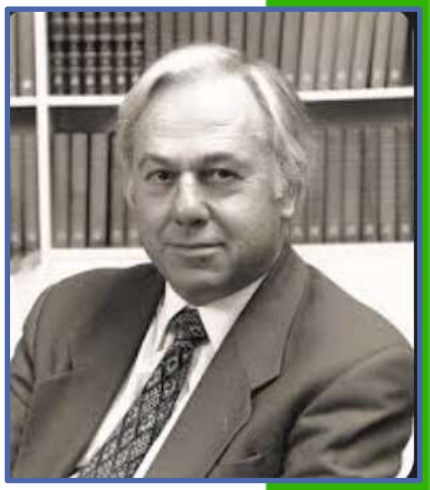
- Mangelhaftes Wachstum vor und nach der Geburt ist assoziiert mit erhöhtem HK Risiko im Erwachsenenalter (Hochdruck, Herzinfarkt, Schlaganfall)
- Epidemiologische Evidenz: Assoziation niedriges Geburtsgewicht und Herz-Kreislauferkrankungen.
- Schlechte mütterliche Ernährung beeinflusst Plazentafunktion, Blutdruckregulierung, Insulinresistenz, Cholesteristoffwechsel

Barker, D.J.P., Winter, P.D., Osmond, C., Margetts, B., & Simmonds, S.J. (1989). Weight in infancy and death from ischaemic heart disease. The Lancet, 334(8663), 577-580.

Juice Plus+ Science Institute
Advancing plant-based nutrition

“Barker Hypothesis”

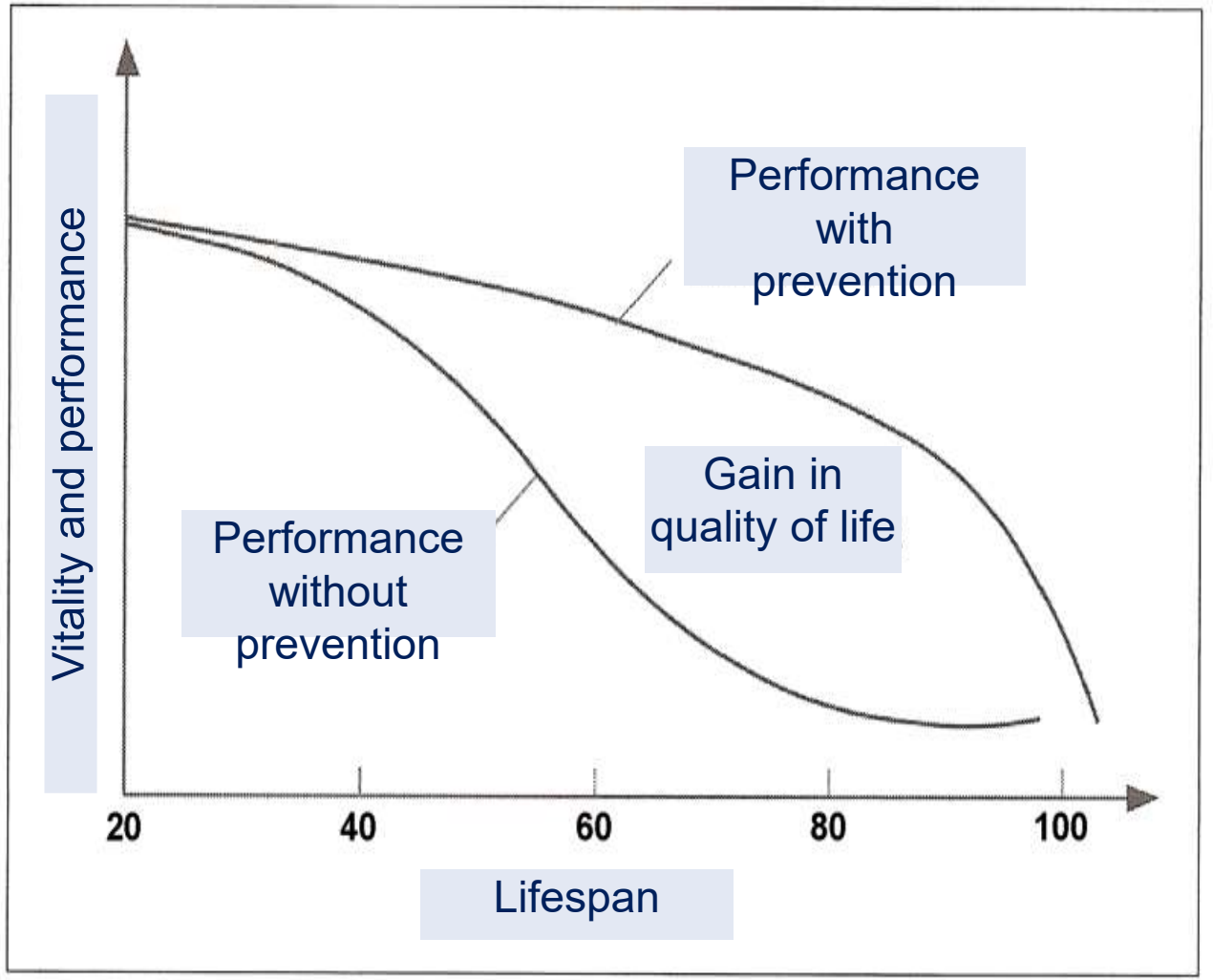
Fetale Ursachen für HK Erkrankungen bei Erwachsenen



Mütterliche, fetale und frühkindliche Ernährung beeinflusst unser HK Risiko!

Interventionen in diesen Lebensphasen haben wesentlichen Einfluss auf unsere spätere Gesundheit

Der Wert der Prävention



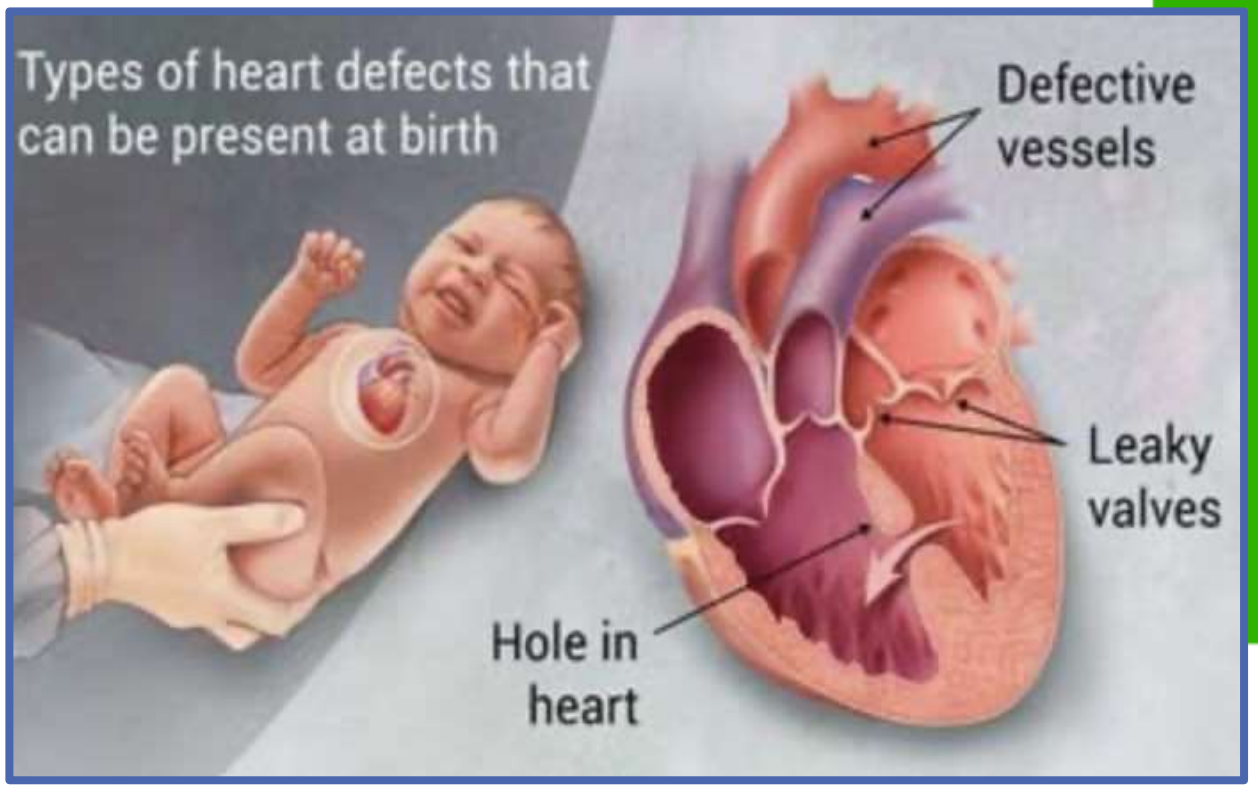
Source: Jacobi et al, Kursbuch Präventionsmedizin, Thieme Verlag 2005

Juice Plus+ Science Institute
Advancing plant-based nutrition

Prävention - wie?

- Ernährung
- Bewegung
- Stress management

- Lebensstil Modifikation

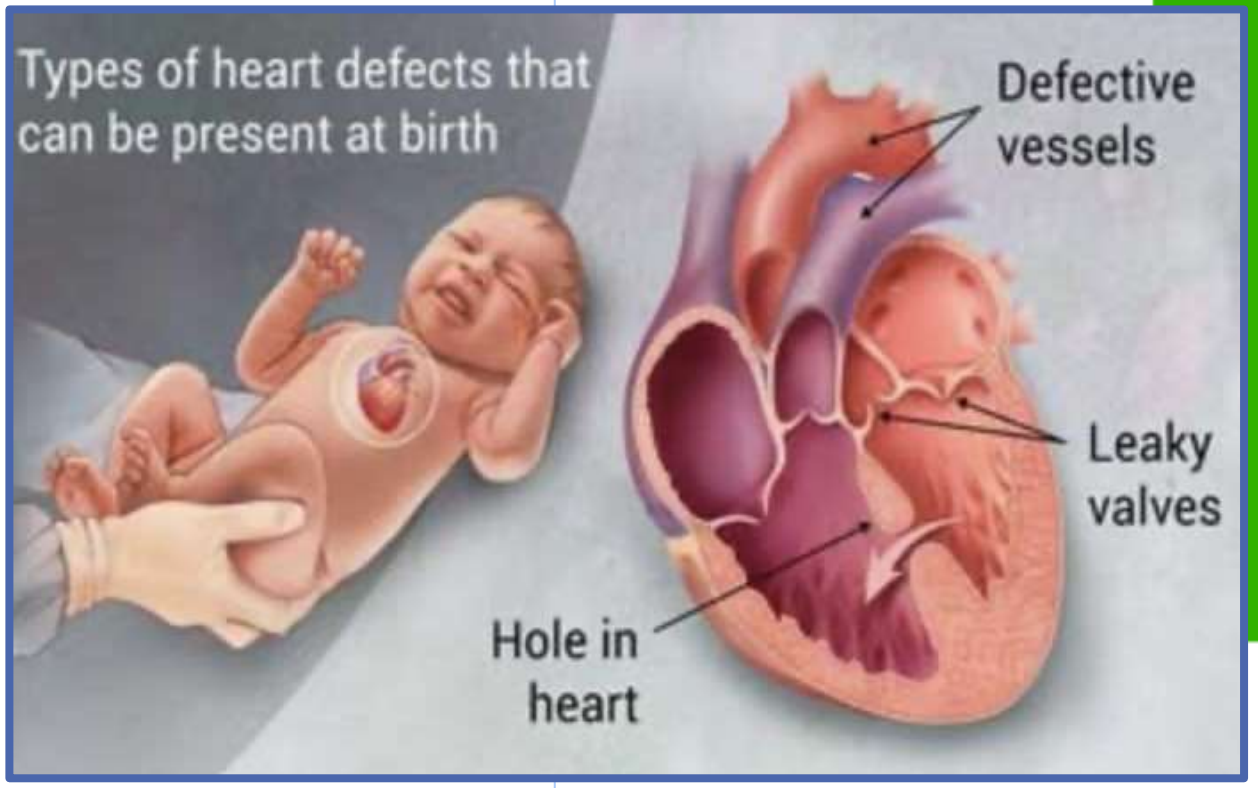


Juice Plus+ Science Institute
Advancing plant-based nutrition

Prävention - wie?

- **Ernährung**
- Bewegung
- Stress management

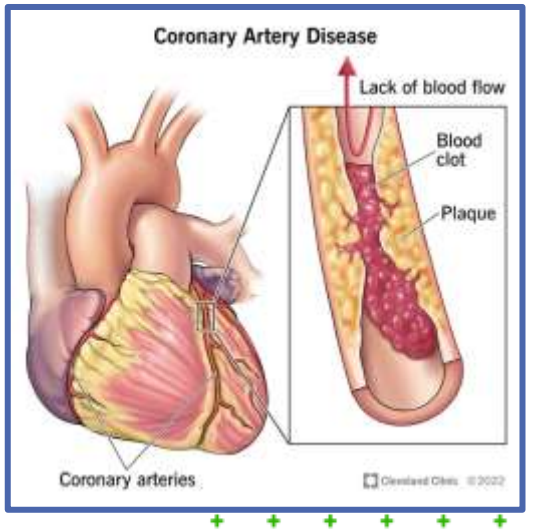
- Lebensstil Modifikation



Juice Plus+ Science Institute
Advancing plant-based nutrition

Allgemeine Benefits fürs HK System

- geringes Risiko für
  - Hochdruck
  - Herzkranzgefäß Erkrankungen
  - Schlaganfall
- Geringere Aufnahme von gesättigten Fettsäuren
- Höhere Aufnahme von Lebensmitteln mit hoher antioxidativer Kapazität (Vitamine, Mikronährstoffe, Polyphenole…)



*Kim, Hyunju, et al. "**Plant-based diets are associated with a lower risk of incident cardiovascular disease, cardiovascular disease mortality, and all-cause mortality** in a general population of middle-aged adults." Journal of the American Heart Association 8, no. 16 (2019)*

Juice Plus+ Science Institute
Advancing plant-based nutrition

The Framingham Heart Study

3 Portionen Obst und Gemüse senken das Schlaganfallrisiko um 22%

JAMA, 1995; 273:1113-1117

Juice Plus+ Science Institute
Advancing plant-based nutrition

WHO: The world health report: reducing risks, promoting health.

The Lancet 2006; **367**:278-279

DOI:10.1016/S0140-6736(06)68046-X

Eat your fruit and vegetables

Lyn M Steffen [a]

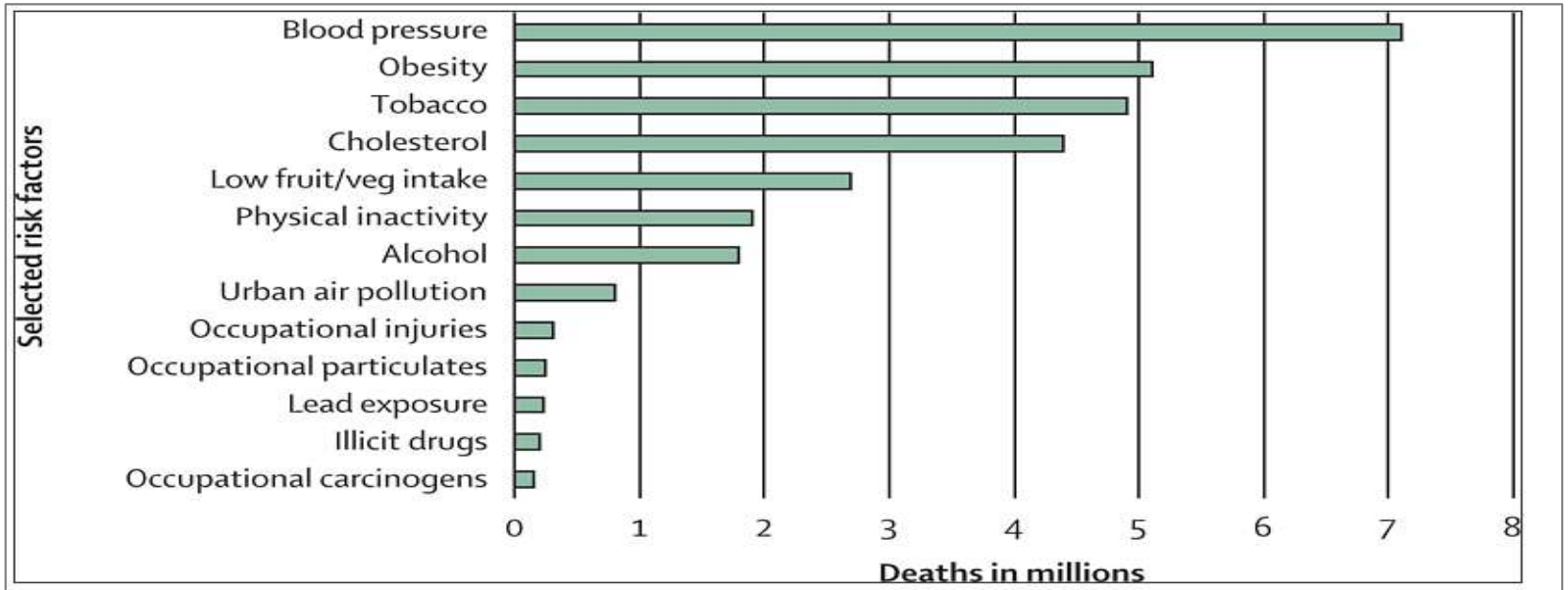


Figure. Number of deaths worldwide attributable to selected risk factors,13 2000.

Juice Plus+ Science Institute
Advancing plant-based nutrition

Plant based nutrition

WHO: The world health report: reducing risks, promoting health.

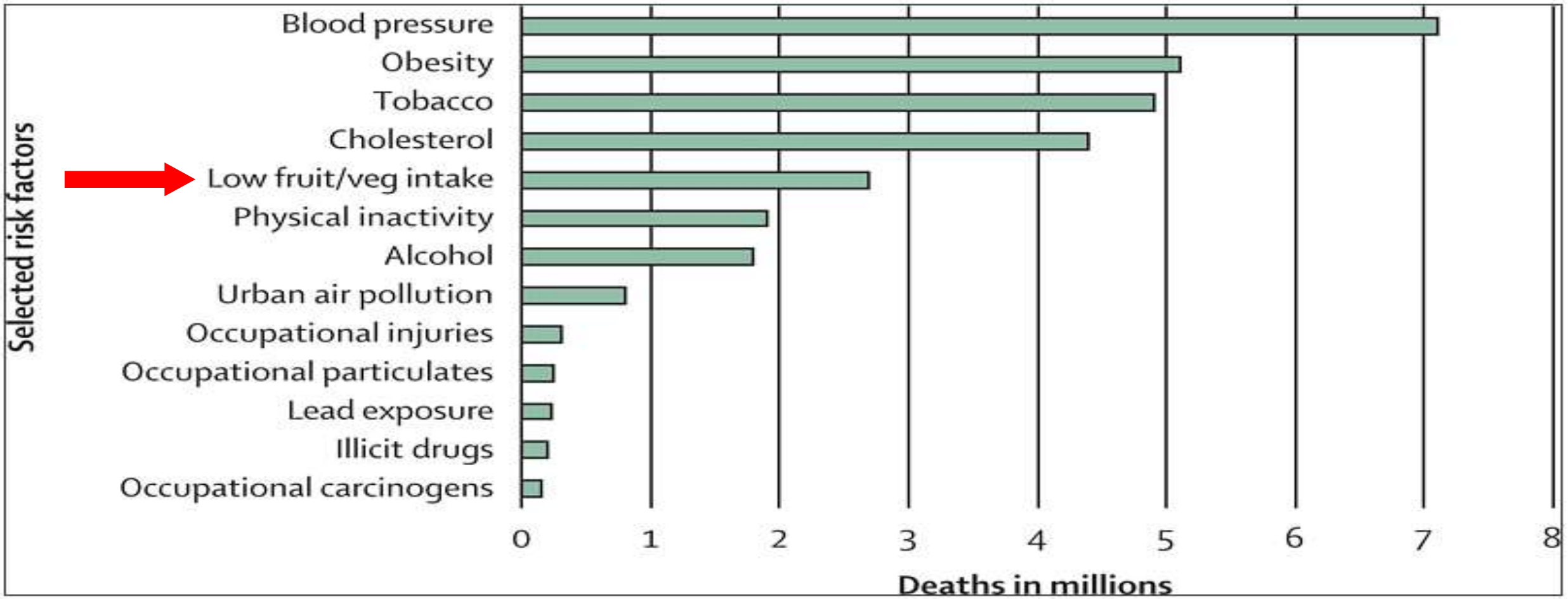


Figure. Number of deaths worldwide attributable to selected risk factors,13 2000.

Science Institute
Advancing plant-based nutrition

Fruit, vegetable, and legume intake, and cardiovascular disease and deaths in 18 countries (PURE): a prospective cohort study

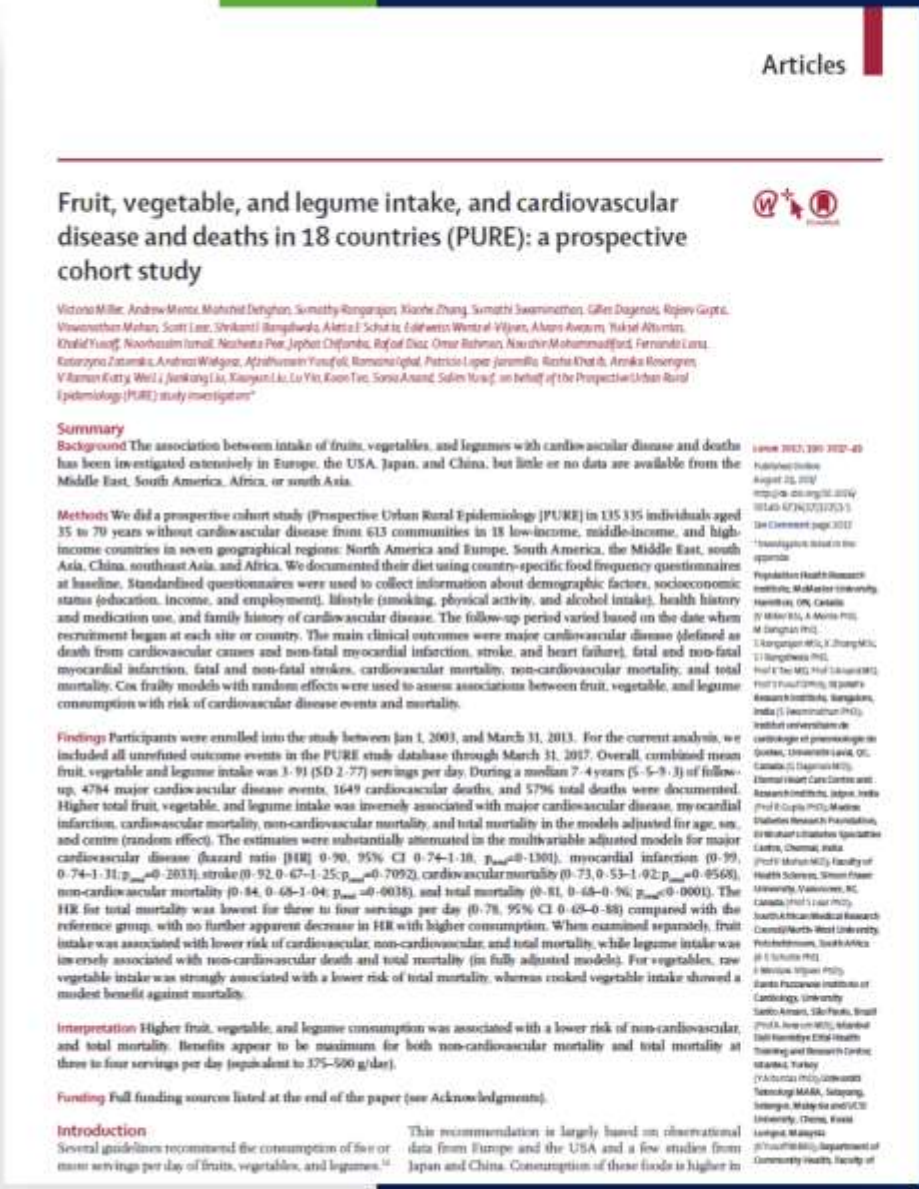
Miller V, Mente A, Dehghan M, et al. Fruit, vegetable, and legume intake, and cardiovascular disease and deaths in 18 countries (PURE): a prospective cohort study. Lancet. 2017;390(10107):2037-2049. doi:10.1016/S0140-6736(17)32253-5

The Lancet 2017;309:2037

Juice Plus+
Science Institute
Advancing plant-based nutrition

CONCLUSION

"Higher fruit, vegetable, and legume consumption was associated with risk reduction on several investigated end points, including cardiovascular, non-cardiovascular and total mortality."



Articles

Fruit, vegetable, and legume intake, and cardiovascular disease and deaths in 18 countries (PURE): a prospective cohort study

Victoria Miller, Andrew Mente, Mahshid Dehghan, Sumathy Rangarajan, Xiaohe Zhang, Sumathi Swaminathan, Gilles Dagenais, Rajeev Gupta, Viswanathan Mohan, Scott Lear, Shrikant I Bangdiwala, Alvaro J E Schutte, Edelweiss Wentzel-Viljoen, Alvaro Avezum, Yuksel Altuntas, Khalid Yusoff, Noorhassim Ismail, Nasheeta Peer, Japhet Chifamba, Rafael Diaz, Omar Rahman, Nasrin Mohammadifard, Fernando Lanas, Katarzyna Zatonska, Andreas Wielgosz, Afshin Yusufali, Romaina Iqbal, Patricio Lopez Jaramillo, Rasha Khatib, Annika Rosengren, V Raman Kutty, Wei Li, Jiankang Liu, Xiaoyun Liu, Lu Yin, Koon Teo, Sonia Anand, Salim Yusuf, on behalf of the Prospective Urban Rural Epidemiology (PURE) study investigators*

Summary

Background The association between intake of fruits, vegetables, and legumes with cardiovascular disease and deaths has been investigated extensively in Europe, the USA, Japan, and China, but little or no data are available from the Middle East, South America, Africa, or south Asia.

Methods We did a prospective cohort study (Prospective Urban Rural Epidemiology [PURE]) in 135 335 individuals aged 35 to 70 years without cardiovascular disease from 613 communities in 18 low-income, middle-income, and high-income countries in seven geographical regions: North America and Europe, South America, the Middle East, south Asia, China, southeast Asia, and Africa. We documented their diet using country-specific food frequency questionnaires at baseline. Standardised questionnaires were used to collect information about demographic factors, socioeconomic status (education, income, and employment), lifestyle (smoking, physical activity, and alcohol intake), health history and medication use, and family history of cardiovascular disease. The follow-up period varied based on the date when recruitment began at each site or country. The main clinical outcomes were major cardiovascular disease (defined as death from cardiovascular causes and non-fatal myocardial infarction, stroke, and heart failure), fatal and non-fatal myocardial infarction, fatal and non-fatal strokes, cardiovascular mortality, non-cardiovascular mortality, and total mortality. Cox frailty models with random effects were used to assess associations between fruit, vegetable, and legume consumption with risk of cardiovascular disease events and mortality.

Findings Participants were enrolled into the study between Jan 1, 2003, and March 31, 2013. For the current analysis, we included all unrefuted outcome events in the PURE study database through March 31, 2017. Overall, combined mean fruit, vegetable and legume intake was 3·91 (SD 2·77) servings per day. During a median 7·4 years (5·5–9·3) of follow-up, 4784 major cardiovascular disease events, 1649 cardiovascular deaths, and 5796 total deaths were documented. Higher total fruit, vegetable, and legume intake was inversely associated with major cardiovascular disease, myocardial infarction, cardiovascular mortality, non-cardiovascular mortality, and total mortality in the models adjusted for age, sex, and centre (random effect). The estimates were substantially attenuated in the multivariable adjusted models for major cardiovascular disease (hazard ratio [HR] 0·90, 95% CI 0·74–1·10, p_{trend}=0·1301), myocardial infarction (0·99, 0·74–1·31; p_{trend}=0·2033), stroke (0·92, 0·67–1·25; p_{trend}=0·7092), cardiovascular mortality (0·73, 0·53–1·02; p_{trend}=0·0568), non-cardiovascular mortality (0·84, 0·68–1·04; p_{trend}=0·0038), and total mortality (0·81, 0·68–0·96; p_{trend}<0·0001). The HR for total mortality was lowest for three to four servings per day (0·78, 95% CI 0·68–0·88) compared with the reference group, with no further apparent decrease in HR with higher consumption. When examined separately, fruit intake was associated with lower risk of cardiovascular, non-cardiovascular, and total mortality, while legume intake was inversely associated with non-cardiovascular death and total mortality (in fully adjusted models). For vegetables, raw vegetable intake was strongly associated with a lower risk of total mortality, whereas cooked vegetable intake showed a modest benefit against mortality.

Interpretation Higher fruit, vegetable, and legume consumption was associated with a lower risk of non-cardiovascular, and total mortality. Benefits appear to be maximum for both non-cardiovascular mortality and total mortality at three to four servings per day (equivalent to 375–500 g/day).

Funding Full funding sources listed at the end of the paper (see Acknowledgments).

Lancet 2017; 390: 2037–49

Published Online August 23, 2017 http://dx.doi.org/10.1016/S0140-6736(17)32253-5

See Comment page 2037

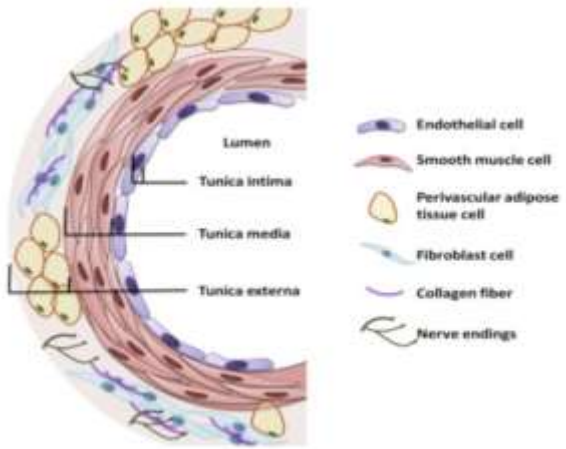
*Investigators listed in the appendix

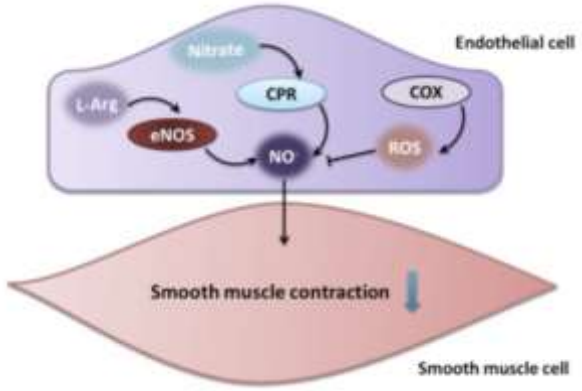
Population Health Research Institute, McMaster University, Hamilton, ON, Canada (V Miller BSc, A Mente PhD, M Dehghan PhD, S Rangarajan MSc, X Zhang MSc, S I Bangdiwala PhD, Prof K K Teo MD, Prof S Yusuf DPhil); St John's Research Institute, Bangalore, India (S Swaminathan PhD); Institut universitaire de cardiologie et pneumologie de Québec, Université Laval, QC, Canada (G Dagenais MD); Eternal Heart Care Centre and Research Institute, Jaipur, India (Prof R Gupta PhD); Madras Diabetes Research Foundation, Dr Mohan's Diabetes Specialities Centre, Chennai, India (Prof V Mohan MD); Faculty of Health Sciences, Simon Fraser University, Vancouver, BC, Canada (Prof S Lear PhD); South African Medical Research Council/North-West University, Potchefstroom, South Africa (Prof A E Schutte PhD, E Wentzel-Viljoen PhD); Dante Pazzanese Institute of Cardiology, University Santo Amaro, São Paulo, Brazil (Prof A Avezum MD); Istanbul Sisli Hamidiye Etfal Health Training and Research Centre, Istanbul, Turkey (Y A Altuntas PhD); Universiti Teknologi MARA, Selayang, Selangor, Malaysia and UCSI University, Cheras, Kuala Lumpur, Malaysia (N Ismail PhD MD); Department of Community Health, Faculty of

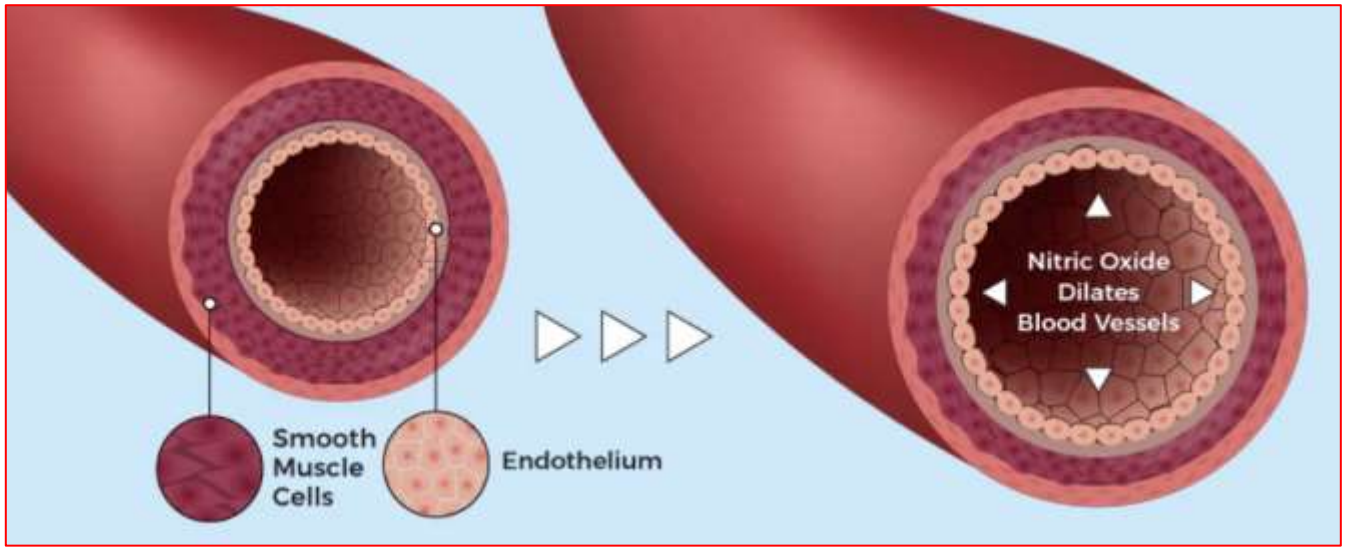
Article available at: https://pubmed.ncbi.nlm.nih.gov/28864331/

Endothel und NO Prduktion

Nobelpreis für Medizin 1998







Juice Plus+
Science Institute
Advancing plant-based nutrition

Effect of a single high-fat meal on endothelial function in healthy subjects.

Vogel RA, Corretti MC, **Plotnick GD.**

Am J Cardiol. 1997 Feb 1;79(3):350-4. doi: 10.1016/s0002-9149(96)00760-6.

Beeinträchtigung der Endothel-Fx für 3—4 Stunden!

The postprandial effect of components of the Mediterranean diet on endothelial function.

Vogel RA, Corretti MC, **Plotnick GD.**

J Am Coll Cardiol. 2000 Nov 1;36(5):1455-60. doi: 10.1016/s0735-1097(00)00896-2.

Schützt die Endothel-Fx

Juice Plus+ Science Institute
Advancing plant-based nutrition

Effect of Supplemental Phytonutrients on Impairment of the Flow-Mediated Brachial Artery Vasoactivity after a Single High-Fat Meal

Plotnick GD, Corretti MC, Vogel RA, Hesslink R Jr, Wise JA. Effect of supplemental phytonutrients on impairment of the flow-mediated brachial artery vasoactivity after a single high-fat meal. J Am Coll Cardiol. 2003 May 21;41(10):1744-9. doi: 10.1016/s0735-1097(03)00302-4. PMID: 12767658.

J Am Coll Cardiology

Juice Plus+ Science Institute
Advancing plant-based nutrition

MAIN RESULTS

- **Measurements on day 21 and 28:**
  - The detrimental effect of a high-fat meal was significantly decreased in both intervention groups (compared to placebo).
  - Trend for serum nitrate/nitrite levels to increase in both intervention groups.
- **Example: measurement on day 28**
  - Placebo group suffered 38% decrease in vasodilation after a high-fat meal
  - FV group suffered 17% decrease
  - FVB group experienced less than 2% drop in vasodilation

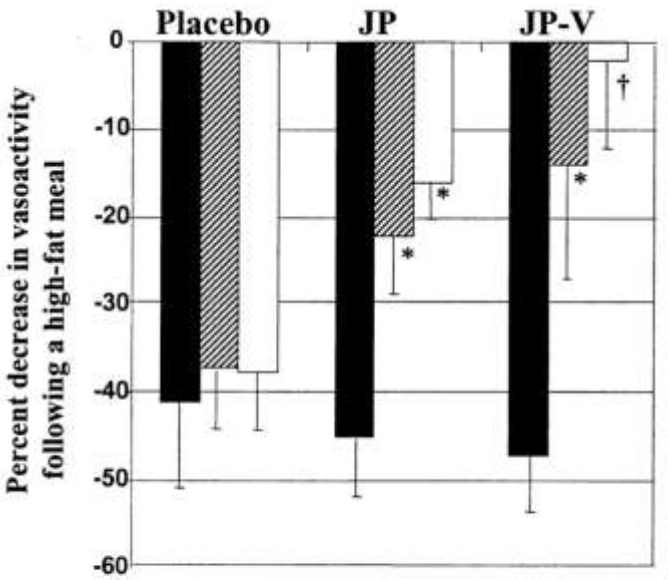


Figure 1. Postprandial decreases on brachial artery vasoactivity at 0, 21, and 28 days after a single high-fat meal in patients randomized to placebo, JP, or JP-V supplementation. *$p < 0.05$, †$p < 0.02$ compared with baseline (day 0). **Solid bars** = day 0; **shaded bars** = day 21; **open bars** = day 28. JP = Juice Plus; V = Vineyard.

Juice Plus+ Science Institute
Advancing plant-based nutrition

CONCLUSION:

FV and FVB significantly decreased the detrimental effect of a high-fat meal on flow mediated brachial artery vasodilation, both at 3 and 4 weeks of supplementation.

Journal of the American College of Cardiology
© 2003 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 41, No. 10, 2003
ISSN 0735-1097/03/$30.00
doi:10.1016/S0735-1097(03)00202-4

Endothelial Function

Effect of Supplemental Phytonutrients on Impairment of the Flow-Mediated Brachial Artery Vasoactivity After a Single High-Fat Meal

Gary D. Plotnick, MD, FACC,* Mary C. Corretti, MD, FACC,* Robert A. Vogel, MD, FACC,* Robert Heuflink, Jr, ScD,† John A. Wise, PhD†

Baltimore, Maryland; and San Marcos, California

OBJECTIVES Our objective was to determine if long-term daily administration of phytonutrient supplements can prevent the immediate adverse impact of a high-fat meal and increase the production of nitric oxide.

BACKGROUND Ingestion of a high-fat meal impairs flow-mediated vasodilation of the brachial artery for at least 4 h; however, co-ingestion of vitamin antioxidants or a green salad has been shown to prevent this effect.

METHODS Flow-mediated brachial artery reactivity test (BART) both before and 3 h after a 900 calorie 50 g fat meal was evaluated in 38 healthy volunteers (age 36.4 ± 10.1 years). Subjects were randomized to four weeks of daily supplementation with a powdered fruit vegetable juice concentrate (Juice Plus [JP]) along with a complex supplement providing nutritional antioxidants and various herbal extracts (Vineyard [V]), JP alone, or a matching placebo. At three and four weeks, BART was repeated both before and after the high-fat meal. Serum nitrate/nitrite concentrations were measured at baseline and at four weeks.

RESULTS Four weeks of the JP-V combination blunted the detrimental effect of the high-fat meal (−47.5 ± 23.4% at baseline vs. −1.7 ± 9.7% at four weeks [$p < 0.05$]). Four weeks of JP alone had a similar beneficial effect (−45.1 ± 19.7% at baseline vs. −16.6 ± 10.3% at four weeks [$p < 0.05$]), whereas there was no substantial effect of the placebo. In the subjects treated with supplements, concentrations of serum nitrate/nitrite increased from 78 ± 39 to 114 ± 62 μmol ($p < 0.02$).

CONCLUSIONS Daily ingestion of modest amounts of a fruit/vegetable juice concentrate with or without adjunctive phytonutrient supplementation can reduce the immediate adverse impact of high-fat meals on flow-mediated vasoactivity and increase nitrate/nitrite blood concentration. (J Am Coll Cardiol 2003;41:1744–9) © 2003 by the American College of Cardiology Foundation

A high intake of fruits and vegetables has been associated with reduced risk for coronary heart disease and ischemic stroke in large prospective case-control studies (1–5). The mechanisms by which fruit and vegetable consumption achieves this benefit remain to be established. They can provide a substantial ration of dietary potassium and soluble

See page 1750

fiber and are typically rich in a range of antioxidant phytonutrients. Previous studies show that antioxidant vitamins—notably C and E—can often exert a favorable effect on endothelial function (6–11). In particular, they appear to help preserve the endothelium's capacity to generate bioactive nitric oxide (NO) in various pathogenic circumstances that tend to impair this activity. Nitric oxide acts to stabilize platelets, promote vasodilation, inhibit smooth muscle migration and hyperplasia, and maintain an anti-inflammatory endothelial phenotype that discourages the influx of activated monocytes and other inflammatory cells. To the extent that dietary antioxidants can offset the harmful impact of endothelial oxidants on NO bioactivity, they have the potential to make an important contribution to vascular health (11).

A sudden increase in the shear stress acting on arterial endothelium induces an endothelium-dependent, NO-mediated vasodilation that is susceptible to non-invasive quantitation by high-frequency ultrasound techniques (12,13). Flow-mediated vasodilation (FMV) of the brachial artery, evoked by the hyperemia that follows relief of pressure-cuff occlusion of arterial blood flow, is now commonly measured to assess the endothelium's capacity for generating bioactive NO in conduit arteries. This FMV is often impaired in patients expressing coronary risk factors associated with endothelial dysfunction, such as hypercholesterolemia, hypertension, hyperhomocysteinemia, insulin resistance, diabetes, and angina (14–24). Our group has previously demonstrated that this vasodilation is transiently impaired for up to 4 h after the ingestion of a fatty meal,

From the *University of Maryland School of Medicine, Baltimore, Maryland; and †Natural Alternatives International, San Marcos, California. Dr. Plotnick was supported by a grant from Natural Alternatives International.

Manuscript received July 2, 2002; revised manuscript received November 20, 2002; accepted January 9, 2003.

Article available at: https://pubmed.ncbi.nlm.nih.gov/12767658/

Prävention von HK Erkrankungen durch pflanzliche Ernährung

Sind Nahrungsergänzungen unbedingt notwendig?

Juice Plus+
Science Institute
Advancing plant-based nutrition

DGE / ÖGE

- **DGE (Deutsche Gesellschaft für Ernährung)**: Nahrungsergänzungsmittel sollten nur bei bestimmten Indikationen (z.B. Mangelzustände, Schwangerschaft) verwendet werden.

- **Österreichische Gesellschaft für Ernährung**: Unterstützt frische Lebensmittel als primäre Quelle für Nährstoffe.
  - ***Quelle**: WHO Global Action Plan for the Prevention and Control of Noncommunicable Diseases.*

Wer nimmt regelmäßig Nahrungsergänzungsmittel?

Österreich: **30-35%** nehmen regelmäßig NE ein. Die Nutzung steigt mit zunehmendem Alter. (*AGES 2021*)

Deutschland: **20-30%**, Frauen und ältere Menschen häufiger *(Bundesinstitut für Risikobewertung 2021, NVS 2008)*

Schweiz: **25-35%** *(Schweizer Gesellschaft für Ernährung 2021)*

Wer nimmt regelmäßig Nahrungsergänzungsmittel?

USA: **57-75%** Multivitaminpräparate und Vitamin-D-Produkte am häufigsten. Starke Zunahme in den letzten Jahren

National Health and Nutrition Examination Survey (NHANES) 2020

Council for Responsible Nutrition (CRN) 2023
Office of Dietary Supplements (ODS), National Institutes of Health (NIH)

Trends und Entwicklung

In den letzten Jahren weltweiter Anstieg des Konsums

Hauptgründe:

- ✓ gesteigertes Bewusstsein für Gesundheit und Wohlbefinden
- ✓ der Wunsch nach einer besseren Ernährung
- ✓ Zunahme chronischer Krankheiten.

Trends und Entwicklung

- Europa: Vitamin D, Magnesium, Omega-3, Multivitamine
- USA: spezifische Antioxidantien und Probiotika

Werden als Teil einer gesundheitsbewussten Lebensweise angesehen

Wissenschaftliche Evidenz oft widersprüchlich

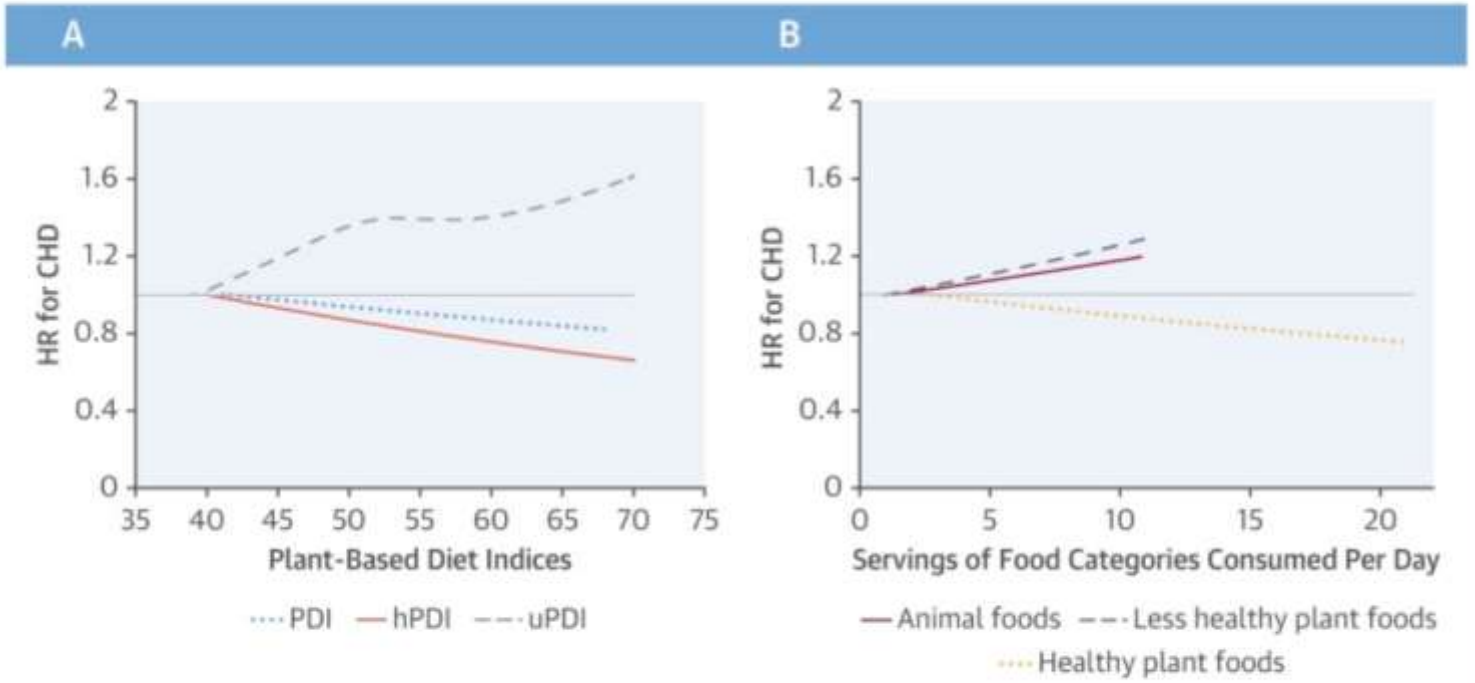
Journal of the American College of Cardiology
Volume 70, Issue 4, 25 July 2017, Pages 411-422

Original Investigation

Healthful and Unhealthful Plant-Based Diets and the Risk of Coronary Heart Disease in U.S. Adults

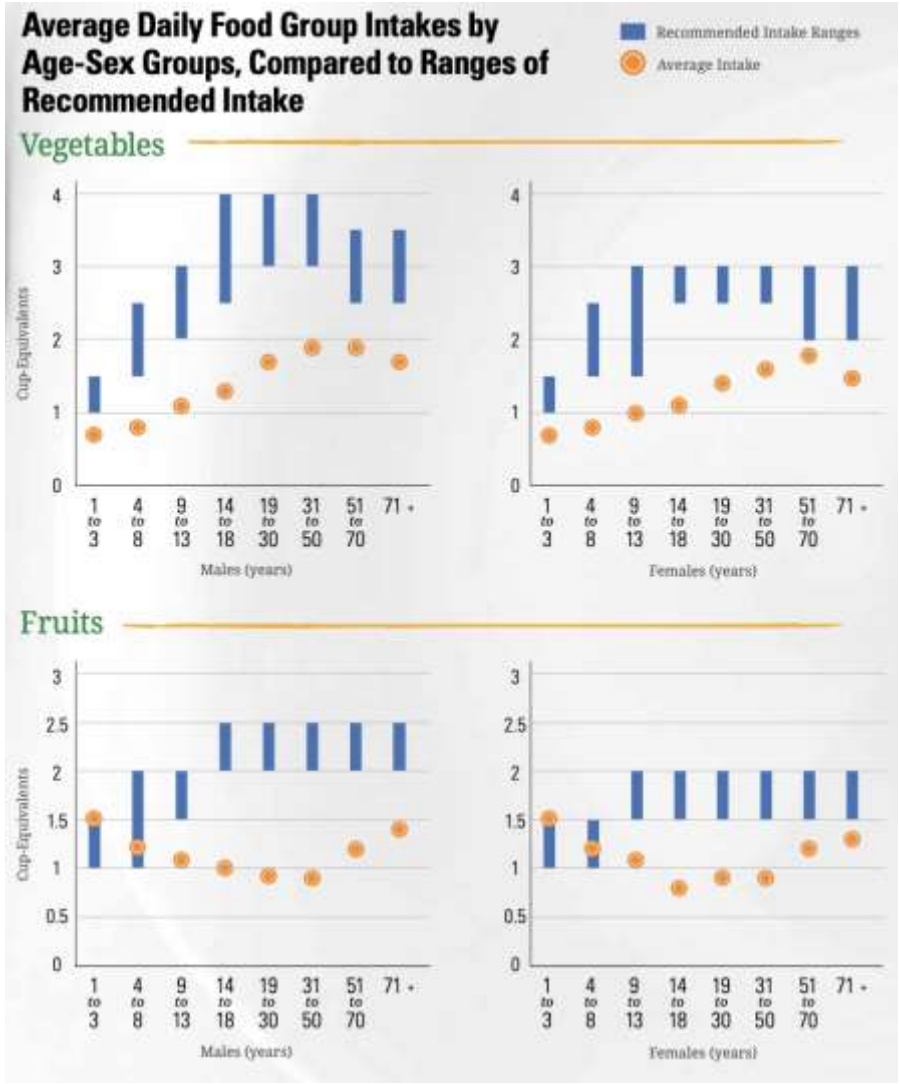
- > 200.000 participants (NHS, PHS),
- > 30 years F/U,
- > 4.5 million pat.years

CENTRAL ILLUSTRATION: Dose-Response Relationship of Plant-Based Diet Indices and Animal, Healthy Plant, and Less Healthy Plant Foods With CHD Incidence



Satija, A. et al. J Am Coll Cardiol. 2017;70(4):411-22.

Obst und Gemüsekonsum
Vergleich Soll - Ist



Juice Plus+ Science Institute
Advancing plant-based nutrition

Sind Nahrungsergänzungen notwendig?

NEIN – aber:

- Änderung von Lebensstil und Ernährungsgewohnheiten????
- Phasen von erhöhtem Bedarf:
  - Schwangerschaft
  - Kindheit
  - Athleten / Sport
  - Chronische Erkrankungen diseases
  - Stress
  - Senioren

Juice Plus+ Science Institute
Advancing plant-based nutrition

Wenn Nahrungsergänzung, dann:

- Sicherheit – Studien?
- Qualität – Kontrollen? Studien?
- Effektivität – Studien?

HK Effekte einer pflanzenbasierten Ernährung

Zusammenfassung

- ✓ Hohe Evidenz für effective Primär- und Sekundärprävention
- ✓ Sollte so früh wie möglich eingeführt werden
- ✓ Wichtig schon vor und während der Schwangerschaft
- ✓ Lebenslanger Einfluss auf die HK Gesundheit
- ✓ Nahrungsergänzung überlegen, wenn der Bedarf nicht sonst gedeckt warden kann.

Juice Plus+ Science Institute
Advancing plant-based nutrition

JP+ als Supplement:

- ✓ JP+ erfüllt alle Kriterien eines seriösen effektiven Nahrungsergänzugsmittels
- ✓ JP+ hat einen beeindruckenden wissenschaftlichen Hintergrund mit 48 publizierten Studien, viele davon RCT-Studien
- ✓ JP+ ist sicher (bestätigt durch zahlreiche universitäre Ethik-Kommissionen)
- ✓ Diese Studien liefern Evidenz, dass JP+ sinnvoll in der Prävention eingesetzt werden kann.

Juice Plus+
Science Institute
Advancing plant-based nutrition