Conception of an interactive database for personalized dietary recommendations in the context of the prevention of cardiovascular diseases using a longevity approach

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Background

Life expectancy has significantly increased in recent years, with the population aged 85 years + in Germany growing from 1.2 million in 1991 to approximately 2.7 million in 2022 . (1)

However, aging correlates with a higher prevalence of diseases, especially cardiovascular diseases (CVD). The GEDA 2009 study by the Robert Koch Institute (RKI) reported a sharp rise in the prevalence of heart attacks, heart failure, strokes, and peripheral artery diseases in individuals over 65 years. (2)

CVD risk is determined by factors such as obesity, hypertension, hypercholesterolemia, tobacco use, and diabetes mellitus. (3) These risk factors increase with age and often coexist, compounding their impact.

In 2019/2020, obesity affected 46% of women and 60.5% of men in Germany, while nearly one in three adults was diagnosed with hypertension. (4, 5) Also, the prevalence of Type 2 Diabetes mellitus (T2D) has risen in the past years. (6)

While current medical approaches mainly focus on pharmacological treatments (7), lifestyle measures, such as nutrition still play a minor role in the German healthcare system.

Developed in the US, the longevity approach aims to promote healthy aging through lifestyle modifications, including exercise, sleep, and nutrition. (8)

Evidence-based dietary guidelines, such as those from of American Heart Association, have already shown promise for improving cardiometabolic health. (9)

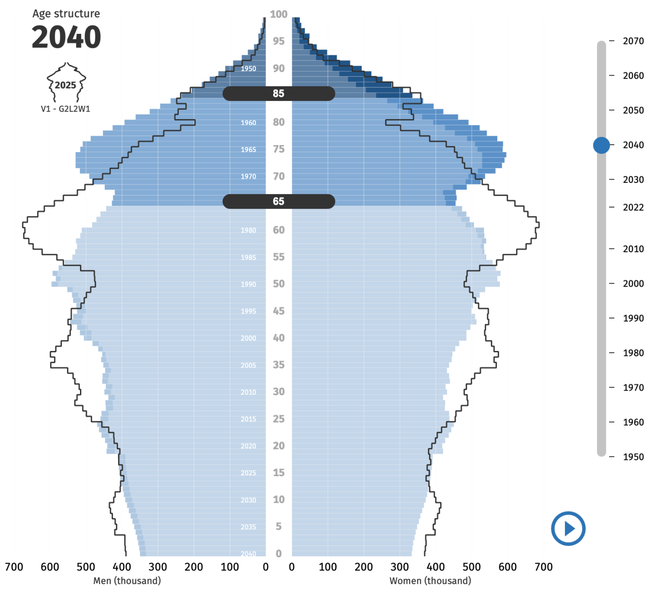

***Figure I**: "Age Structur in Germany – predicted development from 2025 to 2040"*

Nevertheless, **each patient has a unique disease profile** that requires customized nutritional strategies.

This scientific work in collaboration with the *WalkByLab* Brandenburg (dt.: Lauflabor) aims to **develop a comprehensive, patient-friendly nutrition database adapted to individual cardiovascular risk profiles**.

Method

Three fictitious patients with different cardiovascular risk profiles were **created for the conceptual development of an initial database** structure. **The risk factors identified** for the patients included laboratory parameters that are recorded in a standardized manner in the WalkByLab, such as **CRP, HbA1c, LDL, Nt-pro-BNP, BHI, TSH**, as well as body composition parameters such as **BMI, waist-hip ratio, body muscle mass (BMM) and blood pressure**.

A **qualitative literature research** was carried out for each parameter, in which studies and approaches were evaluated based on citation frequency and scientific significance. The most important results from 3–5 selected sources were stored in an Excel spreadsheet.

The concept of the database is to link patients with multiple risk factors to evidence-based studies and the associated nutritional interventions.

These published nutrition recommendations were used to create individualized nutrition care plans tailored to each fictional patient (see Figures III through V).

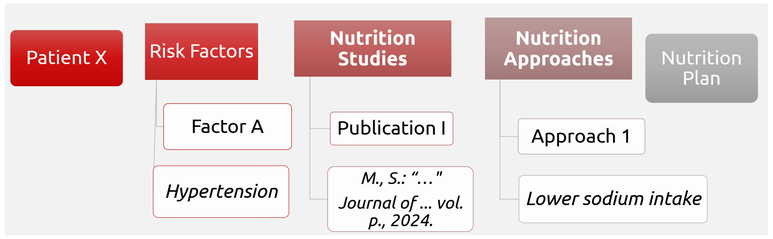

***Figure II:** "Visualization of the database concept"*

Results

During the literature research, it becomes clear that the **evidence for the various parameters differs widely**. Nevertheless, **(1) general recommendations** and **(2) specific dietary recommendations** could be analyzed for all risk factors. A generally recognized approach with high-quality evidence is the predominantly plant-based, anti-inflammatory and nutritious Mediterranean diet.

Key approaches:

General Approach: The *Mediterranean diet* emphasizes *vegetables, fruits, whole grains, legumes and unsaturated fats*, found in olive oil, nuts, and seeds. The proteins come mainly from plant sources, with moderate amounts of poultry, fish, eggs, and low-fat dairy products, while red meat and high-fat dairy products are kept to a minimum. Known for its *nutrient-dense and anti-inflammatory properties*, this diet promotes *cardiovascular, metabolic, and gut health*, improving parameters like CRP, LDL/HDL, and HbA1c.

A. CRP: To reducing CRP levels, the *underlying diagnoses must be treated*. The Mediterranean diet is the best-documented approach due to its anti-inflammatory effect.

B. HbA1C: For Type 2 Diabetes, eating *at scheduled times* and following the *Mediterranean diet have been* shown to have positive effect on weight and blood sugar levels.

C. LDL/ HDL/ TRIG: To improve the lipid profile, saturated fats and cholesterol should be reduced, while intake of unsaturated fats (DHA/EPA omega-3 fatty acids), plant-based proteins and fiber should be increased. Reducing added sugars and alcohol is essential for controlling TRIG.

D. Nt-pro-BNP: For heart failure, *sodium restriction (<1400 mg/day)*, the Mediterranean, and DASH diets are most effective. *Omega-3 and omega-6 fatty acids* improve heart function and vascular health.

E. TSH: For moderate weight loss (BMI > 25), a balanced diet is recommended. Nutrients of concern for thyroid and cardiovascular health include iodine, selenium, iron, and omega-3 fatty acids. Vitamin C may reduce oxidative stress in Hashimoto's thyroiditis

F. BHI: Supporting mitochondrial function involves *vitamin B3 (niacin)* and following "The 3 Lows":
- *low fat* (reducing saturated fats, prioritizing unsaturated fats)
- *low carb* (limiting added sugars and short-chain carbs)
- *low salt* (to support SIRT3 activity and reduce cardiovascular risks).

H. RR: *The DASH diet*, emphasizing plant-based foods, whole grains, and limited sodium (≤1400 mg/day), evidently reduces blood pressure. *A potassium supplementation* (70 mmol/day) helps to regulate sodium. Consuming *beetroot juice* daily, enhances vasodilation and blood flow by providing nitrates.

I. Waist-to-Hip-ratio: The right *meal plan* can help reduce abdominal fat. The *16:2 fasting method* improves blood sugar control and decreases visceral fat storage.

J. BMM: To prevent sarcopenia, *adequate protein intake* (min.1.2 g/kg), *caloric intake, and physical activity* are essential. Protein supplementation or amino acid supplements may be helpful.
Creatine and magnesium help maintain muscle strength and slow muscle loss progression.

G. BMI: Weight loss requires a *caloric deficit*, achieved by *reducing carbs or fats* while *maintaining protein intake* (1.2–1.5 g/kg).

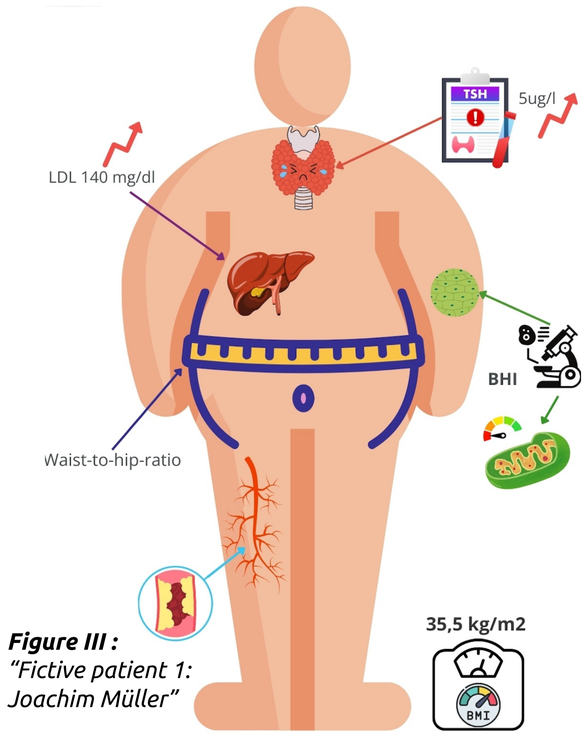

Figure III :
"Fictive patient 1: Joachim Müller"

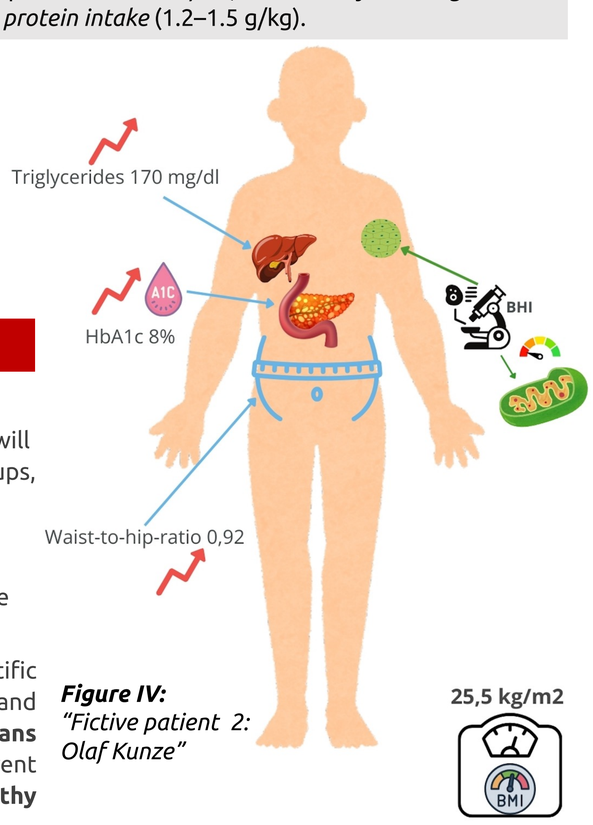

Figure IV:
"Fictive patient 2: Olaf Kunze"

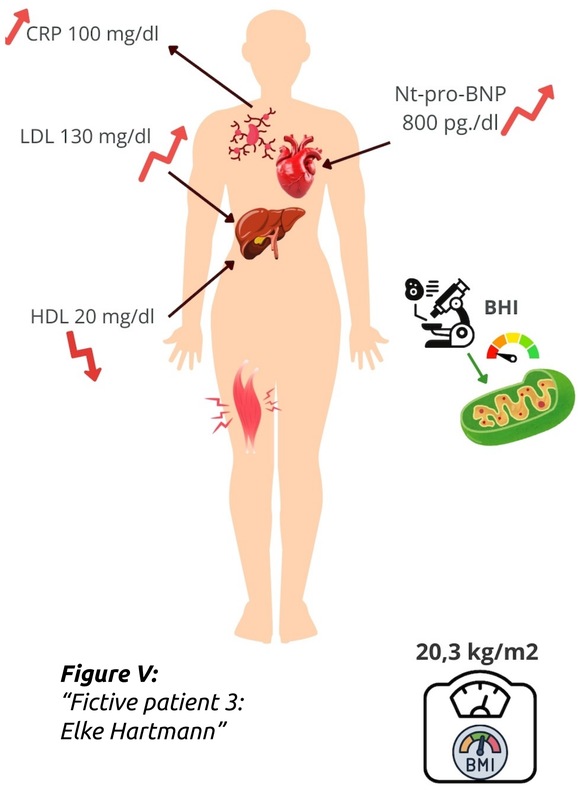

Figure V:
"Fictive patient 3: Elke Hartmann"

Conclusion & Outlook

This work established the initial structure for developing a nutrition database and created a user application for three fictitious patients. The development of a database-driven approach can provide a useful basis for standardized and personalized nutrition plans that are specifically tailored to the risk factors of the patients.

The next step is to **test the concept** in a **controlled study** of real patients from the WalkByLab to assess the effectiveness and applicability of the nutrition plans.

In doing so, practical challenges such as patient adherence to the nutrition plans and confounding factors such as increased physical activity and improved sleep must be taken into account.

As part of future development, **the database** will be expanded to include additional patient groups, parameters and longevity factors. By incorporating **AI-driven tools**, the creation of individualized meal plans and the linking of nutrition/supplement recommendations will be automated.

With regular integration of new scientific findings, this database will provide scalable and practical solutions. **Personalized nutrition plans** have **significant potential** to prevent **cardiovascular disease and promote healthy aging.**

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In Collaboration with the *WalkByLab* www.lauflab.de