Genetic Markers of Biological Age in Multi-component Lifestyle Interventions: Results of a Preliminary Literature Search

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Motivation

Mobile health (mHealth) apps can potentially support patients and health care systems (Jakob et al. 2022). Of particular interest is the application of mHealth apps to multi-component lifestyle interventions, such as diet and nutrition, physical activity, sleep and stress management behavior. Such interventions have the potential to slow down or even revert aging processes (Fiorito et al. 2021). Many clinical and laboratory biomarkers have been evaluated to document the aging process and healthy aging (Li et al. 2021). Popular markers are telomere length and epigenetic methylation clocks (Seale et al. 2022). Studies evaluating epigenetic clocks as biomarkers have yielded inconclusive results (Galow & Peleg 2022).

We plan to study the effects of a mHealth intervention on epigenetic clocks as biomarkers of healthy aging. A preliminary literature search was conducted to inform the design of such an intervention.

Method

A preliminary literature search was conducted that will inform a scoping review. For this purpose, PubMed database was used with the following search terms: lifestyle intervention, epigenetic clock, telomere length and aging biomarker.

Preliminary Results

Occurrence of Intervention components (IC) in % (published and registered studies N = 39)

Intervention component	*N*	*% of IC overall*
Physical activity	13	51%
Diet	13	33%
Supplements	5	15%
Mental health exercises	6	28%
Sleep	3	13%
Combination of ICs	8	28%

Occurrence of published and registered studies

Type of study	*N*	*% of published / registered studies*
Published RTCs	22	56%
Registered RTCs	17	44%

Biological age biomarkers (published studies only)

Type of epigenetic clock	*N*	*% of age biomarkers*	*Thereof significant*	*% signif. per IC*
Epigenetic age clocks	6	27%	4	67%
DNAm changes in local cells/tissues	1	5%	1	100%
Telomere length	15	68%	7	47%

Occurrence of Intervention IC in published studies (N = 17) & significance

Intervention component	*N*	*% of IC published studies*	*Thereof significant*	*% signif. per IC*
Physical activity	10	45%	6	60%
Diet	11	50%	8	73%
Supplements	4	18%	2	50%
Mental health exercises	6	27%	3	50%
Sleep	3	14%	1	33%
Combination of ICs	6	27%	4	67%

Details epigenetic age clocks (only published studies)

Epigenetic age clock	*N*	*Occurrence within age clocks*
Horvath's DNAmAge clock	3	50%
DNAmGrimAge	1	17%
Hannum's DNAm clock	1	17%
Zbiec´-Piekarska's clock	1	17%

Details epigenetic Telomere length (only published studies)

Type of measurement	*N*	*Occurrence within telomere length*
Average Telomere length	15	100%
% change of short telomeres	1	7%

Future Work

As a next step, the scoping review will be finalized. The results will inform the design of a smartphone-based and chatbot-delivered multi-component intervention and the sample size of a randomized controlled trial (RCT). The following data will be collected at the beginning and after the intervention, as well as during a 6-month follow-up of the RCT: vital parameters, serum samples, and stool samples. Epigenetic (biological) age (GrimAge/TruAge) will be determined from saliva and blood cells at the beginning and the end of the intervention, as well as during the follow-up. The metabolome of the blood samples (250 metabolites (NMR von Nightingale (Helsinki); Würtz et al. 2017)) will be determined, too. Adherence to the intervention will be measured continuously via the mHealth app.

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