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Project title

PILOT STUDY FOR THE IDENTIFICATION OF BIOMARKER SIGNATURES OF AGING AND LONGEVITY

Acronym/working title

BioMAge

Principal Investigator

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Registration number of the Ethical approval

Comitato Etico Interaziendale di Novara N° 290/20

Project summary

People worldwide are living longer, but the expanded lifespan of the aging population is accompanied by increased chronic diseases and disability rate that might potentially reduce the length of a healthy life span. Moreover, the complex social and medical costs presented by an expanded unhealthy aging population are continually rising and represent an ever-growing challenge.

Aging is the time-dependent physiological functional decline that affects most living organisms determined by a progressive physiological dysregulation. Aging is the result of the destructive impact of metabolic errors and external stress factors on the individual development of the body, expressed in compensatory hyperfunction and failure of systems for maintaining homeostasis (from molecular to organism levels) and increasing the likelihood of illness and death in life-compatible conditions. Individuals of the same chronological age do not age at the same rate.

To determine the individual rate of aging, the risk of illness and death and the impact of a variety of emerging longevity interventions, it is essential to track the rate of aging by developing a comprehensive set of aging biomarkers.

A critical goal in the field of aging biomarkers is the translation of these hallmarks into robust patterns of molecular changes with aging, with the assumption that departures from this "signature" patterns provide not only information regarding future risk of pathology and functional decline but also clues on compensatory mechanisms by which our organism counteracts the effects of aging. Such signatures could be used both to identify individuals in the trajectory of accelerated, "unhealthy" aging and to track the effectiveness of interventions designed to slow down biological aging and development of associated diseases.

Aging arises from the failure of coordination of biochemical pathways and cellular processes that form a biological network across multiple tissues and cellular constituents with alterations accumulating over time along with a reduction in biological fitness. This condition represents a difficult challenge toward the homeostatic regulation of metabolism (age is one of the greatest risk factors for a wide range of endocrine based diseases), and appears to be exacerbated by a severely diminished capacity in older organisms to appropriately regulate stress response pathways (inflammaging and allostatic overload). Proteomic and metabolomic profiling, by a global investigation of proteins and metabolites, can provide a more robust method to discover causal mechanisms of aging, age-related disease, and longevity.

Extracellular vesicles (EVs), produced by all cells and present in all biological fluids, are critical mediators of intercellular communication both in the microenvironment and at the systemic level. This is due to their ability to transfer proteins, lipids and regulative RNA, thus influencing different physiological and pathological functions of target cells. Whereas most biomarkers (e.g. circulating proteins) do not contain information on the cellular and tissue context of origin, such information is contained in EV, in the form of specific surface markers of the originating cell and of the content of EV enclosed in the corresponding membrane. Determining the cellular origin and content of EV can provide information on the nature, severity and prognosis of a particular disorder, and information on the physiological or pathophysiological mechanisms underlying the process. These characteristics, therefore, make EV excellent biomarkers of both aging and ageing-related diseases.

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Duration of Study

Study start: January 2021
Study end: December 2023

Total number of participants involved:

400

Biological samples collected:

- ✔ serum
- ✔ plasma sodium-citrate
- ✔ Plasma EDTA
- ✔ Plasma lithium-heparin
- ✔ buffy coat
- ✔ urine