WELCOME

Waist-to-Height Ratio, Glycemic Moderation, and Differential Cardiovascular Aging in Gujarati-Indian and Pokhareli-Nepalese Adults

Multi-country Research Findings Presented at

12th National Summit of Health and Population Scientists in Nepal

Presented by

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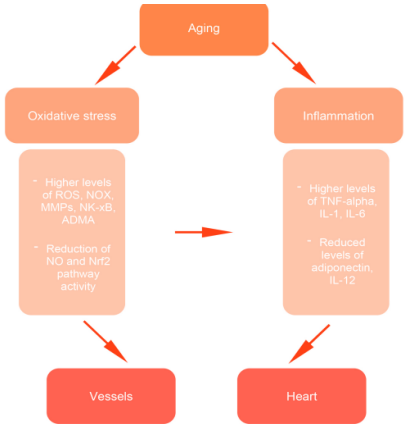
Background

- Man Is as Old as His Arteries
  -Thomas Sydenham (1624–1689)—the English Hippocrates

Cardiovascular Aging/Heart Age

- **An integrated measure of cumulative cardiovascular risk**
- ~A progressive and inevitable biological degenerative process
  - affects structure and function of the heart and vascular system
- The vascular process includes
  - Progressive Vascular wall stiffening and endothelial impairment, driven by
    - Extracellular matrix (ECM) accumulation,
    - Altered matrix metalloproteinase (MMP) activity,
- Other have central roles
  - Oxidative stress & Chronic inflammation



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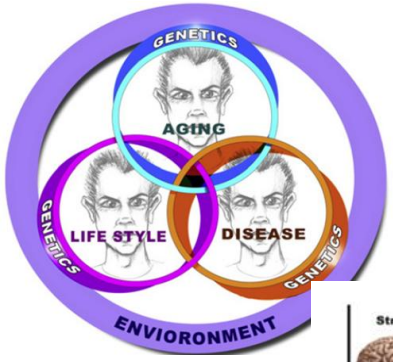
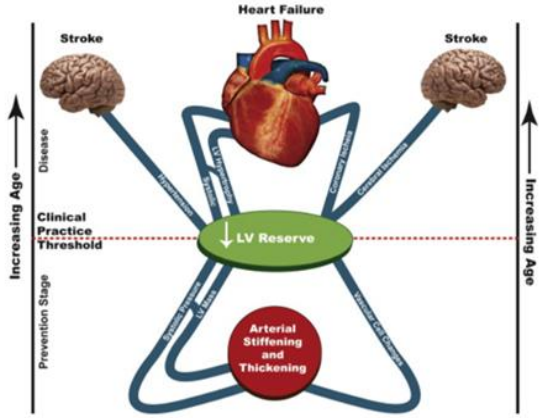
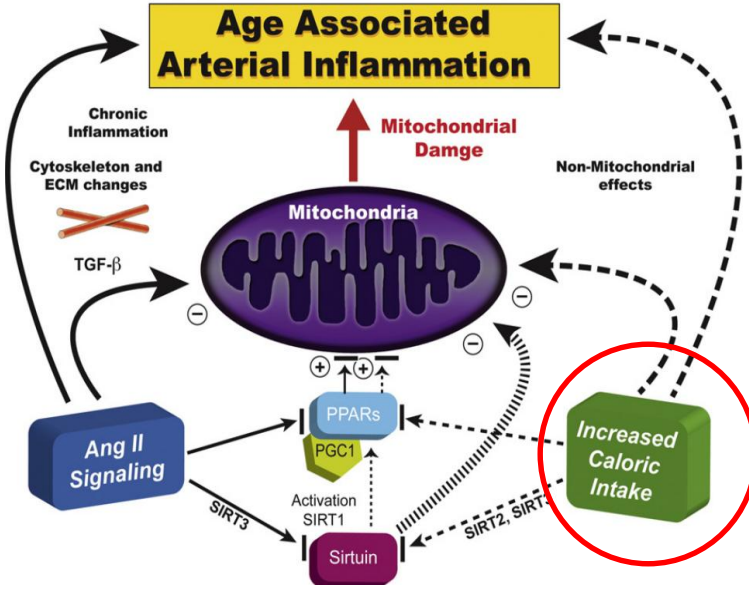
Background cont..

- Aging heart is a promising frontier in preventive cardiology
  - Operates on the edge of cardiovascular diseases
- Many effects of aging on the CV system can be delayed or attenuated by changes in
  - Lifestyle,
    - Diet-
      - Caloric
    - Exercise
  - Or
    - By drugs, e.g. those that suppress Ang II signaling







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Background cont..

What about South Asian populations?

- Cardiovascular disease (CVD) risk manifests at younger ages and lower levels of adiposity
- Central adiposity, commonly assessed using waist-to-height ratio (WHtR), is strongly linked to metabolic dysregulation,
  - Particularly impaired glycemic control
- This may accelerate cardiovascular aging

However

- The metabolic pathways through which central adiposity influences excess heart age across different South Asian populations remain inadequately characterized

Aim & Objectives

Aim

- Assess moderation effect of glycemic control on accelerated Cardiovascular aging

Objectives

- Assess differences in metabolic and body composition characteristics;
- Compare chronological age and accelerated heart age (HA-CA) between Gujarati and Pokhareli adults; and
- Quantify the extent to which fasting blood glucose mediates the association between central adiposity (WHtR) and accelerated cardiovascular aging

Methodology

Design

- Two-country cross-sectional (convenient sample)

Sample size

- Data from two Countries (N=3034)
  - above the age of 30 years and free from any known CVD
  - India (Indian non-lab Heart Study - INHAS): N= 2533
  - Nepal (Pokhara Heart Study, PHS): N= 501
    - For screening tools as suggested by Bujang & Adnan[1,2], at 80% power for detecting a change in percentage value of sensitivity of a screening for 0.50 - 0.70, based on a target significance level of 0.05, a minimum of 450 participants needs to be enrolled for the study

1. Khanal et al.
2. Bujang et al.

Methodology cont..

- **Study duration**
  - Gujarat: 2021-2023
  - Pokhara: 2024-2025
- **Study sites**
  - Gujarat: Ahmedabad, Gandhinagar, Anand
  - Pokhara: Pokhara Metropolitan (Pokhara, Lekhnath, Kristinachnechaur)
- **Participant enrollment**
  - Gujarat: Through administrative support from State health team and door-to-door/camp-based screening activities performed by IIPHG using both lab and non-lab-based tools
  - Pokhara: With support from FCHVs, local leaders, and Institutional supports
- **Ethical approvals**
  - IIPHG
  - NHRC

Methodology cont..

Variables

- Anthropometry,
  - BP
  - FBG
  - Lipid Profiles,
  - Body composition
- Chronological age (CA)
- Sex
- Heart age (HA)
  - Calculated using validated cardiovascular risk algorithms
- Accelerated HA
  - HA-CA

From The Framingham Heart Study	
General CVD Risk Prediction	
Risk Factor	**Units**
Sex	male (m) or female (f)
Age	years
Systolic Blood Pressure	mmHg
Treatment for Hypertension	yes (y) or no (n)
Smoking	yes (y) or no (n)
Diabetes	yes (y) or no (n)
HDL	mg/dL
Total Cholesterol	mg/dL
Your 10-Year Risk (The risk score shown is derived on the basis of an equation. Other print products, use a point-based system to calculate a risk score that approximates the equation-based one.)	
Your Heart/Vascular Age	

Methodology cont..

Moderation analysis

- Standardized regression models were adjusted for place and relevant covariates
- Indirect effects were estimated using bootstrapping with 5,000 replications to derive bias-corrected confidence intervals
- Adjusted R^2 values were reported to assess model explanatory power
- Statistical significance was defined at $p<0.05$

Results

Socio-economic profile of the participants

Variables	Pokhara (%)	Gujarat (%)	P-value
Sex			
Male	327 (65.3)	1674 (66.1)	0.724
Female	174 (34.7)	859 (33.3)	
Occupation#			
Professional job	72 (14.4)	221 (8.7)	<0.001
Skilled job	256 (51.0)	1015 (40.1)	
Unskilled and other jobs	121 (24.2)	656 (25.9)	
Unemployed	52 (10.4)	641 (25.3)	
Educational level			
Bachelor's Degree and above	103 (20.5)	1144 (45.2)	<0.001
Class VIII-XII pass	226 (45.1)	752 (29.7)	
Literate to below class VIII	84 (16.7)	428 (16.9)	
Illiterate	88 (17.7)	209 (8.3)	
Income (USD GNI per capita) *			
Low income (<1135)	271 (54.1)	170 (6.7)	<0.001
Middle income (1136-13935)	230 (45.9)	2363 (93.3)	

*#Some occupations merged ; *World Bank, 2024; 1USD= NPR 133.12 (NRB); INR 83.4043 (RBI) as per Jul 1, 2024; middle income includes both lower and upper middle-income groups*

Anthropometric and biochemical profile

Variables	Pokhara (%)	Gujarat (%)	p-value
Hypertensive	254 (66.7)	1469 (58.0)	0.053
BMI-Asian categories 23.0-27.5 (Increased risk) ≥27.5 (High risk)	 218 (43.5) 184 (36.7)	 1023 (40.4) 886 (35.0)	0.056
High body fat % (Male>25%, Female>30%)	411 (82.0)	1393 (55.0)	<0.001
Metabolic Syndrome	218 (43.5)	1407 (44.5)	>0.05
High WC (Male≥90 cm; Female ≥80 cm)	333 (66.5)	1816 (71.6)	0.019
High WHR (Male>0.89; W>0.81)]	437 (87.2)	2107 (83.2)	0.025
High WHtR (Male≥0.52, Female≥0.51)	408 (81.4)	1979 (78.1)	0.099
Lower MUAC (≤ 24.5 cm)	38 (7.6)	204 (8.1)	0.72

Biochemical profile

Variables	Pokhara (%)	Gujarat (%)	P-Value
Fasting Blood Sugar (mg/dL) Normal (<110) DM (≥126) Mean ± SD	 450 (89.8) 51 (10.2) 98.0±25.0	 2134 (84.2) 399 (15.8) 108.3±52.4	<0.0001
Triglycerides: Mean ± SD **(mg/dL)**	154.8±48.7	158.1±102.2	0.4784
HDL: Mean ± SD **(mg/dL)**	52.91±9.1	43.68±10.6	<0.0001
LDL: Mean ± SD **(mg/dL)**	99±35.8	122.65±34.6	<0.0001
VLDL: Mean ± SD **(mg/dL)**	30.90±9.7	31.81±20.94	0.3409
Total Cholesterol: Mean ± SD **(mg/dL)**	182.81±38.2	191.02±43.4	<0.0001

Chronological and heart age of the participants

Variables	Pokhara	Gujarat	P-value
Mean CA (SD)	46.5 (12.4)	46.7 (13.2)	0.754#
Mean HA (SD)	48.2 (16.4)	52.7 (19.0)	<0.001$
Mean (Difference) HA-CA (SD)	1.7 (9.4)	5.9 (10.5)	<0.001$

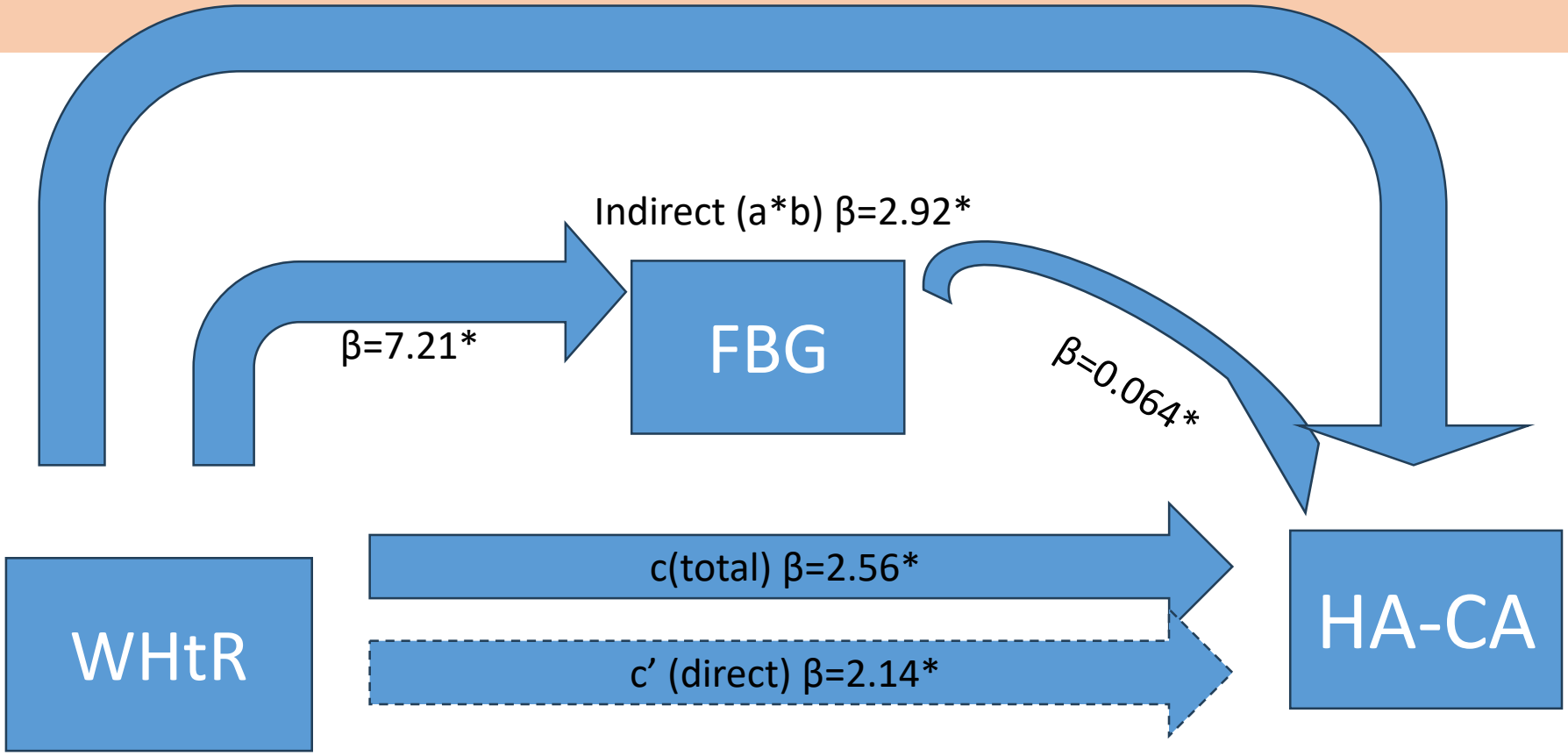
Chi-squared test
$ Independent t-test

Moderation Analysis

Path/effect	#Estimate (β)	SE	95% CI	p-value	Adjusted R^2 (%)
Moderator: FBG					
a: WHtR → FBG	7.21	0.880	5.48 to 8.93	<0.001	2.69
b: FBG → HA-CA	0.064	0.003	0.057 to 0.071	<0.001	11.14
c (total): WHtR → HA-CA	2.56	0.18	1.80 to 2.49	<0.001	8.22
c' (direct): WHtR → HA-CA	2.14	0.18	1.80 to 2.49	<0.001	15.24
$Indirect (a*b)	2.92	0.83	1.30 to 4.54	<0.001	114.1

Standardized and place adjusted; $Bootstrapped 5000 replications

Moderation Analysis



*p<.001

Conclusions

- Despite comparable chronological age, cardiovascular aging differed substantially between populations
- Central adiposity exerted a strong influence on heart age acceleration, predominantly through glycemic pathways

Takeaway message

- Fasting blood glucose (FBG)
  - Is a critical metabolic mederator
  - Should be considered as a population-specific, adiposity-focused strategies for CVD risk assessment in India and Nepal

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THANK YOU for YOUR TIME !!