



Public Symposium

***“Type 2 diabetes in African populations
under transition – The State of the Art”***

Potsdam, Germany

June 7 – 8, 2016

DIFE

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Program

Day 1 - June 7th 2016

10:30-11:15 Registration

11:15-11:30 Welcome and Introduction

Ina Danquah (DIFE)

11:30-13:00 The burden of type 2 diabetes in African populations under transition

(chair: I. Danquah)

Morbidity and mortality of type 2 diabetes in sub-Saharan Africa

Eugene Sobngwi (University of Yaoundé)

Burden of type 2 diabetes in migrant populations

Karien Stronks (AMC, Amsterdam)

Public health implications of the costs of type 2 diabetes in sub-Saharan Africa

Maimouna Ndour Mbaye (Cheick Anta Diop University, Dakar)

13:00-14:00 Lunch Break

14:00-16:00 Risk factors of type 2 diabetes in African populations under transition

(chair: A.P. Kengne)

Genetic risk factors of type 2 diabetes in populations of African origin

Charles Rotimi (NIH, Bethesda)

Cardiometabolic risk and the nutrition transition in West Africa

Helène Delisle (University of Montréal)

Nutrition transition in African migrants in Europe

Cecilia Galbete (DIFE, Potsdam)

Objectively measured physical activity and type 2 diabetes in sub-Saharan Africa

Dirk Lund Christensen (University of Copenhagen)

16:00-16:30 Coffee Break

16:30-17:10 Oral Session 1 (chair: K. Stronks)

Micronutrient intake among Ghanaians living in Europe and their compatriots in Ghana

Lisa Dobbert (University of Potsdam)

Dietary patterns and fatty acid profiles in urban Ghana

Franziska Jannasch (DIFE, Potsdam)



Day 2 - June 8th 2016

09:00-10:30 The double burden of disease (chair: N. Unwin)

Interaction between malaria and type 2 diabetes
Ina Danquah (DifE, Potsdam)

Interaction between HIV and type 2 diabetes
Dinky Levitt (University of Cape Town)

Interaction between tuberculosis and type 2 diabetes
Julia Critchley (St. Georges University, London)

10:30-11:20 Coffee Break

11:20-12:00 Oral Session 2 (chair: H. Delisle)

Double burden of disease and malnutrition in rural Ghana
Marie Aliche (Institute of Tropical Medicine and International Health, Berlin)

Body composition and metabolic risk trajectories in African children –
The BARISTA Study
Rasmus Wibæk (University of Copenhagen)

**12:00-13:00 Adiposity, HbA1c and type 2 diabetes in African populations
(chair: C. Rotimi)**

Relationship between adiposity and type 2 diabetes risk in African
populations: the role of adipokines
Julia Goedecke (South African MRC, Cape Town)

The challenges of diabetes diagnosis in sub-Saharan Africa
Alisha Wade (University of the Witwatersrand, Johannesburg)

13:00-14:00 Lunch

14:00-15:30 Future directions: research, prevention and intervention (chair: E. Sobngwi)

InterConnect – Global data for diabetes and obesity research
Matthias Schulze (DifE, Potsdam)

Community-based prevention programs in sub-Saharan Africa
André Pascal Kengne (South African MRC, Cape Town)

The feasibility of reversing type 2 diabetes: the Barbados Diabetes Reversal
Study
Nigel Unwin (University of the West Indies, Barbados)

15:30 Farewell / Coffee



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Abstracts for Oral Session 1

Micronutrient intake among Ghanaians living in Europe and their compatriots in Ghana
Lisa Dobbert (University of Potsdam)

Dietary patterns and fatty acid profiles in urban Ghana
Franziska Jannasch (DifE, Potsdam)



Micronutrient intake among Ghanaians living in Europe and their compatriots in Ghana

Lisa Dobbert¹, Ina Danquah², Matthias Schulze², Cecilia Galbete² on behalf of the RODAM Consortium

¹University of Potsdam; ²Department of Molecular Epidemiology, German Institute of Human Nutrition Potsdam-Rehbruecke (DIFE), Nuthetal, Germany

Background and aims: Fibre, vitamins and minerals are important nutrients to maintain a healthy body function. In sub-Saharan Africa, micronutrient deficiencies are common. At the same time, fibre and micronutrients have been related to type 2 diabetes. Yet, data on the dietary intake of these nutrients in sub-Saharan Africa and among Africans living in Europe are scarce. Thus, this study aimed at describing the usual daily intake of fibre, vitamins and minerals among adults living in rural and urban Ghana, and among Ghanaian migrants in three European cities.

Materials and methods: In the cross-sectional multi-centre RODAM (Research on Obesity and Diabetes among African Migrants) study, a Ghana-specific Food Propensity Questionnaire was applied to assess the usual daily intake of 134 food groups (g/d) among Ghanaian adults. Using the West African Food Composition Table and the German Nutrient Database, we calculated daily intakes of fibre (g/d) and micronutrients (mg or µg/d). Data are presented as median and interquartile range for the total study population and according to study site, gender, and diabetes status.

Results: In this middle-aged and predominantly female study population (n = 3,810; mean age: 46.2 years; male gender: 36.9%), the median intake of fibre was 34 g/d. This appeared to be higher in rural Ghana, but similar across other study sites. The lowest fibre intake was observed in the diabetes group. Regarding critical vitamins, the main source of retinol-equivalents was β-carotene with median values exceeding the recommended daily intake (RDI) of 5.4 mg/d and the highest intake in rural Ghana. For folate, the median intakes in rural and urban Ghana were below the RDI of 400 µg/d. Folate intake was lowest in the diabetes group, followed by women, participants without diabetes, and men. The median intakes of B-vitamins and vitamins C, D and E were comparable to the corresponding RDIs. Regarding critical minerals, the median intakes of calcium, iron and zinc were below the RDI, whereas this was the opposite for potassium and sodium. The lowest values were observed for the diabetes group, respectively.

Conclusions: Descriptive analysis of the usual daily intakes of fibre, vitamins and minerals are hypothesis-generating and help to inform the evaluation of these nutrients for diabetes status within this adult Ghanaian study population.

Table: Usual daily intakes of fibre, critical vitamins and critical minerals in the RODAM study population

Nutrient	Total (n = 3,810)	Non-T2D (n = 3,451)	T2D (n = 359)*	RDI**
Fibre [g]	34.1 (26.5-44.6)	34.5 (26.7-44.8)	30.7 (25.2-41.5)	>30
β-carotene [mg]	18.3 (12.3-32.8)	18.6 (12.5-32.9)	16.6 (10.8-31.4)	men 6; women 4.8
Retinol equivalents [µg]	2198.2 (1487.8-4105.5)	2208.7 (1496.4 - 4091.9)	2106.0 (1432.6 - 4156.1)	men 600; women 500
Vitamin A [µg]	139.5 (76.2-446.4)	138.7 (77.3 - 442.7)	154.0 (62.4 – 475.0)	men 600; women 500
Folate [µg]	327.2 (257.7-447.2)	328.2 (259.1 - 448.6)	316.3 (245.2 - 441.1)	400.0
Sodium [g]	2742.7 (2141.6-3599.5)	2.7 (2.1-3.6)	2.7 (2.1-3.6)	2.0
Iron [mg]	16.5 (13.1-22.2)	16.7 (13.2-22.3)	15.3 (12.1-21.4)	men 13.7; women 29.4
Zinc [mg]	11.9 (9.3-15.3)	12.0 (9.4-15.3)	11.0 (8.5-14.5)	men 14.0; women 9.8

*defined as self-reported diabetes or fasting glucose >7 mmol/L or documented anti-diabetic medication

**Recommended Daily Intake according to World health Organization



Dietary patterns and fatty acid profiles in urban Ghana

Franziska Jannasch¹, George Bedu-Addo², Matthias B. Schulze¹, Frank P. Mockenhaupt³, Ina Danquah¹

¹German Institute of Human Nutrition Potsdam-Rehbruecke (DifE), Department of Molecular Epidemiology, Nuthetal, Germany; ²Komfo Anokye Teaching Hospital, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana; ³Institute of Tropical Medicine and International Health, Charité – University Medicine Berlin, Berlin, Germany

Background and aims: Sub-Sahara Africa is facing an emergence of type 2 diabetes (T2D). Urbanization and lifestyle changes, including diet, are among the causes. In urban Ghana we have identified two relevant dietary patterns: The 'purchase' pattern (rich in vegetable oil and ready-made foods) was inversely associated with T2D; this was the opposite for the 'traditional' pattern (rich in fish and palm oil). Changes in food preparation, such as frying and new food processing could partially explain these findings. Thus, we analyzed proportions of fatty acids (FAs) in serum phospholipids and investigated their associations with the dietary patterns and with biomarkers of dyslipidemia, possibly on metabolic pathways to T2D.

Methods: In 653 adult Ghanaians, 28 FAs were measured by gas chromatography. After the construction of dietary patterns by factor analysis, we examined the distribution of FAs across the tertiles of the pattern scores. In multiple linear regression models, standardized beta coefficients (β) for the association of pattern scores with FAs were calculated. Adjusted means of serum triglycerides, HDL cholesterol and LDL cholesterol were calculated across the tertiles of those FAs, which were significantly associated with dietary patterns.

Results: Proportions of the serum FAs were for saturated FAs (SFA) 52%, for mono-unsaturated FAs (MUFAs) 12%, for n-3 polyunsaturated FAs (n-3 PUFAs) 9%, n-6 polyunsaturated FAs (n-6 PUFAs) 27% and for trans FAs <1% (figure). The 'purchase' pattern was associated with lower proportions of n-3 PUFAs (β : -0.25, $p < 0.0001$) and higher proportions of linoleic acid (β : 0.24, $p < 0.0001$). The 'traditional' pattern was associated with lower proportions of arachidic acid (β : -0.10, $p = 0.001$). SFAs were associated with lower concentrations of triglycerides, LDL-cholesterol and HDL-cholesterol. Linoleic acid was inversely associated with triglycerides, but positively associated with HDL-cholesterol and LDL-cholesterol. Also, n-3 PUFAs were related to higher concentrations of HDL-cholesterol, LDL-cholesterol and partly triglycerides.

Conclusions: In this urban Ghanaian population, neither SFAs nor trans FAs seem to be responsible for the association of the dietary patterns with T2D. However, the association of linoleic acid with the biomarkers of dyslipidemia was favorable and could therefore give an explanation for the inverse association of the 'purchase' pattern with diabetes. To clarify the association of the n-3 PUFAs with the biomarkers further research will be required.

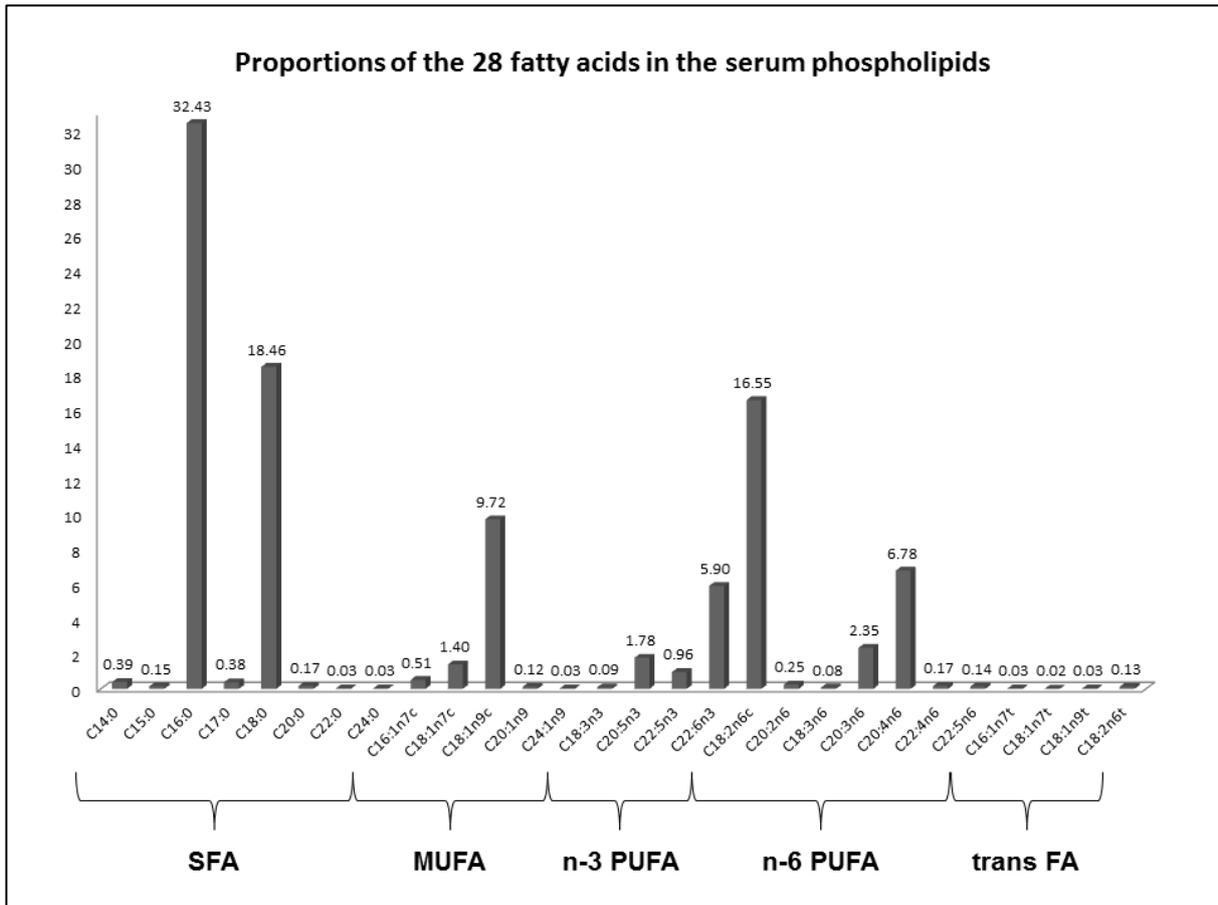


Figure: The proportions of 28 fatty acids in serum phospholipids of urban Ghanaian adults



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Abstracts for Oral Session 2

Double burden of disease and malnutrition in rural Ghana

Marie Aliche (*Institute of Tropical Medicine and International Health, Berlin*)

Body composition and metabolic risk trajectories in African children – The BARISTA Study

Rasmus Wibæk (*University of Copenhagen*)



The double burden of malnutrition and disease among adolescents in rural Ghana: A cross-sectional study

Marie Aliche¹, Andrea Henze², Justice Boakye-Appiah³, Jalil Inusah³, Markus van der Giet⁴, Matthias B. Schulze⁵, Florian J. Schweigert², Frank P. Mockenhaupt¹, George Bedu-Addo³, Ina Danquah⁵

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Background and aims: In sub-Saharan Africa, overnutrition and metabolic diseases appear to gradually supersede persistent health problems like infections as well as macro- and micronutrient deficiencies. This process creates a double burden of malnutrition as well as of disease. But due to rare data on different age groups, regions, gender, and on individuals rather than communities, the actual composition of the double burden and its victims remain unknown. Thus, the study's aim was to determine the proportions of each burden among adolescents in rural Ghana.

Methods: In a cross-sectional study in Agogo in 2015, we collected demographic and medical data of 201 adolescents, and measured anthropometrics and blood pressure. Hemoglobin, CRP, ferritin, retinol, *Plasmodium* species, and fasting plasma glucose were analyzed. Resulting clinical conditions were assessed by age- and sex-specific reference values, whenever available.

Results: In 188 adolescents (males, 50%; mean age, 15.1 years) the proportions for common deficiencies were for iron deficiency 4%, anemia 31%, vitamin A deficiency 36%, underweight 7%, and stunting 15%. As to infection, malaria was diagnosed in 41%, and 7% reported current symptoms compatible with an infection. Overweight or obesity was present in 7%. Regarding metabolic traits, impaired fasting glucose was observed in 1%, hypertension in 9%. Nutrient deficiencies or infections as persistent problems occurred more often among boys than girls (81% vs. 67%, $p < 0.032$). Otherwise, overnutrition tended to affect females more frequently (4.3 vs. 10.6%, $p > 0.096$).

Conclusions: Among adolescents in rural Ghana, nutrient deficiencies and infections still predominate, while overnutrition and related metabolic conditions are already discernable. The importance of gender distinctions requires further investigation.



Table: Proportions of diseases and malnutrition among rural Ghanaian adolescents

Proportion of the burden	male (n=94)	female (n=94)	total (n=188)
Communicable diseases	61.2	35.1	45.2
Non-communicable diseases	10.6	8.5	9.6
Undernutrition	73.4	54.3	63.8
Overnutrition	8.5	14.9	11.7
Old burden (undernutrition and communicable diseases)	47.9	22.3	35.1
New burden (overnutrition and non-communicable diseases)	1.1	2.1	1.6
Double burden of disease	8.5	1.1	4.8
Double burden of malnutrition	5.3	4.3	4.8

Data are presented as percentages.

**Body composition and metabolic risk trajectories in African children – The BARISTA Study**

Rasmus Wibaek^{1,2}, Tsinuel Girma³, Bitiya Admassu⁴, Mubarek Abera⁵, Pernille Kæstel¹, Dorte Vistisen², Marit Eika Jørgensen², Jonathan CK Wells⁶, Kim F Michaelsen¹, Henrik Friis¹, Gregers Stig Andersen²

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Background and aims: When measured with simple anthropometrical methods, growth patterns in early life have been associated with later risk of Type 2 Diabetes (T2D), cardiovascular disease (CVD) and obesity, but these associations are yet to be fully understood. Early in life, differences in fat and lean mass accretion may indicate significant metabolic changes in childhood. We designed a study to test the hypothesis that body composition growth trajectories in early life predispose changes in risk markers of T2D, CVD and obesity measured in 5-6 year old Ethiopian children.

Methods: Using air-displacement plethysmography, fat- and lean mass accretion from birth to 6 months of age were measured in the iABC birth cohort comprising 600 Ethiopian infants enrolled at birth. Latent Class Modelling (LCM) was used to identify groups with distinct 0-6 month fat growth trajectories. In subsequent analysis, these distinct fat growth groups will be fitted in adjusted mixed-effects models with different risk factors for metabolic disease measured at 5 years (blood pressure, haemoglobin, fasting blood glucose, glycosylated haemoglobin (HbA1c), insulin resistance index (HOMA-IR), cholesterol (HDL, LDL) and triglycerides) as dependent variables.

Results: The LCM identified four distinct groups of fat growth trajectories from birth to 6 months, characterised as high, upper-intermediate, lower-intermediate and catch-up fat growth (figure 1). Infants characterised as catch-up fat growers end up on an upward trajectory whereas the other fat growth groups level off around 5 months of age. Once data collection for the 5-6 year follow-up is completed, we will examine whether these 4 distinct fat growth trajectories are associated with different levels of childhood risk markers of T2D, CVD and obesity. Currently, we have collected blood samples from 300 of the planned 400 children.

Conclusions: These results demonstrate that fat accretion in the first 6 months of life is heterogeneous and that catch-up fat growers have an upward trajectory at 6 months. Identification of early-life correlates of risk markers of T2D, CVD is essential for the prevention of these diseases, especially in low- and middle income countries, where maternal and infant undernutrition is highly prevalent in combination with increasing levels of obesity and sedentary lifestyle.

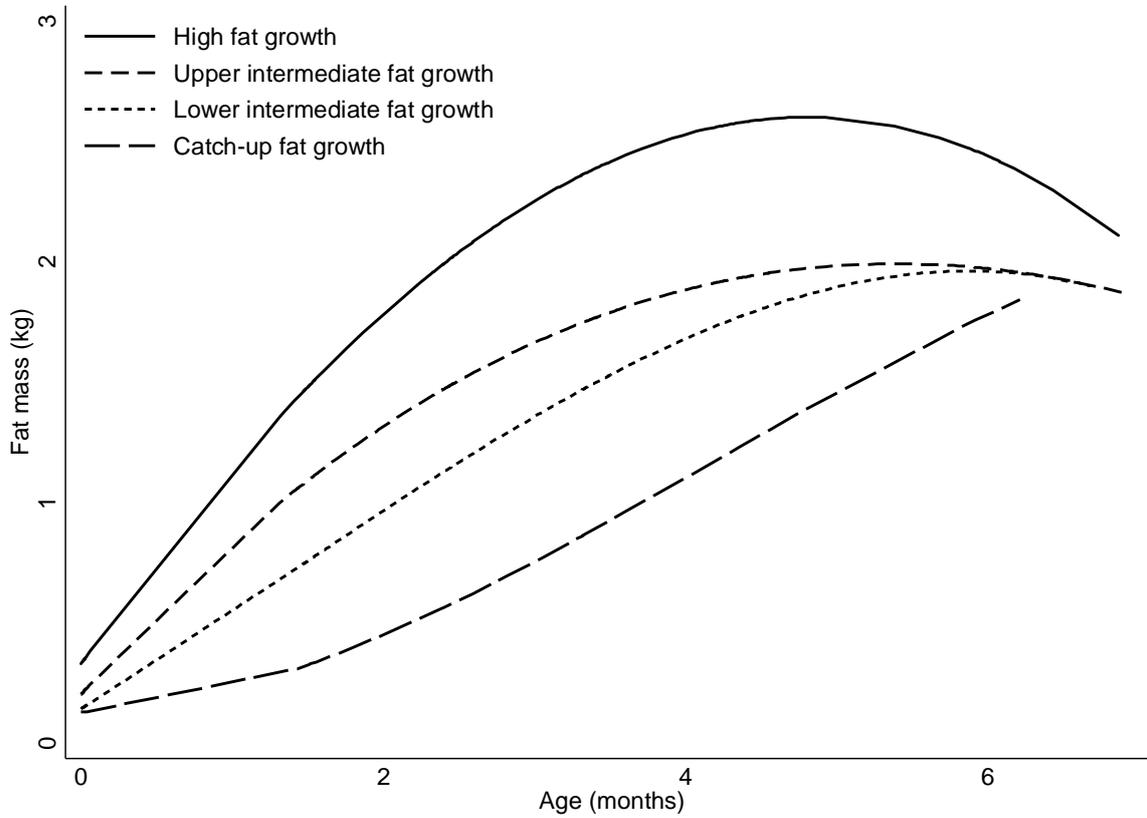


Figure: Four distinct fat mass accretion trajectories from birth to 6 months of age.



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Venue

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