

Global Leadership Training Programme in Africa 2018

Activity Report of Field Research

Relationship between Agrodiversity, Nutrition and Daily-activity in rural Kenya Kenta HARA¹

¹ International Agriculture Development, Tokyo University of Agriculture. The author was supervised by Dr. David Mungai, Wangari Maatai Institute, University of Nairobi during the duration between September 2018 to May 2019.

I. Summary

Lifestyle-related diseases were defined as "a group of diseases in which lifestyle habits such as eating habits, exercise habits, rest, smoking, and drinking alcohol involved in the onset and progression of such". Pathogens, harmful substances, and genetic factors affect the onset and progression of the disease, moreover, it has become clear that eating habits, exercise weeks, how to take rest, lifestyle habits such as preferences, diabetes, hypertension are also deeply involved in the onset and progression of many diseases such as cancer, stroke, and heart disease, which were major causes of Japanese death.

The recent increase in obesity in developed countries is now spreading to developing countries. In response to the site, WHO has announced guidelines for the prevention of lifestyle-related diseases. However, the development of policies and concrete action plans in developing countries have been delayed. When you look at the guidelines on lifestyle-related disease prevention in developing countries, there is a description such as "Please make it a practice run for one hour a day" and it is considered effective for lifestyle-related disease prevention in urban areas. A lifestyle centered on rural agriculture cannot be considered effective.

Agriculture in developing countries is thought to be related to income, diet and physical activity, but few reports have discussed their relevance from the perspective of preventing lifestyle-related diseases. In my research, it was investigated how agricultural biodiversity, food intake and activities were related to the degree of obesity in rural areas in the Republic of Kenya, and I aimed to carry out health promotion strategy through agriculture.

In this survey, I surveyed 10 households living in Vihiga county in rural Kenya, focusing on the distance to the market. In each 5 households in each place, 24-hour meal survey by a recall method, activity survey using Fitbit, and I conducted an agricultural biodiversity assessment using a questionnaire for Luamda village with walking access to the local market and Emuhya village using bikes or cars to the local market.

As a result, there were significant differences in BMI and body fat percentage in different regions. In addition, as a result of conducting multiple comparison test from all samples, it was shown that the result is that the number of steps and the number of steps were indirectly related to the body fat percentage.

The research was promoted by introducing Dr. David Mungai of Nairobi University through UNU. It is necessary to conduct an ethics review through the university for research on human subjects, and a lot of time was spent on the application. In addition, a lot of time was spent on research permission to proceed with procedures based on the ethics review. In the future, I continued research through this research permit. I received great support from the UNU and local universities, and conducted procedures and implementation of research on the site. From now on, the number of subjects were increased and investigation were continued, and changes in physical characteristics and lifestyle changes were clarified comparing different seasons.

1. 緒言：

生活習慣病は「食習慣、運動習慣、休養、喫煙、飲酒等の生活習慣が、その発症・進行に関与する疾患群」と定義されます。病原体や有害物質、さらに遺伝的な要素は、疾病の発症や進行に影響するが、食習慣、運動週間、休養の取り方、嗜好など生活習慣も、糖尿病、高血圧、さらには日本人の3大死因である癌、脳卒中、心臓病など多くの疾病の発症や進行に深く関わっていることが明らかになっている。

昨今、先進国で増加している肥満は開発途上国にも広がっている。その状況を受けて WHO では、生活習慣病の予防に向けた指針を発表した。しかし、開発途上国での政策の作成や具体的な実行プランの作成などは遅れている。実際に開発途上国の生活習慣病予防についてガイドラインを見ると、「1日1時間ランニングを習慣付けてください」などの記述があり、都市部での生活習慣病予防には有効と考えられるが、農村部の農業を中心とした生活様式には有効とまでは言い切れない。

開発途上国における農業は、収入及び食事、身体活動に関係していると考えられるが、それらの関連性を生活習慣病の予防の視点から論じた報告はほとんどない。私の調査では、ケニア共和国における農村地域の肥満度に対して、農業生物多様性、食摂取、活動量がどのように関係しているかを調査し、農業を通じたヘルスプロモーション実施に向けた基礎的情報を収集することを目的にした。

本調査では、マーケットまでの距離を軸にケニア農村部のビヒガ郡で生活しているの農家 10 世帯に対して調査を行なった。ローカルマーケットへ歩きでアクセスできる Luamda 村とローカルマーケットへバイクや車などを使用する Emuhaya 村に対して各 5 件ずつ、身体的特性、24 時間思い出し法による食事調査、Fitbit を用いた活動量調査、質問表による農業生物多様性評価を行なった。

その結果、異なる地域で BMI 及び体脂肪率に有意な差があった。また、全サンプルから多重比較検定を行なった結果、間接的であるが体脂肪率に歩数、歩数が作物生産の多様に関連性があるという結果を示した。

国連大学を通じてナイロビ大学の Dr. David Mungai を紹介いただき研究を進めた。人を対象とした研究のため、大学を通じた倫理審査を行う必要があり、その申請に多くの時間を割いた。また、その倫理審査を基に手続きを進める研究許可に関しても多くの時間を割いた。今後は、この研究許可を通じて研究調査を継続して進めていく。

国連大学及び現地大学からは多大なサポートをもらい、現地での研究調査の手続きと実施を行なった。今後は被験者数を増やして調査を継続し、異なる季節を比較した身体的特性の変化や生活様式の変化についても明らかにしていく。

II. Research Activity

Introduction

According to a report from Lancet, global obesity is expected to increase in the next two decades (NCD Risk collaboration, 2014). In Kenya, the cause of death is also expected to change dramatically from communicable diseases to NCDs (Health Metrics and Evaluation in 2016). Previous research has shown that obesity in urban areas was higher than in rural regions in Kenya (Mbochi et al., 2012). However, this research just questions the nutritional state and daily activity. Dietary factors and physical activity patterns strongly influence overweight and obesity among adults and can be considered to be the major modifiable factors. Obese subjects spent less energy in their daily lives and the common activities preferred by most of the obese subjects were sedentary activities like watching T.V., reading books, socialization and more sitting in working hours (Sharma et al., 2017). Moreover, agrobiodiversity from agriculture has been suggested to influence the dietary diversity in a rural area (Kibrom et al., 2015). Agriculture also provides opportunities for physical activity in rural areas. Studies in Burkina Faso provide data on seasonal and gender differences. The research data showed that there was a higher energy expenditure in the rainy season than in the dry season (Bleiberg et al., 1980), and women had a lower food intake and high energy expenditure of agriculture than men in rural regions (Bleiberg et al., 1981). However, previous studies do not consider agriculture for the prevention of NCDs. They do not consider nutrition, cultivation, and daily-activity in the same study period. This study aims to find out the relationship between food intake, agrobiodiversity and activity level through agriculture in a rural and peri-urban setting in Kenya for the prevention of non-communicable diseases such as obesity and hypertension.

Study Area

Study design:

The study was a cross-sectional study design and applied among farmers in rural and peri-urban urban settings.

Study sites:



Vihiga and Kitui were selected because they represent rural/agricultural areas in Kenya with different social-cultural and agro-ecological conditions. They were also selected because of being research sites for Bioversity International and have some necessary data/information relevant to the study. Kiambu was chosen because it is a peri-urban site. It is expected that urbanization has an influence on dietary

diversity and daily activity associated with the commercialization of agricultural production in the study site. The study was conducted in rural setting areas of Vihiga county (362 km from Nairobi) and Kitui county (254 km from Nairobi) and peri-urban setting area in Kiambu county (16 km from Nairobi).

I was going to utilize study sites of Bioversity International, such as Vihiga and Kitui. And for Kiambu, I got support from the Wangari Maathai Institute at the University of Nairobi.

Selection of villages:

In each of the study counties, villages were purposively selected. Because I was going to compare the differences between the rural setting and peri-urban setting, and also I used previous research sites. Hence the study was conducted in Kaumbuni (rural) village in Kitui county, Esalwa (rural) village in Vihiga and Wangige (peri-urban) village in Kiambu county.

Methodology

Selection of households:

Household listing was obtained from the local administration. With the help of the village elders, households who practice farming and have both husband and wife at home were selected to participate in the study. I was going to visit each household house to inform them of our research purpose and procedures. And also, I was going to collect data in each household house.

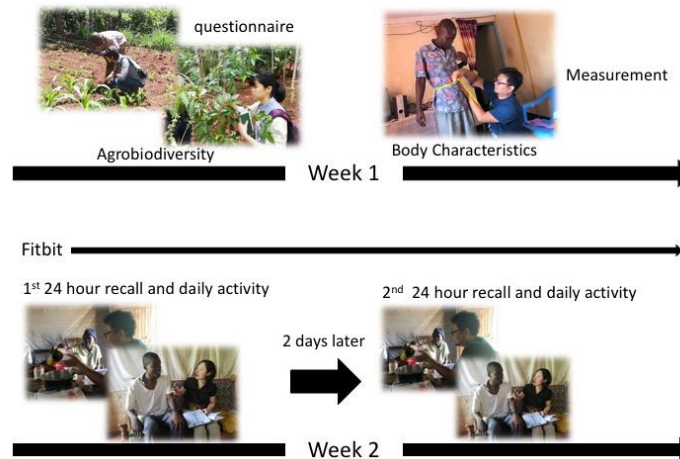
From the sample size, I selected 55 to 56 households in each place randomly. Trained research assistants approached respondents in selected villages in Kiambu, Kitui, and Vihiga counties, and informed them about the opportunity to participate in this study. If they were interested in participating, the research assistants asked questions to check their eligibility for the survey by asking their names, age, and ethnic group. If respondents meet the inclusion criteria, I obtained informed consent.

Measurement and Data collection procedure:

Our Trained Researcher (Nutritionist and Scientist) conducted the body measurement, nutritional, and agricultural questionnaire. The measure was held in Each participant's house. And I made the Identification code for each participant because I conducted this under anonymity.

I conducted face-to-face interviews using a structured questionnaire with participants. Interviews were conducted in a separate room at selected facilities. On the morning of the first day, body characteristics such as height, weight, waist, and hip circumference were determined using tape-measures, weight scales, and body fat meters in household house. Secondly, Researchers asked participants about social economics and demographic information of members in the house. Thirdly, the interviewers interviewed and observed agrobiodiversity in the house and farming field. Fourthly, participants wear Fitbit on the un-dominant arm. On the morning of the second day, I collected dietary diversity through a 24-hour recall method in the house. I received dietary diversity for 5days. Fitbits were collected on the morning of the final day of the survey.

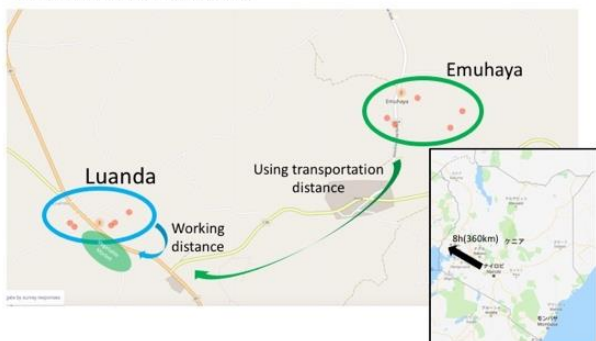
Sampling Method



Research Findings

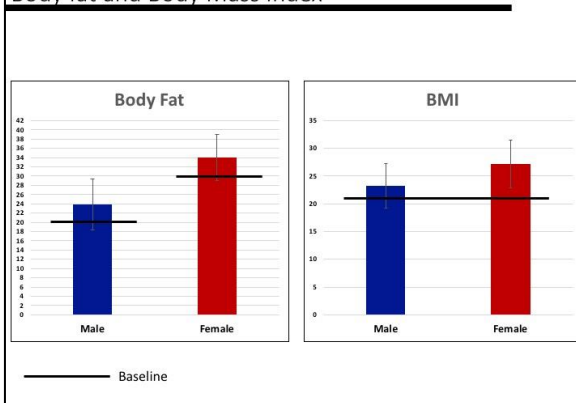
Method : location and sample population

Location: Emuhaya and Luanda, Vihiga, Kenya
 10 household (men: 10 people, female 10 people)
 Differences of Accessibility on Market



In this visiting, I could conduct research in Vihiga county. Participants collected randomly by Community Health Volunteers (CHV). 5 households were selected from Luanda Village which is walking distance from house to vegetable market. Another 5 households were selected from Emuhaya Village which was using transportation distance from house to vegetable market.

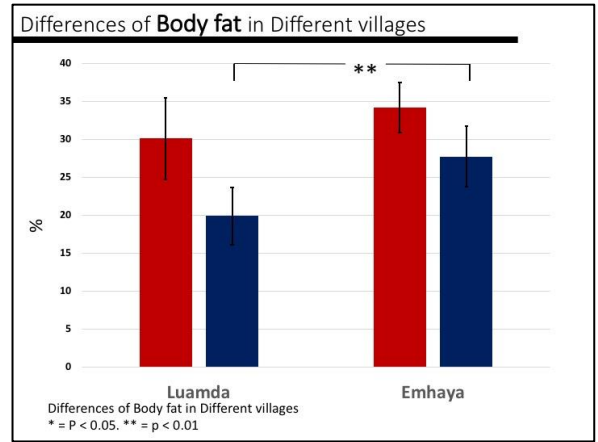
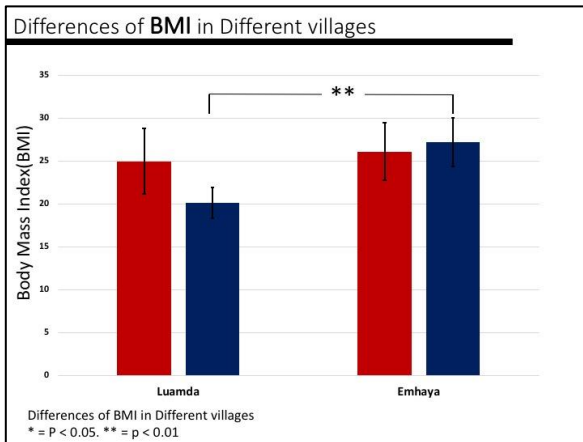
Body fat and Body Mass Index



First, I show the research results of comprising of male and female. Male and female average of BMI was a bit high of the baseline of BMI. Male BMI was 23.7 (± 4.3) and female BMI was 25.6 (± 3.5) in this survey. And Body fat also higher than baseline in both of sex. Male body fat was 23% ($\pm 5.5\%$) and Female body fat was 32% ($\pm 4.7\%$) in different villages. However, other Agrobiodiversity and Nutritional indicators such as Steps, Activity time, Cultivation diversity, Intake energy etc. do not have significant differences between both sexes.

In comparing of different accessibility, male Emuhaya group (20.1 ± 1.8) was higher than male Luanda group (27.2 ± 2.9), and also body fat of male Emuhaya (19.9 ± 3.8) was higher than Luanda group (27.2 ± 4.0). however, other indicators were not significant differences in the survey. To clarify the relation between cause and effect for BMI and

Body fat, I used the statistic method of multivariate analysis. I suggested that Steps Average of a day related to Body fat in both villages and Vegetable diversity of Crops related to Steps Average of a day through multiple regression analysis. BMI was no significant relationship between nutrition and agriculture factors.



Pre-survey by Research Assistant



Pre-survey by Research Assistant



Pre-survey by Research Assistant



Measurement by KENTA HARA



Measurement by KENTA HARA

Discussion

The following points were clarified in this survey.

1. Market access has been suggested to affect the health status of farmers living in Kenya.
2. In the area away from the market showed that body fat percentage was significantly high.
3. The body fat ratio in rural Kenya was related to the number of steps, and it was suggested that the number of steps was causally related to various crop production.

From the above, it was inferred that crop production, such as corn, rice, and straw, increases the amount of activity and causes the increase of the burning of body fat in the rural area of Kenya. However, since there was no significance such as the number of steps due to market access, I would like to clarify the increase in momentum through agricultural activities in the future.

Conclusion

In rural areas of Kenya, agriculture was considered to be beneficial for health maintenance, and in particular, it was thought to be related to conservation and reduction of body fat. Although indirect, the results show that the number of steps was associated with a variety of crop production in the body fat percentage. Also, health promotion in developing countries was suggested to be carried out in agriculture, and it was essential not only medicine but also agriculture in terms of preventive medicine in maintaining physical health.

Acknowledgement

I would like to thank Dr. David Mungai for useful support and discussions. I was grateful to all staff of Wangari Maathai Institute, University Nairobi for supporting letter development and my research life. And also, I would like to say thanks to Dr. Rose Opiyo for providing with me your knowledge of public health study. Finally, I thank the county villagers in Vihiga and Kimabu to participate in my research.

References

- Abegunde, D. O., Mathers, C. D., Adam, T., Ortegón, M., & Strong, K. (2007). The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet*, *370*(9603), 1929–1938. [https://doi.org/10.1016/S0140-6736\(07\)61696-1](https://doi.org/10.1016/S0140-6736(07)61696-1).
- Azadbakht, L., Mirmiran, P. & Azizi, F. Dietary diversity score is favorably associated with the metabolic syndrome in Tehranian adults. 1361–1367 (2005). doi:10.1038/sj.ijo.0803029
- Aziz, S., Noorulain, W., Zaidi, U., Hossain, K., & Siddiqui, I. A. (2009). Prevalence of overweight and obesity among children and adolescents of affluent schools in Karachi. *Journal of Pakistan Medical Association*, *59*(1), 1–3. Retrieved from <http://jpma.org.pk/PdfDownload/1597.pdf>.
- Bleiberg, F. M., Brun, T. a, Goihman, S., &Gouba, E. (1980). Duration of activities and energy expenditure of female farmers in dry and rainy seasons in Upper-Volta. *The British Journal of Nutrition*, *43*(1), 71–82. <https://doi.org/10.1079/BJN19800065>.
- Bleiberg, F., Brun, T. A., Goihman, S., & Lippman, D. (1981). Food intake and energy expenditure of male and female farmers from Upper-Volta. *British Journal of Nutrition*, *45*(3), 505–515. <https://doi.org/10.1079/BJN19810129>.
- Coates, J. C., Colaiezzi, B. A., Bell, W., Charrondiere, U. R., & Leclercq, C. (2017). Overcoming dietary assessment challenges in low-income countries: Technological solutions proposed by the international dietary data expansion (INDDEX) project. *Nutrients*, *9*(3), 1–15. <https://doi.org/10.3390/nu9030289>
- De Vito, E., La Torre, G., Langiano, E., Berardi, D., & Ricciardi, G. (1999). Overweight and obesity among secondary school children in Central Italy. *European Journal of Epidemiology*, *15*(7), 649–654. <https://doi.org/Doi 10.1023/A:1007675005395>.
- Jayawardena, R., Byrne, N. M., Soares, M. J. & Katulanda, P. High dietary diversity is associated with obesity in Sri Lankan adults : an evaluation of three dietary scores. (2013). doi:10.1186/1471-2458-13-314
- Jones, A. D., Shrinivas, A. & Bezner-kerr, R. Farm production diversity is associated with greater household dietary diversity in Malawi : Findings from nationally representative data. *J. FOOD POLICY* *46*, 1–12 (2014).
- Kim, E. K., Yeon, S. E., Lee, S. H., &Choe, J. S. (2015). Comparison of total energy expenditure between the farming season and off farming season and accuracy assessment of estimated energy requirement prediction equation of Korean farmers. *Nutrition Research and Practice*, *9*(1), 71–78. <https://doi.org/10.4162/nrp.2015.9.1.71>.
- Kamau-Mbuthia, E., & Elmadfa, I. (2007). Diet quality of pregnant women attending an antenatal clinic in Nakuru, Kenya. *Annals of Nutrition & Metabolism*, *51*(4), 324–330. <https://doi.org/10.1159/000107674>
- Lachat, C., Otchere, S., Roberfroid, D., Abdulai, A., Maria, F., Seret, A., ... Kolsteren, P. (2013). Diet and physical activity for the prevention of noncommunicable diseases in low- and middle-income countries : A systematic policy review, *10*(6). <https://doi.org/10.1371/journal.pmed.1001465>.

- Mbochi, R. W., Kuria, E., Kimiywe, J., Ochola, S., & Steyn, N. P. (2012). Predictors of overweight and obesity in adult women in Nairobi Province, Kenya. *BMC Public Health*, 12(1), 823. <https://doi.org/10.1186/1471-2458-12-823>
- Risk, N. C. D., & Collaboration, F. (2014). Articles trends in adult body-mass index in 200 countries from 1975 to 2014 : a pooled analysis of 1698 population-based measurement studies with 19 · 2 million participants. *The Lancet*, 387(10026), 1377–1396. [https://doi.org/10.1016/S0140-6736\(16\)30054-X](https://doi.org/10.1016/S0140-6736(16)30054-X).
- Rwandan Diabetes Association. (2016). Annual report. Retrieved from <http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/131377/filename/131588.pdf>.
- Sibhatu, K. T., Krishna, V. V., & Qaim, M. (2015). Production diversity and dietary diversity in smallholder farm households. *Proceedings of the National Academy of Sciences*, 112(34), 10657–10662. <https://doi.org/10.1073/pnas.1510982112>
- WHO. (2013). Global burden of disease related to second-hand smoke. *World Health Organization*, 102. https://doi.org/978_92_4_1506236
- WHO. (2018). Factsheet of Health Statistic. World Health Organization

III. Reflection to the GLTP in Africa

o Your motivation to participate in the GLTP

Africa is not only for the research and arts but also for the interclass business market. However, it is not easy for Japanese people to access and understand about Africa due to distance and security concern. GLTP supported my activity to understand African culture and challenges through the research activity. And GLTP fully supported to identify the host university and supervisor. That support influenced global leadership development in my mind and activity. That's why I participated in this program to develop a career path and my global leadership skills.

Research in Africa is desperate for financial and research support. In this program, research can be carried out jointly with universities that have a partnership agreement with UNU. It is my personal opinion, but if I couldn't participate in the GLTP program, I couldn't investigate in Kenya. Research activities aimed at realizing the SDGs through research were also very attractive. I conducted research in a way that contributed to the goal of SDGs Goal 3, "Health for all".

O Field experiences

In Kenya, there were many barriers to entering the field survey. When conducting human-related research in Kenya, it is necessary to apply for ethics, permit for research, and permit for the target area. In my case, I spent eight months in the process of obtaining this permission. During that time, I could not do a concrete survey. Also, this case was the same for other participants.

In the field survey, I faced many linguistic and local knowledge difficulties, so I conducted a survey with a team of students who graduated from Nairobi University, the host university. As the farmer is targeted in the field, I think that it is necessary to consider the morning time or the evening time to be suitable for the survey. Although the lives of local people cannot be fully explained numerically, understanding the local language is also important for the research to proceed smoothly, and I took a Swahili class once a week to improve communication among local people. Transportation costs squeezed the cost of living as it required to use Uber to travel Nairobi and outside Nairobi.

Large-scale field surveys were not possible during the stay. However, I was able to do activities such as establishing relationships with research assistants and conducting preliminary research for future research. Currently, Kenya conducts a large-scale survey, but the research can be conducted smoothly based on the human relationships established within the GLTP program.

O Challenges

1. Research activities in Kenya required many permits and took longer to process than other African countries. For human-centered research, it is necessary to obtain an ethics review from a nationally recognized ethics review committee, then apply for research permission from the Research Organization, and then obtain permission for the planned site. I used about 8 months to get this permission. After obtaining this application, it was possible to apply for a research VISA for the first time, but the application is still in progress.

2. The upper limit should be reviewed by the program, as a three-month master's stay costed approximately 800,000 yen. Naturally, students who stay for 8 months were higher than that amount. We think that it is necessary to review the setting of the amount according to the length of stay and the process. But without this support, it was difficult to stay for a long time, so I am very grateful.

3. Since local arrangements cannot be made without going on-site, contact with a supervisor should be promoted at an early stage.

O How to make use of this experience to your future career development

Through this experience, I was able to understand the differences in knowledge and culture for Africa. In the future, I would like to do research and business development in Africa. This experience gained the ability to understand and implement what kind of arrangements were needed for research in developing countries. I also had the opportunity to stay at an international organization, so it became more practical experience for my future career. In addition, because I was able to understand local issues through research, I also gained knowledge about problem-solving businesses.

O Encouragement to other students

Living a research life in Africa is a very valuable experience in life. I can also feel the difficulty and fun of studying in different cultures. As GLTP expands to be more mutual, I would like to promote research and interaction with local people. I would like African people to understand Japan through GLTP and build a partnership so that many people as possible can study in Kenya.



Pre research in University of Nairobi
by KENTA HARA



Discussion with Dr.David Mungai in
University of Nairobi by KENTA HARA