

論文の内容の要旨

論文題目 The Double Burden of Malnutrition within Household:
 An Investigation of Diet and Physical Activity in West Java, Indonesia
 (世帯内で生じる栄養不良の二重負荷
 —インドネシア・西ジャワにおける食事・身体活動の調査—)

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General Background: As a consequence of an increase in overnutrition that is not proportional to the decrease in undernutrition, many developing countries are now simultaneously faced with an increasingly high prevalence of overnutrition together with persistent undernutrition. This coexistence of undernutrition and overnutrition is termed the “double burden of malnutrition”. In the last decade, increasing attention has been paid to the emergence of the double burden of malnutrition within households, that is, the coexistence of overnutrition and undernutrition among the members of a single household, as a seemingly paradoxical phenomenon. This study, in search of the mechanisms, comprises two chapters: a review of earlier studies about the double burden within households, and an investigation of data collected in a field survey in West Java, Indonesia.

[Chapter 1: A review]

Background: Despite the increasing attention being focused on the double burden within households, as yet, to the best of my knowledge, there have been no review articles, either narrative or systematic, that have focused primarily on this topic published in scientific journals.

Objectives: To provide an overview of the current situation of the double burden of malnutrition within households and the research that has occurred on it, by reviewing previous studies focusing on the trends in the prevalence, associated factors and the research methods used in the studies.

Data Sources and Study Selection: Studies were identified from the PubMed and Web of Science electronic databases using “(dual OR double) burden (malnutrition OR household)” as the search terms. When assessing eligibility, literature cited in retrieved articles was also screened and added to the pool of articles to be examined. The eligibility criteria were: literature where the author(s) conducted an original analysis either using secondary data or based on an original survey; literature that reported the prevalence of households with a double burden of malnutrition; literature published by the end of June, 2015; and literature where a full-text version was available in English.

Data Extraction: Information was extracted using a data extraction form that included: publication information; data information (country/area, data source, year of data collection, characteristics and number of subjects); analytical methods (combination of under- and overnourished persons, age range, nutritional indicators and cutoffs); and results (number and prevalence of double burden households/pairs and associated factors).

Results: A total of 35 articles were identified as being eligible for inclusion, and 367 sets of prevalence data were extracted. Among the articles, 34 were published in 2000 or later, 23 used secondary data, and 25 focused on mother-child pairs. All of the studies used body mass index (BMI) for adults. For children, 24 studies used height for age and 9 used weight for age. Among 70 countries assessed in the studies, 37 were in Africa. The national prevalence varied from 0.0% to 26.8% by country, year, age range, and nutritional indicators and cutoffs used. The prevalence increased in 27 of the 42 countries that were analyzed across multiple years in a comparative way. Nineteen studies assessed associations between double burden households/pairs and urban residence, income or maternal/household heads' education.

Discussion: In the comparative analyses, an increasing trend was found in the prevalence of double burden households/pairs. However, few studies were directly comparable due to differences in the combinations of under- and overnourished persons, nutritional indicators and cutoffs, age range. While many studies focused on African countries, Asian countries were studied less often. Although urban residence, income and education were frequently assessed, the role of intermediate factors for nutritional status, such as diet and physical activity, remains unclear. It is recommended that future studies should use comparable indicators and cut-offs, study Asian countries and also investigate individual dietary intake and physical activity.

[Chapter 2: The results of a field survey in West Java, Indonesia]

Background: Although earlier studies have reported household characteristics that were associated with the double burden within households, the mechanisms underlying the emergence of the double burden within households remain unclear. One of the methodological gaps in previous studies is the failure to examine dietary intake and physical activity as intermediate factors between household characteristics and the nutritional status of the members. In Indonesia, an increasing trend of overnutrition and the existence of households with a double burden have been observed.

Objectives: To investigate the mechanisms of the double burden of malnutrition within households by the quantitative evaluation of diets and physical activity in rural and urban areas in West Java, Indonesia.

Methods: Field surveys were conducted in two urban communities in *kota* Bandung and two rural communities in *kabupaten* Sumedang for a total of 23 weeks in 2014 and 2015. Questionnaire-based interview information and anthropometric data were collected for 486 individuals in 145 households. Based on individual nutritional status, households with at least one overnourished individual and at least one undernourished individual were categorized as double burden households. Diet and physical activity data during three-day periods were collected from 294 individuals in 94 households. Based on dietary information from weighed dietary records, energy intake and the energy contribution of protein, carbohydrate and fat (nutritional intake indicators), and food item categories (dietary intake indicators) were calculated. Energy intake was adjusted by dividing by basal

metabolic rate in the analysis. Physical activity level was measured by an accelerometer, and converted into values in metabolic equivalent by time.

Analysis: (a) The association between nutritional intake and physical activity, and individual nutritional status was examined by fitting regression models. Also, (b) associations between nutritional/dietary intake and physical activity, and individual characteristics were explored. (c) To assess within-households cohesiveness, intraclass correlation coefficients (ICCs) were calculated for the physical activity level and nutritional intake indicators. (d) By comparing household characteristics, predictors of the double burden within households were explored. Finally, (e) to determine the predictors of being in a double burden household among malnourished individuals, logistic regression analyses were conducted separately for under- and overnourished individuals.

Results: Double burden households comprised 36.4% of the households in Bandung and 16.5% in Sumedang. A regression analysis for BMI revealed a significant negative association with energy intake and positive association with the energy contribution of carbohydrate and fat, but no significant association with physical activity level. In Sumedang, physical activity level and nutritional/dietary intake indicators were associated with individual characteristics including sex, age, educational background and occupation in addition to household income, while in Bandung, few of these associations were found. Overall, the ICC for physical activity level was 0.22, smaller than those for the nutritional intake indicators (0.39~0.50) and the dietary intake indicators for vegetables/legumes and meat/fish (0.35 and 0.34, respectively). The ICC for energy intake and the contribution of protein were smaller in Bandung (0.23 and 0.18) than in Sumedang (0.45 and 0.33). Double burden households tended to have more members and a household head with higher education. Overnourished individuals in double burden households were more likely to be adult, less active, and get less energy from carbohydrate, fat and grain/tubers compared to overnourished individuals in the other household types. Among undernourished individuals, no significant differences were found between those in double burden households and in the other household types.

Discussion: One of the primary reasons why the existence of the double burden within households has been questioned and viewed as paradoxical is because it is believed that the nutritional status of members in the same household should be similar. Furthermore, there are three assumptions underlying this idea: 1) the nutritional status of an individual is influenced by the balance of energy intake and expenditure; 2) nutritional/dietary patterns and physical activity, that determine the energy balance, are influenced by household and individual socioeconomic and lifestyle factors; and 3) household members have common socioeconomic and lifestyle factors due to the shared resources and circumstances, and therefore have similar nutritional/dietary patterns and physical activity levels. The results from the BMI regression analysis indicated that the first assumption was not necessarily supported; this may be attributable to metabolic disorders or nutritional deficiencies. Considering the associations between nutritional/dietary intake, physical activity, and individual characteristics, the second assumption was supported in Sumedang but not in Bandung. Regarding the third assumption,

the ICC values indicated that there was greater variation in physical activity levels among household members, and that there was greater variation in energy intake and the energy contribution of protein in Bandung than in Sumedang. Large variations in energy and protein intake within households can lead to a large variation in the nutritional status within households, that is, to a double burden of malnutrition within households.

Taken together, it is possible that the following “failures” may have emerged as a background to the double burden within households: a lack of association between individual socioeconomic status and/or lifestyle factors, and nutritional intake and physical activity patterns, especially in Bandung; and large individual variations in nutritional intake patterns and physical activity levels within households.

The association between household category and the household head’s educational background was consistent with earlier studies and suggests continued growth in the prevalence of double burden households given the ongoing economic development in Indonesia. The distinctive characteristics found among overnourished individuals in double burden households compared to those in other households suggests a plausible scenario: double burden households emerged from undernourished households when one or more of the adult members became less active, and got less energy from carbohydrates or fat. Those individuals became overweight while others remained normal weight or undernourished, thus these household became double burden households.

Conclusion: My research indicated that in West Java, double burden households, which have been viewed as “paradoxical”, can be understood reasonably well when it is recognized that: nutritional and dietary patterns and physical activity levels are not necessarily determined by household income, occupation, education and other socioeconomic and lifestyle factors; and that members in the same household do not always have similar nutritional and dietary patterns and physical activity levels. As overnourished individuals in double burden households had lower physical activity levels and got less energy from staple foods, future research should examine within-household interactions, and the dynamics of resource allocation and physical activity.