

Nutritional status and diet of slum children in India.

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Research questions

This survey focusses on the following research questions:

1. What is the nutritional status of children in slums?
2. What is the dietary behaviour of children in slums?
3. Which dietary factors influence the child's nutritional status?
4. What is the nutritional state of mothers in slums?

Method

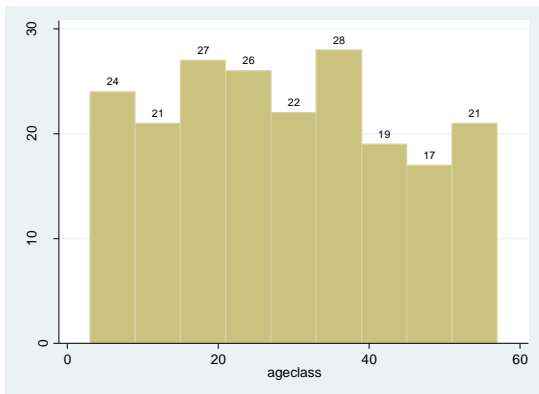
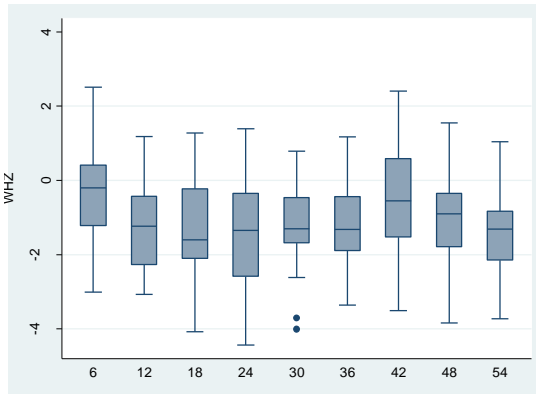
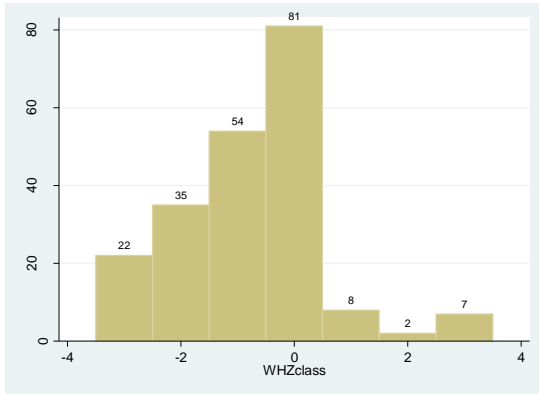
In februari 2011, a survey was undertaken to gain insight in the nutritional status of children living in slums in the Bhubaneswar region of India. Anthropometric measures and a food questionnaire were conducted in 205 children between 6 and 60 months. The questionnaire included food intake, nutritional habits, family structure and social status.

Data collection was done by Belgian nursing students, who had been specifically trained for data collection. All antropometric data were collected twice and independently. Assistance and translation during data collection was provided by local professional health and social workers from the Rushika project.

Results:

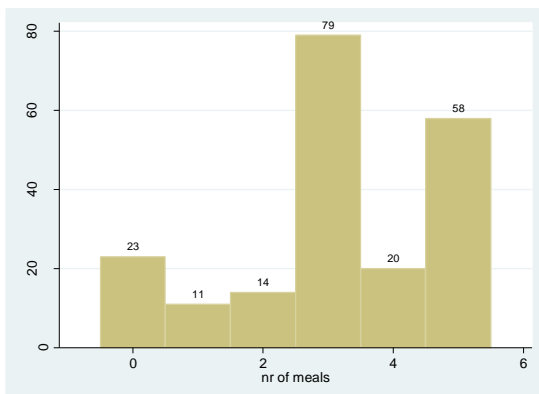
1. Nutritional status of slum children:

The weight-height ratio is generally accepted to define underweight. The weight-height Z-score (WHZ) is used to detect moderate and severe malnutrition, with the WHO worldwide database as a reference list. The mean WHZ of the slum children was rather low, compared to the WHO reference ($\bar{x} = -1.15$, $sd = 1.42$). 35 (16.9%) children were moderate malnourished ($< -2SD$ WHZ), 22 (10.6%) children were severely malnourished ($< -3SD$ WHZ). When the children were divided in agegroups of 6 months, no significant differences in nutritional state could be detected between the agegroups (Pearson χ^2 , $p = 0.910$). One child with lower limb oedema was detected. Eight severely malnourished and 4 moderately malnourished children also showed clinical signs of dehydration.



2. Nutrition

One part in the questionnaire aimed at the regular number of meals the children were given. Regular may not be similar to daily, but is representative for most of the days in a week. The median was 3 regular meals, but with a large range. This range is partially explained by children who still receive breastfeeding. Out of the 48 children who received less than 3 regular meals, only 8 did not receive breastfeeding. 3 other children were breastfed only once a day, in combination with only one regular meal. The other 157 (76.6%) children received at least 3 meals on a regular basis. The number of regular meals is growing with age ($p < 0.001$). The percentages of the different meals and the distribution of the number of regular meals per ageclass are shown in the tables below.



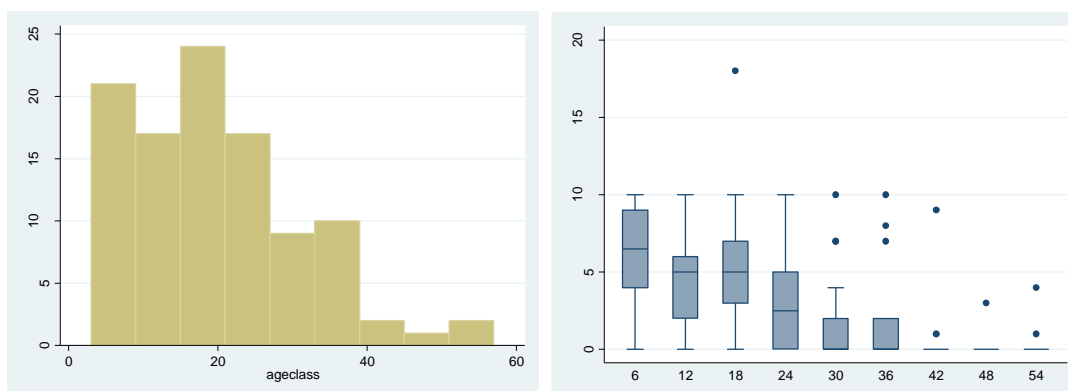
Meal	Proportion
breakfast	79.5%
snack1	36.6%
lunch	83.9%
snack2	39.0%
diner	76.1%

Number of meals	Ageclass									Total
	6	12	18	24	30	36	42	48	54	
0	15	3	2	1	2	0	0	0	0	23
1	3	1	3	2	0	1	1	0	0	11
2	1	2	5	3	0	2	0	0	1	14
3	4	7	8	11	12	12	7	9	9	79
4	0	3	4	4	3	2	3	1	0	20
5	1	5	5	5	5	11	8	7	11	58
Total	24	21	27	26	22	28	19	17	21	205

Analysis of food regimen shows that the childrens' diet mainly consists of rice, vegetables and grains other than rice. Meat, fish and fruit are much less frequently consumed. Out of the 14.6% children (n=30) who scored low on rice consumption 26 received breastfeeding or powdermilk. The 3 remaining children had missing values and were excluded for the further analysis of this part. 15 of these 30 children were over 12 months of age, so were in title to have a complete adult food regime.

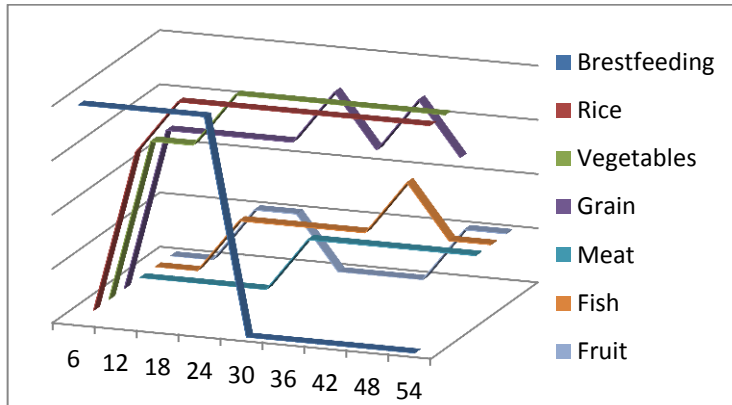
Frequency	Food product					
	Rice	Grain	Vegetable	Meat	Fish	Fruit
Several times daily	63.4	38.0	54.1		0.9	0.9
Daily	19.5	26.3	22.4			4.3
Several times weekly	2.4	16.5	2.4	23.9	30.2	27.3
Weekly		0.9	1.4	23.9	25.8	10.2
Less than weekly or unknown	14.6	18.0	19.5	52.1	42.9	57.0

There is a large proportion of children receiving prolonged breastfeeding after 12 months and breastfeeding is continued well after 40 months in some cases. Breastmilk is a substantial part of daily nutrition for the majority of children, at least till the age of 24 months.



Further analysis of the 202 children, revealed significant differences in food regime amongst the different ageclasses. Food consumption also changed significantly between breastfed and non-breastfed children, except for fruit consumption (p=0.55). In a combined generalized linear model however, including both ageclass and breastfeeding, breastfeeding was a non significant factor

($p=0.56$). The graph below shows the volution of the median scores for different food products over age. While 50% of the children receives breastfeeding until the age of 30 months, several portions of rice, vegetables and grain are introduced to 50% of the children between 6 and 12 months of age. Fish and fruit are introduced after 12 to 18 months to 50% of the children and more on a weekly basis. 50% of the children has never tasted meat before the age of 24 months.



3. Which dietary factors influence the child's nutritional status?

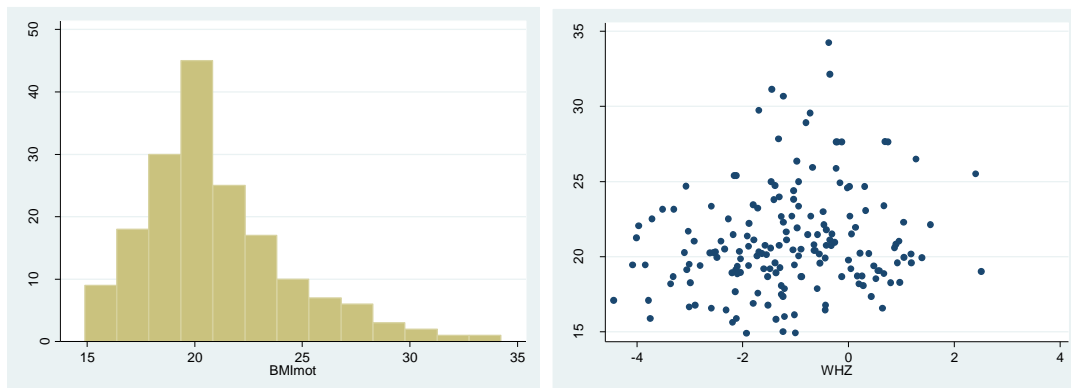
A Generalized Linear Model, including all the food products, the number of regular meals and ageclass, was constructed to test influences on the childrens' WHZ-score. When WHZ was seen as a class variable, fruit and meat consumption were the only significant factors with a small to moderate positive effect on the prevention of moderate and severe malnutrition. When the childs true WHZ-score was used, prolonged breastfeeding became a notable negative factor (coef. $-.47$; $p=.053$).

WHZclass	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]
Brestfeeding	-.3461358	.2233228	-1.55	0.121	-.7838403 .0915688
Rice	.0285591	.1271727	0.22	0.822	-.2206949 .2778131
Vegetables	-.0319254	.0977224	-0.33	0.744	-.2234579 .159607
Grain	-.0326107	.0941753	-0.35	0.729	-.2171909 .1519694
Meat	.3343512	.1329223	2.52	0.012	.0738283 .5948742
Fish	-.0435672	.1273586	-0.34	0.732	-.2931855 .206051
Fruit	.1928063	.0930145	2.07	0.038	.0105013 .3751114
Meal frequency	-.0253511	.0800962	-0.32	0.752	-.1823367 .1316345
Age group	-.0072045	.0083849	-0.86	0.390	-.0236385 .0092295
Unexplained variance	-1.020.257	.377495	-2.70	0.007	-1.760.133 -.2803802

Another model tested the influence of the frequency of meals and the type of meal on the childs' nutritional state. No significant factors were found in this model.

4. What is the nutritional state of mothers in slums?

The weight and length of 174 mothers was assessed and their Body Mass Index (BMI) was calculated. Mothers were divided in three classes, anorexic (BMI<18.5), normal weight (BMI 18.5-25) and overweight (BMI>25). Mean BMI of the mothers was fair, but with important variance (mean=21, SD=3.5). 68.9% of mothers had a normal BMI, 19.5% was underweight, 11.5% was categorised as overweight. There was no significant association between mothers' BMI and the WHZ of their child ($p=0.209$).



Discussion

Assessment of weight and length of the children was done by 2 independent observers. Data for length corresponded very well. Data for weight sometimes showed differences up to 0.5kg, probably due to the use of an analog balance (SECA) instead of a digital balance. Similar balances are used by WHO for medical assessment of children for growth monitoring. But because of their precision and ability to capture a fixed weight, digital balances are more suitable for scientific research. All statistical calculations regarding weight were based on the mean values of both observations, to minimize measurement bias. Nevertheless caution is advised in interpretation of the children's WHZ-scores, as even small measurement bias might have a significant effect on the calculation of WHZ scores in young children.

Parents were also asked the portion sizes of their children's meals. But as these portions were described in a variation of ways, quantification for statistical analysis became impossible. As a consequence, the results of this survey were limited to variation and frequency in nutrition, rather than a description of the quantity of nutritional elements. A thorough analysis of food intake should concentrate primarily on the daily caloric intake and only secondly on variation. Analysis of food samples is essential for both matters. This was not possible within the current survey.

The positive relation between WHZ-score and access to fruit and meat, is to be relativated in the light of the above mentioned remark. Promotion of meat for its nutritional value is in contrast with existing evidence. In many culturally bound diets, consumption of meat is limited and replaced by other sources of proteins. The positive relation might also be explained by the socio-economic or cultural value of meat and fruit. Both are more expensive food products. So people who have access

to these products can afford it or see food as an added value to their life. In this hypothesis, meat and fruit are indicators of a more healthy food pattern in general. The current survey also collected data on family constitution, economic factors, dietary habits, social support and region. As shown in the example of meat and fruit, these factors are possible confounders in the interpretation of the results. At this moment the influence of these factors on the nutritional state of the children has not been analyzed due to their complex nature.

Conclusion

The malnutrition rates of 20% for mothers and 25% for children in the slums of Bhubaneswar, call for attention. Even with the limitations of this study, guidance in transition from breastfeeding to a regular diet seems appropriate. Limited variation in food puts children that already live in a precarious situation at risk for infections growth retardation. WHO offers well standardized advise for young childrens' diet and weaning from breastfeeding.

As breastfeeding is a substantial part of many slum children even after the age of 2, the nutritional state of their mothers is an important factor.

Social support organisations can play an active role in health education, growth monitoring and prevention of malnutrition in general.

Further study of influencing factors is advised in order to detect risk populations and for the planning of specific interventions.

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