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The Asian Enigma: Predisposition for low adult body mass index among people from South Asian descent

by

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Contents

Abstract

Prevalence rates of undernutrition among children and adult women are considerably higher in South Asia in comparison with Sub Sahara Africa. At the same time, South Asia performs better than Sub Sahara Africa with respect to a number of factors generally strongly associated with the occurrence of undernutrition, such as infant mortality, maternal mortality, women's education, per capita food availability, and overall poverty. These seemingly contradictory results are often described as the "Asian Enigma". It has frequently been argued that one of the explanations of the poor nutritional status of children and adult women in South Asia is the disadvantageous position of women and the occurrence of female discrimination in countries in this region.

In the present report an analysis is made of undernutrition prevalence rates in males and females (children, adolescents, adults), as these occur in South Asia and Sub Sahara Africa, and it is investigated whether this reveals a distinct nutritionally disadvantageous position of women relative to men in South Asia. It is followed by an analysis of the prevalence and characteristics of undernutrition in populations from Asian descent in other parts in the world, in particular South Africa, Fiji, the United States, and England.

Results indicate that in children and adults differences in nutritional status between males and females are generally small, both in South Asia and in Sub Sahara Africa. In adolescents, if anything, undernutrition prevalence rates are higher among males than females, both in South Asia and in Sub Sahara Africa. With respect to anaemia, which is generally for a large part attributed to iron deficiency, prevalence rates are almost consistently higher among women than among men, with in South Asia a somewhat higher ratio between the anaemia prevalence rate in males and females than in Sub Sahara Africa. The analysis of undernutrition prevalence rates among population groups of different ethnic descent living in the same country reveals generally higher levels of low Body Mass Index among adults form South Asian background. These higher rates of adult undernutrition cannot be explained on the basis of less favourable socio-economic characteristics, such as lower income or less access to food.

It is hypothesized that, apart from the possible negative effects of a low status of women, there exists among people from Asian descent an ethnic predisposition for a low adult body mass index, which comes to expression under a relatively low or moderate level of standard of living. Through its effect on birth weight of babies, the low body mass index of women contributes to the high levels of child malnutrition in South Asia. One other identified factor which may also contribute to the high levels of undernutrition in South Asia is the occurrence of deficiencies in micronutrients, such as iron, vitamin A, and zinc, caused by an overall low quality of the habitual diet, and in particular a very low consumption of meat. It is stressed that the current findings do not dispute at any degree the occurrence of female discrimination in South Asia, but its nutritional aspects are currently not fully understood and need further investigation.

1. Introduction

Prevalence rates of underweight in children and low body mass index (BMI) in adult women are considerably higher in South Asia in comparison with Sub Sahara Africa (Table 1). At the same time, for a number of factors generally assumed to be strongly associated with the nutritional conditions in a country or region, South Asia fares better than Sub Sahara Africa. Thus, as also shown in Table 1, underfive and maternal mortality rates in South Asia are on average almost half of those of Sub Sahara Africa, while literacy rates or other educational indicators are considerably better in most South Asian countries. As regards overall per capita income, South Asia and Sub Sahara Africa are at comparable levels, while per capita kcal availability is higher in South Asia. The only indicator in Table 1, where from a health or nutritional point of view South Asia has a poorer record than Sub Sahara Africa is the prevalence of anaemia in women.

Table 1. The Asian Enigma

	Women BMI <18.5 [2] (%)	Under-fives weight-for-age <2sd [3] (%)	Per capita income [4] (USD)	Per capita kcal per day [5]	Literacy [4]	Under-five mortality [4]	Maternal mortality [4]	Anaemia prevalence in women [6] %
Sub Sahara Africa [1]	14.4	30.7 [6]	601	2195	62	168	921	41
South Asia	34.1	48.5	594	2403	82	92	564	60
East Asia & Pacific	16.4	11.5	1416	2921	99	37	117	49
Middle East & North Africa	6.2	14.7	1972	3006	88	55	183	44
Latin America & Caribbean	5.4	9.1	3576	2824	97	31	194	23

[1] Definitions of regions may somewhat vary by data-source; [2] Data from DHS (2007), for each region population weighted average, based on those countries for which DHS-results are available; [3] Data from World Bank, 2006a, result for Sub Sahara Africa is a population weighted average for 36 countries, results for other regions directly from World Bank, 2006a; [4] Data from World Bank, 2006a; [5] Data from FAO, 2003a, 1997/1999; [6] Data from Stoltzfus, 2003.

These seemingly contradictory results with respect to the various nutritional and nutrition related parameters, as reported for South Asia and other developing regions, have been described in the mid 1990s as the "Asian Enigma" (Ramalingaswami et al., 1997). In Ramalingaswami's frequently quoted contribution, the poor nutritional status of South Asian children and women have been attributed, at least partially, to the widely occurring phenomena of female discrimination and the overall poor status of women in this part of the world.

In subsequent publications various other authors have made reference to the poor nutritional conditions and nutritional neglect of women in South Asia (Buckshee, 1997; Bhutta, 2000; Underwood, 2002; Osmani and Sen, 2003; Borooh, 2004; Fikree and Pasha, 2004; Darnton-Hill

et al., 2005). And also in a large-scale study on women by the International Food Policy Research, the phenomenon of the "Asian Enigma" has been subject to further analysis (Smith et al., 2003). In that report, three factors were identified as playing an important role in the much higher undernutrition rates in South Asia in comparison with Sub Sahara Africa. The first one is, again, the relatively low status of women in South Asia, the second one is the often poor state of sanitation in South Asian countries, while as a third factor it was concluded that urbanisation has a positive effect on children's nutritional status in Sub Sahara Africa, but a negative effect in South Asia. It should furthermore be noted that, according to the IFPRI-study, it is in particular the magnitude of the effects of these various factors which strongly contributes to the existing differences in nutritional status of children between South Asia and Sub Sahara Africa. In other words, while for example a certain difference in sanitation conditions would only moderately affect children's nutritional status in Sub Sahara Africa, the same difference would have a much stronger impact in South Asia.

The purpose of the present paper is to shed some further light on the problem of the Asian Enigma, and its possible explanations. There are several reasons for undertaking this exercise. In the first place, while in the past nutritional knowledge on adult nutrition was largely restricted to women, in recent years a significant amount of information has become available on the nutritional status of men. This gives the opportunity to study in more detail the prevalence of gender differentials and female discrimination, in as far as this concerns nutrition. In the second place, for some countries outside South Asia, but which are home for considerable numbers of people from Asian descent, ethno-specific information is available on most variables of relevance, including health, nutrition, education, and other indicators related to overall standard of living. A typical example is South Africa, but also for some other countries such information is available. A third reason is that overall data availability on the various nutritional and nutrition related nutritional variables at national and subnational level is rapidly increasing, which also creates new opportunities to investigate the issue, but now with larger and often more representative datasets.

The structure of the paper is as follows. First, we review prevalence rates of undernutrition in the various developing regions, separately for male and female children, adolescents, and adults, and it is explored whether there are regional differences in the distribution between male and female undernutrition. In the section that follows, the possibility of an ethnic component in undernutrition prevalence is investigated on the basis of anthropometric data in adults from countries that harbour sizeable population segments from different ethnic descent, including people from Asian descent. After a discussion section the paper ends with a brief concluding section.

2. Nutritional status of males and females

In this section it is explored to what extent a disadvantageous position of women in South Asia comes to expression in the form of a lower nutritional status of women compared to men, and also whether in this respect major differences between South Asia and other developing regions, and in particular between South Asia and Sub Sahara Africa, can be observed. The assessment will be primarily made on the basis of anthropometry, but available information on the occurrence of micronutrient deficiencies, in particular iron, iodine and vitamin A, will also be reviewed.

Anthropometry and gender

Table 2 gives the estimated prevalence rates of low weight-for-age in boys and girls under five years of age in five developing regions. The Table shows that in all five regions the overall differences between prevalence rates of undernutrition in boys and girls are small. Yet, when comparing South Asia with Sub Sahara Africa, in South Asia the percentage of girls being underweight is slightly higher than that of boys, while in Sub Sahara Africa the reverse is the case. Also at the level of individual countries, gender differences in prevalence rates of undernutrition are generally small (WHO, 2006b; DHS, 2007). These findings at the level of regions or countries do not imply that there are no reports of more sizeable differences in nutritional status between boys and girls at a more disaggregated level, but such observations are generally made in more specific population segments, which cannot be considered representative for larger population groups (Srivastava and Nayak, 1995; Rousham, 1996; Ngare and Muttunga, 1999; Yadav and Singh, 1999; Choudury, et al., 2000; Pande, 2003; Shaik et al., 2003; Baig-Ansari et al., 2006).

Table 2. Prevalence rates of low weight-for-age in underfives

	Boys weight-for-age < median – 2sd %	Girls weight-for-age < median – 2sd %	Ratio
Latin America	8	7	1.14
Middle East	18	16	1.13
Sub Sahara Africa	29	28	1.04
East Asia	17	17	1.00
South Asia	44	47	0.94

Source: Unicef (http://childinfo.org/areas/malnutrition/)

For adolescents, making a comparison between the nutritional status of males and females is more complex, which is partially the result of the fact that adolescence is a period of major physiological change, including rapid changes in physical growth. In fact, with respect to undernutrition prevalence among adolescents, there is at present no universally accepted method for its measurement (WHO, 2005, 2006c). Most commonly used is the BMI, with as cut-off point the 5th percentile of a norm BMI-for-age. But also height-for-age is often used for assessing

undernutrition in adolescents, with as cut-off point the 3rd percentile of a norm height-for-age (WHO, 1995). Undernutrition prevalence rates, and also differences between males and females can vary strongly, depending on the indicator used (Deshmukh et al. 2006; Jayatissa and Ranbanda, 2006). Apart from these measurement problems in assessing the nutritional status of adolescents, a more practical problem when analyzing differences between males and females is that, contrary to children under 5 years, for adolescents data availability is much more limited, and large scale representative surveys are hardly available. Many reports which provide information on the nutritional status of adolescents only give anthropometric data on women. A main reason for the stronger interest in women's nutritional condition is their role in the reproductive process, and the relationships between women's health and birth outcomes.

As regards gender differences in undernutrition prevalence in adolescents, most studies which use BMI as indicator report higher rates in males than in females. In many studies the difference is approximately a factor two or even more, and such observations have been made in both Asian and African countries, and also in countries form Latin America, without however revealing clear differences in the gender distribution of undernutrition between these various regions (Nubé, 2006). With height-for-age as indicator, differences in undernutrition prevalence between adolescent males and females are generally smaller, with in some studies more males being classified as undernourished and in other reports more females . However, also here there are no clear indications that there are fundamental differences between Asian and African populations in the gender distribution of adolescent undernutrition. In a number of more recent studies, these patterns have been confirmed, in both African and South Asian countries (Deshmukh et al., 2006; Jayatissa and Ranbada, 2006; Rao et al., 2006; Zalilah, et al., 2006).

Finally, also for adults the availability of results from representative studies with information on undernutrition prevalence in both males and females is limited. Here, BMI is generally accepted as the main indicator of overall nutritional status, with a BMI of 18.5 as the most commonly used cut-off point below which individuals are classified as undernourished. Table 3 provides results on undernutrition prevalence rates in male and female adults from studies in seven Asian and eleven African countries. A criterion for datasets to be included in Table 3 was a sample size of at least 1000 individuals. An exception is Sri Lanka with a sample size of 823, but included as no larger sample could be identified. Furthermore, in selecting data to be included in Table 3, preference was given to results for low income, often rural, populations segments, as these are the population groups where undernutrition is generally highest.

Table 3 reveals that for most countries for which suitable studies are available, from both Asia and Africa, the differences in undernutrition prevalence between adult males and females are generally small, and there is no clear pattern of higher undernutrition rates in either adult males or adult females. Yet, Table 3 also includes some results that differ from this general pattern. In one survey undertaken in slums in Dhaka, Bangladesh, the prevalence of undernutrition appeared to be considerably higher among women than among men, and in the age group 20-29 years the difference between male and female nutritional status was even larger (Pryer and Rogers, 2006). However, other data sources for Bangladesh do not reveal such differences. For example, in two other studies from Bangladesh, with sample sizes larger than 1000 (not included in Table 3, as they report only mean BMI's and no prevalence rates of undernutrition), it was found that the mean BMI's were slightly higher for women than for men, implying that for these study populations the undernutrition prevalence rates were likely to be rather similar in men and women or even slightly lower among women than among men (Zaman et al., 2004; Hussain et

al., 2006) [1)]. For the Sub Sahara African countries in Table 3, results for Mauritania and South Africa deviate from the general pattern, with considerable higher undernutrition prevalence rates among male adults, while the two studies in Togo yield conflicting results.

Table 3. Prevalence of low BMI in adult males and females in representative and non-representative population samples from Asian and Sub Sahara African countries

	males [1)] BMI <18.5 %	females[1)] BMI <18.5 %	sample size	location	reference
South Asia					
Bangladesh	64.0	64.0	1260	rural villages	Tetens et al., 2003
Bangladesh	41.0	50.0	1097	slums, Dhaka	Pryer and Rogers, 2006
India [2)]	49.0	49.3	21361	rural	Naidu and Rao, 1994
India	14.2	14.1	12582	urban	Shah and Mathur, 2005
India	25.1	22.6	12894	slums	Shah and Mathur, 2005
India	32.2	32.1	13409	rural	Shah and Mathur, 2005
India	19.5	19.1	99598	urban	Shukla et al., 2002
Indonesia	14.0	11.0	1944	urban and rural	Tesfaye et al., 2007
Laos	18.4	18.2	5952	national	FAO, 2003
Pakistan	25.0	25.3	18315	national	Pappas et al., 2001
Sri Lanka	43.0	43.3	823	rural	Ramanujam & Nestel, 1997
Vietnam	32.5	35.3	2020	urban and rural	Tesfaye et al., 2007
Vietnam	30.9	32.8	6993	province (Ha Tey)	FAO, 1999a
SSA					
Cameroon	23.5	23.5	1457	rural	Long et al., 1998
Congo	20.2	20.5	1344	rural	Delpeuch et al., 1994
Ethiopia	36.7	42.7	4050	urban and rural	Tesfaye et al., 2007
Guinea	11.1	8.8	4392	urban	FAO, 1999b
Ghana	16.2	16.6	9213	national	Nubé et al., 1998
Mali	14.5	19.1	15.5	national	FAO, 1999c
Mauritania	22.2	12.6	2112	national	FAO, 1998a
Nigeria	21.0	18.5	4061	urban	Rotimi et al., 1999
South Africa	12.9	5.6	13528	national	Puoane et al., 2002
Togo	17.4	9.8	4443	urban	Shetty & James, 1994
Togo	20.9	25.7	1053	2 provinces	FAO, 1999d
Zimbabwe	12.0	15.0	1283	district	FAO, 2001

[1)] All results for adults, but age-group definitions may differ somewhat in the various reports (> 18 yrs, > 20 yrs, 20-50 yrs, etc.)

In conclusion, information on prevalence rates of undernutrition in adult males and females reveals that in the various developing regions in the world there are generally no major gender differences in undernutrition prevalence rates. This also holds for South Asia, the region for

which discrimination of women is most frequently reported. An exception is perhaps the nutritional status of adolescents, with generally a higher prevalence rate of undernutrition among males than females. However, it should be noted that in particular for this age group the interpretation of the anthropometric indicators is complex.

Micronutrient deficiencies and gender

Anthropometric variables are not the only indicators on the basis of which the nutritional status of individuals or population groups can be assessed, and information may also be collected at the level of micronutrients (vitamins, minerals). One micronutrient for which a deficiency is known to be widely prevalent is iron. Iron deficiency causes anaemia, and in a public health context it is generally assumed that fifty percent or more of all anaemia cases can be attributed to iron deficiency (Ahmed, 2000; Stoltzfus, 2003). In South Asia, prevalence rates of anaemia are among the highest in the world, and in a number of studies the high levels of nutritional anaemia in South Asian women have been associated with female discrimination (Buckshee, 1997; Brabin et al., 1998; Osmani and Sen, 2003; Borooah, 2004).

Table 4 provides information on estimated prevalence rates of anaemia in men and women in various regions in the world (Stoltzfus, 2003), and reveals that in all regions the anaemia prevalence is much higher among females than among males. These higher rates of anaemia prevalence among women are generally, at least partially, attributed to the specific needs and vulnerabilities of women of reproductive age (Darnton-Hill et al., 2005).

Table 4. Prevalence of anaemia in males and females in different regions in the world

Region	Women %	Men %	Ratio
Africa [a]	41	28	1.5
Latin America [b]	23	11	2.1
Eastern Mediterranean [c]	44	17	2.6
Southeast Asia (I) [d]	49	32	1.5
Southeast Asia (II) [e]	60	36	1.7
North America [f]	8	5	1.6

Excluding Egypt, Morocco, Somalia, Sudan and Tunisia; [b] Excluding Cuba; [c] Afghanistan, Djibouti, Egypt, Iraq, Morocco, Pakistan, Somalia, Sudan, Yemen; [d] Indonesia, Sri Lanka, Thailand; [e] Bangladesh, Bhutan, Dem. People's Rep. of Korea, India, Maldives, Myanmar, Nepal; [f] Including Cuba; Source: Stoltzfus, 2003.

When considering the magnitude of the differences in anaemia prevalence between males and females in various regions in the world, the largest difference is recorded for the Eastern Mediterranean region. In South Asia (Southeast Asia II in Table 4), the ratio between the anaemia prevalence rates in males and females appears to be higher than in Africa, but the difference is not very large. However, when considering results on differences in anaemia prevalence between males and females at the level of individual countries, or population groups within countries, the outcomes are more varied, with occasionally a much higher prevalence of anaemia in women, in particular among adolescent women (Verma et al., 1999; Basu et al., 2005). On the other hand, in Bangladesh, where undernutrition rates in children are of similar magnitude as in India, large

scale survey data reveal only moderate differences in anaemia prevalence between males and females (Ahmed, 2000).

For other micronutrients only limited information is available which would allow for an assessment of possible gender differences in the prevalence rates of deficiencies, and this is partially the result of the fact that most surveys in adolescents or adults report only on women of reproductive age. As regards iodine deficiency and goitre, most studies reveal a higher prevalence among women, but this might have a physiological basis and not be the result of any form of nutritional discrimination (Darnton-Hill et al., 2005). For vitamin A deficiency, limitedly available data on children do not reveal any gender component (Labadarios and Van Middelkoop, 1995; Jayatissa and Ranbada, 2006), and for older children or adults there is no information available on possible gender differences. Also for zinc or other micronutrient deficiencies gender specific data are not available.

Thus, as regards micronutrients, most relevant within the context of the present study is the occurrence of anaemia, which is almost universally more widely prevalent among women than among men. With respect to these gender differences in anaemia prevalence rates, there appears to be some regional variation, with possibly in South Asia a larger difference between male and female anaemia prevalence rates in comparison with Sub Sahara Africa. However, much more marked are the differences between regions in the absolute levels of anaemia prevalence, with by far the highest rates occurring in South Asia.

3. Nutritional status of people from different ethnic descent living in the same country

Another possibility for explaining the large differences in undernutrition prevalence rates between South Asia and Sub Sahara Africa (Table 1), would be the existence of an ethnically determined component with respect to birth weight, growth of children, or body build characteristics of adults. As regards children, WHO has recently published its results from new growth studies in children from well-to-do families in various parts of the world, including South Asia (India) and Sub Sahara Africa (Ghana), and concludes that growth potentials are similar for children form all parts of the world, regardless of ethnicity (WHO Multicentre growth reference study group, 2006). Therefore, WHO supports and promotes the application of universal growth standards and cut-off points for measuring undernutrition among children from different countries or regions in the world. As regards body mass index in adults, however, the situation might well be different, and it can not be assumed beforehand that there are no ethnic differences between the BMI characteristics of people from different parts of the world. In this section we address this issue by reviewing data from countries that harbour sizeable population segments from both Asian and African descent, and for which the required anthropometric data are available. The countries for which such type of information will be reviewed are South Africa, Fiji, USA, and England. Where available, information on other factors, generally presumed to be associated with the occurrence of undernutrition, will also be presented.

South Africa

Table 5 presents information on undernutrition prevalence rates among children and adults, for four population groups living in South Africa, namely Africans (blacks), whites, Indian/Asian people, and coloured people (mixed ethnic background). In addition, information is presented on two nutrition related economic parameters (total household food expenditures and the percentage of households below the food poverty line).

Table 5. Undernutrion, food expenditures, and food poverty, by ethnic/demographic group in South Africa

	Males BMI < 18.5 [1)] %	Females BMI < 18.5 [1)] %	Children Height-for-age < - 2sd [2)] %	Household food spending.[3)]	Households below food poverty line [4)] %
African, black [5)]	12.9	4.8	28.3	119	55.6
Mixed , coloured	12.1	10.5	19.1	161	34.9
Indian/Asian	16.9	14.9	6.1	260	9.0
White	5.0	3.1	4.9	348	3.1

[1)] Adults, 15 years and over (Puoane et al., 2002); [2)] Children underfives, with height-for-age below median – 2sd (WHO, 2006b); [3)] Household food spending, as % of poverty line (Rose and Charlton, 2002); [4)] Percentage of households below food poverty line (Rose and Charlton, 2002); [5)] African: ancestry from the African continent; Mixed, coloured: mixed heritage including aboriginal (Koi, San), Malay, European, and African; Indian/Asian: descendants from East Asia, primarily the Indian subcontinent; White: European ancestry.

Table 5 shows that out of the four population groups, the prevalence of undernutrition in children, age 0-5 years, is highest among children belonging to African households. In line with this result is the fact that, in comparison with the other population groups, for these households the mean level of household food expenditures is lowest, while the percentage of households in food poverty is highest. However, when considering the results on the prevalence of undernutrition in adults (BMI<18.5), Table 5 shows that the highest prevalence rate is among men and women belonging to households from Indian/Asian descent, this despite the fact that these households have a much higher level of food expenditure than African households, and also despite the fact that the percentage of households in food poverty is much lower. Table 6 shows that also with respect to various other socio-economic characteristics, such as employment and education, both males and females from Indian/Asian descent are better off than Africans and also better off than the population group of mixed ethnic background.

Table 6. Employment and educational records for men and women in four population groups in South Africa

	Employment [1)]		Education [2)]	
	Male unemployment %	Female unemployment %	Males Grade 10 or higher	Females Grade 10 or higher
African, black	30.0	37.9	23.6	24.5
Mixed, coloured	18.2	21.4	28.3	28.6
Indian/Asian	15.3	20.1	52.8	47.0
White	4.2	6.4	63.0	66.3

[1)] Unemployment rates in adults, 20 years and older, means for Sept. 2003 and March 2004 (Statistics South Africa, 2004); [2)] Calculated from South African Statistics (2006).

In conclusion, available data on undernutrition prevalence rates in four ethnically different population groups in South Africa reveal the highest level of child undernutrition among African households, but the highest levels of adult undernutrition among adult members of Indian/Asian households. The relatively high percentage of individuals with a low BMI in Indian/Asian households cannot be explained on the basis of a low level of access to food in these households, nor on the basis of other socio-economic characteristics.

Fiji

The two main population groups living in Fiji (South Pacific), are the indigenous Fijians and the Indo-Fijians. As shown in Table 7, there are large differences in nutritional status between these two population groups, with high levels of undernutrition among Indo-Fijian children and adults, and a practical absence of undernutrition among indigenous Fijians (FAO, 2003c). These differences cannot be explained on the basis of differences in overall standard of living. For example, as shown in Table 7, according to a household survey from 1990-1991, the percentages of households living below the poverty line were of similar magnitude for indigenous Fijians and Indo-Fijian households.

Table 7. Prevalence of undernutrition in adults and children, and prevalence of food poverty in Fijians and Indo-Fijians in Fiji

	Men [1)] BMI < 18.5 %	Women[1)] BMI < 18.5 %	Underfives Weight-for-age < median -2sd [1)] %	Households below poverty line [2)] %
Fijians	0.2	2.3	3.1	10.4
Indians	21.7	17.9	15.0	9.2

[1)] FAO, 2003c [2)] UNDP - Fiji Multi-Country Office, 2007.

United States

The United States' Pediatric and Pregnancy Nutrition Surveillance Systems (PedNSS and PNSS) are federally funded programs in which the nutritional status of infants, children and women from low-income households is being monitored. Enrolment in the program is on a voluntary basis. Table 8 provides for the year 2004 for different population groups results on prevalence rates of a low BMI in non-pregnant women, undernutrition in children, low birth weight in babies, and anaemia in women before being pregnant. It is important to note that the BMI cut-off point in Table 8 is not 18.5, but 19.8. It is therefore more appropriate to use the term "low BMI", than the term "undernutrition", for the adult population segment with a BMI<19.8

Table 8. Prevalence of low BMI in adults , undernutrition in children, low birth weight, anaemia, and poverty, in different population groups, enrolled in the paediatric and pregnancy surveillance schemes in the United States (PedNSS and PNNS).

	Low BMI in women [1)] %	Underweight in children [2)] %	Low birth weight [3)] %	Anaemia in women [4)] %	Poverty [5)] %
White, Not Hispanic	14.0	4.5	7	25.8	5.3
Black, Not Hispanic	9.7	6.0	11	44.7	19.1
Hispanic	8.6	3.9	6	27.1	18.5
American Indian/ Alaskan Native	8.1	3.3	7	28.1	
Asian/Pacific Islander	21.2	5.9	8	25.3	8.8

[1)] BMI<19.8 in pre-pregnant women (PNSS, 2004); [2)] Children below 5 years, weight-for-age < 5th percentile of reference (PedNSS, 2004) ; [3)] Calculated from PNSS-Table 12C (PNSS, 2004); [4)] Anaemia in third trimester (PNSS, 2004); [5)] US Department of Commerce, 2001

Table 8 shows that the prevalence rate of low BMI is approximately twice as high among women from Asian descent in comparison with the prevalence of low BMI among black women. Such difference cannot be explained on the basis of differences in overall standard of living, as almost 20% of enrolled black women belong to households classified as poor, against less than 10% of women belonging to households from Asian descent. It may further be noted that on the basis of the occurrence of low birth weight and the prevalence of anaemia, the health or nutritional

condition of women from Asian descent appears to be better than that of black women, despite the high prevalence of a low BMI.

England

Finally, Table 9 gives results on prevalence rates of low BMI in seven different population groups in England (Health Survey for England, 1999), and shows that a low BMI is most common among inhabitants from South Asian descent and among males from Chinese descent. Also here, the cut-off point for low BMI (20) differs from the cut-off point generally used in developing countries for the assessment of undernutrition.

Table 9. Prevalence of low BMI in different population groups in England

	Black Caribbean BMI<20 %	Indian BMI<20 %	Pakistani BMI<20 %	Bangla-deshi BMI<20 %	Chinese BMI<20 %	Irish BMI<20 %	General Population BMI<20 %
Male adults	9.4	18.8	15.9	18.3	17.9	12.7	10.3
Female adults	7.3	24.6	18.5	21.6	12.6	7.0	14.3

Source: Health Survey for England, 1999.

The combined information on four countries, with in each of them considerable population segments from different ethnic/geographic backgrounds, shows that there are generally distinct differences in prevalence rates of low BMI in adults between the various population groups. Where countries harbour a population segment from Indian or Asian descent, it is generally among this population group where the prevalence of a low BMI is highest.

It also appears that the generally higher levels of low adult BMI in population groups from South Asian descent, in comparison with other population groups, cannot be explained on the basis of lower levels of access to food, lower levels of overall standard of living, or a less favourable position with respect to other socioeconomic characteristics. It is therefore hypothesized that the observed high levels of adult undernutrition in populations from Asian descent are to be attributed to an ethnically determined predisposition for a low body mass index.

4. Discussion

The present paper aims to contribute to the understanding of the Asian Enigma, the phenomenon of high levels of undernutrition among children and women in South Asia, despite better performance in terms of health indicators such as infant and maternal mortality, and higher levels of per capita expenditures and per capita kcal availability in comparison with, for example, Sub Sahara Africa. In this report, two main factors which might contribute to the relatively high levels of undernutrition in South Asia have been analysed in some detail. The first one is the occurrence of nutritional discrimination of women in South Asia, and this is investigated on the basis of available information on possible differences in nutritional status between males and females (children, adolescents, adults) as these occur in South Asia, Sub Sahara Africa, and other developing regions. The second factor is the possible existence of an ethnic predisposition for low body mass index among adults from Asian descent, which is investigated on the basis of anthropometric information from countries or regions where people from different ethnic background, including people from Asian descent, are living together. A third factor which might contribute to differences in undernutrition prevalence between South Asia and Sub Sahara Africa are differences in the overall quality of the habitual diets of low income people in these regions. A crude assessment of these dietary qualities is made on the basis of information on prevalence rates of micronutrient deficiencies in the various developing regions.

Female discrimination and nutrition

Gender disparities are a major concern in developing countries, affecting many aspects of life, including health, education, access to labour markets, and even access to justice and human rights. There are considerable differences in the position of women between various regions in the world, and South Asia is particularly known as a region where women are in a disadvantageous position relative to men. One frequently mentioned characteristic is the phenomenon of "missing women" which reflects the fact that South Asia is the region in the world with the lowest female-to-male ratio, reflecting the fact that average life expectancy of South Asian women, relative to the life expectancy of men, is among the lowest in the world. Also from numerous recent publications and studies, it shows that the disadvantageous position of women in South Asia remains an important issue on the overall development agenda (Osmani and Sen, 2003; Borooah, 2004; Bhutta et al., 2004; Patel et al., 2005). In this context, it is important to stress that the present study does not pursue any mitigation or disguise of the problems of women's discrimination in South Asia or any region of the world. The question, however, which is being addressed in this report is whether, and also to what extent, women's discrimination finds expression in a less favourable nutritional status of women compared to men, and whether differences between South Asia and Sub Sahara Africa in this respect are of such magnitude that it could explain the considerably higher levels of child and adult undernutrition in South Asia compared to Sub Sahara Africa.

As regards children under five years of age, available data reveal for South Asia a slightly higher percentage of girls with a low weight-for-age than boys, while in Sub Sahara Africa the reverse is the case. Yet, in both regions, the difference in undernutrition prevalence between boys and girls is relatively small, in the order of magnitude of a few percent. With respect to adolescents, assessing possible gender differences is complex, as there is no full consensus how their nutritional status can best be assessed. On the basis of results on BMI, there is in the various

developing regions of the world a general pattern of a higher prevalence of low BMI among male than among female adolescents, but this pattern is observed both in South Asia and in Sub Sahara Africa. When the nutritional status of adolescents is assessed on the basis of height for age, there appears to be no discernable pattern of a better nutritional status for either males or females. Finally, with respect to adults, the overall prevalence rates of low BMI are much higher in South Asian countries than in most Sub Sahara African countries, but at the same time most available large scale surveys reveal that undernutrition prevalence rates are generally rather similar in adult men and women, both in South Asia and in Sub Sahara Africa. With respect to micronutrients, there appears to be a globally consistent pattern of higher levels of iron deficiency anaemia in women than in men. While in Sub Sahara Africa the anaemia prevalence is estimated to be about 1.5 times higher in women than men, in South Asia this factor is about 1.7. Thus, in relative terms women in South Asia are slightly worse off than men, when compared with women in Sub Sahara Africa, but also here the difference is not very large and much more evident is the fact that the absolute levels of anaemia, in both males and females, are considerably higher in South Asia than in Sub Sahara Africa. For other micronutrients there are no data which clearly point to a less favourable nutritional condition of women compared to men, nor in South Asia neither in Sub Sahara Africa. On the basis of these results, it appears difficult to explain the high levels of both child and adult undernutrition in South Asian countries on the basis of a less favourable nutritional status of women compared to men.

A specific period of time during which the nutritional and health needs of women are critical, is pregnancy. Within the context of the Asian Enigma, two aspects of the health and nutritional condition of pregnant women need to be mentioned. In the first place, there are a number of studies, mainly from South Asia, which report on the occurrence of high workloads of women during pregnancy and on the adverse effects of these workloads on the birth weights of their babies (Sachar et al., 1991; Rao et al., 2003; Chorgade et al., 2006). Such high workloads of women could be considered an indication of insufficient care for women's health during pregnancy. However, data availability appears to be insufficient to assess whether there are in this respect major differences between South Asia and Sub Sahara Africa. The second issue to be mentioned is the often reported practice of women in South Asia to reduce food intake during pregnancy, in order to prevent complications during labour and delivery (Hutter, 1996; Garner et al., 1992). However, also here information is insufficiently available to assess whether there are in this respect major cultural differences between South Asia and Sub Sahara Africa, which makes it difficult to evaluate these practices within the context of the Asian Enigma.

In conclusion, anthropometric surveys in adults in developing countries generally reveal similar rates of undernutrition in adult males and adult females. For adolescents, if anything, undernutrition is more common among males than among females. With respect to anaemia, women in South Asia could well be in more disadvantageous position relative to men, in comparison with Sub Sahara Africa, possibly as a result of female discrimination, though the nutritional evidence is limited. On the basis of these results, it appears that the Asian Enigma can at most for only a small part be explained on the basis of nutritional discrimination of women in South Asia.

Ethnic predisposition

In most reports and analyses which focus on, or relate to, the Asian Enigma, very little attention has been paid to differences in body composition characteristics between people from different

ethnic descent. In the present study, it is investigated whether such differences exist. Results from four countries (South Africa, Fiji, United States, and England) which harbour sizeable population segments from different ethnicity, including people from Asian and African background, reveal consistently higher prevalence rates of low BMI among people from Asian descent. South Africa is the country which provides the most telling results. Available data for South Africa reveal a considerably higher level of low BMI in adults from Asian descent in comparison with people from African descent, this despite higher incomes and better access to food among the Asian population segment. Also in Fiji and in the United States, there is a considerably higher prevalence rate of underweight among adults from Asian descent, which cannot be explained on the basis of indicators related to access to food, other indicators of standard of living, or overall health conditions. Finally, data on England also reveal highest prevalence rates of low BMI among people whose background is from India, Bangladesh, and Pakistan, and also among people from Chinese descent.

The concept that ethnicity may affect the BMI characteristics of people is not new. Literature and research, however, appear to have a strong focus at the higher end of the BMI-range, where the linkages between overweight and obesity and the risks of non-communicable diseases and disorders such as hypertension, diabetes and cancer, are being investigated. Numerous studies have shown that at the higher end of the BMI range, there are significant ethnic differences in body composition between people from African, Asian and Caucasian descent, with the same BMI in people from different ethnic descent representing, on average, a different level of body fat and a different level of lean body mass (Deurenberg, et al., 2003; Snehalatha, 2003; Wang et al., 2003). Associated with these differences in body composition are differences in susceptibility to, and prevalence of, various non-communicable diseases (Lear et al., 2003; Shiwaku et al., 2004).

But also at the lower end of the range the existence of ethnic differences in BMI has been recognised in earlier reports. For example, in a number of studies from the 1990s, differences in BMI characteristics between populations where low BMI commonly occurs, were analysed and described (Norgan, 1995). In an attempt to account for such differences in body build, the Cormic index was introduced, with which corrections can be made for undernutrition prevalence rates among people from different ethnic descent. The Cormic index is still occasionally being used, but its acceptance appears to be limited (Adak et al., 2006). Of more recent date are studies in Norway on ethnic differences in BMI of adolescents (Kumar et al., 2004). In addition, there are a number of studies in which possible ethnic differences in foetal growth and the occurrence of low birth weight have been investigated and postulated (Seed et al., 2000; Vangen et al., 2002; Kumar et al., 2004; Mathai et al., 2004).

In conclusion, the reviewed studies on undernutrition prevalence in people from different ethnic background in South Africa, Fiji, the United States, and England, strongly suggest that there are also at the lower end of the BMI-range differences in BMI characteristics between people from different ethnic descent, with a predisposition for low BMI among adults from Asian descent. Through the well established effects of a low BMI of pregnant women on the occurrence of low birth weight of their babies, and the relationship between low birth weights and the occurrence of child undernutrition, such predisposition for low BMI can be considered an important contributing factor to the high levels of child undernutrition in South Asia (Shrimpton, 2003; Ramakrishnan, 2004). Finally, it is also important to note that such presumed predisposition for a low BMI does not need to come always to expression. For example, in a study on risk factors for

coronary disease in five Indian cities, the overall prevalence rate of undernutrition (BMI<18.5) appeared to be 5%. Though no males were included, the very low undernutrition rate among women almost excludes a large gender difference (Singh et al., 1999). And in a population-based cohort study in Delhi, mean BMI's of adults, aged 26-32 years, were 24.9 for males and 24.6 for females, with 66% of men and 61.8% of women having a BMI>23. Though prevalence rates of undernutrition are not reported in that stydy, in view of these high mean BMI's, and the high prevalence rates of overweight, the prevalence of undernutrition in this population groups is bound to be very low, both in males and females (Sachdev, et al., 2005).

Dietary quality and micronutrients

A third factor, besides women's discrimination and ethnic predisposition, that could play a role in the high levels of undernutrition in South Asia is an overall poor quality of the habitual diet of low-income people in this region, and in particular a diet providing insufficient quantities of essential micronutrients, such as iron, vitamin A, zinc, or other vitamins and minerals. Already in the introductory section, and also in the section on micronutrient deficiencies and gender, it has been shown that anaemia levels are very high in South Asia, and there are several other studies that also report considerably higher prevalence rates of anaemia in South Asia in comparison with Sub Sahara Africa, and also in comparison with other developing regions (Stephenson et al., 2000; Ramakrishnan, 2002; Caulfield et al., 2006). Anaemia is generally the result of a combination of factors, including a low dietary intake of iron, frequent occurrence of infectious disease, and possible blood losses in the reproductive cycle, but in South Asia one specifically important contributing factor is probably the overall very low level of meat consumption (Sharma et al., 2003). India, Bangladesh, and Sri Lanka are among the countries in the world with the lowest levels of meat consumption (Speedy, 2003), and in many studies a direct linkage between low levels of meat consumption and anaemia prevalence has been implied (Verma et al., 1999; Ahmed et al., 2006; Choudhary et al., 2006).

But also with respect to other micronutrients, there are indications that in South Asia the prevalence of deficiencies is higher than in most other regions in the world. For example, a most recent World Bank document reports vitamin A prevalence rates of 40% and 32% for respectively South Asia and Africa, and according to the same report is South Asia also the region in the world with the highest prevalence rate of zinc deficiency (Caulfield et al., 2006; HarvestPlus, 2007). Finally, for iodine deficiency, there are large differences in prevalence rate between various regions in the world. However, the variations within countries are often even larger, which makes it less meaningful to make comparisons between such vast geographic entities as South India and Sub Sahara Africa.

In conclusion, deficiencies in micronutrients are an important aspect of undernutrition in low income countries. While there are some indications of higher rates of micronutrient deficiencies in South Asia in comparison with Sub Sahara Africa, in particular with respect to iron, zinc and vitamin A, reliable representative information is still scanty, which renders it difficult to arrive at firm conclusions on a possible systematic difference in overall dietary quality between South Asia and Sub Sahara Africa.

Health consequences of low body mass index in adults

It is the main proposition of the present paper that, at the lower end of the BMI-range, there are

differences in body mass index characteristics between people from different ethnic descent, with in particular a predisposition for a low body mass index among people from South Asian background. At the same time, for the assessment of undernutrition among adults there appears to be a broad international consensus to accept and use a BMI of 18.5 as the cut-off point below which individuals are considered underweight or undernourished, irrespective of ethnic background.

Within the context of the in this report described differences in body mass characteristics between people from different ethnic descent, also at the lower end of the BMI-range, the question needs to be addressed what the adverse health effects of a low BMI are, and whether ethnicity matters with respect to these adverse health effects. A first and crude approach in evaluating the adverse health effects of low BMI is an analysis of the relationships between BMI and overall mortality. Most studies on the relationships between BMI and all case mortality show a U-type of relationship, with mortality risks increasing at both ends of the BMI-range. Lowest mortality risks are generally found in a BMI range between 20 and 22, and it is at BMI values somewhere between 18 and 19, where mortality risks begin to increase more steeply (Calle et al., 1999; Seidell et al., 1996; Flegal et al., 2005; Gu et al., 2006). It is for these reasons that a BMI cut-off point of 18.5 has been selected for the classification of undernutrition in adults (WHO, 1995).

Yet, available data do not always show the same pattern in the relationships between BMI and mortality. For example, one longitudinal study in Bangladesh revealed lowest mortalities in the 16.4-20.7 BMI range, which is lower than the commonly observed range of lowest mortality risk of about 20-22, and the study also revealed that at any BMI-level the mortality risk for an individual in Bangladesh is lower compared to the mortality risk at that BMI-level in the United States (Hosegood, 2003). In fact, also in an earlier study in Bangladesh, it was reported that morbidity risks only started to increase at BMI results lower than 17, which is considerable lower than the commonly used cut-off point for undernutrition of 18.5 (Pryer, 1993).

Also with respect to other aspects of health performance, it cannot be assumed beforehand, that relationships with BMI are similar for people from different populations or from different ethnic background. For example, while it is generally assumed that at around a BMI of approximately 18.5 work capacity and productivity starts to decline (Strickland, 2002), in a study among female teapluckers in Sri Lanka, there appeared to be a significant relationships between blood haemoglobin values and productivity, but no relationship between BMI and productivity (Selvaratnam et al., 2003).

In conclusion, while it appears to be an established fact that there are at the higher end of the BMI-range ethnically determined differences in the relationships between BMI and various health risks, such differences are also likely to exist at the lower end of the BMI-range. In principle, such information needs to be taken into consideration when evaluating differences in adult undernutrition prevalence rates between regions or between ethnically different populations in the world.

5. Conclusion

From results presented in this report, it appears that the occurrence of women's discrimination in South Asia, or in other developing regions, does not clearly result in a distinctly poorer nutritional status of women compared to men. Only with respect to anaemia, there are some indications of a nutritionally more disadvantageous position of women relative to men in South Asia, when compared with Sub Sahara Africa, but even in this respect the available information is not unambiguous.

On the other hand, available data on differences in prevalence of low BMI in population segments from different ethnic background, but living in the same country under conditions of low or moderate standard of living, reveal almost consistently higher prevalence rates of undernutrition in adults from Asian descent in comparison with adults from African descent, and these differences cannot be explained on the basis of indicators of standard of living or other socio-economic characteristics. It is therefore hypothesized that there is an ethnically determined predisposition for low body mass index among adults from Asian descent. The question what the possible health effects, negative or positive, of such an ethnically determined predisposition for a low BMI are, needs to be addressed. Finally, a third factor that might play a role in differences in undernutrition prevalence rates between South Asia and Sub Sahara Africa is an overall lower quality of the habitual diet of low income people, resulting in particular in lower intakes of micronutrients such as iron, zinc and vitamin A. On the basis of the presented results, caution is warranted when making crude comparisons between nutritional condition as these can be observed in South Asia and Sub Sahara Africa.

Endnotes

1)
The study by Hussain et al. (2006) reports BMI-data collected in about 5000 adults in a rural community north of Dhaka, Bangladesh. Mean BMI's for males and females, by age group, are as follows: 20-30 years, 19.2 (M) and 19.6 (F); 30-40 yrs, 19.7 (M) and 19.5 (F); 40-50 yrs, 19.6 (M) and 19.5 (F); >50 yrs, 18.8 (M) and 18.6 (F). The study by Zaman et al. (2004) reports BMI-data collected in approximately 1300 adults in a rural community southeast of Dhaka, Bangladesh. In this study mean reported BMI's are 18.5 for males and 18.7 for females.

2)
In contrast to the data on India included in Table 3, the FAO Nutrition Country Profile 1998 reported for several Indian States considerably higher undernutrition prevalence rates among women than among men; however, in 2007 the FAO Nutrition Country Profile for India (FAO, 1998b) was withdrawn from FAO's website and the status of these data is therefore unclear.
(http://www.fao.org/ag/agn/nutrition/profiles_en.stm).

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The Centre for World Food Studies (Dutch acronym SOW-VU) is a research institute related to the Department of Economics and Econometrics of the Vrije Universiteit Amsterdam. It was established in 1977 and engages in quantitative analyses to support national and international policy formulation in the areas of food, agriculture and development cooperation.

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