# DRAFT FINAL REPORT OF A SURVEY ON ANAEMIA IN THREE DISTRICTS OF KZYL-ORDA, KAZAKHSTAN

**by**
**Suraiya Ismail and Hereward Hill**
**London School of Hygiene and Tropical Medicine**
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(*) London School of Hygiene and Tropical Medicine
School of Oriental and African Studies

# EXECUTIVE SUMMARY

A project was implemented in the Kzyl-Orda region of Kazakhstan to determine the prevalence of anaemia and factors associated with low haemoglobin levels. The study comprised six surveys, two in each of three districts (Kazalinsk, Djalagash and Zhanakorgan), spanning two years (1994 and 1995) and two seasons. A random sample of 4238 non-pregnant women aged 15-45 years and 2492 children aged 6-72 months participated in the surveys. Data were gathered on haemoglobin levels, weights and heights (or lengths for children under 2). A questionnaire was administered which sought to gather information on socioeconomic factors, health and reproductive history, access to food, food patterns and child feeding practices.

The sample was almost exclusively Kazakh and Muslim, and most women had completed at least secondary school. The average age at marriage was 21 years, and 22 at the birth of the first child. The sample was 43% urban and 57% rural, but the urban settlements were small with close ties to rural areas. Access to health care and education was good even in remote rural parts of the region, although most health centres suffer now from lack of drugs and medical supplies. Sanitation and water supply was uniformly poor in the region.

A moderate prevalence of anaemia was found: 38.3% among women and 48.7% among children. The mean haemoglobin for women was 12.0 g/dl and 10.7 g/dl for children. Among women there was both undernutrition (27.9%) and overweight (22.2%). Undernutrition decreased and obesity increased with age. Among children there was virtually no wasting and 20% of children were overweight. The level of stunting in children was low (16.6%). Levels of anaemia varied significantly between districts, with Kazalinsk having the highest prevalance among both women and children. Most undernutrition (in women) and lowest weight for height z-scores (in children) were also found in Kazalinsk, but Zhanakorgan had the highest level of stunting. Significant differences between districts were also found in access to land for horticulture, receipt of state benefits and the diversity of fruits and vegetables grown and animals owned, with Kazalinsk households generally least well off. Also differing between districts was contraceptive use (the IUD), birthspacing and child deaths.

Geophagia (the consumption of clay or soil) was practiced by nearly 24% of women and 29% of children, and was strongly associated with a higher prevalence of anaemia. Among children, the prevalence of anaemia varied dramatically with age: 64% in the 12-23 month age group and 8% in children over 4 years of age. Multiple regression analyses highlighted these associations: for women geophagia, and for children, geophagia and age were the most important explanatory variables for haemoglobin levels. Also entering the equation for women were contraceptive use, a previous diagnosis of anaemia (no treatment is currently available in the region), recent morbidity, district of residence, wealth (as measured by ownership of household items), tea consumption and diversity of horticultural production. For children, own nutritional status and birthweight entered the equation as well as district of residence and the household's horticultural production.

Frequency of consumption, during the previous month, of a range of food items was investigated by means of a questionnaire. The dietary pattern that emerged reflected the nomadic pastoralist history of the Kazakh people: meat and dairy products consumed two or more times a day, a high frequency of consumption of fats and tea, and a low consumption of fruits and vegetables. Seasonal differences in frequency of consumption very probably exist, but our findings on differences between survey rounds could not be attributed solely to seasonality in food availability: an economic downturn in the region, accompanied by unemployment, wage arrears and shortages could also have contributed to reduced diet diversity.

In general, there appears to be a downward trend in the nutritional status of children, when the data from this study are compared to data from 1992 and 1993, when a monitoring system was first established. This finding highlights the need to continue monitoring child nutritional status at least, in order to intervene if needed. Questions were asked on live births and child deaths which enabled the estimation of mortality rates in children under five years for the years 1982-93, using the Brass technique. Under 5 mortality estimates for Kzyl-Orda (over 100 deaths per 1000 live births) are high, when compared to national figures from many developing countries, and in comparison to figures available for Kazakhstan as a whole, indicating that Kzyl-Orda is a particularly depressed region of Kazakhstan. Such high mortality rates are surprising when one considers the relatively good anthropometric status of children. Further investigation is needed to explain the high child mortality, but the possibility exists that while access to health centres may be good, the quality of care and appropriateness of treatments offered may be less than adequate.

The project has established a basic system of monitoring nutritional status in the region. Training and equipment have been provided, and discussions have been held with personnel of the Ministry of Health in Almaty and with regional administrators and health authorities in Kzyl-Orda and the three districts surveyed. There is considerable interest in continuing a monitoring system and in initiating interventions to combat anaemia and improve the diet. Professionals in the region are eager to import and apply western ideas and technology. It is unlikely however that much will be achieved without external support, as funding and resources from the Ministry of Health in Almaty are very limited. There has been some interest shown in the region by UNICEF and the World Bank, and it is to be hoped that these agencies are able to address at least some of the needs of the region. This report proposes, in addition to continuing support for the monitoring system, a number of possible interventions to combat anaemia. The prevalence of anaemia itself could be monitored through these interventions. The interventions range from the provision of iron and folate supplements to pregnant women and young children to food-based strategies to improve access to a varied and balanced diet. Integral to any strategy to combat anaemia would be a well-designed and culturally appropriate nutrition and health promotion programme, which is likely to have benefits beyond the reduction in anaemia prevalence. Beyond specific nutrition interventions, there is also a need for assistance to improve the quality of health care, medical supplies and availability of medicines; especially needed are improvements in sanitation, water supply and food hygiene practices.

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# DRAFT FINAL REPORT OF A STUDY OF ANAEMIA IN THE KZYL-ORDA REGION OF KAZAKHSTAN

## 1.0 Introduction

A series of six surveys were conducted in three districts of the Kzyl-Orda region of Kazakhstan (see maps in Appendix 1), to assess the prevalence of anaemia among young children (6-72 months) and non-pregnant women of childbearing age (15-45 years). The region of Kzyl-Orda stretches along the Syr Darya river, with Uzbekistan to the south and the Aral Sea to the West. The three districts studied were Kazalinsk, Djalagash and Zhanakorgan. Kazalinsk borders the eastern shores of the Aral Sea, Zhanakorgan lies closest to Almaty, the capital of Kazakhstan, and Djalagash is mid-way between the two. The Syr Darya river passes through all three regions and its water is used in extensive rice cultivation on state farms. Beyond the reach of irrigation, the land is essentially steppe and desert. Sheep and cattle herding farms are found here, while some isolated communities in the desert raise camels and sheep. Withdrawal of water for irrigation from the Syr Darya and Amu Darya rivers has resulted in a decrease in flow and a 40% decline in surface area of the Aral Sea since 1960 (World Bank 1993). The region is experiencing social upheaval as the country embarks on a process of economic transformation. During the current phase of transition, the region is seeing rising unemployment, wage arrears and loss of benefits in kind, deterioration in the health services and a fall in real wages as prices rise.

Two surveys per district were carried out during 1994 and 1995 (Table 1B in Appendix 2). Previous project reports present detailed analyses of the four surveys conducted in 1994. This report summarizes the analysis by district of all six surveys, and presents also the results of the analysis of food frequency data and multiple linear regressions. The report also discusses briefly some special issues and topics, and concludes with recommendations for action.

The project was directed by staff of the London School of Hygiene and Tropical Medicine, and the surveys were carried out in collaboration with the Kazakh Institute of Geography, regional and district administrators and chief medical officers, and the School of Oriental and African Studies (London University).

## 2.0 Description of surveys

### 2.1 Survey sites

**Kazalinsk** is the poorest of the districts in Kzyl-Orda with a rapidly deteriorating infrastructure, lack of sanitation, and water reportedly contaminated with pesticides, fertilisers and salt. In its principal town of Novokazalinsk, many people work on the railways or in the railway engineering workshops. Large scale unemployment is now reported among these workers. **Djalagash** is the centre of the rice growing region. In addition to agriculture, people are employed in the grain silos and on the railway. Fewer people live in the district, and public facilities such as hospitals are smaller and with fewer resources than in the other two districts. **Zhanakorgan**, protected by a range of mountains, has a milder climate which enables substantial fruit production. Infrastructure, living conditions and provision of health services are also better. Previously the district benefitted from employment in the mines in the foothills of the mountains, but many have now closed. The proximity to Uzbekistan and the large urban centre of Chimkent is useful for commerce in Zhanakorgan.

The three districts were selected (out of a total of 9 districts) after consultation with the Kazakh Institute of Geography and the Regional Administrator of Kzyl-Orda, as being representative of a region that is large and varied in economic activity, wealth and resources. Two districts border on the Aral Sea, Aralsk and Kazalinsk. Kazalinsk was selected in preference to Aralsk because Aralsk had already received considerable aid and interest.

### 2.2 Methodology

Information was gathered by means of a questionnaire administered to the sample women, and covering areas such as socioeconomic factors, reproductive history, food patterns and access to food, morbidity, child feeding practices. Heights (or lengths for children under 24 months) and weights of all women and children were taken. Each woman and child was asked to provide a finger-prick blood sample. Haemoglobin levels were obtained using HemoCues. Further blood analyses were carried out on a subsample of the women and children, using a Coulter Counter (CBC5) purchased through funding from the Polden-Puckham Trust.

The draft questionnaire was designed in the United Kingdom with advice from Dr Shirin Akiner, our collaborator in London University's School for Oriental and African Studies. Following translation into Russian at SOAS, it was back-translated into English in Kazakhstan. It was finalized after piloting in Kzyl-Orda, and printed locally. Further improvements in layout and design were made at the end of the first survey of Kazalinsk, based on recommendations of the fieldworkers and the computer specialist, Mark Winstanley, who designed the data entry system.

A laboratory specialist, Dennis Barnard, tested and calibrated the HemoCues and the Coulter Counter. He was also responsible for training the technicians in the necessary laboratory techniques, the use of the blood analysis equipment, and in safe and hygienic procedures.

The Institute of Geography made available a member of its staff, Alma Akinova, to act as survey coordinator, and to be paid from project funds for the duration of the project. Ms Akinova had previously carried out anthropometry surveys in the Kzyl-Orda region, in collaboration with staff at the London School of Hygiene and Tropical Medicine. In each of the survey districts, Kazakh speaking fieldworkers were interviewed and selected by the project director (Suraiya Ismail) and the project manager (Hereward Hill). Translators were recruited from the Pedagogical Institute in Kzyl-Orda.

Fieldworkers were trained in interview and anthropometric techniques in a week-long course organized in Kzyl-Orda by the project manager. Throughout, uniformity of procedure, precision and accuracy of measurement were stressed. At the end of each session a quality control exercise was conducted to identify those needing further training and to rectify faults. To ensure the maintenance of high standards, retraining exercises were undertaken in September 1994 and in June 1995. Fieldworkers failing to achieve the requisite standard were not employed. Quality control exercises were also held on the first day of fieldwork in each district to ensure consistency. Fieldworkers were supervised at all sites on a daily basis by the project manager and the survey coordinator.

## 2.3 Survey samples

The sampling technique and the sample itself was selected by the project's consultant statistician, Ian White. Out of the full list of health centres for each district a random sample of 20-25 health centres (the clusters) were selected based on a probability proportional to size, and the random sample of women was selected from the list of women registered at the selected health centres (all inhabitants of the area covered by a health centre are required to be registered at that health centre). Women were invited to come to the health centre on a specific day, bringing with them their children aged 6-72 months. Sample sizes for each survey are given in Table 1A, while survey dates are given in Table 1B.

## 2.4 Organisation of fieldwork

Equipment was purchased and sent from the USA, except for small items which were purchased in the UK. Prior to the first survey, all equipment was air-freighted to Almaty and then to Kzyl-Orda. Between survey rounds, equipment was stored at the Institute of Geography in Almaty.

A central project office was established in Kzyl-Orda, and district offices were set up in the main towns of each survey district. A bus and bus driver were hired to transport the team

and equipment daily to the health centres. Procuring petrol for the bus presented a formidable challenge, and certainly would not have been achieved without the kind assistance of the regional and district administrators and chief medical officers. Accommodation and meals for the project team were arranged in each district capital.

## 3.0 Results and discussion

All tables and figures presenting the results of the analyses on the total sample and by district are to be found in Appendix 2. Data were analyzed using SPSS Version 5.0.

### 3.1 Description of sample

The sample was almost exclusively Muslim and Kazakh, in contrast to the population of Kazakhstan as a whole where only 40% of the population are of Kazakh origin, the rest being Russian (40%), or from other Central Asian countries, Germany or Korea. Literacy levels were high among the women: 84.5% had completed secondary education, 11.2% had received tertiary education. Of the total sample, 57% lived in rural areas, but there was a significant difference in household location between the districts, with the Zhanakorgan sample having the highest proportion of rural households, and Kazalinsk the highest proportion of urban households (Table 1C). The definition or rural and urban locations is discussed in Section 4.3

Tables 2 and 5 provide the basic information on the sample of women and children. The mean age of the women was 30.1 years, and 76.8% were married, widowed or divorced (very few of the latter). There was a significant difference between districts in the mean age of the women and their marital status, with Djalagash women being older and more likely to be married than the women from the other two districts. The mean age at marriage was 21.3 years, and 22.4 years at the birth of the first child. The mean age of the children was 32.7 months, with 51.1% boys and 48.9% girls. There were no significant differences between the districts in the distributions of the children's ages and sexes.

### 3.2 Analysis by district

#### 3.2.1 Anaemia

Tables 2 and 5 give the mean haemoglobin levels (in g/dl) and prevalences of anaemia (as defined by WHO) for the women and children by district and for the total sample. The distributions of haemoglobin levels of women and children are given in Figures 6 and 7 in Appendix 2. The mean haemoglobin level of the women was 12.0 g/dl, but interdistrict means were significantly different from each other. Similarly, while the prevalence of

anaemia in the total sample was 38.3%, the prevalence varied significantly between the districts. Kazalinsk had the lowest haemoglobin values and the highest prevalence of anaemia, while Zhanakorgan had the highest haemoglobin levels and the least anaemia. Among the children, the prevalence of anaemia was 48.7% and the mean haemoglobin level was 10.7. Again, significant interdistrict differences were found among the children, but only between Kazalinsk and the other two districts, with Kazalinsk having the most anaemic children and the lowest haemoglobin values. Haemoglobin and anaemia levels were significantly associated with age (see Figure 1). This association and its implications are discussed in Section 4.2.

### 3.2.2 Nutritional status

The mean weight and height of the women was respectively 56.8 kg (+/-10.4; range 29.5 to 99.7 kg) and 158.6 cm (+/-5.8; range 125.3 to 179.1). The mean body mass index (Table 2) was 22.6 kg/m$^2$, 27.9% of the sample were below the normal range for BMI (20-25 kg/m$^2$, Shetty and James 1994), and 22.2% were above the normal range (overweight). The only significant interdistrict difference was between the mean BMI's of Zhanakorgan and Djalagash ($p < .05$).

Table 5 gives the mean z-scores for height for age and weight for height for the children, and the prevalences of stunting (<-2SD), mild wasting (<-1SD) and overweight (>1SD). Mean height for age was -0.97 z-scores, with a low-to-moderate prevalence of stunting of 16.6%. There were however significant interdistrict differences with least stunting and highest z-scores found in Kazalinsk and the reverse in Zhanakorgan. There was virtually no moderate (<-2SD) or severe (<-3SD) wasting in the sample: one child below -3SD and 18 children below -2SD. Mean z-score for weight for height was 0.24, and only 9.4% of children were mildly wasted while 20% were overweight. Highest weight for height z-scores were found in Zhanakorgan and lowest in Kazalinsk, while the prevalence of overweight children was highest in Zhanakorgan.

The distributions of women's body mass indices and children's weights for height and heights for age are given in Appendix 2 (Figures 4, 5 and 8).

### 3.2.3 Health and reproductive factors

Tables 3 and 6 present selected data on women's reproductive history and on the health of women and children. The practice of geophagia (the eating of soil, clay or earth) was common in the region, among both women and children. Geophagia is both a symptom and a cause of anaemia, in that it disappears after iron therapy but also contributes to iron deficiency by interfering with the absorption of dietary iron. Among women 23.8% freely admitted to practising geophagia, and 28.9% of children were stated to be geophagic by their mothers. The practice of geophagia was strongly associated with haemoglobin and anaemia levels (see reports of 1994 surveys and also Section 3.3). A much higher proportion (>50%) of geophagic mothers had children who were also geophagics, than did

mothers who were not geophagic (<25%). This could be for any of the following reasons:

a) There was a highly significant correlation between maternal and child haemoglobin levels (and anthropometric status), suggestive of deprived households with a higher prevalence of anaemia. If iron deficiency anaemia is associated with geophagia, either as a symptom or as a causal factor, then it is not surprising that geophagic mothers are more likely to have geophagic children;

b) Geophagic mothers may be more permissive with regard to the practice in their children;

c) Mothers who admit to geophagia in themselves may more freely admit to the practice in their children. It should be noted however that there appeared to be no stigma attached to the practice.

Among women, 25.7% had been diagnosed as anaemic in the previous year, but only 7.5% of children had been so diagnosed. The diagnosis of anaemia could be taken as a measure of access and utilization of health services. However, access to health is generally excellent, with health centres and health professionals to be found in even the most remote regions. We were told also that utilization of services was equally good; however, it is possible that it has deteriorated in recent times since reduced funding has severely curtailed the treatments that can be offered at the health centres. Currently there is no iron therapy available, hence our finding that those who were previously diagnosed as anaemic by their health centre were more likely to be found anaemic by us (see Reports of 1994 surveys). More than 19% of women and 23.3% of children reported experiencing at least one episode of illness in the two weeks prior to the survey. No significant inter-district differences were found.

Other than abortion, the only method of contraception available to Kzyl-Orda women is the intrauterine device (IUD). Of the total sample, 41.7% used the IUD, but the percentage was significantly lower in Zhanakorgan than in the other two districts. The use of the IUD is associated with longer and heavier menstrual flow, and hence also with a higher prevalence of anaemia, as found in our study. Birthspacing was calculated among women who had more than two children, since this too has been associated with a higher prevalence of anaemia; no association with haemoglobin levels or anaemia was found by our study. Sixty-eight percent of women had experienced no child deaths, among 23.9% of women fewer than one out of three children had died, while among 8.2% of women the proportion of deaths was one out of three or higher. Kazalinsk women had longer birthspacing and more child deaths than those of the other two districts. Birthweights of the child sample were not obtained from health centre records; mothers were simply asked if they remembered their child's birthweight, and if so what it was. The prevalence of low birthweight (<2500g) was 8.2% and the mean birthweight was almost 3300g. Kazalinsk had the highest prevalence (10%) of low birthweight and the lowest mean birthweight (3247g).

### 3.2.4 Socioeconomic factors

No direct questions on income were asked, although information was obtained on occupations and official wages for these occupations. Given the present situation with wage arrears however, it is unlikely that the official wages can be used to assess household income. Questions were asked on ownership of a range of household items and these were summed to derive a total possession score as an indicator of wealth, but there was no check on the veracity of the responses since the questionnaire was administered at the health centre. In addition, quantitative information was obtained on state benefits (pensions, child benefits, student and maternity benefits) received by the household. Table 4 presents the results of these questions on ownership of household items and receipt of state benefits. Reports of 1994 surveys present figures for ownership of individual items; these figures did not change substantially in 1995. More than 22% of households claimed to possess three or less items, while almost 10% claimed to own nearly all the items on the questionnaire list. There were no differences between the districts. There were, however significant differences between the districts in the receipt of state benefits. While fewer Kazalinsk households received no benefits at all, also fewer Kazalinsk households received a high level of benefits (>1000Tenge per month).

### 3.2.5 Household food supply

Efforts were made to assess households' access to food, the frequency of consumption of a range of food items during the previous month, and child feeding practices. The objective of the questions on frequency of consumption was to provide a basis for the design of a suitable nutrition promotion programme, rather than to attempt to link the responses to levels of anaemia. Quantitative information in the form of 24-hour recalls was obtained on a 20% subsample of women and children, but these data have not yet been analyzed.

#### a) Food access

It was not the intention of the surveys to obtain detailed information on agricultural and livestock production in the region, which would have required a visit to the home and that the male household head also be interviewed. To assess a household's access to food, other than through purchases, women were simply asked if their families owned a plot of land, which fruits and vegetables were grown on these plots, which animals the family kept if any, and how many of each kind of animal. No effort was made to quantify fruit and vegetable production as it was felt that responses would be too inaccurate to be of much use. Indeed, even the analysis of the quantitative information on animal ownership proved to be unhelpful and it was decided to use only the variety of animals owned in subsequent analyses. The question on produce grown referred to the previous season, but since our surveys covered more than six months of the year, the range of produce can be taken as representative of fruit and vegetable production in the region throughout the year. We felt also that the information obtained on produce and animals would provide a useful input to future horticultural or livestock programmes, indicating also the potential for improvement

in nutrient intake, especially micronutrient intake.

We also asked questions on purchase points for fruits and vegetables, again with the view that this information would prove useful for the design of programmes to improve the supply of micronutrient rich foods. We found that almost all households either purchased fruits and vegetables at markets or grew them themselves, and that the numbers were almost equally divided between these two ways of procuring fruits and vegetables.

Nearly 73% of households owned a plot of land, and ownership was significantly lower in Kazalinsk. While this reflects the differences in urban/rural composition of the district samples, it is important to note that ownership of land is not limited to rural households. Indeed only 57% of the sample households lived in rural areas. The distinction between rural and urban areas is not very clear (see Section 4.3): most 'urban' households own land, and they may also own cattle and sheep.

Of the households who owned land, 26.8% grew few items (<3items), while 36.6% had a much more diversified horticultural production (7-9 items). Nearly one third or all households had 2-3 varieties of animals, while a similar number owned 4-7 different kinds of animals. There were significant interdistrict differences in both these variables, with access to food (as assessed by horticultural and livestock diversity) being poorest in Kazalinsk.

### b) Child feeding

Breastfeeding is common in the region, and 97.6% of our sample children were breastfed. The average duration of breastfeeding was 14 months, but the duration of breastfeeding in Zhanakorgan was significantly shorter (13.2 months) than in Djalagash (14.5 months). Complementary milks are introduced quite early, at a mean age of 7.8 months, and more than a third of the children had received a complementary milk by the age of 4 months. Complementary milks were introduced latest in Kazalinsk. The most common complementary offered to Kzyl-Orda children was cow's milk (81%), followed by formula milk (18.9%), and then a variety of other milks such as the milk of sheep, goats and camels. In the past, state-supported creches and kindergartens were widely available, and infants and children were offered meals at these facilities. Many such child care facilities have now closed down, and those that continue to function do not always provide meals. In our sample, 15.6% of children received a meal at a kindergarten, but the percentage in Kazalinsk was considerably higher (29.4%) than in the other two districts (10.9% and 10.1%).

### c) Food frequency results

Food frequency and seasonality results are given for two districts: a comparison of 1994 and 1995 data from Djalagash and Zhanakorgan. Women were questioned about the frequency of consumption of a range of foods during the previous month, in order to obtain a picture of their habitual diets and those of their children. Diets in Kzyl-Orda are generally quite monotonous, with a very limited number of processed foods, which makes

the collection of such data easier and more accurate than it would be for more complex diets. Foods and food groups used for the analysis are shown in Table 10, while Table 11 summarizes the diet for the region.

Meat, dairy products, bread and tea are the most important components of the Kzyl-Orda diet. By preference, meat is consumed three times a day, most commonly mutton or beef, occasionally horse meat, and very rarely camel meat. The stomach, intestines, liver and kidneys of the animals are also consumed with moderate frequency. Meat is generally boiled or fried in butter, sunflower oil or margarine. A range of milks and dairy products are available, including soured milk and cream and cheeses from a variety of animals. Tea is consumed almost continually, before, during and after meals. The staples of the region are bread, rice and potatoes, with the occasional addition of roasted buckwheat or millet (especially in Zhanakorgan). The consumption of meat and dairy products is higher in Djalagash than in Zhanakorgan (Table 13); the informal sector is much more active in Zhanakorgan, and it is possible that some of these products (and fruits and vegetables when in season) are sold at nearby markets (Chimkent or in Uzbekistan). The consumption of poultry, fish and eggs is generally very low. Fish consumption was much higher in the past, when fish from the Aral Sea was readily available. The consumption of fruits and some vegetables (such as tomatoes) is highly seasonal: the fruit harvests run from August to October, with most fruits (except melons) available for only 1-2 weeks during this period.

It is interesting to examine the diet from the perspective of iron deficiency anaemia. At first glance, it is surprising to find moderately high levels of anaemia in a region where meat is consumed so frequently. However, the diet also includes substantial amounts of dairy products. Hallberg (1992) reports that calcium interferes with the absorption of both heme iron and non-heme iron. He states: "....additionof milk, milkshake or cheese to common meals such as pizza or a hamburger reduced [total] iron absorption by 50-60%". The diet is also quite poor in enhancers of non-heme iron absorption (such as fruits and vegetables), and tea (an inhibitor of non-heme iron absorption) is consumed almost continually.

### d) Seasonality

Seasonal differences in diet by district are shown in Table 14. Altogether the frequency of consumption of more foods decreased than increased in Round 2 (1995) in comparison to Round 1 (1994), especially in Djalagash. A serious confounding factor in the analysis of seasonality is the deterioration in the economic situation in the region, which may partly explain the general decrease in meat consumption. Another factor however is that animals are slaughtered prior to winter to reduce the need for fodder, hence a greater availability of meat during Round 1. It is important to mention though that the fall in frequency of consumption of meat was not great: in Round 1 the median frequency was three times a day, falling to 2.5 times a day in Round 2 (which however may have been accompanied also by a fall in portion sizes). Increased frequency of consumption of milk and dairy products in Djalagash children and of dairy products in Zhanakorgan children may have been the result of a campaign to promote these foods, by local health authorities.

Differences between survey rounds in the consumption of fruits and vegetables in the two districts is explained by the months of the surveys: in Djalagash Round 1 and Zhanakorgan Round 2 were during the fruit harvests, while the other round for each district was either before (Djalagash) or after (Zhanakorgan) the harvests. The increases in median frequencies of consumption of fresh fruit from Round 1 to Round 2 in Zhanakorgan were substantial: from less than three times a week to three times a day among women and from once a week to twice a day among children.

The higher frequency of consumption of rice in Djalagash during Round 2 may be due to chance: rice grown in Kzyl-Orda is transported to Russia (near Moscow) to be milled, returning to the Kzyl-Orda markets in a sporadic fashion, so that there may be a glut followed by scarcity.

Variety scores were calculated from the food frequency data: monthly, weekly, or daily scores representing the number of foods or groups (as in Table 10) consumed at least once per month, week or day respectively. Table 13 presents the mean scores and the distributions of the scores by survey round for women and children. The analysis includes children breastfed at the time of the survey, hence the low minimum values. It should be noted that no special weaning foods are prepared by Kzyl-Orda families: the data and our own observations indicate however that children consume relatively less meat and more milk than adults.

All differences between rounds in variety scores were highly significant, both means and distributions. Clearly diet variety fell substantially in Round 2, among both women and children. Poor dietary diversity is associated with a greater likelihood of deficiencies, especially those of micronutrients. A substantial percentage of the sample had very low scores, especially in Round 2: among women, 21.2% were consuming fewer than 13 foods or groups per month, 24.7% fewer than 10 per week and 16.2% fewer than 5 per day.

## 3.3 Multiple Linear Regressions

The results of multiple linear regression analyses are presented in Table 8 for women and Table 9 for children.

### 3.3.1 Dependent variable: haemoglobin levels

A little over 14% of the variance in women's haemoglobin levels and 29.7% of the variance in children's haemoglobin levels were explained by the variables entered into the equations, using the forward method of entry (SPSS 5.0) and $p < .05$ as the entry criterion. For both women and children, the practice of geophagia was a very important variable in the equation: in the case of women, it was the most important variable, and in children it came second only to age. Residence in Kazalinsk (and Djalagash in the case of children) had a negative effect on haemoglobin levels of women and children, while residence in

Zhanakorgan contributed positively to women's haemoglobins. The anthropometric indices entered both equations, indicating that an individual who was anaemic was also likely to have a poorer anthropometric status. For women, a prior diagnosis of anaemia and the use of the IUD contraceptive made strong negative contributions to haemoglobin levels, but no other reproductive history variables (such as birthspacing) entered the equation. Age also had a negative effect on haemoglobin levels of women, as did recent morbidity. Reported birthweight entered the children's equation.

The location (urban or rural) of the household entered only the children's equation, unlike the district variables (residence in Kazalinsk, Djalagash or Zhanakorgan) which entered also the women's equation, suggesting that interdistrict differences (in perhaps socioeconomic conditions, and access to and quality of health services and food supply) are more important than whether the family lives in an urban or rural area (see Section 4.3). The variety of produce grown entered the equations of both women and children. Interestingly while diversity of livestock ownership had no significant impact on haemoglobin levels of either women or children, the number of cups of tea (an inhibitor of non-heme iron absorption) consumed per day did influence the haemoglobin levels of women. Of the socioeconomic variables, possession of a greater number of household items was associated with higher haemoglobin levels of women but not of children. The total amount of benefits received by the household entered the equation for children, but not for women.

### 3.3.2 Dependent variable: anthropometric status

In the regressions for the anthropometric variables, 14.4% of the variance in body mass index (Table 8, part 2), 6.8% of the variance in weight for height (Table 9, part 2), and 17.9% of the variance in height for age (Table 9, part 3), were explained by the variables that entered the equations. For women's BMI, age and haemoglobin levels contributed most to the variance, while previous diagnosis of anaemia, recent morbidity and height were all negatively associated with BMI. Residence in Djalagash and the total amount of benefits received were also negatively associated with BMI, while a positive contribution to BMI was found from livestock ownership.

The variables entered into the equation for the children's weight for height explained a disappointingly low percentage of the variance, possibly because the variables entered would seek to explain undernutrition of which there is very little in the Kzyl-Orda sample. We should rather be looking for variables that would explain overnutrition, and indeed maternal BMI (which entered the equation) may be one of these. Reported birthweight was an important contributor to the variation in both weight for height and height for age, a finding also of studies from developing countries, which highlights the importance of pre-pregnancy and antenatal intervention. Maternal height, found to be associated with birthweight in many studies, was positively associated with height for age in the Kzyl-Orda children. Interestingly, early introduction of complementary milks and the provision of a meal at kindergartens both lead to higher weights for height. Variety in livestock ownership and produce grown by the households were associated with weight for height and height for age respectively. Residence in Kazalinsk and a higher possession score were also associated with lower levels of stunting.

## 4.0 Discussion of selected issues and topics

### 4.1 Geophagia

The practice of geophagia has emerged as an important factor associated with anaemia in the region of Kzyl-Orda. Table 15 shows that moderate and severe anaemia was found among 23% of geophagic women and 49% of geophagic children, but only among 8% and 24% of non-geophagic women and children respectively. If indeed geophagia is simply a symptom of anaemia then treatment of iron deficiency should eliminate its prevalence. If, however, it precedes and contributes to the development of anaemia, then there is need for an education programme. Either way, there is need for good research into geophagia; geophagia needs to be examined by anthropologists, biochemists and physiologists.

### 4.2 Children's haemoglobin by age

Age was the most important factor associated with haemoglobin levels among children. Mean haemoglobin levels varied from 9.5 g/dl among 12-23 month children to 11.7 g/dl or higher among children over the age of four years (Figure 1). The literature does not indicate the need to use different cut-off points for different ages of children below the age of 5-6 years, and yet the prevalence in our sample of moderate and severe anaemia in the 12-23 month children was nearly 64%, falling to 8% among the children over 4 years. Clearly in Kazakhstan, most children are recovering from anaemia without iron therapy, so the questions arise as to whether the weanling anaemia is pathological or physiological, and whether there are any long-term sequelae to anaemia in the weaning period. Studies from Chile and Costa Rica suggest that even mild anaemia if untreated has a negative impact on mental and psychomotor development scores. In cases of severe or chronic anaemia in very young children, lower scores persist even if normal haemoglobin levels are achieved. These studies would suggest that prevention rather than treatment should be the intervention of choice.

Another aspect of the strong association of haemoglobin levels with age emerges when comparing studies with either different age groups of children or different proportions in each age group. As an example, Table 16 shows the inappropriateness of comparing our study (with children aged 6-72 months) to the results from Region 2 (which includes Kzyl-Orda) of the Kazakhstan Demographic and Health Survey. The latter survey found 71.4% anaemia among the children in comparison to 48.8% anaemia in our surveys, but the DHS sample included only children aged 6-36 months. If we examine anaemia levels among only 6-36 month children in Kzyl-Orda, we obtain a prevalence of 67.4%, similar to the figure reported by the DHS survey. This variation of haemoglobin with age is particularly important when making inter-country comparisons; at best we are given the age range, but we do not know the relative proportions of children in different age groups.

## 4.3 Definition of urban and rural locations

The region of Kzyl-Orda includes only one town of any substantial size, and that is Kzyl-Orda itself. However, even the town of Kzyl-Orda is very small in comparison to the city of Almaty. Our "urban" households dwelt in small communities that described themselves as urban, but that also maintained a very close link with rural life and rural households. It is a feature of the culture that people living in small urban settlements have at least a plot of land to cultivate fruits and vegetables. In these smaller towns typical of those included in the survey, households may also have cattle or sheep which are released in the morning to graze freely in the environs of the town and then return at night to the houses. It should be noted also that even people living in blocks of flats (in "urban" areas) often use pit latrines situated across the road from the block. In these respects, the urban/rural divide is not clearly marked. On the other hand, town dwelling employees will be paid in cash, have better access to transported products, including fruits, and perhaps access to a better quality of care although the latter is difficult to assess. There are altogether sufficient differences between rural and small urban communities to warrant maintaining the distinction. However the terms "small town" and "state farm" may provide a more accurate picture of the situation.

If a large city had been surveyed, there is no doubt that the distinction between urban and rural households would have been much more marked. In the DHS survey, the prevalence of moderate and severe anaemia among Almaty city children was lower than the prevalence in any of the regions (which presumable included small and large towns). In Uzbekistan (Ismail, Hill and Micklewright, 1996), lowest levels of stunting and wasting were found in the city of Tashkent (Table 20), and no differences in nutritional status were found between rural and small town Uzbek children in Fergana and Karakalpak.

## 4.4 Changes in nutritional status with time

The London School of Hygiene and Tropical Medicine initially established links with the Kazakh Institute of Geography in 1991. In 1992, with funding from Save the Children Fund (UK), Alma Akinova from the Institute was given training in anthropometric techniques and data entry by staff of the LSHTM. Ms Akinova then weighed and measured 800 kindergarten children aged 48-60 months. The same children were weighed and measured again a year later, in 1993. The kindergartens were located in the three districts where this anaemia study was carried out (Kazalinsk, Djalagash and Zhanakorgan), as well as in Aralsk, a district the borders the Aral Sea and Kazalinsk. Figure 2 (in Appendix 2) shows the changes in nutritional status of children aged 4-5 years and 5-6 years since 1992 and 1993 respectively, by comparing Ms Akinova's results with those of similarly aged children from the anaemia study. Only children from Djalagash and Zhanakorgan have been included in this investigation of trends, since no figures exist for 1995 for Kazalinsk. In both age groups, there would seem to be a clear downward trend in both height for age and weight for height, with the greatest change occurring between 1994 and 1995 in all groups except for weight for height for the 5-6 year olds. In these two districts, mean haemoglobin levels fell significantly among women, but not among children, between 1994

and 1995.

We need to interpret these findings with caution; the 1994 and 1995 data sets were obtained during different seasons, and as with the food frequency data (Section 3.2.5), economic change is confounded by seasonality in food supply. In addition, the 1992 and 1993 data sets comprised only kindergarten children, while the 1994 and 1995 data sets consisted of a mix of attenders and non-attenders. The 1992, 1993 and 1994 data sets were all gathered during the same season. It is possible therefore either that economic conditions deteriorated sharply between 1994 and 1995, or that the change in nutritional status can be attributed to a seasonal food supply. The observations of our project team would support the first option. At the very least, the situation warrants monitoring (see Section 5.2).

## 4.5 Under 5 mortality

The survey questionnaire included questions on numbers of live births and on deaths of children. This section of the questionnaire was designed as recommended by Brass, and the Brass technique was used to estimate under 5 mortality in the region (UN 1990 gives a full description of the technique). Figure 3 in Appendix 2 shows the results of our calculations and gives under 5 mortality rates from 1982 to 1993, for our three Kzyl-Orda districts. We were advised by staff of the Centre for Population Studies at LSHTM not to attempt calculations of either infant mortality rates or of mortality rates for each district. Furthermore, we were advised to treat the last point on the graph (1993) with caution since it tends to over-estimate mortality; one correction factor has already been applied, but the Centre is in the process of estimating another correction figure for this point (the 1994 point is completely disregarded by the Brass technique because it is based on figures from women aged 15-19 years only).

Our estimated figures for under 5 mortality seem to be high; figures of such magnitude are to be found in the "high" category of Unicef's State of the World's Children Reports. It is very important to remember however that Unicef's mortality rates are for the country as a whole, and it is quite inappropriate to compare our regional figures to Unicef's national ones. Kazakhstan appears for the first time in the Unicef reports in 1992, with a mortality rate of 50, falling to 49 in 1993 and 48 in 1994. We can say with some certainty that Kzyl-Orda has a much higher under 5 mortality rate than Kazakhstan as a whole, and that there was a downward trend in mortality between 1982 and 1991. While most recent trends may be questionable, there is no doubt that under 5 mortality rates in the Kzyl-Orda region have been and still are high. Indeed the rates are surprisingly high given the relatively good nutritional status of the children, a fact which raises questions about the quality of health care in the region and the availability of appropriate treatment for disease conditions (even when it was still part of the Soviet Union).

## 4.6 Comparison with other countries

Women and children's anthropometric status and anaemia levels are compared with those from selected countries in Tables 17-20. These comparisons should be considered with caution for the following reasons: comparisons between national data from one country and regional data from another are not really valid, the survey years are different, the ages included in the sample are different (this latter point is especially important when comparing children's data - see Section 4.2 above). Women's body mass indices in Kzyl-Orda (Table 17) are lower than in the United Kingdom, higher than some developing (Togo, Brazil and China) and much higher than others (India). Kzyl-Orda was similarly placed with regard to anaemia levels in women. The Kazakhstan 1995 Demographic and Health Survey gives a figure of 48.8% for the national prevalence of anaemia among women, in comparison to our figure of 36.2%. It is important to note though that the KDHS sample included pregnant women, unlike the Kzyl-Orda sample, which is likely to raise the prevalence figure. Morse (1994) found much higher levels of anaemia among non-pregnant women in the Muynak district of Uzbekistan.

Morse also found higher levels of anaemia among children in Muynak. Kzyl-Orda children are comparable to those from Jamaica, Egypt and China in the prevalence of anaemia, but have a lower prevalence than children from Bangladesh and, probably, Somalia. Table 20 compares the anthropometric status of Kzyl-Orda's children with those of other countries. In general, the Kzyl-Orda children have a much better nutritional status, with virtually no wasting and low levels of stunting than children from other developing countries. While Morse's study found more stunting and wasting in Muynak, figures from the Uzbekistan Living Standards and Measurement Survey (Ismail et al, 1995) found comparable figures for the regions of Karakalpak (which did not include the district of Muynak) and Fergana, but much lower figures in the city of Tashkent. The Kyrgyzstan study (World Bank, 1995) found a higher level of wasting than was found in either Uzbekistan or in Kazakhstan. No figures for stunting are available from the Kyrgyzstan study.

## 5.0 Conclusions and recommendations for future action

The following conclusions are derived from the results of the study of anaemia in the Kzyl-Orda region, a study that comprised six surveys conducted in three districts:-

* The levels of anaemia among women and children are moderately high in Kzyl-Orda. On the other hand, the anthropometric status is generally good: there is virtually no wasting among children, and levels of stunting are low. There is a significant proportion of women and children who are overweight.

* Considerable differences exist between districts, and these differences are more important than differences between rural and urban households, possibly because our sample contained no really large urban settlements. However, even where anaemia

levels are lowest (Djalagash and Zhanakorgan), the prevalence is high enough to warrant action.

* The dietary pattern reflects the nomadic pastoralist history of the Kazakh people: a heavy reliance on meat and dairy products, a high frequency of consumption of fats and of tea, and a low frequency of consumption of fruits and vegetables. In general the diet is monotonous, and diet diversity may have decreased recently, although it is not clear whether this reflects upon the economic situation or is a seasonal effect.

* Regression analyses indicated that the practice of geophagia was strongly associated with lower haemoglobin values, in both women and children. The practice is common in the region, and would benefit from further investigation. There was also a strong association between age and anaemia levels among children, with the prevalence of anaemia highest in the weaning age group.

* Variables that entered equations in multiple linear regression analyses explained a large amount of the variance in children's haemoglobin levels, a moderate amount of the variance in women's haemoglobin levels, women's BMI and children's height for age z-scores. On the other hand, very little of the variance in children's weight for height z-scores was explained by the variables that entered the equation.

* Socioeconomic, reproductive history and health variables entered the regression equations for anaemia and anthropometric indices. Also entering were variables that indicated a household's access to food. These findings suggest that there are a number of preventive measures that could be taken to reduce the prevalence of anaemia, such as improvements in food supply, alternative methods of contraception and reducing morbidity.

* There appears to be a downward trend in nutritional status of children in at least two districts of the region, Djalagash and Zhanakorgan (no comment can be made about Kazalinsk). While seasonality may explain some of the deterioration between 1994 and 1995, it is likely that economic conditions have worsened. There is at the very least a need to monitor the situation.

* Under 5 mortality rates were estimated using the Brass technique for the total sample. Our estimates indicate a high under 5 mortality rate, of more than 100 deaths per 1000 live births. The rates are surprisingly high when one considers the relatively good nutritional status. There is a suggestion also that there has been a trend towards lower under 5 mortality rates, similar to the trend nationally. National rates for under 5 mortality (1991-93) are much lower than Kzyl-Orda rates, suggesting that Kzyl-Orda is indeed a depressed region of Kazakhstan.

## 5.1 Working in the region

Working in the region of Kzyl-Orda is not an easy undertaking. Climatic conditions are harsh, the infrastructure is deteriorating and shortages in fuel (leading to transportation problems) and medicines are widespread. Links between the regional health authorities and the Ministry of Health in Almaty are now poor, with little or no direction or resouces coming from the central level. As yet however regional health authorities seem unable to take major policy decisions, or lack the resources to act. A possible solution may be to assist regional authorities in establishing links with external agencies, bilateral and international, and with NGOs, so that they may procure for themselves the technical assistance and resources they need for action. Indeed, this may already be happening: UNICEF and the World Bank are taking an interest in the region, and projects may soon be underway.

On the positive side, well-trained professionals are to be found even in remote areas of the region, and medical personnel are generally dedicated to the improvement of health. However, low pay and morale may reduce motivation and encourage migration to large urban centres. The highly educated workforce is well placed to learn new techniques, and keen to import and apply western ideas and technology. The high level of literacy greatly facilitated our survey work, leading as it did to an understanding of the need for surveys and information gathering, and hence to a willingness to participate. The literacy level should also ensure good participation in health and nutrition interventions.

To address the nutritional problems highlighted by the results of our surveys, we propose that support should continue to be provided to the monitoring system that we have begun, and that pilot interventions be implemented to combat anaemia.

## 5.2 Monitoring system

As a result of our work in the region, there now exists a body of trained personnel, able to undertake anthropometric measurements and measure haemoglobin levels in three districts of the region. We have engaged in discussions with the Ministry of Health in Almaty and with regional administrators and health authorities about the need to continue monitoring at least the nutritional status of children. Our recommendation was that a very simple monitoring system should be maintained, based at selected health centres only (possibly those covered by our surveys), and that heights and weights be taken routinely of a sample of children twice a year to capture seasonality. Anthropometric equipment used for the survey has been left in the region, but more would be needed to cover those regions not covered by the anaemia study and to replace malfunctioning items. It is unlikely however that monitoring will continue unless funding is made available to support it. It is also important to consider the actions that would need to be taken should a serious deterioration in nutritional status occur.

For the monitoring of haemoglobin levels, we feel that this would best be done as part of the programmes to combat anaemia (see Section 5.3).

## 5.3 Programmes to combat anaemia

### a) Supplementation

Given the moderately high levels of anaemia in young children and women of child-bearing age, a programme of routine supplementation for pregnant women and weaning age children is needed. While serum folate levels were not investigated in this study, it is likely that intake is low as intakes of fresh fruit and vegetables are low; we would therefore recommend that the supplement include both iron and folic acid.

### b) Nutrition and health promotion

An improved Kazakh diet would be beneficial not only for the reduction of anaemia, but also for the reduction of chronic diseases (cancers and cardiovascular disorders) that are said to be widely prevalent in the country. Guidance could also be given on the timing of the consumption of enhancers and inhibitors of iron absorption, but care needs to be taken with regard to tea as there are no other non-alcoholic beverages available in the region (except milk). Water quality is poor, and any health programme would need to encourage the boiling of water. There is also a need for improved food handling practices.

### c) Food-based programmes

Our findings indicate that fruits and vegetables are well appreciated, and that consumption rises sharply when they are plentiful. A study is needed to investigate the feasability of increasing supplies of fruits and vegetables at the household level and in markets, and of ways to bridge the seasonal gap. Fortification is another option for increasing iron intakes in the region. Very little wheat is grown in Kzyl-Orda, more is grown in northern Kazakhstan, and milling is likely to be centralized which would facilitate fortification. However, it is also possible that Kazakh wheat, like rice, is sent to Russia to be milled and then re-imported into Kazakhstan. An alternative would be to fortify the flour after milling, possibly at bakeries (of which there are approximately 10 in Kzyl-Orda), or at some central place prior to the delivery of the flour to the bakeries. Whichever method is used a major concern would be quality control.

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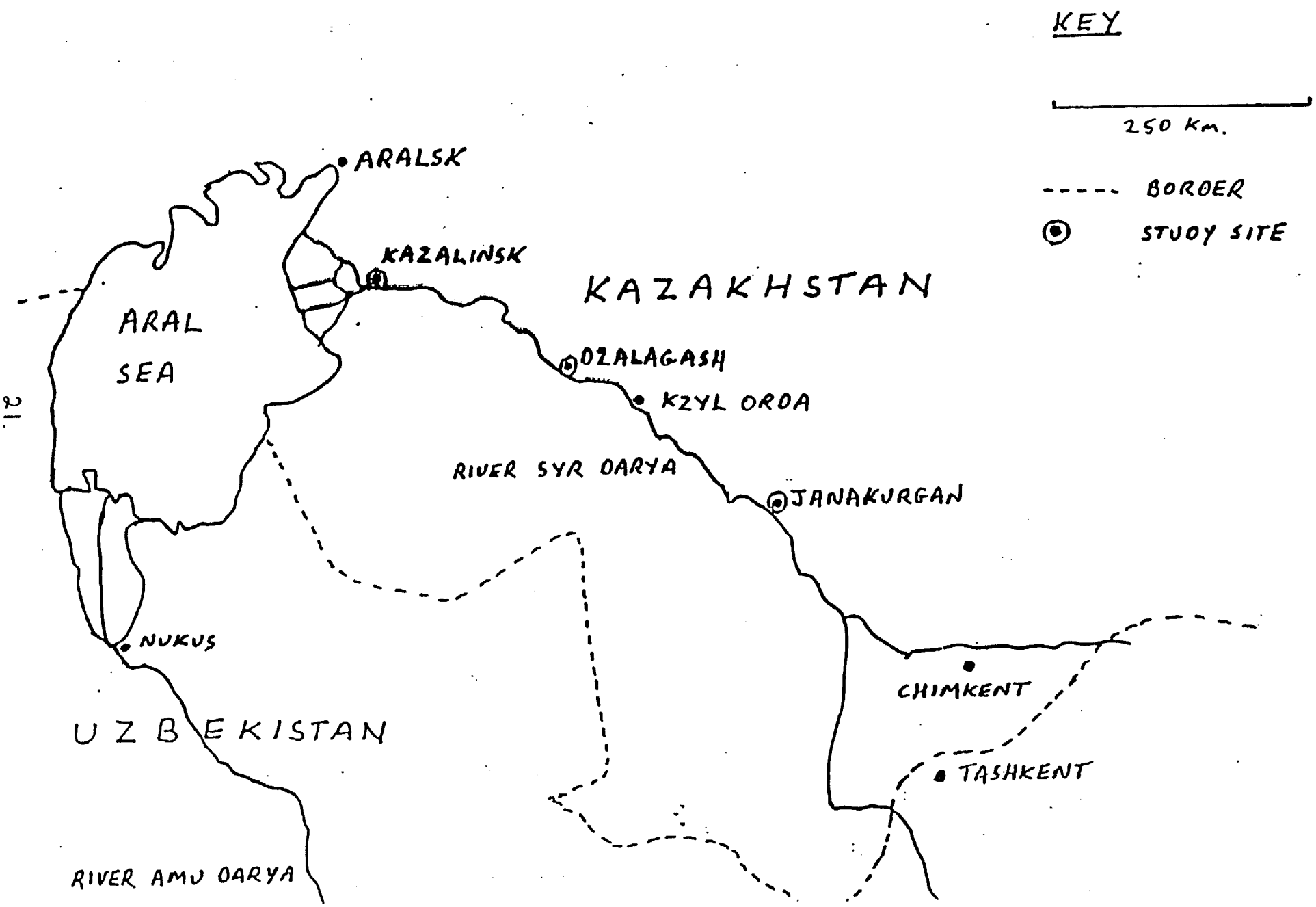
# APPENDIX 1

# MAPS OF THE STUDY AREA

## APPENDIX 1: MAP OF CENTRAL ASIA

| | | | |
|---|---|---|---|
| 1 | - TADZHIKISTAN | 4 | - INDIA (JAMMU KASHMIR) |
| 2 | - GORNO-BADAKHSHAN | 5 | - AZERBAIDZHAN |
| 3 | - PAKISTAN | 6 | - MONGOLIA |

APPENDIX 1: MAP OF THE STUDY REGION



# APPENDIX 2

## SURVEY RESULTS: TABLES AND FIGURES

**Table 1A: The Sample**

| | Kazalinsk | Djalagash | Zhanakorgan | Total |
|---|---|---|---|---|
| **1. Women** | | | | |
| Round 1 | 423 | 900 | 803 | 2126 |
| Round 2 | 775 | 734 | 603 | 2112 |
| Total | 1198 | 1634 | 1406 | 4238 |
| **2. Children** | | | | |
| Round 1 | 270 | 576 | 586 | 1432 |
| Round 2 | 410 | 383 | 267 | 1060 |
| Total | 680 | 959 | 853 | 2492 |

**Table 1B: Survey Dates**

| | Kazalinsk | Djalagash | Zhanakorgan |
|---|---|---|---|
| Round 1 | Jun/Jul 1994 | Oct/Nov 1994 | Nov/Dec 1994 |
| Round 2 | Sep/Oct 1994 | Jul 1995 | Aug 1995 |

**Table 1C: Location of Households**

| | Kazalinsk | | Djalagash | | Zhanakorgan | | Total | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| Urban | 643 | 54 | 686 | 42 | 488 | 35 | 1817 | 43 |
| Rural | 547 | 46 | 948 | 58 | 918 | 65 | 2413 | 57 |

Table 2: Women's Data (1)

| | | Kazalinsk | Djalagash | Zhanakorgan | Total |
|---|---|---|---|---|---|
| 1. | **Mean age (years)** | 29.8 | 30.6 | 29.8 | 30.1 |
| | SD | 8.6 | 8.9 | 8.7 | 8.7 |
| 2. | **Marital Status** | | | | |
| | Single % | 25.8 | 20.3 | 24.3 | 23.2 |
| | Married/widowed/divorced % | 74.2 | 79.7 | 75.7 | 76.8 |
| 3. | **Age at Marriage** | | | | |
| | Mean | 21.1 | 21.4 | 21.3 | 21.3 |
| | SD | 3.0 | 6.0 | 4.6 | 4.9 |
| 4. | **Haemoglobin** (g/dl) | | | | |
| | Mean | 11.7 | 11.9 | 12.2 | 12.0 |
| | SD | 1.6 | 1.7 | 1.7 | 1.7 |
| 5. | **Anaemia** (%) | | | | |
| | None | 54.0 | 63.6 | 65.9 | 61.6 |
| | Mild | 34.4 | 24.3 | 23.9 | 27.0 |
| | Mod. & severe | 11.5 | 12.2 | 10.1 | 11.3 |
| 6. | **Body mass index** | | | | |
| | Mean | 22.5 | 22.4 | 22.8 | 22.6 |
| | SD | 3.9 | 4.0 | 4.1 | 4.0 |
| | % <20 kg/m$^2$ | 29.5 | 28.7 | 25.7 | 27.9 |

Notes:

Significant interdistrict differences were found in:-

a) Mean age ($p<.01$)
b) Marital status ($P<.005$)
c) Mean BMI ($p<.05$)
d) Mean haemoglobin ($p<.001$) and anaemia levels ($p<.001$)

Table 3: Women's data (2)

| | Kazalinsk | Djalagash | Zhanakorgan | Total |
|---|---|---|---|---|
| **1. Geophagia** | | | | |
| % Yes | 26.0 | 24.2 | 21.4 | 23.8 |
| **2. Previously diagnosed anaemia** | | | | |
| % Yes | 29.0 | 26.4 | 21.9 | 25.7 |
| **3. Recent morbidity** | | | | |
| % ≥1 episode | 17.6 | 20.0 | 19.7 | 19.2 |
| **4. Use of IUD** | | | | |
| % Yes | 44.9 | 43.6 | 36.7 | 41.7 |
| **5. Birthspacing** | | | | |
| Mean (years) | 3.2 | 2.9 | 2.8 | 3.0 |
| SD | 1.6 | 1.2 | 1.2 | 1.3 |
| **3. Percent of children who died** | | | | |
| 0 | 67.8 | 67.5 | 68.7 | 68.0 |
| ≤33.3% | 21.7 | 25.2 | 24.2 | 23.9 |
| >33.3% | 10.5 | 7.4 | 7.1 | 8.2 |

**Notes:**

Significant interdistrict differences were found in the following variables: at $p<.05$ for the practice of geophagia and for the percent of children dead, and at $p<.001$ for the remainder, except recent morbidity. No difference was found for recent morbidity.

Table 4: Women's Data (3)

| | Kazalinsk | Djalagash | Zhanakorgan | Total |
|---|---|---|---|---|
| **1. Total possession score** | | | | |
| ≤3 items % | 19.5 | 23.1 | 24.1 | 22.4 |
| 4-5 | 37.8 | 37.2 | 36.0 | 37.0 |
| 6-7 | 32.6 | 29.8 | 30.7 | 30.9 |
| 8-11 items | 10.1 | 9.8 | 9.2 | 9.7 |
| **2. Total benefits received** | | | | |
| None % | 58.8 | 65.5 | 67.4 | 64.2 |
| <1000 Tenge | 33.5 | 12.7 | 10.8 | 17.9 |
| ≥1000 | 7.8 | 21.8 | 21.8 | 17.9 |
| **3. Own a plot of land** | | | | |
| % Yes | 66.4 | 75.0 | 75.7 | 72.8 |
| **4. Produce grown** | | | | |
| <3 items % | 30.5 | 25.8 | 25.2 | 26.8 |
| 4,6 items | 41.0 | 34.6 | 35.7 | 36.6 |
| 7-9 items | 28.5 | 39.6 | 39.1 | 36.6 |
| **5. Variety of animals kept** | | | | |
| ≤1% | 39.0 | 28.1 | 27.0 | 30.8 |
| 2,3 | 34.5 | 37.3 | 38.7 | 37.0 |
| 4-7 | 26.4 | 34.6 | 34.4 | 32.2 |

Notes:

a) Significant interdistrict differences were found for all variables at the $p<.001$ level, except for the total possession score.
b) For 'produce grown', the percentages are of households who own a plot only.

Table 5: Children's Data (1)

| | | Kazalinsk | Djalagash | Zhanakorgan | Total |
|---|---|---|---|---|---|
| 1) | **Age (m)** | | | | |
| | Mean | 33.2 | 32.8 | 32.3 | 32.7 |
| | SD | 17.2 | 16.9 | 16.9 | 17.0 |
| 2) | **Sex** | | | | |
| | Male % | 51.0 | 50.2 | 52.3 | 51.1 |
| | Female % | 49.0 | 49.8 | 47.7 | 48.9 |
| 3) | **Haemoglobin (g/dl)** | | | | |
| | Mean | 10.2 | 10.8 | 10.9 | 10.7 |
| | SD | 1.6 | 1.7 | 1.8 | 1.7 |
| 4) | **Anaemia (%)** | | | | |
| | None | 40.4 | 56.1 | 55.3 | 51.2 |
| | Mild | 21.1 | 13.7 | 18.4 | 17.3 |
| | Mod | 35.4 | 28.1 | 24.0 | 29.0 |
| | Severe | 3.1 | 2.1 | 2.2 | 2.4 |
| 5) | **Height for age (z-score)** | | | | |
| | Mean | -0.83 | -0.97 | -1.12 | -0.97 |
| | SD | 1.2 | 1.2 | 1.2 | 1.2 |
| | **Stunting (%)** | | | | |
| | <-2SD | 13.4 | 16.0 | 20.4 | 16.6 |
| 6) | **Weight for height (z-score)** | | | | |
| | Mean | 0.17 | 0.22 | 0.33 | 0.24 |
| | SD | .9 | 1.0 | 1.0 | 1.0 |
| | **Mild wasting (%)** | | | | |
| | <-1SD | 10.8 | 8.7 | 8.7 | 9.4 |
| | **Overweight (%)** | | | | |
| | >+1SD | 17.3 | 17.8 | 25.3 | 20.0 |

**Notes:**
Significant differences between districts were found in:
a) Mean haemoglobins and anaemia levels ($p<.001$).
b) Mean height for age z-score ($p<.001$) and stunting ($p<.005$)
c) Mean weight for height z-score ($p<.01$) and wasting ($p<.001$).

Table 6: Children's data (2)

| | Kazalinsk | Djalagash | Zhanakorgan | Total |
|---|---|---|---|---|
| **1. Geophagia** | | | | |
| % Yes | 30.7 | 28.7 | 27.7 | 28.9 |
| **2. Previously diagnosed anaemia** | | | | |
| % Yes | 6.5 | 6.6 | 9.1 | 7.5 |
| **3. Recent morbidity** | | | | |
| % ≥1 episode | 21.5 | 25.4 | 22.5 | 23.3 |
| **4. Birthweight** | | | | |
| % <2500g | 10.0 | 7.6 | 7.6 | 8.2 |
| Mean (g) | 3247 | 3323 | 3306 | 3297 |
| SD | 587 | 585 | 575 | 582 |

**Notes:**

Significant interdistrict differences were found only for percent low birthweight ($p<.05$) and mean birthweight ($p<.05$)

Table 7: Children's data (3)

| | Kazalinsk | Djalagash | Zhanakorgan | Total |
|---|---|---|---|---|
| **1. Breastfeeding** | | | | |
| % breastfed | 97.1 | 98.2 | 97.3 | 97.6 |
| % breastfeeding now | 28.7 | 26.3 | 24.2 | 26.2 |
| Cessation of BF: | | | | |
| Mean age (m) | 14.2 | 14.5 | 13.2 | 14.0 |
| SD | 8.2 | 7.0 | 6.6 | 7.2 |
| **2. Age of introduction of complementary milk** | | | | |
| ≤4m (%) | 35.8 | 36.5 | 41.8 | 38.1 |
| 5-8m (%) | 29.5 | 36.2 | 32.8 | 33.2 |
| 9-12m (%) | 12.4 | 15.8 | 16.5 | 15.1 |
| ≥13m (%) | 22.4 | 11.4 | 9.0 | 13.5 |
| **3. Complementary milks used** | | | | |
| Cow's milk % | 78.1 | 82.9 | 81.2 | 81.0 |
| Formula milk % | 20.0 | 19.2 | 17.7 | 18.9 |
| Other % | 7.2 | 3.4 | 4.9 | 5.0 |
| **4. Receives meal at kindergarten** | | | | |
| % Yes | 29.4 | 10.9 | 10.1 | 15.6 |

**Notes:**

Significant interdistrict differences were found in:-

a) Mean age of cessation of breastfeeding ($p<.005$)
b) Age of introduction of complementary milk ($p<.001$); use of cow's milk ($p<.05$) and other milks ($p<.005$)
c) Meal at kindergarten ($p<.001$).

## Final Regression Models (1): Table 8

### WOMEN

### 1. Dependent variable = haemoglobin levels

A total of **14.2%** of the variance in haemoglobin levels was explained by:-

| Variable | Beta | Sig | Notes |
|---|---|---|---|
| Geophagia | -0.22 | (a) | 0=No, 1=Yes |
| Previous anaemia | -0.15 | (a) | 0=No, 1=Yes |
| Use of IUD | -0.07 | (a) | 0=No, 1=Yes |
| BMI | 0.12 | (a) | Continuous variable |
| Age | -0.1 | (a) | Continuous variable |
| Kazalinsk resident | -0.06 | (b) | 0=No, 1=Yes |
| Possession score | 0.05 | (b) | Range = 0-11 |
| Zhanakor resident | 0.05 | (b) | 0=No, 1=Yes |
| Produce grown | 0.04 | (c) | Range = 0-9 (includes landless) |
| Tea consumption | -0.03 | (d) | Continuous (cups/day) |
| Recent morbidity | -0.03 | (d) | 0=none 1=≥1 episode |

### 2. Dependent variable = body mass index

A total of **14.4%** of the variance in BMI was explained by:-

| Variable | Beta | Sig | Notes |
|---|---|---|---|
| Age | 0.36 | (a) | Continuous variable |
| Haemoglobin | 0.11 | (a) | Continuous variable |
| Previous anaemia | -0.11 | (a) | 0=No, 1=Yes |
| Djalagash resident | -0.05 | (b) | 0=No, 1=Yes |
| Height | -0.04 | (b) | Continuous variable |
| Recent morbidity | -0.04 | (c) | 0=none 1=≥1 episode |
| Animals kept | 0.04 | (c) | Range = 0-7 |
| Total benefits received | -0.03 | (d) | Continuous variable |

**Significance levels**
a = $p<.001$
b = $p<.005$
c = $p<.01$
d = $p<.05$

**Final Regression Models (2): Table 9**

CHILDREN

1. **Dependent variable = haemoglobin levels**

A total of **29.7%** of the variance in haemoglobin levels was explained by:-

| Variable | Beta | Sig | Notes |
|---|---|---|---|
| Age | 0.4 | (a) | Continuous variable |
| Geophagia | -0.26 | (a) | 0=No, 1=Yes |
| Kazalinsk resident | -0.2 | (a) | 0=No, 1=Yes |
| Height for age (z-score) | 0.13 | (a) | Continuous |
| Location | -0.07 | (a) | 0=rural, 1-urban |
| Produce grown | 0.06 | (b) | Range = 0-9 |
| Birthweight | 0.06 | (b) | Continuous |
| Djalagash resident | -0.06 | (c) | 0=No, 1=Yes |
| Weight for height (z-score) | 0.04 | (d) | Continuous |
| Total benefits | 0.04 | (d) | Continuous |

2. **Dependent variable = weight for height z-score**

**A total of 6.8% of the variance in weight for height was explained by:-**

| Variable | Beta | Sig | Notes |
|---|---|---|---|
| Birthweight | 0.14 | (a) | Continuous |
| Maternal BMI | 0.12 | (a) | Continuous |
| Recent morbidity | -0.08 | (a) | 0=None, 1=≥1 episode |
| Age when other milk received | -0.08 | (a) | Continuous |
| Animals kept | 0.08 | (a) | Range = 0-7 |
| Haemoglobin level | 0.07 | (b) | Continuous |
| Meal at kindergarten | 0.05 | (c) | 0=No, 1=Yes |

**Significance levels**
a = $p<.001$
b = $p<.005$
c = $p<.01$
d = $p<.05$

**Final Regression Models (3): Table 9 (continued)**

**CHILDREN (continued)**

3. **Dependent variable = height for age z-score**

A total of **17.9%** of the variance in height for age z-score was explained by:-

| Variable | Beta | Sig | Notes |
|---|---|---|---|
| Maternal height | 0.27 | (a) | Continuous variable |
| Birthweight | 0.22 | (a) | Continuous variable |
| Haemoglobin level | 0.16 | (a) | Continuous variable |
| Kazalinsk resident | 0.11 | (a) | 0=No, 1=Yes |
| Possession score | 0.1 | (a) | Range = 0-11 |
| Age | -0.09 | (a) | Continuous |
| Sex | 0.05 | (d) | 0=Male, 1=Female |
| Produce grown | 0.05 | (d) | Range = 0-9 |

**Table 10: Foods consumed in Kzyl-Orda and food groups used for analysis**

| Food Group | Items used in food group |
|---|---|
| Meat | Boiled or fried mutton, beef, horsemeat, tinned beef, mutton soup |
| Tripe | Stomach and intestines of sheep, cows, horse |
| Organ meats | Liver and kidneys of sheep, cow, goose |
| Poultry | Boiled or fried chicken and goose |
| Fish | Fresh, tinned, salted or pickled |
| Cereals | Roasted millet, wheat, groundwheat, buckwheat, oats. |
| Bread | Brown, white and fried. |
| Milk | Milks of cows, sheep, camel, mare, milk soup, sour milk. |
| Dairy products | Cream, yoghurt, cheese, curds. |
| Butter | Butter from cow's milk and sheep's milk; sour butter. |
| Vegetables | Cabbage, beetroots, onions, tomato, borscht, vegetable soup. |
| Fresh Fruit | Melon, water melon, apple, pear, apricot, peach. |
| Preserved fruit | Tinned, dried, stewed fruit. |
| Alcohol | Beer and vodka. |
| Tea | Black tea, green tea (very rare). |
| Water | Tap water, mineral water. |
| Fats | Oil (sunflower), margarine. |
| Eggs | Eggs |
| Rice | Rice |
| Potatoes | Potatoes |
| Sugar | Sugar (refined, white) |

**Table 11: Total sample: Median frequencies of consumption of food groups**

| | <1/month | <1/week | 1-4/week | 5/week-1/day | >1/day |
|---|---|---|---|---|---|
| A. WOMEN | Poultry<br>Alcohol<br>Preserved fruit | Fish<br>Cereal<br>Eggs | Tripe<br>Organ meats<br>Vegetables<br>Fresh Fruit<br>Rice | Butter<br>Dairy products<br>Potatoes | Meat<br>Fats<br>Bread<br>Milk<br>Tea<br>Sugar<br>Water |
| B. CHILDREN | Poultry<br>Preserved fruit | Tripe<br>Fish<br>Cereal<br>Eggs | Organ meats<br>Dairy products<br>Vegetables<br>Fresh Fruit<br>Rice<br>Potatoes | Butter<br>Fats | Meat<br>Bread<br>Milk<br>Tea<br>Water<br>Sugar |

**Table 12: Variety scores for foods consumed by survey rounds**

| | Women (2) | | Children (3) | |
|---|---|---|---|---|
| | Round 1 | Round 2 | Round 1 | Round 2 |
| **A. Monthly score (1)** | | | | |
| 1. Mean ± SD | 15.6 ± 2.4 | 14.3 ± 2.4 | 14.3 ± 4.0 | 12.9 ± 3.9 |
| Range | 6 - 20 | 5 - 20 | 1 - 20 | 1 - 19 |
| | % | % | % | % |
| 2. Very low | 11.0 | 21.2 | 13.9 | 20.0 |
| Low | 17.8 | 28.5 | 15.6 | 26.8 |
| Medium | 31.8 | 31.3 | 22.3 | 27.8 |
| High | 16.2 | 11.6 | 29.8 | 21.5 |
| Very high | 23.2 | 7.3 | 18.4 | 3.9 |
| **B. Weekly score (1)** | | | | |
| 1. Mean ± SD | 13.8 ± 2.6 | 12.2 ± 2.5 | 12.6 ± 3.8 | 11.1 ± 3.5 |
| Range | 5 - 20 | 4 - 20 | 1 - 20 | 1 - 18 |
| | % | % | % | % |
| 2. Very low | 11.3 | 24.7 | 13.2 | 19.4 |
| Low | 18.7 | 29.4 | 17.8 | 28.0 |
| Medium | 29.4 | 29.9 | 22.9 | 26.4 |
| High | 25.1 | 12.2 | 25.3 | 20.7 |
| Very high | 15.6 | 3.7 | 20.8 | 5.4 |
| **C. Daily score (1)** | | | | |
| 1. Mean ± SD | 7.7 ± 2.2 | 7.1 ± 1.7 | 7.0 ± 2.5 | 6.6 ± 2.1 |
| Range | 3 - 17 | 1 - 13 | 1 - 14 | 1 - 12 |
| | % | % | % | % |
| 2. Very Low | 14.9 | 16.2 | 14.1 | 13.7 |
| Low | 15.6 | 19.2 | 25.8 | 28.5 |
| Medium | 19.8 | 24.0 | 20.3 | 23.6 |
| High | 30.8 | 33.8 | 16.9 | 19.6 |
| Very high | 18.9 | 7.7 | 22.9 | 14.5 |

(1) Monthly, weekly, daily scores: number of food groups (see Table 10) consumed at least onced per month, week or day respectively.

(2) All differences between survey rounds 1 and 2 are statistically significant ($P \leq .005$). Children's sample includes those who are partially breastfed.

**Table 13: Differences between districts in median frequencies of consumption**

| Higher consumption in Djalagash | | Higher consumption in Zhanakorgan | |
|---|---|---|---|
| **Women** | **Children** | **Women** | **Children** |
| Meat<br>Poultry<br>Fats<br>Milk<br>Dairy products<br>Potatoes | Milk<br>Dairy products<br>Fruit | Cereal<br>Fruit<br>Water | Cereal |

Note: There was no difference between districts in median frequencies of consumption for good groups not mentioned in this table.

**Table 14: Seasonal differences (between Rounds 1 and 2 by district in median frequencies of consumption.**

| **A. Djalagash: women** | | | **Zhanorkorgan: women** | | |
|---|---|---|---|---|---|
| **Higher in Round 2** | **Lower in Round 2** | **No difference** | **Higher in Round 2** | **Lower in Round 2** | **No difference** |
| Rice<br>Water | Meat<br>Tripe<br>Organ meats<br>Poultry<br>Cereal<br>Dairy products<br>Vegetables<br>Fresh fruit<br>Potatoes | Fish<br>Butter<br>Fats<br>Bread<br>Milk<br>Tea<br>Sugar<br>Eggs<br>Preserved fruit | Milk<br>Vegetables<br>Fresh fruit<br>Water | Meat<br>Organ meats<br>Cereal<br>Fats<br>Dairy products | Tripe<br>Poultry<br>Fish<br>Butter<br>Bread<br>Tea<br>Rice<br>Sugar<br>Potatoes<br>Eggs<br>Preserved fruit |
| **A. Djalagash: children** | | | **Zhanorkorgan: children** | | |
| **Higher in Round 2** | **Lower in Round 2** | **No difference** | **Higher in Round 2** | **Lower in Round 2** | **No difference** |
| Fats<br>Milk<br>Dairy Products<br>Rice<br>Water | Meat<br>Tripe<br>Organ meats<br>Poultry<br>Cereal<br>Vegetables<br>Fresh fruit<br>Potatoes | Fish<br>Butter<br>Bread<br>Tea<br>Sugar<br>Eggs<br>Preserved fruit | Dairy products<br>Fresh fruit | Meat<br>Tripe<br>Organ meats<br>Cereal<br>Butter | Poultry<br>Fish<br>Fat<br>Bread<br>Milk<br>Vegetables<br>Potatoes<br>Preserved fruit<br>Rice<br>Sugar<br>Eggs<br>Tea<br>Water |

**Table 15: Geophagia**

| | Women | Children |
|---|---|---|
| Geophagics % | 24 | 31 |
| Prevalence of mod. & severe anaemia among: | | |
| a) Geophagics % | 23 | 49 |
| b) Non-geophagics % | 8 | 24 |

**Table 16:**

| | Kzyl Orda Surveys (3 districts) | | DHS Survey (Region 2) |
|---|---|---|---|
| Age Group | 6-72m | 6-36m | 6-36m |
| Non-anaemic % | 51.2 | 32.6 | 28.6 |
| Anaemic % | 48.8 | 67.4 | 71.4 |
| Mean Hb (g/dl) | 10.7 | 10.0 | N/A |

TABLE 17: WOMEN'S ANTHROPOMETRIC STATUS IN SELECTED COUNTRIES

| Country(1) | Year | Moderate + Severe Undernutrition % (2) | Overweight and Obesity % (2) |
|---|---|---|---|
| United Kingdom | 1990 | <5 | 30 |
| Kyrgyzstan | 1993 | 5 | 32 |
| Kazakhstan (3) | 1994 | 9 | 23 |
| Togo | 1986 | 10 | 23 |
| Brazil | 1974/5 | 12 | 26 |
| China | 1992 | 12 | 11 |
| India | 1988/90 | 49 | 4 |

(1) Togo, Brazil, China, India (Shetty and James 1994), Kyrgyzstan (World Bank 1995), United Kingdom (OPCS 1990)
(2) Based on BMI classification
(3) Kzyl-Orda Region only

TABLE 18: ANAEMIA LEVELS AMONG NON-PREGNANT WOMEN IN SELECTED COUNTRIES

| Country (1) | Survey Year | Survey Location | Anaemia Prevalence (2) | Mod.& Severe anaemia prevalence (3) |
|---|---|---|---|---|
| Somalia | 1988 | Rural NW | NA | 25.1 |
| Botswana | 1986 | National | 10.2 | NA |
| Bangladesh | 1982 | National | 74 | NA |
| Uzbekistan | 1993 | Muynak | 63 | NA |
| Kazakhstan | 1994 | Kzyl-Orda | 36.2 | 10.2 |
| China | 1992 | National | 26 | NA |
| UK | 1988 | National | 22.8(4) | NA |

(1) Somalia, Botswana, Bangladesh figures from FAO Nutrition Country Profiles, Uzbekistan (Morse 1994), China (ACC/SCN 1992), United Kingdom (OPCS 1990)
(2) Includes mild, moderate and severe anaemia
(3) Only moderate and severe anaemia
(4) Cut-off used was <12.5g/dl. Hence UK prevalence is not directly comparable to others.
NA = not available.

TABLE 19: ANAEMIA LEVELS AMONG CHILDREN IN SELECTED COUNTRIES

| Country (1) | Survey Year | Survey Location | Age Group | Anaemia Prevalence % (2) | Mod.& Severe anaemia prevalence % (3) |
|---|---|---|---|---|---|
| Somalia | 1988 | NW Rural | 0-5y | NA | 50.0 |
| Bangladesh | 1982 | National | 0-6y | 74 | NA |
| Tanzania | 1984 | Iringa | 0-5y | NA | 25.0 |
| Jamaica | 1985 | National | 0-5y | 43.6 | NA |
| Egypt | 1986 | National | 6-71m | 51.6 | NA |
| China | 1995 | South<br>Southeast<br>North | 0-4y<br>0-4y<br>0-4y | 59.6<br>73.4<br>43.2 | |
| Uzbekistan | 1993 | Muynak | 6-60m | 71.0 | NA |
| Kazakhstan | 1994 | Kzyl Orda | 6-71m | 47.6 | 32.2 |

(1) Figures from all countries from FAO Nutrition Country Profiles except China (Guang-Jun 1995) and Uzbekistan (Morse 1994).
(2) Includes mild, moderate and severe anaemia
(3) Only moderate and severe anaemia

NA = not available.

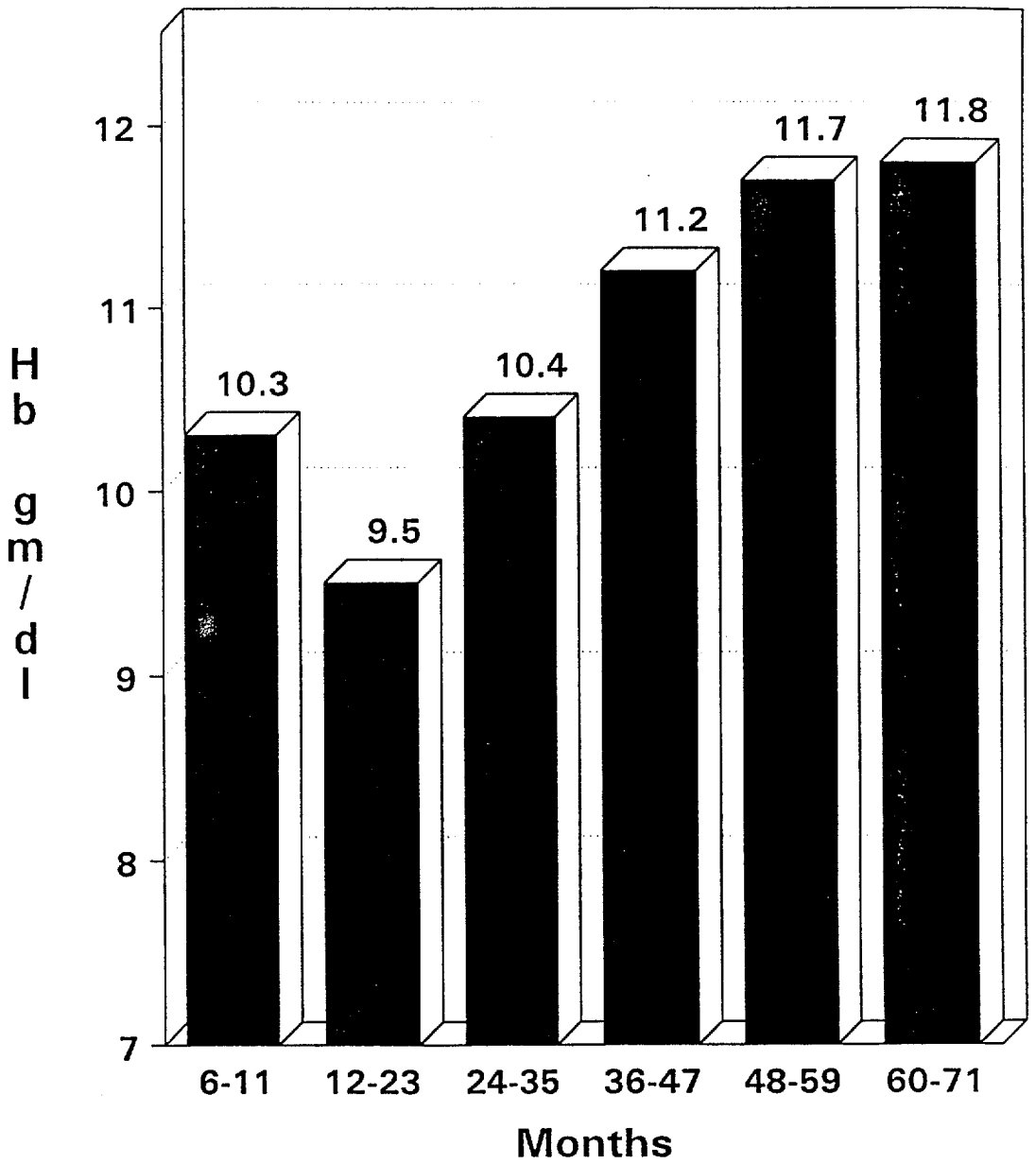
Table 20: Children's anthropometric status in selected countries

| Country (1) | Year | Stunting % (2) | Wasting % (2) |
|---|---|---|---|
| Brazil | 1989 | 15.4 | 2.0 |
| Honduras | 1987 | 33.9 | 1.9 |
| Ethiopia | 1992 | 64.2 | 8.0 |
| Tanzania | 1991-2 | 42.6 | 6.0 |
| India | 1988 | 62.1 | 19.2 |
| Mongolia | 1992 | 26.4 | 1.7 |
| China | 1987 | 32.1 | 3.6 |
| China (poor rural provinces) | 1989 | 41.8 | 2.2 |
| Kazakhstan (Kzyl Orda) | 1994 | 15.0 | 0.5 |
| Uzbekistan (Muynak) | 1993 | 25.9 | 3.6 |
| Kyrgyzstan | 1993 | NA | 7.0 |
| Uzbekistan | 1995 | | |
| Tashkent | | 7.1 | 2.7 |
| Fergana | | 17.9 | 4.4 |
| Karakalpak | | 14.3 | 3.4 |

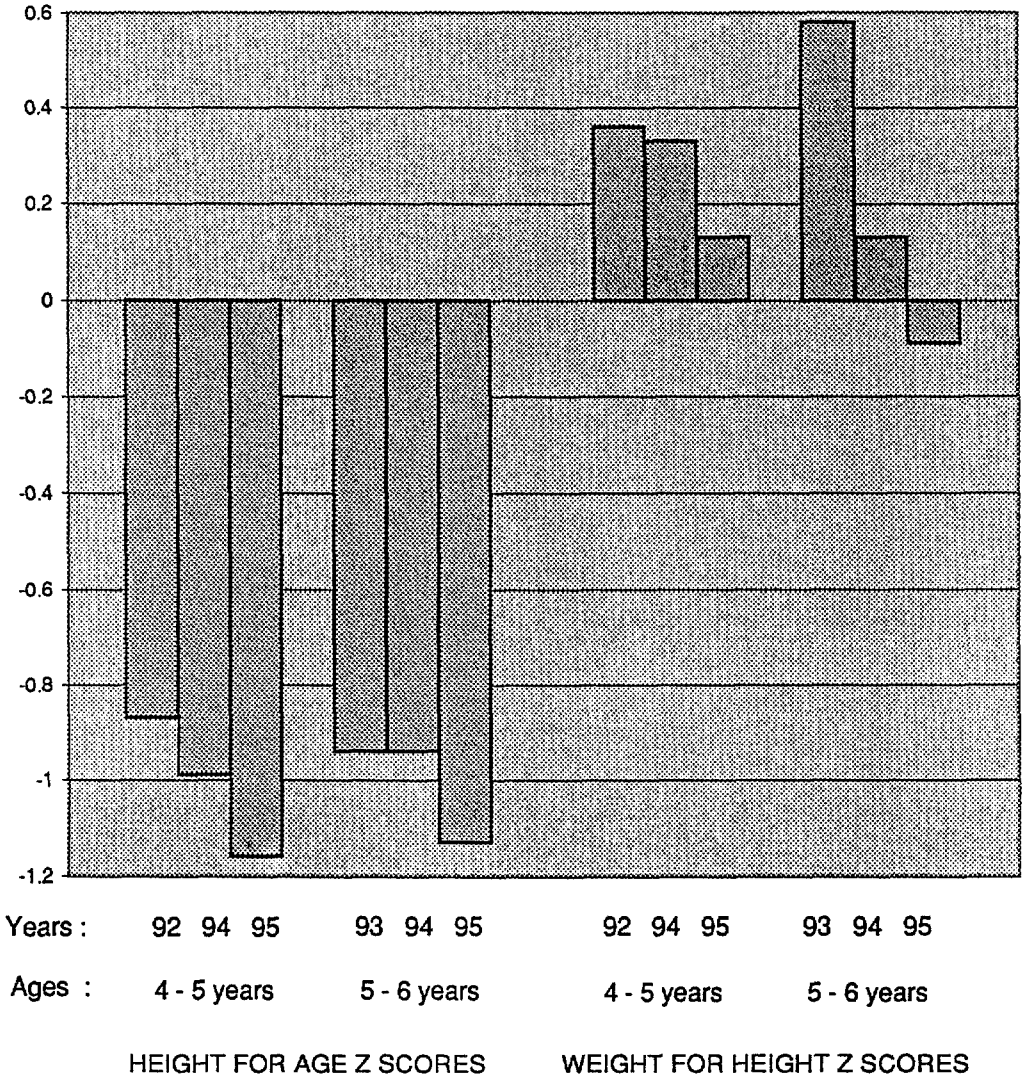
(1) Unless otherwise stated, the figures are from national surveys. All figures taken from WHO Global Database (de Onis et al 1993) except Uzbekistan (Morse 1994), Kyrgyzstan (World Bank 1995) and poor rural provinces of China (Chang Ying et al 1994), Uzbekistan (Ismail, Hill, Micklewright, 1995).

(2) Stunting/wasting: <-2SD below reference median.

Figure 1: Children's Haemoglobin Levels by Age Group



## Figure 2 : Nutritional Status of Children



## Figure 3 : Under Five Mortality Rate (Total Sample)

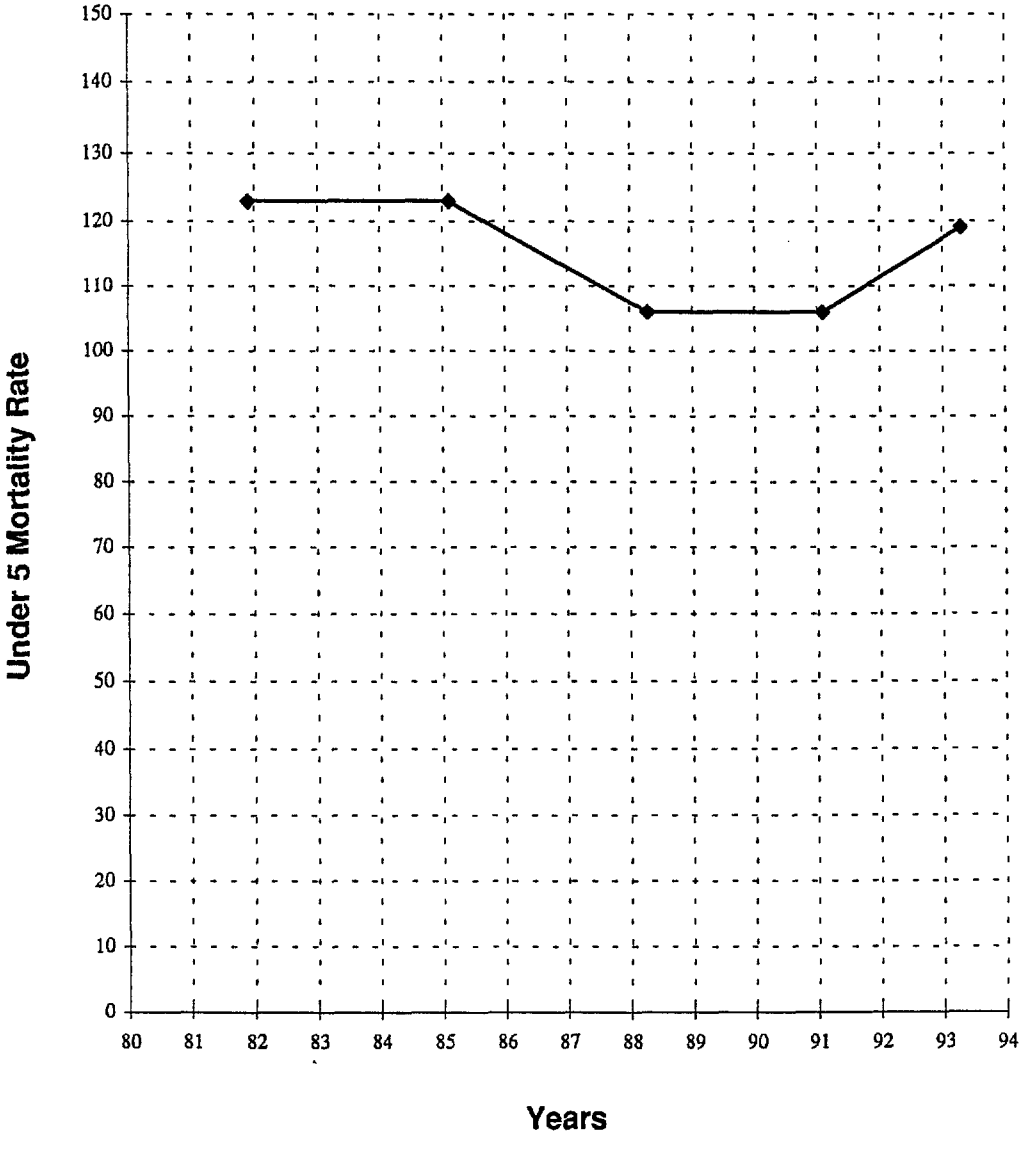
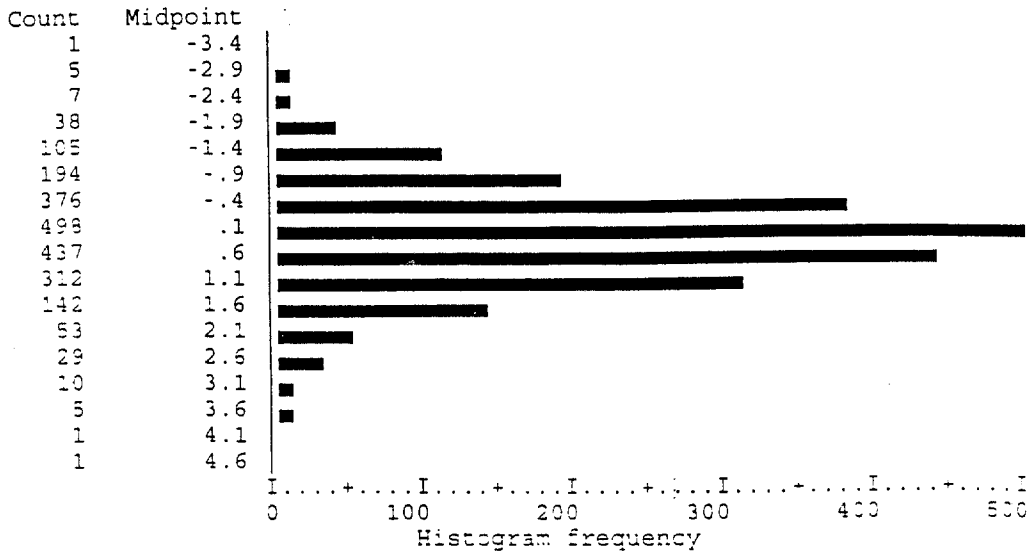


FIGURE 4: WEIGHT FOR HEIGHT Z-SCORE DISTRIBUTION

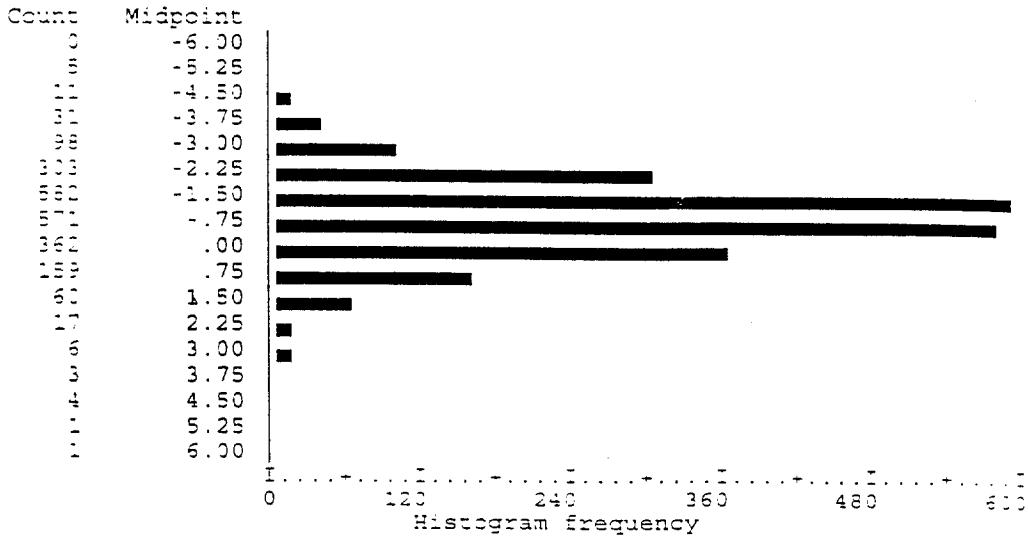



| | | | | | |
|---|---|---|---|---|---|
| Mean | .238 | Std err | .020 | Median | .210 |
| Mode | -.090 | Std dev | .956 | Variance | .915 |
| Kurtosis | .734 | S E Kurt | .104 | Skewness | .164 |
| S E Skew | .052 | Range | 8.490 | Minimum | -3.640 |
| Maximum | 4.850 | Sum | 527.650 | | |

* Multiple modes exist. The smallest value is shown.

Valid cases 2214 Missing cases 278

FIGURE 5: HEIGHT FOR AGE Z-SCORE DISTRIBUTION




| | | | | | |
|---|---|---|---|---|---|
| Mean | -.974 | Std err | .026 | Median | -1.030 |
| Mode | -1.370 | Std dev | 1.200 | Variance | 1.440 |
| Kurtosis | 2.057 | S E Kurt | .104 | Skewness | .433 |
| S E Skew | .052 | Range | 11.330 | Minimum | -5.590 |
| Maximum | 5.740 | Sum | -2156.640 | | |

* Multiple modes exist. The smallest value is shown.

Valid cases 2214 Missing cases 278



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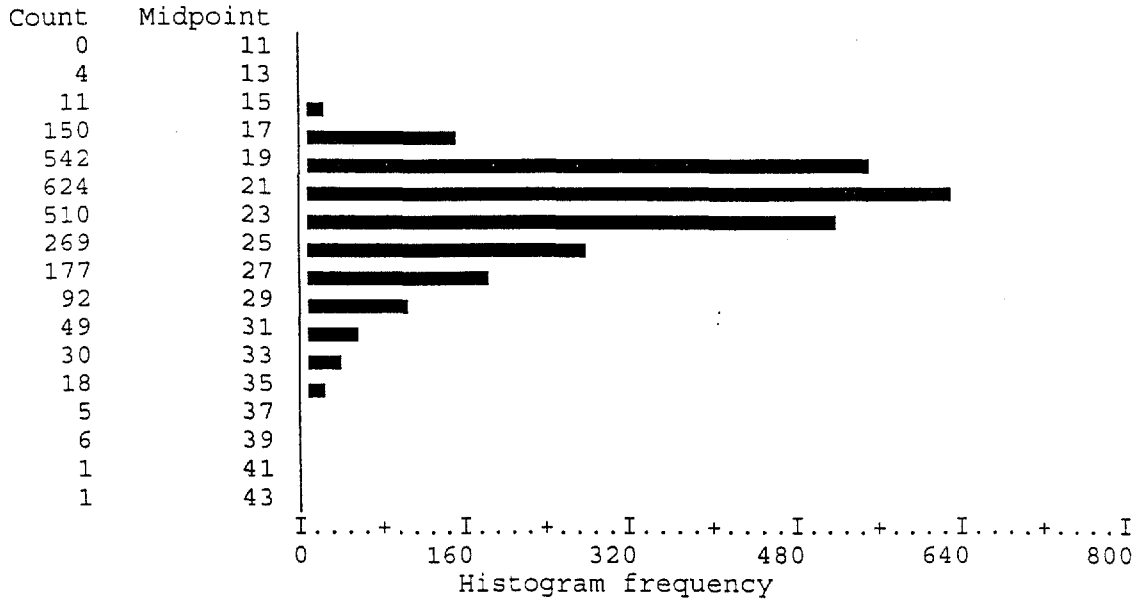
FIGURE 8: WOMEN'S BMI DISTRIBUTION




| | | | | | |
|---|---|---|---|---|---|
| Mean | 22.385 | Std err | .076 | Median | 21.723 |
| Mode | 20.088 | Std dev | 3.773 | Variance | 14.234 |
| Kurtosis | 2.088 | S E Kurt | .098 | Skewness | 1.184 |
| S E Skew | .049 | Range | 30.084 | Minimum | 12.280 |
| Maximum | 42.364 | Sum | 55715.228 | | |

* Multiple modes exist. The smallest value is shown.

Valid cases 2489 Missing cases 3

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# APPENDIX 3

# BIBLIOGRAPHY

## APPENDIX 3

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